NURSES PERCEPTIONS OF THE FACTORS CONTRIBUTING TO THE SPREAD OF TUBERCULOSIS IN A CLINIC IN THE ODI MORETELE SUB DISTRICT OF GAUTENG

By

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SUPERVISOR: PROF SP HATTINGH

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DEDICATION

I would like to dedicate this study to my late father Josias Chaba Molele, he believed in me and always reminded me on the importance of education as a woman. Without his love and guidance this study would not be meaningful.

Above all, to God, who enabled me with the wisdom and knowledge to complete the study.

Student number: 46431551

I declare that **NURSES PERCEPTIONS OF THE FACTORS CONTRIBUTING TO THE SPREAD OF TUBERCULOSIS IN A CLINIC IN THE ODI MORETELE SUB DISTRICT OF GAUTENG** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

_____ 11 June 2015

Mahlodi Annah Molele Date

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NURSES PERCEPTIONS OF THE FACTORS CONTRIBUTING TO THE SPREAD OF TUBERCULOSIS IN A CLINIC IN THE ODI MORETELE SUB DISTRICT OF GAUTENG

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ABSTRACT

Introduction: Despite being one of the most preventable diseases, TB still remains a serious and largely neglected disease. Nurses as compared to the general population are at greater risk of acquiring nosocomial TB. This study was conducted to describe the perceptions of nurses on the underlying contributory factors that may lead to the spread of TB in the clinics treating TB patients.

Methods: Quantitative, non – experimental, descriptive, exploratory and cross sectional design was used. A structured and pretested questionnaire was used.

Findings: The key contributory factors identified were insufficient TB training for staff and lack of knowledge on the TB legislative framework and TB policy directives.

Conclusion: The findings indicate the need for a comprehensive TB infection prevention and control policy, with associated standards for provision and practice.

KEY CONCEPTS

Health care workers, health care facilities, prevention, perception, Tuberculosis and risk factors.

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ABBREVIATIONS AND ACRONYMS

AFB	Acid-Fast Bacilli
AIDS	Acquired Immunodeficiency Syndrome
ANOVA	Analysis of Variance
ART	Antiretroviral Therapy
ARV	Antiretroviral
BCG	Bacille Calmette-Guerin
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
CNO	College of Nurses of Ontario
DOT	Directly Observed Treatment
DOTS	Directly Observed Treatment Short-course
EPTB	Extra-Pulmonary Tuberculosis
FFP	Filtering face piece
HBM	Health Belief Model
HCWs	Health Care Workers
HIV	Human immunodeficiency virus
HR	Hazard Ratio
IC	Infection control
ICN	International Council of Nurses
IGRA	Interferon-gamma release assay
IQR	Interquartile range
ILO	International Labour Organization
IPC	Infection Prevention and Control
IPT	Isoniazid Preventive Therapy
LTBI	Latent Tuberculosis Infection
MDG's	Millennium Development Goals

MDR-TB	Multidrug-Resistant Tuberculosis
MTB	Mycobacterium Tuberculosis
NDoH	National Department of Health
NGOs	Non Governmental Organizations
NIH	National institutes of Health
NSP	National Strategic Plan
NTP	National Tuberculosis [control] Programme
PHC	Primary Health Care
PTB	Pulmonary Tuberculosis
RAC	Range across countries
RHRU	Reproductive Health and Research Institute
RNTCP	Revised National Tuberculosis Control Programme
SANC	South African Nursing Council
TB	Tuberculosis
TST	Tuberculin Skin Test
UNAIDS	Joint United Nations Programme on HIV and AIDS
USA	United States of America
UVGI	Ultraviolet Germicidal Radiation
VCT	Voluntary Counselling and Testing
WHO	World Health Organization
XDR-TB	Extremely Drug Resistant Tuberculosis

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CHAPTER 1

Orientation to the study

1.1 INTRODUCTION

Airborne transmitted infections are among the leading causes of morbidity and mortality worldwide. Tuberculosis (TB) is the most well-known airborne disease, accounting for 1.5 million deaths each year globally, of which an estimated 75% occur in the African and South-East Asian regions (World Health Organization [WHO] 2014:19). In 2012, the estimated global incidence of TB was approximately 9.0 million, with Africa contributing a quarter of all the cases (WHO 2014:1). Since the WHO declared TB a global emergency in 1993, new cases of TB and deaths from the disease have dropped dramatically in several countries with a high burden of the disease (WHO 2014:1). However, no significant decline in the number of new cases has been noted in the African region, particularly South Africa.

In 2013, South Africa reported 0.40–0.5 million incident cases, following India with 2.0–2.3 million and China with 0.9–1.1 million (WHO 2014:8). Figure 1.1 indicates that South Africa has the world's highest incident cases of TB and ranks third amongst the top five countries burdened by TB. Lygizos, Shenoi, Brooks, Bhushan, Brust, Zelterman, Deng, Northrup, Moll and Friedland (2013:online) maintain that TB infection control has been neglected in the health care facilities of the TB endemic area.

Niehaus, Schablon, Preisser, Ringshausen and Diel (2014:online) point out that the evidence that TB may be transmitted between patients and health care workers (HCWs) and vice versa in health care settings sparked renewed interest in TB infection control, especially in resource-limited settings with a high TB prevalence. The WHO (2013b:9) emphasised that the risk of TB infection can be spread in clinics treating infected patients and is an urgent issue to be addressed. Despite this concern, the researcher found few studies addressing this specific issue.

The risk of the nosocomial transmission of TB is high in Sub-Saharan Africa, especially due to the high incidence of patients infected with the human immunodeficiency virus (HIV), which in turn lowers the resistance for infections (Corbett & Macpherson 2013:1126). Bantubani, Kabera, Connolly, Rustomjee, Reddy, Cohen and Pym (2014:online) emphasise the added concern that the risk of contracting TB between patients and staff and amongst each other is greater when larger numbers of infectious TB patients are managed at health care facilities that do not have effective infection control measures.

Health care workers in high TB burdened countries have been found to have a higher risk of contracting TB infection than the general population (Churchyard, Mametja, Mvusi, Ndjeka, Hesseling, Reid, Babatunde & Pillay 2014:246; Muzzi, Seminari, Feletti, Scudeller, Marone, Tinelli, Minoli, Marena, Mangiarotti & Strosselli 2014:online; Naidoo, Seevnarain & Nordstrom 2012:1600; Nienhaus et al 2014:online; Sissolak, Marais & Mehtar 2011:online).

Nurses are at greater risk of acquiring nosocomial TB as they spend more time in contact with infectious patients and their families, especially those working in primary health care (PHC) settings as they serve as the first line of contact with active sufferers who are often not diagnosed (Merte, Kroll, Collins & Melnick 2014:464; Mathew, David, Thomas, Kuruvilla, Balaji, Jesudason & Samuel 2013:72). According to Odendal (2013:2), nurses are the primary care givers in the early identification and management of suspected TB cases. Ghebrehiwet (2008:1) emphasises that nurses are essential in ensuring a high level of case detection as this is the cornerstone for TB control.

Ghebrehiwet (2008:1) states that nurses working in health care facilities perform several roles, including ensuring prevention of the disease and alleviation of suffering, and promotion and restoration of health. TB in health care workers can be used as a proxy to quantify nosocomial TB transmission in low- and middle-income countries (Claassens, Van Schalkwyk, Du Toit, Roest, Lombard, Enarson, Beyers & Borgdorff 2013:online).

Health care workers' increased risk of contracting TB can be attributed to a number of factors including inadequate knowledge of health care personnel or a lack of control measures to prevent infections (Woith, Volchenkov & Larson 2012:1092). Lundy and

Jones (2009:447) maintain that factors such as nurses' cultural beliefs, religious beliefs, knowledge and skills affect their perception of diseases, including TB. These factors might serve as barriers to the effective implementation of the TB control programme in PHC facilities.

Nurses providing TB services come from a wide range of backgrounds and have different levels of knowledge, and diverse attitudes and perceptions (Ghebrehiwet 2008:5). They may also differ in their levels of patient care service delivery. The researcher is of the opinion that nurses need to be aware of how their perceptions may affect their service delivery and should try not to let their cultural or personal beliefs affect their practice. Ghebrehiwet (2008:5) adds that nurses must try to work with the patients for a constructive solution to solving preconceived ideas related to TB infection and control. Since nurses are responsible for the prevention, detection, treatment and management of TB in the clinics, their knowledge about the disease is essential. Woith et al (2012:1094) concur and state further that training in the national TB control guidelines should be emphasised to ensure that all health care workers, including medical and nursing professionals, are well equipped to tackle the TB epidemic.

South Africa currently has national and provincial legislation on infection control practices. In addition, the National Department of Health (NDoH) (2009:91) introduced three types of infection control measures to reduce the nosocomial transmission of TB in health care facilities, namely administrative control measures, environmental controls and personal respiratory protection (see chapter 2 for full discussion).

1.2 BACKGROUND TO THE RESEARCH PROBLEM

TB is a disease of considerable impact in South Africa and globally (WHO 2014:1). Although an ancient disease, TB still remains a leading cause of mortality and morbidity worldwide, second only to HIV (WHO 2014:1). Despite being one of the most preventable diseases, TB still remains a serious and largely neglected disease (WHO 2009:6). It is estimated that one third of the world's population is infected with TB (WHO 2013a:6). Of 1.3 million deaths in 2012, an estimated 940 000 occurred among HIV-negative cases and an additional 320 000 among patients co-infected with TB and HIV (WHO 2013a:7).

TB was declared a public health emergency in 1993 due to its vast public health implications (WHO 2013a:6). This contributed to global structured efforts with notable improvements in national TB programmes worldwide (NDoH 2014:78). Global targets for reductions in the epidemiological burden of TB have been set for 2015 and 2050 in the context of the Millennium Development Goals (MDG) and separately by the “Stop TB Partnership”, a global coalition of stakeholders established to coordinate international efforts (NDoH 2014:78). The principal MDG target is that the incidence rate should fall by 2015. The additional targets set by the Stop TB Partnership are that prevalence and death rates should be halved by 2015 compared with their level in1990, and that TB should be eliminated as a public health problem by 2050, defined as less than one case per million of the population (NDoH 2014:85). Table 1.1 shows that South Africa carries the third highest burden of TB cases after India and China. In 2012, the incidence in South Africa was 630/100 000 population which showed an increase of over 400% since 1997 (WHO 2013a:9).

Table 1.1 Estimated epidemiological burden of TB in 22 high burden countries

COUNTRY	POPULATION	MORTALITY			HIV-POSITIVE TB MORTALITY			PREVALENCE			INCIDENCE			HIV-POSITIVE INCIDENT TB CASES		
		BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH
Afghanistan	29825	11	4.6	20	<0.1	<0.1	0.3	110	54	180	56	47	67	0.3	0.2	0.5
Bangladesh	154 695	70	29	130	<0.1	<0.1	0.1	670	340	1 100	350	290	410	0.2	0.2	0.3
Brazil	198 656	4.9	4.6	5.2	2.5	2.2	3	120	51	210	92	76	110	16	13	19
Cambodia	14 865	9.3	4.3	16	0.6	0.4	0.7	110	96	130	61	52	70	2.7	2.3	3.1
China	1 377 065	44	43	46	1.2	0.9	1.5	1 400	1 200	1 600	1 000	880	1 100	7.3	6.4	8.2
DR Congo	65 705	36	16	64	6.3	5.5	8.1	380	200	620	210	190	250	16	14	19
Ethiopia	91 729	16	12	21	5.6	4.6	7.3	210	170	250	230	170	290	23	17	30
India	1 236 687	270	170	390	42	37	48	2 800	1 900	3 900	2 200	2 000	2 400	130	120	140
Indonesia	246 864	67	30	120	2.1	1.8	3	730	350	1 200	460	380	540	7.5	5.6	9.7
Kenya	43 178	9.5	5.4	15	7.7	6.6	8.9	130	71	210	120	110	120	45	44	47
Mozambique	25 203	13	1	41	45	35	53	140	28	340	140	96	190	83	58	110
Myanmar	52 797	25	12	44	4.6	3.8	5.3	260	200	320	200	170	230	19	16	21
Nigeria	168 834	27	1.6	86	19	11	25	270	43	710	180	85	310	46	21	80
Pakistan	179 160	62	27	110	1.2	0.8	1.3	670	320	1 100	410	340	490	3.8	3.1	4.6
Philippines	96 707	23	22	25	0.1	<0.1	0.1	450	390	500	260	210	310	0.5	0.4	0.6
Russian Federation	143 170	19	18	20	1.8	1.5	2.2	170	73	320	130	110	150	9.3	7.9	11
South Africa	52 386	31	3.7	86	88	75	100	450	160	880	530	430	630	330	270	390
Thailand	66 785	9.2	3.8	17	2.2	1.9	2.8	110	47	190	80	66	95	12	10	14
Uganda	36 346	4.7	0.8	12	9.2	8	12	64	24	120	65	53	79	35	28	42

COUNTRY	POPULATION	MORTALITY			HIV-POSITIVE TB MORTALITY			PREVALENCE			INCIDENCE			HIV-POSITIVE INCIDENT TB CASES		
		BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH	BEST	LOW	HIGH
UR Tanzania	47 783	6.1	3.2	9.9	7	5.8	8	84	45	140	79	74	84	32	30	34
Viet Nam	90 796	18	12	25	2.1	1.8	2.7	200	78	370	130	99	170	9.3	6.9	12
Zimbabwe	13 724	4.6	0.2	16	18	15	20	59	13	140	77	60	97	55	42	69
High-burden countries	4 432 959	780	630	940	270	250	280	9 600	8 200	11 000	7 000	6 700	7 400	880	810	960
AFR	892 529	230	160	310	250	230	270	2 700	2 100	3 300	2 300	2 100	2 500	830	760	910
AMR	961 103	19	16	21	6.4	5.6	7.2	390	300	490	280	260	300	31	28	34
EMR	616 591	100	63	150	4.2	3.8	4.7	1 100	730	1 600	670	590	750	11	10	12
EUR	904 540	36	35	36	3.9	3.4	4.4	510	380	650	360	340	390	19	17	21
SEAR	1 833 359	450	330	590	51	46	56	4 800	3 700	6 100	3 400	3 200	3 700	170	160	180
WPR	1 845 562	110	96	120	4.8	4.2	5.4	2 400	2 100	2 600	1 600	1 500	1 800	24	21	27
Global	7 053 684	940	790	1 100	320	300	340	12 000	11 000	13 000	8 600	8 300	9 000	1 100	1 000	1 200

Source: WHO (2013a:9)

1.2.1 Health profile of South Africa

South Africa, officially the Republic of South Africa, is a country located at the southern tip of Africa. It has 2,798 kilometres of coastline stretching along the Atlantic and Indian Oceans. To the north lie the neighbouring countries of Namibia, Botswana and Zimbabwe; to the east are Mozambique and Swaziland, and within it lies Lesotho, an enclave surrounded by South African territory (see figure 1.1). South Africa is the 25th largest country in the world by land area, and the world's 25th most populous nation, with close to 53 million people.

Figure 1.1 Map of South Africa showing the nine provinces

Source: Statistics South Africa (2012b:1.1)

The country is divided into nine provinces which are divided into 52 districts: 8 metropolitan and 44 district municipalities (Statistics South Africa 2012b:1.2).

Table 1.2 Mid-year population estimates by province, 2013

Province	Area (km^2)	Population size (2013)
Western Cape	129,462	6,016,900
Northern Cape	372,889	1,162,900
North West	104,882	3,597,600
Mpumalanga	76,495	4,128,000
Limpopo	125,754	5,518,000
KwaZulu-Natal	94,361	10,456,900
Gauteng	18,178	12,728,400
Free State	129,825	2,753,200
Eastern Cape	168,966	6,620,100

Source: Statistics South Africa (2012b:1.1)

South Africa is among the 22 countries burdened by the TB epidemic (WHO 2014:7). Figure 1.2 illustrates the incidence of TB from 1990 to 2010 and further how HIV affected the control of TB in the country. The figure shows that the incidence of TB in the country has been on the increase since 1994, and further that the increase in the total number of TB cases reported has been fuelled by the emergence of HIV in the country. Different results are displayed in different colours. From figure 1.2 it can be concluded that TB and HIV act interactively to enhance and accelerate the development of TB and progression of HIV infection.

According to the NDoH (2014:8) HIV-positive individuals are more likely to develop active TB than those without the infection. Furthermore, 50 to 60% of HIV- positive people infected with TB will go on to develop active disease during their lifetime (NDoH 2014:8). Edessa, Woldeyes and Shibeshi (2014:54) state that TB is a major opportunistic complication of HIV infection.

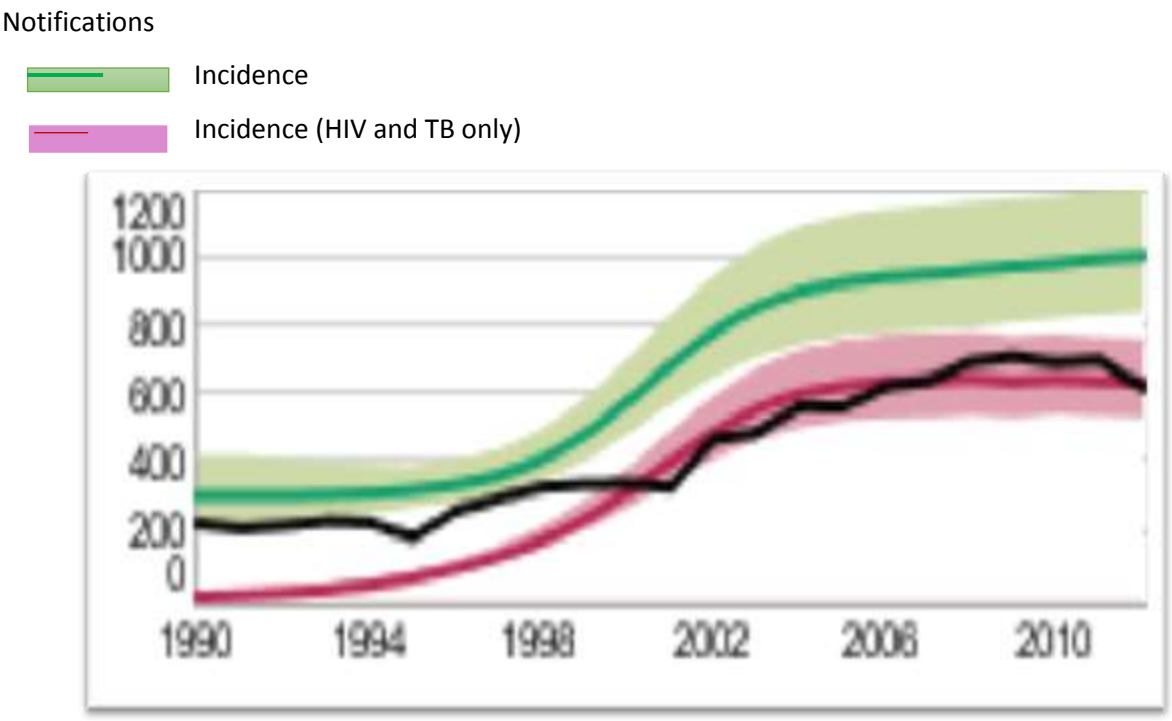


Figure 1.2 Incidence of TB in South Africa, 1990 to 2010

Source: WHO (2013a:9)

TB has been the major cause of death among South Africans. Table 1.3 compares the absolute number of deaths for the ten leading underlying natural causes of death in South Africa between 2008 and 2010. From the table it is clear that the number of deaths in South Africa resulted from three medical conditions, namely TB, influenza and pneumonia, and intestinal infectious diseases.

Table 1.3 also shows a consistent decrease in the number of deaths from TB, influenza and pneumonia, and intestinal infectious diseases. However, the number of deaths due to diabetes mellitus and HIV disease consistently increased over the three years (Statistics South Africa 2013:53). Furthermore, the number of deaths due to TB, influenza and pneumonia, and intestinal infectious diseases all decreased by 10% or more between 2009 and 2010 and the number of deaths due to diabetes mellitus increased by 3,8% between 2009 and 2010 and those due to HIV disease increased by 3,0% during the same period. The results are consistent with Goldin's (2014:169) finding that deaths from communicable diseases are on the decline and being replaced by non-communicable diseases. Moreover, non-communicable diseases were responsible for two out of every three deaths reported globally (Goldin 2014:169).

Table 1.3 Ten leading underlying natural causes of death, 2008–2010

Causes of death (based on ICD-10)	2008			2009			2010		
	Rank	Number	%	Rank	Number	%	Rank	Number	%
Tuberculosis (A15-A19)**	1	75 281	12,6	1	69 791	12,0	1	62 827	11,6
Influenza and pneumonia (J09-J18)	2	45 826	7,7	2	43 449	7,5	2	39 027	7,2
Intestinal infectious diseases (A00A09)	3	39 530	6,6	3	31 070	5,4	3	27 383	5,0
Forms of heart disease (I30I52)	4	26 327	4,4	4	26 738	4,6	4	25 827	4,7
Cerebrovascular diseases (I60-I69)	5	24 473	4,1	5	25 062	4,3	5	24 664	4,5
Diabetes mellitus (E10-E14)	6	19 636	3,3	6	20 680	3,6	6	21 475	3,9
Human immunodeficiency virus [HIV] disease (B20-B24)	7	15 179	2,5	7	17 785	3,1	7	18 325	3,4
Hypertensive diseases (I10-I15)	10	14 236	2,4	8	15 486	2,7	8	14 890	2,7
Chronic lower respiratory diseases (J40-J47)	9	14 338	2,4	9	14 334	2,5	9	13 099	2,4
Other viral diseases (B25-B34)	…	…	…	…	…	…	10	12 332	2,3
Certain disorders involving the immune mechanism (D80-D89)	8	14 728	2,5	10	13 256	2,3	…	…	…
Natural causes		252 720	42,4		251 777	43,4		235 630	43,3
Non-natural causes		53 350	9,0		50 283	8,7		48 377	8,9
All causes		**595 624**	**100,0**		**579 711**	**100,0**		**543 856**	**100,0**

Source: Statistics South Africa (2013:53)

1.2.2 TB mortality by province

The study was conducted in one of the sub-districts in the Gauteng province, and to better understand the extent of the problem the researcher also reviewed the burden of the disease per province. Table 1.4 represents the total number of deaths from TB reported in 2012. From table 1.4 it is clear that the highest number of deaths resulting

from TB were in KwaZulu-Natal (118 205), followed by the Eastern Cape (10 205), Gauteng (9 227), Mpumalanga (5 595), North West (4 942), Limpopo (4 199), and the Western Cape (3 573). The lowest number occurred in the Northern Cape (1 396). Gauteng ranks third in TB mortality after KwaZulu-Natal and the Eastern Cape.

Table 1.4 TB mortality by province

Province	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo
No of deaths due to TB	3 573	10 205	1 396	5 004	18 205	4 942	9 247	5 595	4 199

Source: Statistics South Africa (2013:48)

1.2.3 Tshwane district profile

The City of Tshwane is classified as a Category A municipality and covers an area of 3 200 km². The Tshwane health district is situated in the northern part of Gauteng Province and is one of six health districts in the province and forms part of the Tshwane/Metsweding Region C. The Tshwane District is subdivided into five regions, namely the Central, East, South, North-west and North-east Region (see figure 1.3). The District has a total population of 2,708,702 people. The population density is high at 472.9 people per square kilometre.

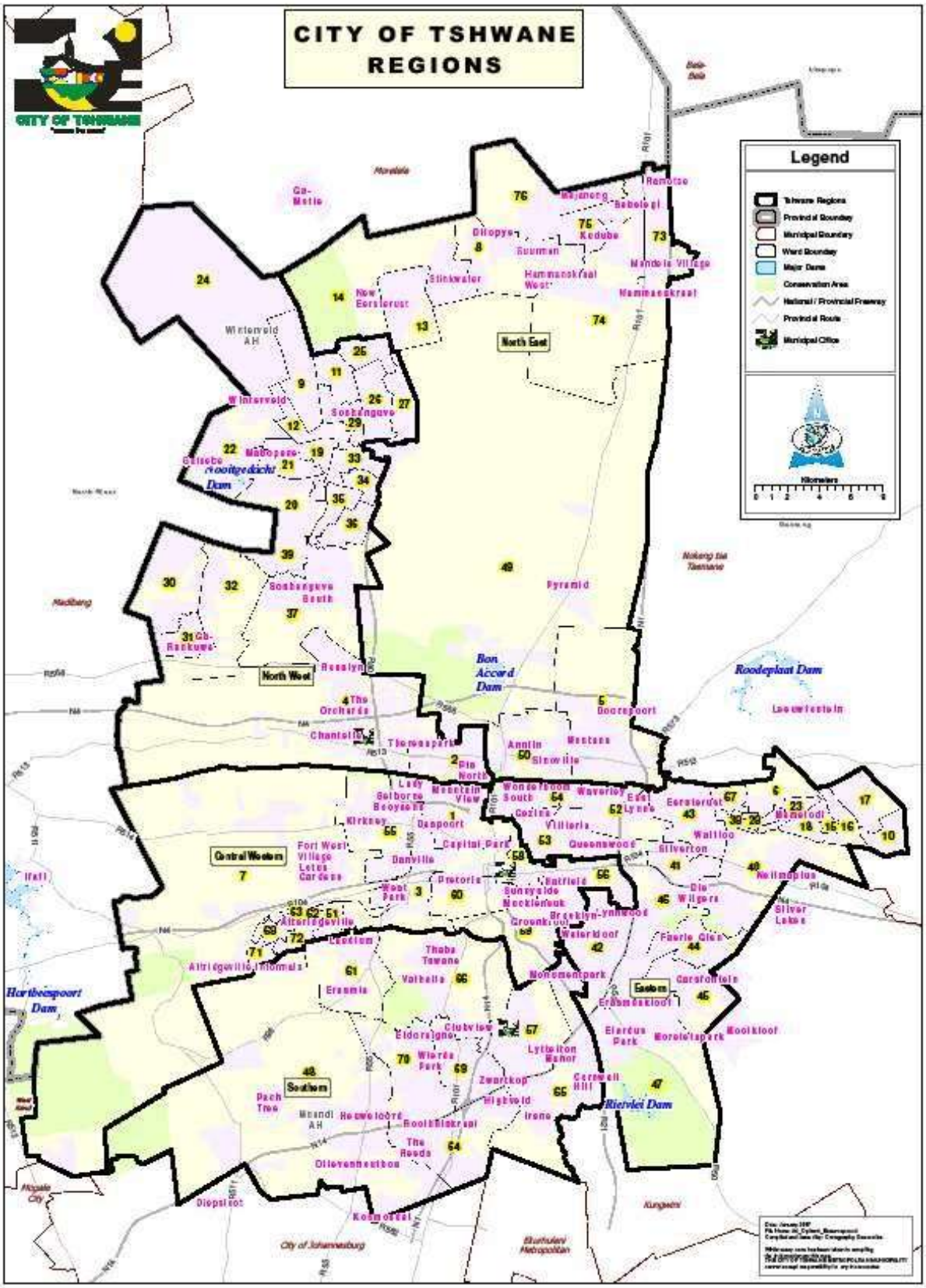


Figure 1.3 Map of the Tshwane district showing five regions

Source: Department of Health and Social Development (2012:11)

1.2.3.1 Health services in Tshwane district

The *National Health Act, 61 of 2003* as amended describes the establishment of the district health system (South Africa 2003:s 29). The National Health Act*, 61 of 2003* as amended states that the system consists of various health districts, and the boundaries of health districts coincide with district and metropolitan municipal boundaries (South Africa 2003:s 29). Furthermore, the *National Health Act, 61 of 2003* stipulates that the relevant member of the Executive Council responsible for local government in the province in question may divide any health district in the province into sub-districts and may determine and change the boundaries of such sub-districts (South Africa 2003:s 30). The PHC services in the Tshwane municipal area are planned and coordinated jointly by the Tshwane health services division and the Department of Health and Social Development through an interim district health advisory committee and joint sub-district teams (Department of Health and Social Development 2012:14).

The health care services in Tshwane are delivered through one regional hospital, five district hospitals, eight community health centres, 68 clinics and three satellite service units (Department of Health and Social Development 2012:14). The Tshwane district is divided into five regions and the health care facilities selected for the study are among the five regions in the district. The PHC approach is a method currently used in the district to deliver health services. This method was developed in September 2001 by the Department of Health to outline comprehensive PHC services, which within a period of 5 years of implementation, should be available to the population throughout the country. The package was anticipated to contribute to meeting greater social needs and promote equity by reducing the gap between those who have access to an appropriate level of healthcare and those who do not (NDoH 2001:22). The PHC services are aimed at promoting health, preventing illness, curing diseases and, where the need arises, referring patients to a secondary or tertiary level of care.

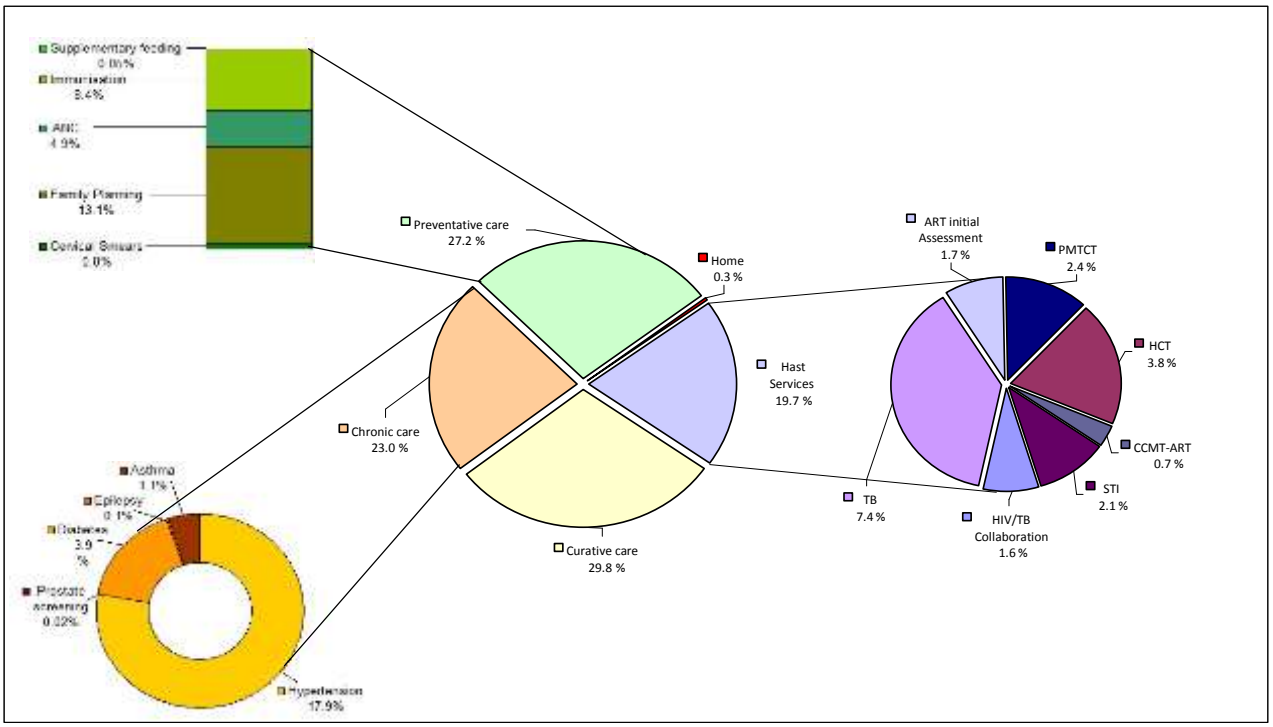


Figure 1.4 City of Tshwane disease and service profile, July 2010-June 2011

Source: Department of Health and Social Development (2012:30)

The PHC facilities in the district deliver four types of health care services to the surrounding communities, namely:

- **Preventive services**

Preventive services include supplementary feeding to malnourished individuals; immunisation, including providing vaccination services as per extended programme of immunisation; antenatal care for pregnant women to prevent pregnancy-related morbidity and mortality; family planning to ensure prevention of unwanted and unplanned pregnancies, and smears for early detection of cervical cancers in order to reduce mortality and morbidity.

- **Chronic care provision.** Chronic care provision includes care and management of chronic conditions related to asthma, hypertension, diabetes and prostate cancer.

- **Curative service delivery.** Curative service delivery entails the care of minor ailments.

- **Care services.** Care services are for those persons who are positive with the HIV and those who already have the Acquired Human Deficiency Syndrome (AIDS). In lay terminology this is called HAST services (see figure 1.5). HAST is an acronym for **H**IV **A**IDS ***S***exually transmitted infections and **T**uberculosis.

The *Constitution of the Republic of South Africa* stipulates that everyone has the right to access to health care services (South Africa 1996:s 27). In this regard, Tshwane district set a target that 90% of all households should reside within a five kilometre radius of a public health care facility (Department of Health and Social Development 2012:14). Nteta, Mokgatle-Nthabu and Oguntibeju (2010:online) state that this system aims to bring health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process. In a study to investigate the accessibility and utilization of the PHC services in three community health care centres in the Tshwane District, Nteta et al (2010:online) estimated that 43.2%, 47% and 9.1% of residents walked, used public transport and their own transport respectively, to access health care services. The Department of Health and Social Development (2012:14) states that currently 98% of all households in the Tshwane District reside within a five kilometre radius of a public health facility which is higher than the set target.

To ensure the accessibility of public health services after hours, 13 of the PHC clinics in the Tshwane district region offer extended hours of health care services (Department of Health and Social Development 2012:15). The district hospitals (Mamelodi Hospital, Pretoria West Hospital, Odi Hospital, Jubilee Hospital, and the Tshwane District Hospital) also provide 24-hour health services (Department of Health and Social Development 2012:14).

The PHC facilities have experienced an increase in clinic attendance by patients (Department of Health and Social Development 2012:14). A total of 1 439 950 patients visited the PHC clinics during the 2010/11 financial year compared to 1 352 231 in 2008/2009, which represents an increase of 7% in clinic attendance (Department of Health and Social Development 2012:15). Data from the PHC clinics indicated a 39% increase in clinic attendance from 2006 to 2011 with an average increase of 6.5% a year (Department of Health and Social Development 2012:14). The number of clinic

visitors is increasing, and the AIDS pandemic and the TB crisis demand more staff to deal with these issues. This statement is supported by Goldin (2014:165) who maintains that more people means more access to health care services. Goldin (2014:165) adds that not only population has been the driver of increased health care demand but also the increasingly significant impact of major changes in health conditions.

1.3 PROBLEM STATEMENT

A problem statement "articulates the problem and describes the need for a study through the development of an argument" (Polit & Beck 2012:73). The problem statement is inter-related with the research design, theoretical framework, literature review, and the hypothesis (LoBiondo-Wood & Haber 2014:164). Polit and Beck (2012:73) describe a research problem as "a troubling condition which can be solved by generating evidence through research".

From the introduction and background above, it is clear that a concerted effort should be taken to reform TB control and change strategies in TB control policy because despite available efforts developed to control the epidemic, the rate of TB in South Africa has increased since the 1990s (Wood, Lawn, Johnston-Robertson & Bekker 2011:111). South Africa is among the 22 high TB burden countries in the world (WHO 2014:7). This study was conducted in the Odi Moretele sub-district (currently known as the North East region) of Tshwane in the Gauteng province after the researcher realised that the sub-district reported 2 211 cases of TB, which is 617 cases more than reported in the Southern region (see table 1.5). The cases emerged despite the enforcement of TB control measures to curb the epidemic (NDoH 2009:91). The WHO (2011:1) recommends the three I's in the control of TB, namely intensified case finding, infection control and isoniazid preventive therapy (IPT). Case finding can be either passive or active (Mwansa-Kambafwile, McCarthy, Gharbaharan, Venter, Maitshotlo & Black 2013:online). Passive case finding refers to screening people that present themselves to a health care facility for problems unrelated to TB whilst active case finding involves actively going out into the community to look for cases. Furthermore, finding and treating TB cases early reduces transmission and morbidity as patients with undiagnosed, untreated pulmonary TB (PTB) continue to transmit infection thereby further increasing the TB burden (Mwansa-Kambafwile et al 2013:online).

The Tshwane annual report for 2011 revealed a 2.9% TB case finding rate in the City of Tshwane clinics, which indicated a decrease of 0.1% compared to the previous year. The district had a set target of 3% and achieved 2.4%, which was 0.6% less than the set target (Department of Health and Social Development 2012:34). In addition, of the total number of cases reported, PTB was the highest (70%) in comparison with other forms of TB notified during 2011 (Department of Health and Social Development 2012:34).

Table 1.5 presents the bacteriological coverage of Tshwane district clinics reported in 2011. From the table it is evident that the PHC facilities are still faced with an increased number of infectious TB. The findings show that the number of cases with positive sputum was twice as high as the number of cases with extra pulmonary TB (EPTB), which is considered un-infectious. This increasing number of infectious TB cases may present a problem in the health care facilities to both health care workers and patients without the disease. As indicated earlier, PHC facilities are among the areas where TB transmission occurs as large numbers of people are congregated and nurses, who are the backbone of the TB control programme, are the first point of contact for patients.

Table 1.5 Tshwane district report on bacteriological coverage, 2011

Area	Central Western	Eastern	North East	North West	Southern	Total
Bacteriological coverage	**97,5%**	**95%**	**86,8%**	**81,5%**	**97,3%**	**88,2%**
Number of PTB cases with positive sputum	631	738	349	1 285	314	**3 317**
Number of PTB cases with negative sputum	472	702	378	2 027	313	**3 892**
Number of adult PTB patients with no smear	166	209	223	1 210	78	**1 886**
Number of PTB cases, 0 to 7 years (primary TB) with no smear	138	156	124	458	64	**940**
Total number of PTB cases > 7 years (able to produce a sputum sample)	1 269	1 649	950	4 522	705	**9 095**
Number of EPTB cases	263	297	187	603	120	**1 470**
Total number of TB cases diagnosed	3 570	3 751	2 211	10 105	1594	**20 00**

Source: Department of Health and Social Development (2012:34)

1.4 RATIONALE FOR THE STUDY

The researcher was employed as a professional nurse in the facilities under study from 2008 to 2011. Since 2011 she has been an HIV/TB nurse mentor with a multi-disciplinary team of health care workers involved with clients who have contracted TB and their families. The researcher's role involves networking, consulting and collaborating on TB issues with the nurses, other health care workers and non-governmental organisations (NGOs). The researcher's involvement with the TB programme and interaction with the patients, their family members and the community motivated her to undertake the study. Corvalan, Hales and McMichael (2005:13) maintain that "the environment is partly the result of human interventions, which are themselves the outcome of the growing epidemic in health care facilities and a country as whole". The data was collected in the Odi Moretele sub-district between 1 October and 1 November, 2013.

1.5 PURPOSE OF THE STUDY

The purpose of the study was to describe the perceptions of nurses working in a clinic of the Odi Moretele municipality on the underlying contributory factors in the clinics under investigation that may lead to the spread of TB in the clinics treating TB patients.

1.6 RESEARCH OBJECTIVES

In order to achieve the purpose, the objectives of the study were to

- Describe the perceptions of nurses working in selected Odi Moretele municipality clinics of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients.
- Identify barriers to the implementation of and adherence to tuberculosis preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality.
- Explore the likelihood of compliance with TB preventive measures by nurses working in the selected clinics of the Odi Moretele municipality.

1.7 RESEARCH QUESTIONS

The study therefore wished to answer the following questions:

- What do nurses perceive as the underlying factors in the selected clinics that may lead to the spread of TB in clinics treating TB patients?
- What are the barriers to implementation of and adherence to TB preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality?
- What is the likelihood of compliance with TB preventive measures by nurses working in the clinics of the Odi Moretele municipality?

1.8 SIGNIFICANCE OF THE STUDY

This study may serve as a learning paradigm for and enhance the insight and knowledge of facility managers, all health care personnel, and nurses working in clinics where patients suffering from TB receive assessment and treatment. The findings of the study should be of benefit to facility managers, as the ones responsible for running the clinics, and provide leaders in health care with information to facilitate commitment to control measures for the prevention of TB in PHC clinics.

1.9 THEORETICAL FRAMEWORK

The study was based on the conceptual framework of the Health Belief Model (HBM). The model is based on people's beliefs about whether or not they are susceptible to disease and how their perceptions of the benefits of trying to avoid disease influence their readiness to act (National Institutes of Health [NIH] 2005:13). Health behaviour is based on perceived threat of disease (Rosenstock, Strecher & Becker 1988:177). Rosenstock et al (1988:177) state that people (in this study nurses) are ready to act if:

- They believe they are susceptible to the condition (perceived *susceptibility* to TB).
- They believe the condition has serious consequences (perceived *severity* of contracting TB).

- They believe taking action will reduce their susceptibility to the condition or its severity (perceived *benefits* of applying TB control measures).
- They believe the cost of taking action (perceived barrier) is outweighed by the benefits.
- They are exposed to prompt actions (*cue to action* in preventing the disease and prompting recovery, diagnosis and effective treatment of TB).
- They are confident in their ability to successfully perform an action (*self-efficacy*)

The HBM has six fundamental constructs: perceived susceptibility; perceived seriousness; perceived benefits; perceived barriers; cues to action, and self-efficacy. Table 1.6 summarises the constructs of the HBM as applied in the study. The model is discussed fully in chapter 2.

Table 1.6 Summary of the HBM and its application

Concepts	Definition	Application
Perceived susceptibility	One's perception of the chances of getting a condition	Define populations at risk, risk levels; personalize risk based on a person's features or behaviour; heighten perceived susceptibility if too low
Perceived severity	One's perception of how serious a condition and its sequelae are	Specify consequences of the risk and the condition
Perceived benefits	One's perception of the efficacy of the advised action to reduce risk or seriousness or impact	Define action to take; how, where, when; clarify the positive effects to be expected
Perceived barriers	One's perception of the tangible and psychological costs of the advised action	Identify and reduce barriers through reassurance, incentives, assistance
Cues to action	Strategies to activate "readiness"	Provide how-to information, promote awareness, reminders
Self-efficacy	Confidence in one's ability to take action	Provide training, guidance in performing action

Source: Hodges and Videto (2011:148)

Despite measures developed by the Centers for Disease Control and Prevention (CDC), WHO and NDoH to control the spread of TB in health care facilities, TB infection remains a major public health problem in PHC health care facilities. The nature of their work puts health care workers at higher risk of contracting TB in their health care facilities compared to the general population. Educational level, lack of knowledge, inadequate training, attitude and perception have been found reasons for the poor

implementation of TB preventive measures in health care facilities by health care workers (Akin, Gorak, Unsar, Mollaoglu, Ozdilli & Durna 2011:777; Sissolak et al 2011:online; Woith et al 2012:1094). The HBM was used to acquire a better understanding and identify reasons for the non-compliance with TB preventive measures among nurses in the PHC facilities under study. Becker (1974:324) used the model to explore and assess why people did not use preventive health services (e.g., immunisation services) and to understand why people used or failed to use health services. The model can guide the development of health interventions with the aim of changing behaviours (Glanz, Lewis & Rimer 1997:19). Figure 1.5 is a schematic representation of the HBM as used in the study (see chapter 2 for discussion).

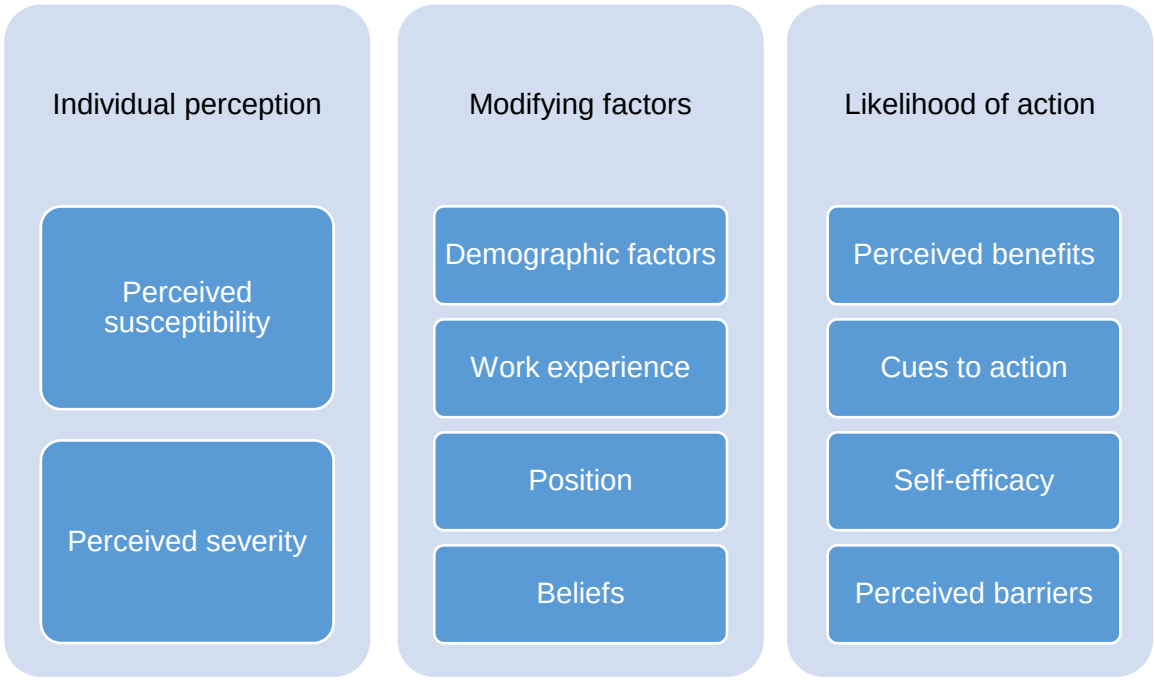


Figure 1.5 Perspectives of the HBM

Source: Glanz, Rimer and Viswanath (2008:52)

1.10 RESEARCH DESIGN

Walliman (2011:13) refers to the research design as a framework for the collection and analysis of data and which research methods are appropriate. Brink, Van der Walt and Van Rensburg (2006:92) describe a research design as “a set of logical steps taken by the researcher to answer the research question”. The researcher used a non-experimental, quantitative, exploratory, descriptive and cross-sectional design to

explore and describe the respondents' perceptions of the underlying contributory factors in the selected clinics that led to the spread of TB in clinics treating TB patients.

1.10.1 Non-experimental

Research designs may be experimental or non-experimental. Non-experimental designs are used for descriptive studies as the participating units are measured on relevant variables at a point without manipulation (Basavanthappa 2007:149). In non-experimental studies researchers do not intervene by manipulating independent variables (Polit & Beck 2012:223). The main purpose of non-experimental research is to describe phenomena and to explore and explain relationships between variables (Brink et al 2006:102). The researcher used a quantitative approach, using an explorative, descriptive and cross-sectional design to describe the respondents' perceptions and experiences (see chapter 3 for detailed description of research design and methodology).

1.10.2 Quantitative

The study followed a quantitative approach. Quantitative studies assign numerical values to data collected to answer research questions and a literature review identifies theoretical frameworks (Bouma, Ling & Wilkinson 2012:52). Polit and Beck (2012:14) state that quantitative research is allied with positivist paradigm. The positivist approach assumes that nature is basically ordered and regular and that an objective reality exists independent of human observation (Polit & Beck 2012:14). Bouma et al (2012:53) add that quantitative research relies on the findings of previous studies as a guide to build on existing knowledge.

The researcher considered a quantitative approach appropriate to explore the respondents' perceptions. A literature review was undertaken to discover what had been researched on the phenomenon under study and to develop the theoretical framework which guided the development of the data-collection questionnaire (see annexure E). The framework assisted objectivity as the study followed a specific model and not the researcher's personal beliefs or preconceptions. Data was collected by means of a structured, self-designed questionnaire.

1.10.3 Exploratory

Exploratory research investigates the full nature of the phenomenon, the manner in which it is manifested, and other factors related to it (Polit & Beck 2012:18). An exploratory approach was considered appropriate to explore and understand the respondents' perceptions and experiences (see chapter 3). The structured questionnaire also assisted the researcher to identify other factors related to the phenomenon under study.

1.10.4 Descriptive

A descriptive design enables researchers to describe variables in order to answer research questions with no attempt at establishing a cause-effect relationship (Brink et al 2006:102) (see chapter 3). Houser (2012:279) points out that descriptive survey studies are used whenever accurate information about the characteristics or frequency of a phenomenon is required. The researcher considered a descriptive design suitable to answer the research question.

1.10.5 Cross-sectional

In a cross-sectional study the researcher obtains all relevant information from the respondents at a single point in time, and no future follow-up contacts are made (Polit & Beck 2012:184). Cross-sectional studies entail the collection of data on more than one case (usually many more than one), generally using a sampling method to select cases in order to be representative of a population (Walliman 2011:11; Ruane 2008:93). In this study the researcher administered the structured questionnaire to the respondents once and there was no other contact with them. The specific time frame in which the data collection took place was 1 October to 1 November 2013.

1.11 RESEARCH METHODOLOGY

Polit and Beck (2012:12) describe research methodology as "steps, procedures and strategies taken to investigate the problem being studied and to analyse the collected data". The research methodology includes the population; sample and sampling; data

collection and analysis, and validity and reliability (see chapter 3 for detailed discussion).

1.11.1 Population

According to Polit and Beck (2012:273), a population is “the entire aggregate of cases in which a researcher is interested”. A distinction is made between the target and the accessible population (Polit & Beck 2012:273). According to Babbie (2010:210), the accessible population is “that aggregation of elements from which the sample is actually selected”. The target population is “the entire set of individuals or element that meets the sampling criteria” (Burns & Grove 2009:351).

For this study, the population comprised all nurses in the PHC facilities of Tshwane District, Gauteng. The target population was all the nurses in the PHC facilities of Odi Moretele sub-district of Tshwane, and the accessible population was all the nurses in the seven selected PHC facilities of Odi Moretele sub-district of Tshwane (see chapter 3).

1.11.2 Sample and sampling

A sample refers to a subset of a population (individuals, elements or objects) or a group selected to act as representatives of a population as a whole (Polit & Beck 2012:275; Offredy & Vickers 2010:131). The sample assists the researcher to achieve a better response rate than when using the whole population, which is time consuming (Babbie 2010:215; Babbie & Mouton 2011:174).

Brink et al (2006:124) describe sampling as the “process of selecting the sample from a population in order to obtain information regarding the phenomenon in a way that represents the population of interest”. Polit and Beck (2012:275) add that sampling is “a process of selecting a portion of the population to represent the entire population so that inferences can be made”.

For this study, the sample comprised the 86 nurses in the seven selected PHC facilities of Odi Moretele sub-district who met the inclusion criteria and consented to participate in the study (see chapter 3 for detailed discussion).

1.11.3 Data collection

The collection of quantitative data involves highly structured methods in which exactly the same information is gathered from study participants in a comparable and pre-specified way (Fitzpatrick & Kazer 2012:125). Data collection should be objective, systematic and repeatable (Gerrish & Lacey 2010:23). Robson (2007:166) maintains that the researcher should use the simplest method of collecting the data to get answers to the research question and should not collect any more data than necessary. Mindful of these conditions, the data-collection instrument selected for this study was a self-designed, structured questionnaire.

1.11.4 Data-collection instrument

In this study the researcher used a structured self-designed questionnaire for data collection (see chapter 3 for discussion). A questionnaire is a method that requires participants to give written or verbal replies to a set of questions (Polit & Beck 2012:265). A questionnaire can be used to collect information on attitudes, perceptions, knowledge and experience.

The questionnaire was based on the HBM, which was the theoretical framework that guided the study. The HBM posits that people will take action to undergo a health prevention behaviour when they are ready; they see it as beneficial, and the difficulty is not greater than what is to be gained (NIH 2005:12).

1.11.5 Data analysis

Statistics refer to the systematic collection of numerical data and their interpretation (Offredy & Vickers 2010:182). Statistics can be used to tell a complete and compelling story about the data collected during research (Jacobsen 2012:187). Polit and Beck (2012:379) define data analysis as the systematic organization and synthesis of research data. In this study data was analysed by means of descriptive and inferential statistics. Inferential statistics are used to make inferences about the population (Polit & Beck 2012:404). Offredy and Vickers (2010:181) define descriptive statistics as the process that researchers use in order to reduce, organise and give meaning to the data collected using an appropriate data-collection instrument.

Descriptive statistics involve identifying and understanding the nature and attributes of nursing phenomena and sometimes the relationship among these phenomena. Descriptive statistics include the presentation of data in tables and diagrams as well as the calculation of percentages, averages and measurement of dispersion and correlation (Offredy & Vickers 2010:182). Thus descriptive statistics can assist the researcher to organise and summarise meaningless data (see chapter 3 for detailed discussion).

1.11.6 Validity and reliability

The credibility of a study depends on identifying, measuring and collecting the right information (Houser 2012:210). The measurement instrument forms the foundation of the entire study (Houser 2012:210). In order to accurately and truthfully measure a phenomenon, the measurement instrument must be both valid and reliable (Polit & Beck 2012:331). The quality of a research instrument is determined by its validity and reliability (see chapter 3). In quantitative studies, *validity* and *reliability* are two of the most important concepts used to evaluate the rigour with studies are carried out.

1.11.6.1 Reliability

Brink et al (2006:157) describe reliability as the extent to which measures are consistent or repeatable over time. Reliability of the instrument is the consistency with which it measures the target attributes (Polit & Beck 2012:331). Reliability is a matter of whether a particular technique, applied repeatedly to the same object, would yield the same result each time (Burns & Grove 2009:389). Reliability of a questionnaire refers to its ability to yield the same data when it is re-administered under the same conditions, but it is difficult to obtain a replication of data when dealing with people (Robson 2007:92). Consequently, reliability does not ensure accuracy. Reliability for quantitative research focuses mainly on stability and consistency (Polit & Beck 2012:331-332).

The stability of a questionnaire is the degree to which it produces similar results on being administered twice. Polit and Beck (2012:331) recommend a stability test by means of the test-retest (pilot study) method. The researcher used a group of nurses who were not included in the study to conduct a test-retest to ensure stability. The

questionnaire was administered on two occasions, two weeks apart and the results compared. A reliability coefficient was calculated on the two sets of data for each part of the questionnaire. Reliability coefficients range from 0.00 to 1.00, with higher values indicating greater reliability. The test-retest findings were within these values (see chapter 3).

1.11.6.2 Validity

Burns and Grove (2009:393) define validity as "the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration". Polit and Beck (2012:336) describe validity as "the degree to which an instrument measures what it is supposed to measure". To ensure content validity, the researcher based the questionnaire items on the theoretical framework (HBM); the NDoH (2009:1) policy guidelines, and the WHO (2009:1) infection prevention and control manual. The questionnaire contained closed and open-ended questions. The questionnaire was also submitted to the Gauteng Department of Health Infection Control Directorate and the University School of Pathology for content, accuracy, clarity and relevance.

1.12 ETHICAL CONSIDERATIONS

According to Henn, Weinstein and Foard (2009:80), ethics is "a branch of philosophy and refers to moral conduct". It is also a method, procedure or view for deciding how to act when analyzing complex issues (Ross 2012:147). It also concerns researchers' behaviour and the consequences their research for the people they study (Ross 2012:147). Ethical issues have the potential to impact at every stage of the research process and in any research project (Henn et al 2009:80). It is therefore the responsibility of the researcher to have a clear understanding of the ways in which ethical dilemmas can arise when carrying out the research study. All researchers are expected to follow appropriate ethical behaviour when conducting their research. Ethical behaviour refers to what is in accordance with the principles of conduct that are considered correct, especially those of a given profession (Henn et al 2009:81). When humans are used as study participants, care must be exercised in ensuring that their rights are protected (Ashcroft 2008:131). Accordingly, the researcher adhered to the ethical principles of permission, veracity, justice, beneficence, and respect (see table 1.7 and chapter 3). The research proposal was sent to the University of South Africa

Health Studies higher degrees committee for approval prior to commencement of the study (see annexure A).

Table 1.7 Summary of ethical principles and human rights in the study

ETHICAL PRINCIPLES	APPLICATION IN THE STUDY
Principle of veracity	• Telling the truth, being honest and sincere • The rights of participants to have full disclosure before participating in research
Principle of justice	• Being fair to participants and not giving preference to some over others • Participants needs must come before the objectives of the study • A duty to avoid discrimination, abuse or exploitation of the participants on the ground of race, religion, sex, age, class and sexual orientation
Principle of beneficence	• The researcher should benefit both the individual participant and society in general • A duty to do good and prevent harm (physical, psychological, social and economic) • A duty of care to protect the weak and vulnerable
Principle of fidelity and respect	• Building of trust where the researcher is obliged to safeguard the welfare of participants • A duty to respect the rights, autonomy and dignity of participants • A duty to promote the well-being and autonomy of participants • The right to self-determination (the freedom to decide whether to participate or not, and to withdraw at any time) • The right to privacy and respect • The right to anonymity and confidentiality

Source: Moule and Hek (2011:36)

1.13 DEFINITIONS OF KEY TERMS

In this study, the following key terms were used as defined below:

TB. Martin (2015:777) defines TB as “an infectious disease caused by the bacillus Mycobacterium tuberculosis and characterised by the formation of nodular lesions in the tissues”.

In this study, TB referred to an airborne infectious disease which patients and healthcare workers may acquire from those patients or other health care workers who have TB but are not on treatment in the Odi Moreteli municipality clinics in Gauteng.

Nurse. A nurse is defined by Martin (2015:524) as “a person trained and experienced in the nursing matters and entrusted with the care of the sick and carrying out of medical and surgical routines”.

The Nursing Act 33 of 2005, as amended defines a professional nurse as “a person who is qualified and competent to independently practise comprehensive nursing in the manner and to the level prescribed and who is capable of assuming responsibility and accountability for such practice” (South Africa 2005:s 34).

The Nursing Act 33 of 2005, as amended defines a staff nurse is a “person educated to practise basic nursing in the manner and to the level prescribed” (South Africa 2005:s 34).

The Nursing Act 33 of 2005, as amended defines an auxiliary nurse is a “person educated to provide elementary nursing care in the manner and to the level prescribed” (South Africa 2005:s 34).

For the purpose of the study, the term “nurse” referred to a person who is a qualified healthcare professional and capable of caring for the sick, providing medical care or medical advice to people seeking it, and able to assume accountability and responsibility for such a role. Nurse, therefore, referred to any nurse (professional nurse, staff nurse and auxiliary nurse) registered with the South African Nursing Council (SANC) to practise such profession and works in the Odi municipality clinics in Gauteng.

Clinic. Venes (2013:501) defines clinic as “a center where preliminary diagnosis is made and treatment given”.

Perception. The *Oxford Advanced Learner's Dictionary* (2006:1079) defines perception as "the way in which something is regarded, understood or interpreted". For the purpose of the study perception refers to the nurses understanding of TB and understanding is important in determining nurses' knowledge and if nurse are knowledgeable their perception and attitude towards TB will also be positive. Therefore knowledge, attitude, and understanding will be used in the study to address the perception of nurse on TB.

Health care facilities. Venes (2013:1077) defines health as "a condition in which all functions of the body and mind are normally active".

The *Oxford Advanced Learner's Dictionary* (2006:213) defines care as "a process of caring for somebody or something and providing what they need for their health and protection".

The *Oxford Advanced Learner's Dictionary* (2006:523) defines facilities as the "buildings, services and equipment that are provided for a particular purpose".

Mitchell and Haroun (2012:46) describe health care facilities as "sources that offer services for patients with all types of needs". Health care facilities range in size from a private physician's office to nationwide health care systems that include hospitals, clinics and long-term care facilities.

In this study, health care facilities referred to the health care sources provided and equipped with the nursing staff to provide medical care to persons in need of medical care and/or health care information. These health care facilities offer preventive, promotive and curative services to all.

1.14 LAYOUT OF THE STUDY

The study consists of five chapters. Chapter 1 introduces the study, briefly describing the problem, purpose and significance, and research design and methodology of the study.
Chapter 2 discusses the literature study conducted for the study.
Chapter 3 covers the research design and methodology.

Chapter 4 presents the data analysis and interpretation.

Chapter 5 presents the findings and makes recommendations for practice and further research.

1.15 CONCLUSION

This chapter stated the research problem, purpose and significance of the study; the research design and methodology, and ethical considerations. Key terms were defined and an outline of the study given.

Chapter 2 discusses the literature review undertaken for the study.

CHAPTER 2

Literature review

2.1 INTRODUCTION

Chapter 1 described the problem, purpose, significance and research design and methodology of the study. This chapter discusses the literature review conducted for the study.

A literature review involves researching, reading and understanding literature relevant to the study (Brink et al 2006:55). In addition, it assists researchers to comprehend and extend their knowledge of the phenomenon under study (Polit & Beck 2012:105). Aveyard (2010:5) defines a literature review as the "comprehensive study and interpretation of literature that relates to a particular topic". The purpose of the literature review is to identify the central issues in the field, to build bridges between related topic areas, to criticize previous studies, and to attempt to integrate what others have done and said (Hall 2008:34; Oliver 2012:5). The researcher conducted a literature review to:

- Determine what has already been established in the literature about contributory factors to the spread of TB in health care facilities.
- Explore nurses' perceptions of the barriers to effective implementation of TB preventive measures.
- Examine nurses' perceptions of the likelihood of compliance with TB preventive measures.

2.2 SCOPE OF THE LITERATURE REVIEW

The literature review covered books, articles, reports and research on the topic. The researcher reviewed local and international TB control policies and guidelines were reviewed to obtain statistical data on the extent of TB and its control; the HBM; health care workers perceptions, and the role of nurses in TB control. The literature review assisted the researcher to develop the theoretical framework based on the HBM, and the research questions for the study.

2.3 THEORETICAL FRAMEWORK

Blonna, Loschiavo and Watter (2011:23) describe a theory as “a set of interrelated concepts, definitions, and propositions that presents a systematic view of events or situations by specifying relations among variables in order to explain and predict the events of the situation”. Theory provides a road map for studying problems, developing appropriate interventions, evaluating their success, and explains the dynamics of health behaviour (NIH 2005:5).

Polit and Beck (2012:128) refer to a framework as “the general conceptual foundation of the study”. Furthermore, although not every study is based on a formal theory or conceptual model, every study has a framework (Polit & Beck 2012:128). This study was grounded on the conceptual framework of the HBM. A theoretical framework consists of “a group of statements composed of concepts related in some way to form an overall view of a phenomenon; it also provides explanations about our experiences of phenomena in the world” (Trainor & Graue 2013:13).

A conceptual model “broadly presents an understanding of the phenomenon of interest and reflects the assumptions and the philosophic views of the model’s design” (Polit & Beck 2012:128). Theoretical frameworks provide descriptive and prescriptive explanations. Descriptive explanations refer to understanding the interaction among a set of variables, and prescriptive explanations anticipate a particular set of outcomes (Fitzpatrick & Kazer 2012:508).

2.4 HEALTH BELIEF MODEL (HBM)

A model stimulates research and provides the researcher with the platform to describe and explain the phenomenon under study (Polit & Beck 2012:130). This study was based on the HBM. The HBM is designed to motivate people to take positive health actions and use the desired behaviour to avoid negative health consequences (Brannon, Feist & Updegraff 2013:69; Edberg 2010:58).

Polit and Beck (2012:136) add that the HBM is based on the understanding that people are likely to take a health- related action if they believe that a negative health condition can be avoided, and have a positive expectation that by taking a recommended action, a negative condition can be avoided. The researcher regarded the HBM as suitable for

this study as it addresses individuals' behaviour through the use of six constructs (see figure 2.1). The HBM illustrates that individuals are likely to carry out health preventive measures if they feel that they are susceptible to a health condition, such as TB (Polit & Beck 2012:136).

The HBM was originally developed as a systematic method to explain and predict preventive health behaviour and thereby provide a framework for understanding why certain individuals fail to engage in preventive health measures (Hayden 2013:65). The HBM attempts to predict health-related behaviour in terms of belief patterns (Brannon et al 2013:69). The model was designed to explain and predict preventive behaviours, as well as sick role and illness behaviour (Bradley 2003:248; Gochman 1988:27; Gurung 2013:188; Hochbaum 1956:377).

The underlying concept of the HBM is that health behaviour is determined by personal beliefs or perceptions about a disease. Individuals must show an interest in and concern about their own health, and believe themselves to be vulnerable to a particular health threat and the consequences thereof (Polit & Beck 2012:136). The model postulates that once individuals perceive a threat to their own health, they can simultaneously be cued to action. If the perceived benefits outweigh the perceived barriers, they will be led to undertake the recommended preventive health action (Hayden 2013:65).

Demographic, socio-psychological and structural variables can influence an individual's decision (Polit & Beck 2012:136). The HBM has become a popular framework used in nursing studies that focus on patient compliance and preventive health care practices (Polit & Beck 2012:136). This study used the HBM to determine the TB preventive practices among nurses in the health care facilities under study.

2.4.1 Origin and development of the HBM

Hochbaum, Rosenstock and Kegels (1952:online) social psychologists at the public health service of the United States of America (USA) developed the HBM in the 1950s to understand why people failed to adopt prevention strategies or screening tests to detect disease early. The model was particularly developed for TB and the public were not receptive of being tested if they did not have symptoms (Hochbaum 1956:377). Furthermore Hochbaum (1956:377) corroborate that people's belief in personal threat of

disease as well as in the effectiveness of any recommended action determined their health behaviour. People would not take preventive action or be screened or tested if they did not have symptoms, therefore certain beliefs or perceptions about the disease had to exist (Hochbaum 1956:379). Later the HBM was used for patients' responses to symptoms and compliance with treatment.

The HBM has six constructs (Hayden 2013:65):

- Perceived susceptibility – people's subjective perception of the risk of acquiring an illness or disease.
- Perceived severity – people's feelings on the seriousness of contracting an illness or disease (or leaving it untreated).
- Perceived benefits – people's perception of the effectiveness of various actions available to reduce the threat of illness or disease (or to cure it).
- Perceived barriers – people's feelings on the obstacles to performing a recommended health action.
- Cue to action – the stimulus needed to trigger the decision-making process to accept a recommended health action.
- Self-efficacy – people's level of confidence in their ability to successfully take a recommended action.

2.4.2 Core assumptions of the HBM as applied to the study

The HBM is based on the understanding that individuals will take health-related action (for instance, implementation and compliance with the TB preventive measures in the health care facilities) if they:

- Feel that a negative health condition (i.e., TB disease) can be avoided.
- Have a positive expectation that by taking a recommended action, they will avoid a negative health condition (i.e., implementing and complying with TB preventive measures in their health care facilities will be effective in preventing TB).
- Believe that they can successfully take a recommended health action (i.e., they can implement the TB preventive measures).

The HBM originally consisted of four constructs representing the perceived threat and net benefits: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Rosenstock et al 1988:175). These constructs were proposed as accounting for people's "readiness to act". An added construct, cues to action, would activate that readiness and stimulate overt behaviour.

In 1988 Rosenstock et al (1988:175) added the concept of self-efficacy to help the HBM better fit the challenges of changing habitual unhealthy behaviours. Self-efficacy, or people's confidence in the ability to successfully perform an action, is a key factor in determining the presence or absence of action. In other words, people have to believe that they can execute a behaviour required to produce a desired outcome. If self-efficacy is lacking then a barrier is added to taking a recommended health action.

Rosenstock et al (1988:175) maintain that people are ready to act if:

- They regard themselves as susceptible to the condition.
- The condition will have potentially serious consequences.
- They believe a course of action available to them would be beneficial in reducing either their susceptibility to or the severity of the condition.
- The benefits of taking the action outweigh the anticipated barrier or costs.
- There are good reasons to believe that action is needed.

2.4.3 Scope and application of the HBM

The HBM uses psychological indicators to predict health behaviours and conditions (Maiman & Becker 1974:336). The model assumes that people's beliefs and attitudes about health behaviours influence their actions just as much as their knowledge of the consequences of these behaviours (Maiman & Becker 1974:336). The model has been applied to a broad range of health behaviours and subject populations. The three broad areas identified are preventive health behaviours, sick role behaviours, and clinic visits (Conner & Norman 1996:176; Janz & Becker 1984:3). In this study, preventive health behaviours referred to individuals' beliefs regarding susceptibility to TB disease, the severity of the disease, and the efficacy of implementing the TB preventive measures. Sick role behaviours referred to individuals' compliance with recommended measures for TB prevention and control in their health care facilities.

The HBM originally focused on preventive actions, such as accepting a screening test or an immunisation. The model has extended beyond screening behaviours to include all preventive actions to illness behaviours and sick role behaviours (Hochbaum 1956:377). Since the extension of the model the general assumption is based on the understanding that individuals will take action to ward off, screen for, or control ill health and a condition if they regard themselves susceptible to the condition; believe it to have potentially serious consequences; believe that a course of action available to them would be beneficial in reducing either their susceptibility to, or the severity of the condition, and believe that the anticipated barriers to taking action are outweighed by its benefits (Rosenstock et al 1988:175).

In 1977, Bandura introduced the concept of self-efficacy to the HBM to increase its explanatory power and make it a more useful tool for practitioners. Bandura (1977:191) defines self-efficacy as "the continuum that one can successfully execute the behaviour required to produce the outcome". The concept of self-efficacy was introduced to apply to long-term behavioural change and is important in the initiation and maintenance of behavioural change. Common psychosocial and environmental factors are also involved in the development and modification of individual health-related behaviour.

2.4.4 Components of the HBM applied to TB prevention

The HBM is divided into five components, namely individuals' perception of the health problem (including perceived susceptibility and perceived severity); modifying factors (including demographic factors, work experience, position and beliefs); the likelihood of action (including perceived benefits and perceived barriers); self-efficacy, and cues to action (see figure 2.1).

The HBM suggests that the likelihood of individuals engaging in a recommended health action is based on their perception (Rosenstock et al 1988:175). The HBM posits that in order for a behavioural change to occur, three factors in health-related action must be present. Individuals' must feel threatened by their current behaviour; believe that a specific change in behaviour will be beneficial by resulting in a valued outcome at an acceptable cost, and must feel competent to implement the recommended change (Rosenstock et al 1988:178).

The HBM has been used to assess screening or preventive behaviours. For the purpose of this study, the components of the HBM applied to TB. The recent increases

in TB morbidity have made additional demands on TB control programmes and this has placed health care facilities in the spotlight. Guidelines for TB control recommend that health care facilities treating patients with TB implement the three priority strategies for TB prevention and control: administrative control measures, environmental control measures, and personal protective measures (CDC 2005:1; WHO 2009:1; NDoH 2009:1). In addition, it is recommended that the following be implemented in the health care facilities: identifying and treating persons who have active TB; finding and screening persons who have had contact with TB patients to determine whether they are infected with TB or have active TB and providing appropriate treatment, and screening populations at high risk for TB infection and the development of TB to detect infected persons, and providing therapy to prevent progression to active TB (CDC 2005:1; WHO 2009:1; NDoH 2009:1).

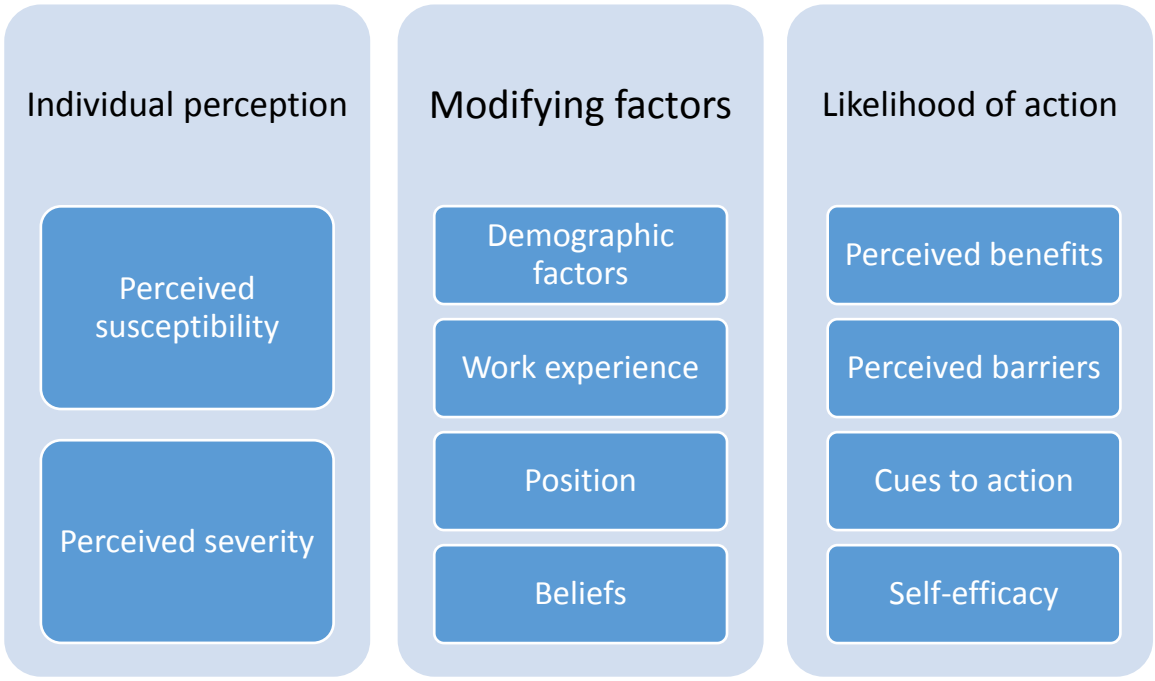


Figure 2.1 Perspectives of the HBM

Source: Glanz, Rimer and Viswanath (2008:52)

2.4.4.1 Individual perception

People's perception of an issue/disease varies. Individual perceptions involve individuals' belief about their susceptibility to disease, as well as the seriousness with which they view the perceived threat of illness (Contento 2009:67). The level of individuals' knowledge of an issue (in this study, TB) influences their perception. As

such, the decision of nurses working in a health care facility treating TB patients to implement and comply with the TB preventive measures will be determined by the individual's perception of the susceptibility to the disease and severity of the disease. Individuals' perceptions focus on their perceived susceptibility and perceived severity.

2.4.4.1.1 Perceived susceptibility.

Perceived susceptibility refers to the extent to which individuals believe they are at risk of contracting a disease or developing a health problem; that is, their personal evaluation of a risk (Blonna et al 2011:23). Sometimes, however, the perception of the risk may be based on misinformation or lack of information, and when this information is corrected the perceived level of risk may change to adopt risk reducing behaviour (Blonna et al 2011:23). In this study, perceived susceptibility was based on two components, namely definition of population at risk, and their levels and personalisation of risk based on a person's traits or behaviours (NIH 2005:14).

- *Definition of population at risk and their levels*

TB is carried in airborne particles known as droplet nuclei generated when persons with TB cough or sneeze (Porth 2011:550). Infection occurs when a susceptible person inhales the droplet nuclei containing the bacilli, and the bacilli then become established in the alveoli and spread throughout the body (Porth 2011:550). Kellerman (2014:387) maintains that the susceptibility to TB infection and subsequent progression to TB disease is influenced by the complex interaction of host, pathogen, and environmental factors. Twenty to thirty percent of individuals exposed to a person with active TB become infected (McCance & Huether 2014:331). The immune system is able to contain the infection in 90% to 95% of persons infected (McCance & Huether 2014:331). Following infection, protective immunity mediated by the subsets of T-lymphocytes produces soluble lymphokines that enable macrophages to kill intracellular bacilli (Kellerman 2014:387). Moreover, the bacilli are often not completely eradicated and remain dormant in macrophages or other cells with potential reactivation to active TB when the immune system wanes (Kellerman 2014:388). People with medical conditions and children under five are considered to be at risk because their immune system might not be adequate to fight the TB bacteria following infection

while HIV-infected individuals are more prevalent to active TB disease due to HIV associated immuno-suppression (Diedrich & Flynn 2011:1410; Getahun, Gunneberg, Granich & Nunn 2010:S204; Houlihan, Mutevedzi, Lessels, Cooke, Tanser & Newell 2010:online). The risk of nosocomial transmission of TB is high in sub-Saharan Africa, especially due to the high incidence of HIV-positive patients with their lower resistance to infections (Getahun et al 2010:S205).

Nienhaus et al (2014:online) point out that evidence that TB may be transmitted between patients and Health care workers and vice versa in health care settings renewed interest in TB infection control, especially in resource-limited settings with high TB prevalence. Bantubani et al (2014:online) emphasise that the risk of contracting TB between patients and staff and amongst each other is greater when larger numbers of infectious TB patients are managed at health care facilities that do not have effective infection control measures.

Not only patients or persons who suffer from various diseases or conditions are susceptible to TB, but healthy nurses who work in clinics and are exposed to the Mycobacterium bacilli may also contract the disease. Health care workers in high TB burden countries have a higher risk of contracting TB infection compared to the general population (Churchyard et al 2014:246; Muzzi et al 2014:online; Naidoo et al 2012:1600; Nienhaus et al 2014:online; Sissolak et al 2011:online).

In a study to estimate the incidence of new TB infection among young nursing trainees at the Christian Medical College in Southern India, Christopher, Daley, Armstrong, James, Gupta, Premkumar, Michael, Radha, Zwerling, Schiller, Dendukuri and Pai (2011:online) found that Health care workers in high burden TB countries had a higher risk of TB infection and disease compared to the general population because of their exposure to large numbers of recognized and unrecognized smear-positive PTB cases managed at their health care facilities, due to inadequate implementation of TB infection control. In addition, the estimated prevalence of latent TB infection among Health care workers in low- and middle-income countries was 54% (Christopher et al 2011:online).

Nurses' role in TB control places the added responsibility on them to protect patients and themselves from the disease through the implementation of infection

control measures (Mahmud, Dates, Akil & Ahmad 2011:2530) (see table 2.2). Therefore nurses' knowledge of TB is vital to change their perception regarding the disease. Knowledge plays a major role as it determines how people react and perceive the health problem, prompts people to execute public health measures, such as interruption of person-to- person transmission, by promptly identifying and treating patients with infectious PTB and ensuring that they are not exposed to new contacts until treatment has rendered them non-infectious (Mahmud et al 2011:2530).

- *Level and personalisation of risk of infection based on individual behaviour*

Personalisation of the risk of contracting the disease is significant as it prompts individuals to implement precautionary measures. Several factors associated with personal risk may influence individuals' perception of susceptibility. For instance, their general TB knowledge, level of training, and insight into the TB control guidelines and policies may influence personal behaviour (Oblitas, Loncharich, Salazar, David, Silva & Velásquez 2010:132). Nurses of different categories may implement TB control measures differently through having different perceptions of the disease susceptibility (Oblitas et al 2010:132). The NDoH (2009:92) recommends the use of workplace, practice and administrative controls as they reduce the risk of TB transmission within the healthcare facilities, by preventing TB exposure for staff and patients and reducing the spread of infection by insuring rapid and recommended diagnostic investigation and treatment for staff and patients known to have TB.

2.4.4.1.2 Perceived severity.

Perceived severity refers to the extent to which an individual believes an illness to be serious. It is determined by the individual's belief about the significance or gravity of an illness, thus not everyone assigns the same weight to a health condition (Blonna et al 2011:24). TB is an infectious disease caused by the bacillus Mycobacterium tuberculosis, which typically affects the lungs (PTB) but can affect other sites as well (EPTB) (WHO 2014:1). The disease is spread in the air when people who are sick with PTB expel bacteria, for example by coughing (WHO 2014:1). Persons who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli (CDC

2005:5). The CDC (2005:5) emphasises the following characteristics of a patient with TB to be associated with infectiousness of the disease: presence of a cough, especially lasting 3 weeks or longer; failure of the TB patient with TB to cover the mouth and nose when coughing; inappropriate or inadequate treatment (drugs, duration); positive culture for mycobacterium TB, and positive acid fast bacilli sputum smear results.

In 1993, the WHO declared TB a global emergency which led to the recommendation of the directly observed treatment short course (DOTS) as a cost-effective strategy for TB control worldwide (Boire, Riedel, Parrish & Riedel 2013:online). Despite the DOTS strategy, TB still remains a major public health problem (Boire et al 2013:online; WHO 2014:1). Although a preventable disease, the risk of health care-associated TB still remains high for patients and nurses; outbreaks of health care-associated TB are usually associated with delays in diagnosis and treatment or the care of patients in sub-optimal facilities (Godfrey, Villa, Dawson, Swindells & Schouten 2014:e117).

Perceived severity of the disease can be attributed to several factors, including lack of knowledge on the disease, which may lead to individual failure to implement specific control measures for the condition. Lack of knowledge on TB may increase the risk of TB infection, although having knowledge does not necessarily translate into safe practice. Individuals may have knowledge on TB, but may perceive themselves not to be susceptible to the disease and may therefore not implement preventive measures against the disease (Woith et al 2012:1092). Nurses' knowledge and perception of TB and the disease control measures may be enhanced by the following as recommended by the NDoH (2007:13).

- *Staff training*

  Infection prevention and control is effective only if all staff working in a facility understands the importance of the infection prevention and control policies and their role in implementing them (NDoH 2007:13). As part of training, nurses and Health care workers should receive job category specific instruction (NDoH 2007:13). Training should be provided before initial assignment and continuing (ongoing) education provided thereafter.

Aspects to be included in training

- *Basic concepts of mycobacterium tuberculosis transmission and pathogenesis*. TB particles are minute, usually 1-5 microns in size, and can be kept airborne by the normal air currents and can therefore be spread throughout the room or the building. TB infection occurs when a susceptible person inhales the droplet nuclei containing the bacilli, and the bacilli then become established in the alveoli and spread throughout the body (Lyons 2011:441). Following infection with the bacilli usually two to three weeks the body's immunity usually limits further multiplication and spread of the bacilli (Lyons 2011:441). About 1% of the people infected with the bacilli will progress to the active disease and 5-10% will remain latently infected and may only develop the active disease after months, years or decades, when the bacteria begin to replicate and produce the disease (VanMeter & Hubert 2014:291). It is therefore important that health care facilities ensure that health care workers are educated on the signs and symptoms of TB; transmission of TB, including the difference between latent and active TB infection, and how they are managed.
- *Risk of TB transmission to health care workers and patients and supportive data.* It is the responsibility of the individual facility to ensure that health care workers are trained in the principles and practices of TB infection control that reduce the risk for transmission of the disease in their health care facilities, including information on the hierarchy of TB infection control measures and the facilities' policies and procedures. Additional site specific control measures should be provided to nurses working in highly infectious areas such as the TB room (WHO 2009:4). The potential for nosocomial transmission and occupational exposure to persons who have infectious TB in the health care facilities should be emphasised so that nurses can promptly identify those suspected or confirmed to have infectious TB and separate them from the rest of the group to reduce the risk of exposure (Godfrey et al 2014:e116). Health care workers should be given information on the prevalence of the disease in their community and facility to ensure proper planning of community and facility specific infection control measures that is (WHO 2009:7).

- *Signs and symptoms of TB.* Nurses should be offered training on the signs and symptoms of TB to enable them to promptly identify those patients that are infectious at their health care facilities and isolate them. This will also ensure that health care workers are knowledgeable as to when the patient with active TB on treatment can be deemed un-infectious and knowledge of signs and symptoms of TB among health care workers play a significant role in the control of TB as they will investigate those with signs and symptoms and properly manage them. Those who require treatment will receive treatment and consequently the risk of infection to others will be reduced (WHO 2009:11).
- *Impact of HIV infection on increasing risk of developing TB disease and the importance of TB as a major cause of morbidity and mortality in people living with HIV* (WHO 2011:1). TB is one of the major causes of morbidity and mortality among HIV-infected individuals as it impairs their cell-mediated immunity and reduces the body's ability to fight the TB infection. Active screening and early recognition of TB in people living with HIV can reduce mortality and morbidity. It is therefore the responsibility of the health care facilities to ensure that health care workers are trained in the screening of all patients including health care workers with HIV (WHO 2011:4). People living with HIV should be screened for active TB, using the four symptom screen: cough of any duration; fever; soaking night sweats, and unexplained loss of weight. The aim of the symptom screen is to ensure early identification of TB in people living with HIV in order to reduce mortality and morbidity in this population (WHO 2011:4).
- *Importance of the infection prevention and control measures and health care workers' responsibilities in implementing them.* The infection prevention and control measures are the responsibility of every health care worker in the health care facility. However, the facility still remains responsible for ensuring that there is a facility-specific TB infection control plan available for individual facilities, and that health care workers are trained to execute such plan (WHO 2009:5). The WHO (2009:11) recommends that individual facilities have a TB infection control committee which will ensure that TB prevention and control measures are adhered to and that health care workers receive training relevant to persons in their particular occupation.

- *Measures to minimize TB exposure for health care workers with compromised immune systems*. Health care workers should be encouraged to report any medical conditions that may impair their cell-mediated immunity as this affects their immune system's ability to fight TB and other infections. Those found to have such medical conditions can be given the opportunity to work in areas with low risk for TB disease. Health care workers with compromised immune systems should also be educated on the importance of screening for signs and symptoms using the four symptom screen to exclude active disease (WHO 2011:4). The WHO (2013b:25) recommends that health care workers working in the health care facilities treating TB patients should be screened for TB using the tuberculin skin test (TST) and those found to have a positive skin reaction should be further screened for signs and symptoms of TB. If they do not have any signs and symptoms of TB they should be treated for latent TB infection. Those with active TB should be given a full course of TB treatment and be educated on the risk of transmitting the infection to other Health care workers and patients. It is therefore the responsibility of individual health care facilities to ensure that nurses are trained in the measures to be implemented to minimize TB exposure for health care workers with compromised immune systems.
- *Patient education and awareness.* Patients in the health care facilities should be educated on the signs and symptoms of TB, including cough etiquette and isolation for TB suspects, to reduce TB-related stigma (Linton 2012:598).

- *Implementation of screening programmes for nurses and other health care workers*

  Health care workers' work puts them at increased risk of contracting TB in their work settings compared to the general population. The NDoH (2014:81) recommends that health care workers be screened annually for TB disease. TB screening can be done through chest radiography, sputum microscopy for acid fast bacilli, TST (NDoH 2014:81). TST is considered to be imperative as it can diagnose latent TB infection and in this case latently infected personnel can be given prophylaxis, such as IPT currently

used in South Africa, to protect them for progressing to active TB (WHO 2011:9).

The WHO (2011:9) recommends that IPT be given as prophylaxis for the prevention of active TB amongst HIV-infected patients. In a study to measure the level of uptake and effectiveness of IPT in reducing the incidence of TB in people living with HIV receiving HIV care between 2007 and 2010 in five hospitals in southern Ethiopia, Yirdaw, Jerene, Gashu, Edginton, Kumar, Letamo, Feleke, Teklu, Zewdu, Weiss and Ruff (2014:online) found that IPT intake in addition to antiretroviral treatment (ART) could be beneficial in reducing risk of TB among people living with HIV in high TB and HIV settings in resource-limited countries. The findings revealed that the TB incidence rate in those who took IPT was 0.7 per 100 per year and 6.1 per 100 per year for those who did not (IRR: 0.11; 95% confidence interval [CI]: 0.08–0.15 before controlling for effect of ART). This protective effect of IPT intake persisted whether therapy completion was documented or not. Therefore for this efficacy the WHO (2011:4) recommends that IPT be considered as part of a package of prevention and care for nurses and other Health care workers exposed to TB. Churchyard, Chaisson, Maartens and Getahun (2014:339) examined preventive therapy utilisation, particularly continuous IPT, in HIV-positive people to reduce individual risk of TB and contribute to TB control. The study found that IPT combined with ART reduced the risk of TB by 80% to 97% and death by up to 50% in HIV-infected persons. Moreover, IPT, taken for 12 months with ART, decreased TB incidence by 37% (hazard ratio [HR] 0.63; 95% CI 0.41 - 0.94) overall compared with ART alone (Churchyard et al 2014:340). Christopher et al (2011:online) found a 41% prevalence of latent TB infection among student nurses and recommended IPT implementation among nurses.

- **Increasing access to voluntary HIV testing for Health care workers**

Encouraging and enabling health care workers to know their HIV status should be a priority of all health care services, as the rate of HIV infection in health care workers may be similar to that of the broader community (NDoH 2007:15). Expansion of access to HIV testing for health care workers is essential for the facilities to give extra care to those found to be HIV infected. In addition, HIV-infected health care workers are at increased risk of developing TB if exposed (NDoH 2007:15). Between 30% and 40% of people infected with HIV living in high burden TB settings will develop TB in their lifetime

and their chances of developing TB is 10% annually compared to the lifetime 10% for HIV-negative people (Li, Manji, Spiegelman, Muya, Mwiru, Liu, Chalamilla, Fawzi & Duggan 2013:1281; Pretorius, Menzies, Chindelevitch, Cohen, Cori, Eaton, Frazer, Gopalappa, Hallett, Salomon, Stover, White & Dodd 2014:S33; WHO 2011:2). Therefore immuno-compromised Health care workers should be given opportunities to work in areas with lower risk of exposure to TB (NDoH 2007:15).

2.4.4.2 Likelihood of action

Variables affecting the likelihood of taking action to prevent a disease are influenced by the degree of individual perceptions of the severity of the disease and to what level the individual feels at risk of contracting the disease. Hodges and Videto (2011:148) maintain that this is viewed together with the cost-benefit analysis of taking preventive action and the perceived ability to take preventive action. Furthermore, an individual's perceived benefits and perceived barriers to engaging in the recommended action are weighed, along with the perceived level of threat and self-efficacy related to the specific behaviour, to produce the likelihood of action (Hodges & Videto 2011:148). In this study, nurses' perception of the factors contributing to the spread of TB will influence their perceived level of threat to TB and their likelihood of implementing recommended actions for prevention of the disease in their health care facilities. Self-efficacy refers to nurses' beliefs regarding their ability to successfully implement and comply with the TB preventive measures, after perceiving themselves to be susceptible to TB within their health care facilities. The likelihood of action focuses on the constructs of perceived benefits, perceived barriers, self-efficacy and cues to action which will be discussed further as applicable to the study.

2.4.4.2.1 Perceived benefits.

Perceived benefits are the benefits that people believe will come from changing their behaviour. For behavioural change to occur which may be beneficial for their health, the change must be perceived as advantageous (Blonna et al 2011:24). An individual must have a belief regarding the efficacy of the recommended TB preventive measures (Blonna et al 2011:24).

> Perceived benefits may differ for nurses and depend on several factors. Some nurses may perceive implementation of TB control measures as important

whereas others may not. Woith et al (2012:1094) found that ongoing education for nurses and other health care workers motivated them to implement TB control measures, enhanced their attitudes, and led to appropriate personal beliefs which influenced their behaviour. Nurses reported that they implemented TB control measures due to fear of infecting their loved ones, and that they wanted to stay healthy. Although education increases the likelihood of TB control measures, there are still problems (Woith et al 2012:1093). Some nurses may still not implement the recommended control measure despite knowing the risks involved. According to Woith et al (2012:1093), although the respondents perceived TB as a serious disease, they were not able to execute TB control measures due to facility-related and individual factors. Facility-related factors included unavailability of resources needed for implementation, while individual factors included discomfort and allergic reactions experienced from wearing N95 masks (Woith et al 2012:1093). Health care associated TB is a multifaceted problem, and requires an understanding of nurses' perception of the TB control measures.

Besides TB being an airborne infectious disease, it is also a preventable disease. Nurses' perceptions of TB preventive measures are important, especially in health care facilities as the incidence of TB infection and disease among individuals in health care settings exceeds that among the general population (Sissolak et al 2011:online). Nurses should be educated and trained on how, where and when to implement TB control measures and their roles in TB control should be clearly defined (Sissolak et al 2011:online). The International Council of Nurses (ICN) (2008:42) stipulates fundamental responsibilities of nurses, including health promotion and illness prevention. Failure to adhere to their responsibilities may lead to a negative health outcome. It is their role as nurses to identify individuals at risk of contracting TB within their health facilities and to take preventive measures to protect their health (ICN 2008:42). Therefore health promotion and disease prevention are critical in the control of TB in health care settings.

- *Health promotion*

  Health promotion refers to the process of enabling people to increase control over and improve their health (Talbot & Verrinder 2009:265). Health promotion is a cornerstone for good health, and is an art and science that is integrated into PHC to reduce existing health problems (Sharma & Romas 2010:27). It also aims at reducing differences in current health status and ensuring equal opportunities and resources to enable all people to achieve their fullest health potential (Talbot & Verrinder 2009:265). This includes a secure foundation in a supportive environment, access to information, life skills and opportunities for making healthy choices (Dixey 2013:1).

  Health care workers and patients in PHC facilities are sometimes exposed to conditions that are hazardous to their health. TB is one of the conditions that may threaten their health as it is an airborne disease and can be contracted through inhalation (Dixey 2013:1). Therefore a supportive environment, and nursing skills and competencies are of paramount importance in the prevention of the disease and can be achieved through education of Health care workers and nurses so that it enables them to tackle the complex challenges of TB (Odendal 2013:2).

- *Disease prevention*

  Second to health promotion is the implementation of disease prevention strategies to reduce the spread of TB in health care facilities. Nosocomial infections occur globally and affect both developed and resource-poor countries (WHO 2013b:1). Infection rates are higher among individuals with increased susceptibility due to factors such as age, occupation and underlying illness (Alavi & Alavi 2013:online).

  TB is considered a nosocomial infection because people with suspected or confirmed TB are found at the same health care facilities as individuals without TB, thereby placing them at risk of acquiring TB as they are exposed (Alavi & Alavi 2013:online).

  TB is the leading cause of morbidity and mortality for people living with HIV. At heath care facilities both TB infected and uninfected patients

congregate. Patients with infections or carriers of pathogenic microorganisms found in PHC settings are potential sources of infection (WHO 2013b:3). Disease prevention within health care facilities is essential for the containment of the disease. Implementation of infection control practices is the role of nursing staff (ICN 2008:42). Nurses should be familiar with the practices to prevent the occurrence and spread of infection, and maintenance of appropriate practices (ICN 2008:42). This role can be enhanced by the facility manager, who must provide leadership by supporting the infection control programme.

The nursing role in health promotion and disease must be fostered to allow effective and full functioning of the nursing workforce as it tackles the global TB pandemic (ICN 2008:43). Nurses are challenged to deal with the burden of TB-related disease, and they also play an essential role for the successful global TB control program initiatives. Nurses in the primary health care settings are responsible for the proper identification and management of patients with suspected TB, management of patients with confirmed TB, protection of non TB patients from those with infectious TB, screening of patients who have been in contact with TB patients, and implementation of TB prevention and control measures (Glaziou, Falzon, Floyd & Raviglione 2013:online; NDoH 2014:81).

Nurses are therefore considered the natural ally in the fight against TB due to their frontline presence in health care facilities. In addition, nursing skills and competencies in the detection and management of TB are needed for appropriate control of TB in the health care facilities (ICN 2008:43). Nursing education training programmes focusing on TB prevention and care at the basic and more advanced levels are an effective way of improving competencies and will prepare the nurses to deal with the complexities of the disease and its management (ICN 2008:44). Nurses trained in TB control should receive ongoing training and support to perceive TB control as essential. Through proper support nurses will have access to information needed to make a success of the programme (Firmino, Tavares, Tiemi, Paula & Scatena 2012:31). A strong PHC system is associated with better health outcomes (WHO 2009:5). The

NDoH (2011:51) emphasises a strong PHC system as pivotal in the control of TB.

According to the WHO (2009:9), efficacious control measures for the prevention of TB in health care settings include administrative control measures, engineering and personal respiratory protection. Well-designed and managed TB infection control programmes have been effective in reducing TB transmission in health care facilities (Farley, Tudor, Mphahlele, Franz, Perrin, Dorman & Van der Walt 2012:online; Robert, Affolabi, Awokou, Nolna, Manouan, Acho, Gninafon & Trebucq 2013:194).

In South Africa the NDoH (2009:91) has laid down guidelines for the national control and management of TB to be adhered to at health care facilities to reduce the spread of TB. The guidelines are intended to reduce the production of infectious TB aerosols in the local environment; to eliminate infectious TB aerosols once generated, and to decrease or prevent inhalation of infectious TB particles by staff and clients, and thereby minimise the individuals' risk of developing reactivation of TB (NDoH 2009:92).

a) *Three-level hierarchy for TB prevention in health care facilities*. The NDoH (2009:92) guidelines for TB management stipulate certain measures for the reduction of TB in health care facilities and entail administrative control measures, environmental control measures, and personal protection.

- *Administrative control measures*

When an infectious person with TB coughs, sneezes or laughs, tiny droplets containing Mycobacterium TB are released into the air. These droplets are invisible to the naked eye and remain airborne for several hours, until removed by natural or mechanical ventilation (NDoH 2009:92). A person who inhales these droplets can become infected with mycobacterium TB and later go on to develop active TB (NDoH 2009:92). Administrative measures aim to reduce droplet nuclei containing Mycobacterium tuberculosis in health facilities and thus to reduce the

exposure of staff and clients (NDoH 2009:92). A comprehensive, written infection control plan underpins administrative control Administrative controls include the early investigation, diagnosis and effective treatment of patients diagnosed with active TB disease (Liao, Lin & Cheng 2013:74). This includes ready access to laboratory diagnosis and a heightened diagnosis amongst nurses and other Health care workers (Liao et al 2012:74). Seto, Conly, Pessoa-Silva, Malik & Eremin (2013:S41) maintain that when a patient is first seen in the hospital or other health care site, usually in an outpatient setting, a system should be established for clinical triage where patients are screened for specific signs and symptoms. Furthermore, the moment these symptoms are detected, the patients should be separated from other patients in the health care facility (Seto et al 2013:S41).The following administrative control strategies are recommended to reduce the production of infectious TB particles in health care settings:

- *Screening of clients*. All clients entering health care facilities should be screened for cough as they enter the facilities (Seto et al 2013:S41). A designated staff member at the facility should be assigned to perform this task. A poster promoting client disclosure of coughing should be displayed in a prominent position in the reception area. This will reduce stigma and encourage clients to come forward if they have a problem.
- *Education of clients in coughing hygiene.* All clients should be educated that TB is spread through coughing and those with a current cough will be advised to cover their mouth with a tissue or their elbow while coughing and not to cough into the air or their hands (Robert et al 2013:194).
- *Provision of masks to coughing clients.* Coughing in the masks traps the droplets from the cough and prevents the generation of the droplet nuclei which may be suspended in the air and cause exposure for other patients (Reproductive Health and HIV Research Unit [RHRU] 2009:30). This is possible if there is a continuous supply of masks to coughing patients, therefore regular and timely ordering of masks is essential to ensure an uninterrupted supply.

- *Patient triage.* Waiting areas and, if possible, a separate queue should be made to allow separation of clients who cough from those who do not (Nelson & Williams 2014:394; Robert et al 2013:194). Clients who cough should be directed to the appropriate area as they enter the facility.
- *Reduction of waiting time for clients who cough.* Establish a separate queue for clients who cough and ensure shorter waiting time as the longer they remain at the facility, the more droplet particles they generate (Godfrey et al 2014:e117).
- *Early referral and investigation for TB clients who are coughing.* When a cough is not the primary reason for visiting the health facility, and clients other services, they should receive assistance and then be referred for investigation of the cough (Nelson & Williams 2014:394).
- *Provision of a safe environment for sputum collection.* Infection prevention control will be meaningless if no space is provided for safe sputum collection (Nelson & Williams 2014:395). A safe environment ensures that other patients are not exposed to the TB droplets nuclei (Nelson & Williams 2014:395). Therefore all sputum should be collected in a safe environment. A designated area should be identified for sputum collection. In most cases, the safest place for this is outdoors, as there is adequate ventilation.

Tenna, Stenehjem, Margoles, Kacha, Blumberg and Kempker (2013:1294) emphasise that administrative controls will not be successful without staff commitment, and its implementation is necessary within the health care facilities to ensure the success of TB prevention efforts. Health care personnel working at the facilities should be aware of the risks to themselves and patients on account of TB (Tenna et al 2013:1294). These staff should be committed to reducing the risk of TB through implementation of these measures (Tenna et al 2013:1294). An infection prevention and control committee should be formed to co-ordinate activities. The committee should consist of multidisciplinary members, comprising the facility manager, all professional nurses including the TB control programme nurse, enrolled nurses and nursing assistants, general workers, administrative workers and security guards (RHRU 2009:15). This committee ensures that staff members are trained in TB preventive measures and their

implementation and that there is an accessible TB prevention plan in the health care facility (see table 2.1)

Table 2.1 Summary of the responsibilities of the infection and control committee

The responsibilities of the infection prevention and control committee are to
• Meet monthly • Produce and update a TB control plan • Review the quality of TB infection control in the facility • Ensure ongoing staff training in TB infection control • Make any changes to the TB infection control protocol • Ensure that TB infection control is implemented • Ensure that finances allow for implementation of TB infection control interventions

Source: RHRU (2009:11)

- **Environmental control strategies to eliminate infectious TB particles in the health care facilities**

  Environmental controls do not eliminate the risk of contracting the disease, but can reduce it (Jindal 2011:609). Environmental control measures that can be implemented in a low-resource setting include ventilation (natural and mechanical) and space. Natural ventilation relies on open doors and windows, which assist with the dilution and removal of air from infectious patient areas away from patients not suffering from the disease (Lygizos et al 2013:online). In health care facilities that do not have adequate windows to allow for natural ventilation, affordable mechanical ventilation (e.g., fans) can be used to reduce the concentration of infectious droplet nuclei. In traditional homes in rural KwaZulu-Natal, South Africa, Lygizos et al (2013:online) found that natural ventilation reduced high TB transmission risk.

a) *Ventilation as an environmental control strategy.* Ventilation is essential in the prevention of TB. Ventilation involves the removal of infected air and replacement with clean air. This has the effect of removing infectious particles and diluting those that remain, so that the chances of inhaling infectious particles are minimized (Nelson & Williams 2014:394). It also controls the direction of airflow so that air flows from less contaminated to more contaminated areas.

- *Maintain well-ventilated areas for clients.* Waiting areas for clients should be selected on the basis of the degree of ventilation available in that area.
- *Maintenance of good air circulation by opening windows and use of fans in waiting areas and consulting rooms.* Inside waiting areas should be well ventilated through opening windows. Air mixing should be maintained. The mixing of air is critical to ensure that all air has an equal chance of being vented to the outside. When air is still, pockets of air may contain higher concentrations of infectious droplets, and therefore increase risk to clients.

b) *Use of ultraviolet germicidal radiation (UVGI) units.* UVGIs are useful companion interventions to administrative controls and ventilation, but are expensive and require regular maintenance and are therefore not recommended for low-resource settings.

- **Personal risk reduction strategies to reduce the inhalation of infectious TB particles by staff and clients in health care facilities**

  Health care workers working with infected patients and suspect patients should always wear “N95 masks”, which are masks that filter particles one micron in size with a filter efficiency of at least 95% to prevent themselves from being infected with TB (Nelson & Williams 2014:394). Respirators are currently the best available method of guarding against the inhalation of TB bacilli. Patients suspected of being infected by TB should be offered surgical masks to protect other patients and Health care workers from being exposed to their droplet nuclei (Shenoi, Escombe & Friedland 2011:online).

Personal respiratory protection is the third line of defence for TB control when TB risk cannot be adequately reduced by administrative and engineering controls. This includes respiratory masks, which, unlike facemasks, prevent contamination by small particles (Ratnamani & Rao 2013:282)**.** If fitted and used properly to prevent face seal leaks, a respirator greatly reduces the chance that inhaled air will contain infectious tubercle bacilli (Bock, Jensen, Miller & Nardell 2007:S110). N95 masks are useful where strategies to limit production of infectious aerosols are only partially effective. N95 masks can be used by Health care workers to prevent themselves from inhaling the TB bacilli (Bessesen, Savor-Price, Simberkoff, Reich, Pavia & Radonovich 2013:904; Ratnamani & Rao 2013:282). However, respirators that are not worn as recommended or cared for in a manner that maintains their integrity afford little protection. According to a study in the San Francisco Department of Public Health and the University of California, Francis (2007:71) found that the effectiveness of the N95 respirator mask is determined by face-seal and fit characteristics. A well-fitting respirator and a fit test produce better results than a well-fitted respirator without a fit test or a poor fitting respirator with fit test. The overall effectiveness of the N95 respirator mask protection is affected by the level of respirator selected, fit characteristics, the care in using the respirator, and training on fit tests.

- **Encouraging health care workers to know their HIV status and to take isoniazid prophylaxis, if appropriate**

TB is the most frequent life-threatening opportunistic disease among people living with HIV and remains a leading cause of mortality, even among persons receiving ART (NDoH 2010:3); IPT dramatically reduces morbidity and mortality from TB among people living with HIV (Getahun, Kittikraisak, Heilig, Corbett, Ayles, Cain, Grant, Churchyard, Kimerling, Shah, Lawn, Wood, Maartens & Granich 2011:online; Gray, Young, Zar, Cotton, Van Dalen & Kremer 2009:1447; Saraceni, Cohn, Cavalcante, Pacheco, Moulton, Chaisson & Golub 2014:100). The WHO and Joint United Nations programme on HIV and AIDS (UNAIDS) recognize the effectiveness of IPT among people living with HIV and recommend its use

as part of an essential care package for these patients (WHO 1998:7; UNAIDS 2010:1). This statement recommends IPT for all people living with HIV in areas with a prevalence of latent TB infection of more than 30% and for all people with documented latent TB infection or exposure to an infectious TB case (WHO 1998:7; UNAIDS 2010:5). The NDoH (2010:1) reinforced these recommendations in the guidelines for TB preventive therapy among HIV-infected individuals in South Africa. However, the successful implementation of the recommendations depends on individual countries' commitment. In a study to measure progress in implementing IPT among the 69 countries with high burden of HIV and TB, only 41 countries responded (Date, Vitoria, Granich, Banda, Fox & Gilks 2010:253). Of the 41 countries that responded, 21 (51%) had a national policy on IPT but only 6 (28%) of them had achieved nationwide implementation of policy recommendations and guidelines. South Africa is considered a high TB prevalence area and isoniazid may be an effective TB preventive measure for people living with HIV and will also prevent subsequent development of active TB (NDoH 2010:2).

2.4.4.2.2 Perceived barriers

Barriers are created when health care workers or nurses believe that the behaviour change they propose to patients will be ineffective. Individuals who perceive barriers are unlikely to adopt positive preventive behaviours as they believe that actions to overcome or address the barriers will not produce the desired result (Blonna et al 2011:24). In this study, perceived barriers referred to nurses' perception of the negative aspects of the recommended TB preventive measures. South Africa has guidelines for the management of TB in health care facilities, and it is important for the facilities to have a policy in place which reflects the current guidelines and legislation on the control of TB in health care settings (NDoH 2014:3).

A strong PHC system is associated with better health outcomes. Moreover, a strong PHC system is pivotal in the control of TB (NDoH 2011:51). Health care providers in PHC facilities are at the forefront of the battle against TB, and at increased risk of acquiring TB infection from their work environments. Although TB infection control measures in place in clinics may reduce infection transmission, implementation remains

a major challenge. Nurses in PHC facilities have the responsibility to promote health, prevent illness, restore health, and alleviate suffering (ICN 2008:43). These inherent nursing roles are essential for proper TB control and must be fostered to accomplish effective and full functioning of the nursing workforce in tackling the TB pandemic (ICN 2008:43). Fulfilling these responsibilities requires a diversity of skills, knowledge and training of nurses (ICN 2008:43). Perceived barriers to taking action may be influenced by broad interconnected themes related to the health care system and wider contextual conditions. Lack of knowledge of TB control and health system factors contribute to the poor outcome of the TB control programme (Sissolak et al 2011:online; Woith et al 2012:1092). Lack of training on TB control policies resulted in failure of nurses to implement TB control practices (Sissolak et al 2011:online). Training of Health care workers enhanced their knowledge, understanding and skills and led to improved programme outcomes (Sissolak et al 2011:online).

A study of 57 Health care workers in a 350-bed government district hospital in KwaZulu-Natal, South Africa to assess TB infection control knowledge (TB symptoms/transmission and the use of surgical masks/respirators), attitude (perceptions of various TB infection control tasks and topics) and practice (frequency of, and barriers to, TB infection control implementation) found that respondents were knowledgeable about the symptoms of TB, transmission and use of respirators, and further that the majority were able to identify classic PTB symptoms (Kanjee, Catterick, Moll, Amico & Friedland 2011:334). However, Kanjee et al (2011:335) found several barriers to practices, including that doors and windows, respectively, were ‘always’ closed in their work area observation (during winter); big interdepartmental differences in natural ventilation; the use of a respirator in a room with TB cases/suspects varied between ‘always’ and ‘often’, and compliance ranging from 24.1% to 98.5% by department. Respondents in the study also cited insufficient supplies, discomfort and appearance as impediments to wider use of respirators by staff and occasional cold weather as barriers to natural ventilation (Kanjee et al 2011:335). In a study in Ioannina University Hospital in NW Greece, Charisis, Tatsioni, Gogali, Efthymiou, Katsanos, Daskalopoulos and Konstantinidis (2013:4679) reported that barriers to implementing prevention strategies for TB in hospitals resulted from inadequate personnel knowledge and practices. For example of the respondents who had managed a suspected case, 75.8% used regular masks and 4.7% high protection masks (Charisis et al 2013:4679).

For the purpose of this study, perceived barriers referred to barriers that nurses identify to prevent them from implementing the TB control measures. In health care settings it is the responsibility of the TB infection control committee, facility manager, TB nurse and TB coordinator to ensure that all staff members implement the measures and that an accessible policy is in place outlining the national guidelines for TB control in health care facilities and the role of each health care worker (RHRU 2009:30). Table 2.1 summarises the role of nurses in TB prevention.

Table 2.2 Role of nurses in TB prevention

Role of nurses in TB prevention		
Direct care	**Management**	**Teaching**
• Health promotion • TB prevention (vaccines and biosafety measures) • Comprehensive valuation of patients and families (physical, psychological, nutritional, socioeconomic and cultural) • Comprehensive care to patients and families with TB, multidrug-resistant TB (MDR-TB), pregnant women, vulnerable or disadvantaged populations • Health education for patients, families and communities • Social reinsertion • Empowerment • Critical education for popular participation	• Participation in policy making • Participation in fair budget allocation • Participation in care standards and protocols adapted according to inequality • Nursing resource distribution • Direct care management considering existing inequities • Advocacy	• Human resource training in TB nursing – inequity, social disadvantages, solidarity, citizenship, human rights, participatory budget, etc. • Training collaborators or nursing staff – understanding inequities • Critical health education • Self-learning

Source: ICN (2008:42-55)

2.4.4.2.3 Cues to action

Cues to action refer to the signals or reminders that prompt people to do something (Blonna et al 2011:25). In this study cues to action refer to internal and external events that trigger performance of the recommended action; in this case, implementing measures for TB prevention and control.

According to the WHO (2014:1), South Africa had the third highest estimated total burden of TB in 2013, after only India, and China, countries with much larger populations. This indicates the seriousness of the condition in South Africa and that TB is now a public health emergency and measures should be put in place to tackle the epidemic (NDoH 2010:1; WHO 2013b:1). Health care settings in South Africa are faced with an increased incidence of TB transmission in their facilities as persons with undiagnosed, untreated and potentially contagious TB gather in these facilities putting nurses, other Health care workers and people in these settings at risk of acquiring the disease (WHO 2013b:1). Health care workers in high TB burden countries have a higher risk of TB infection and disease compared to the general population because of their exposure to large numbers of recognized and unrecognized smear-positive PTB cases managed at the health care facilities due to inadequate implementation of TB infection control (Christopher, Shankar, Datey, Zwerling & Pai 2014:247). Furthermore, Christopher et al (2014:247) add that the estimated prevalence of latent TB infection in Health care workers in low- and middle-income countries is 54%, with an annual risk of developing TB disease of between 0.5 and 14.3%. These estimates also affect South Africa as it is classified among middle-income countries.

In a study in three district hospitals in KwaZulu-Natal, South Africa to compare the difference in TB incidence among health care workers with versus without a history of working in TB wards, to estimate the incidence of TB among health care workers, and to identify risk factors for TB disease in Health care workers, Tudor, Van der Walt, Margot, Dorman, Pan, Yenokyan and Farley (2014:online) found that health care workers working in a TB ward had an increased incidence of TB. Furthermore, the study revealed an increased incidence of TB among health care workers with a history of working in TB wards, paediatric wards, outpatient departments, and stores/workshop compared to those without such a history (Tudor et al 2014:online). In addition, health care workers living with HIV had a greater incidence of TB than HIV-negative ones. TB incidence among health care workers was approximately two-fold greater than that of the general population over the study period (Tudor et al 2014:online).

In the Western and Eastern Cape Province, and Cape Town, South Africa, Jarand, Shean, O'Donnell, Loveday, Kvasnovsky, Van der Walt, Adams, Willcox, O'Grady, Zumla and Dheda (2010:1179) analysed 334 case records for clinical and microbiological features, and treatment outcomes for patients with extensively drug-

resistant TB (XDR-TB). Jarand et al (2010:1180) found that 10 of the patients with XDR-TB were health care workers; eight were HIV-uninfected, and four had died of XDR-TB despite treatment. In addition, all 10 health care workers had received an average of 2.4 courses of TB treatment before being diagnosed as XDR-TB (Jarand et al 2010:1180).

from the studies conducted It is evident that health care workers with active TB risk infecting their patients, their fellow staff, families and communities with TB; conversely, health care workers are also at risk of acquiring TB from their patients, fellow staff and family and community members.

Facilities should have written TB policies, TB screening programmes, protective devices for staff members, on-going infection control meetings and written infection control plans, to ensure that nurses and other health care workers understand the importance of TB control measures and will motivate them to implement it. A study to identify barriers and motivators to the use of infection control measures among Russian TB health care workers indicated that supportive behaviour by institutional administrators on ward rounds on the units and words of encouragement to staff promoted the use of infection control measures among staff and also reminded them on the importance of infection control measures (Woith et al 2012:1092). The participants indicated that they practised TB infection control measures as they feared spreading the disease to their family members and friends while some noted that seeing colleagues become infected motivated them (Woith et al 2012:1095).

2.4.4.2.4 Self-efficacy

Self-efficacy refers to people's belief in their own ability to do something (Jones 2014:55). People generally do not try to do something new unless they think they can do it (Jones 2014:55). If people believe a new behaviour is useful (perceived benefits) but do not think they are capable of doing it (perceived barriers), the chances are that it will not be tried. Self-efficacy in this study referred to nurses' beliefs regarding their ability to successfully implement and comply with the measures for TB prevention and control.

The United Nations MDG for TB is to halt and begin to reverse the incidence of the disease by 2015. The WHO Stop TB target is a 70% case detection rate with successful

treatment of 85% of those detected (NDoH 2009:12). The NDoH (2011:51) considers nursing a historical partner in the work against TB, but with greater performance demands. Nurses working in PHC settings are often the first to identify and manage suspected TB cases. This early identification is essential to ensuring a high level of case detection and is a pillar of TB control (ICN 2008:43). Strengthening initiatives should not just target nurses working in specialist TB services, but the generalist nurses as well (ICN 2008:43). In the era of HIV/AIDS, TB is often a co-infection, and overall nursing competence in detection, control, and care is crucial (ICN 2008:43).

Educational outreach has improved TB case detection by nurse practitioners working in South African PHC clinics (WHO 2009:18). In an assessment of barriers to implementation of TB infection control among health care providers in two South African PHC clinics in a Cape Town township with a high TB prevalence, Adeleke (2012:197) found that in-service training and leadership characterized by delegation with supervision motivated health care providers to do the right thing. Moolphate, Lawpoolsri, Pungrassami, Sanguanwongse, Yamada and Kaewkungwal (2013:67) emphasise that healthcare workers' knowledge and understanding about translating guidelines into practice enhance their ability to implement TB preventive measures. Therefore nurses should be trained in the current guidelines of TB control and have access to the policies for TB control in their facilities. TB control policy should also be available in a summarized form and presented in the form of a poster in health care facilities (WHO 2009:17).

2.4.4.3 Modifying factors

Modifying factors refer to factors that influence individual behaviour (Hiremath 2011:178). In this study, modifying factors include demographic variables such as age, qualifications, position and experience. These variables may influence nurses' perception of the factors contributing to the spread of TB in their health care facilities. Rosenstock et al (1988:178) point out that everyone may not perceive personal threat in the same way consequently other factors may influence individuals' perception. In this study, variables such as age, experience and position may influence nurses' perceptions of factors contributing to the spread of TB and consequently their likelihood of implementing and complying with the TB preventive measures in their health care facilities. In addition, training, cultural and ethnic background, practice settings,

preferred sources of information, and learning styles may influence them. It is essential that nurses supporting clients with TB have positive attitudes (College of Nurses of Ontario [CNO] 2009:4). Nurses caring for TB clients come from a wide range of backgrounds and perspectives. Personal and cultural factors may affect their practice (CNO 2009:4). Health care workers need to be aware of and understand the impact culture can have on patients' TB knowledge, attitudes and beliefs and practices (Purnell 2014:5). Nurses should not try to challenge and destabilise cultural interpretations, but should work with patients and seek constructive solutions (Hess 2009:100).

Mentoring can be used to transmit skills, knowledge and attitudes and to alter nurses' perception of TB control (Ghebrehiwet 2008:14). Clinical mentorship is a system of practical training and consultation that fosters ongoing professional development to provide sustainable, high quality clinical care outcomes. Clinical nurses or other mentors must be experienced, practising clinicians in their own right, with strong teaching skills (Ghebrehiwet 2008:14). Mentoring should be seen as part of the continuum of education required to create competent nurses (Ghebrehiwet 2008:15). Mentoring is an integral part of the continuing education process taking place at the facilities where health care workers manage patients.

2.4.5 Limitations of the HBM

Martin, Haskard-Zolnierek and DiMatteo (2010:6) point out that the model tends to analyse the constructs separately. Petrie and Weinman (2013:296) add that the model is static in nature and tends to ignore the potentially critical determinants of health protective behaviours. The model does not give attention to the social and affective process influencing decisions except to ascribe them to the general categories of costs, benefits and severity (Petrie & Weinman 2013:296).

2.5 LEGISLATIVE CONTROL TO GUIDE NURSES ON THE IMPLEMENTATION OF TB CONTROL PROGRAMMES IN THE HEALTH CARE FACILITIES

TB is still the global leading cause of adult death due to a single infectious agent (WHO 2001:4). The WHO (2001:4) states that the high mortality and morbidity are often due to the result of inadequate measures and neglect that have allowed TB control systems to deteriorate or even disappear in many parts of the world. Incorrectly conceptualised and

poorly supervised programmes have contributed to an increase in the burden of the disease (WHO 2001:4). The overriding aim of legislative measures is to prevent the transmission of TB infection and the development of the disease following infection (WHO 2001:3).

Health legislation expresses and formulates health policy and provides a framework for its implementation (WHO 2001:3). Health legislation is mainly determined by health policy and not the other way round.

TB control is covered under communicable disease legislation which aims to:

- Protect the population from communicable diseases by preventing their occurrence or spread
- Ensure that health and other authorities implement the measures necessary to control communicable diseases and to coordinate their efforts
- Safeguard the rights of individuals who are affected by measures to control communicable diseases pursuant to the legislation

In South Africa, the *National infection prevention and control policy for TB, multi-drug resistant TB (MDR-TB) and XDR-TB* (NDoH 2007:4) aims to reduce mortality, morbidity and transmission of the disease until it no longer poses a threat to public health. The purpose is to prevent the transmission of infection and the development of disease following infection. TB control regulations include measures intended to:

- Protect uninfected persons against TB infection
- Detect cases of infectious TB as early as possible after the onset of symptoms and to initiate treatment
- Ensure that persons with active TB are given adequate treatment
- Notify and report cases of TB
- Perform screening to detect TB infection and disease among close contacts of index case
- Prevent the development of disseminated disease in children by offering BCG vaccination

- Prevent the development of the disease by offering prophylactic treatment to certain groups of infected persons

Legislation guides policy makers in the development of TB control policies. Laws serve as guiding principles to ensure that policies are developed within the acceptable standards. The legislative framework of the TB control programme in South Africa (see section 2.5.1-2.5.3) includes

- National Health Act, 61 of 2003
- Occupational Health and Safety Act, 85 of 1993
- South African national TB control guidelines
- National Strategic Plan, 2012-2016
- Millenium Development Goals

2.5.1 National Health Act, 61 of 2003

The National Health Act was developed to ensure unity in the various elements of the national health system with a common goal to actively promote and improve the national health system in South Africa, and to provide for a system of co-operative governance and management of health services, within national guidelines, norms and standards, in which each province, municipality and health district must address questions of health policy and delivery of quality health care services. The Act stipulates that patients should be provided with the best care possible and that health care providers should be qualified and skilled to provide health care services. Therefore nurses working in the TB environment must be skilled and qualified to render such services.

2.5.2 Occupational Health and Safety Act, 85 of 1993

The Occupational Health and Safety Act, 85 of 1993 stipulates that the employer has the responsibility to provide and maintain all equipment necessary to perform work and all systems according to which work must be done, in a condition that will not affect the health and safety of employees. TB has been considered an occupational disease for

many years and one effective strategy for reducing TB transmission in health care facilities is through occupational health policies (Chai, Mattingly & Varma 2013:103). In October 2009, the International Labour Organization (ILO) (2009:6) added TB to its list of occupational diseases, in recognition of the fact that health care workers are at increased risk for TB compared to the general population, and that methods to prevent, diagnose, treat and follow-up cases are well established. Protective equipment should be provided where required to mitigate risks and hazards (CDC 2005:38). Health care workers are required to have free initial and annual screening for TB infection and should also be provided with training and education on TB infection control and prevention (Chai et al 2013:103). Under personal protection, employers are required to provide appropriate particulate respirators to employees and to ensure that they fit correctly (CDC 2005:39). Liao et al (2013:69) stress that the implementation CDC-recommended infection control measures effectively controls outbreaks and prevents TB transmission

2.5.3 South African national TB management guidelines

The NDoH introduced the South African national guidelines for TB control in 2014 with the aim of providing guidance to primary health care personnel and managers in addressing the challenges of TB control and successfully managing clients presenting with TB, including those co-infected with HIV, as well as early detection of drug resistant TB.

Delay in diagnosis may worsen the disease and increase TB transmission (WHO 2009:3). Therefore, timely diagnosis and treatment is critical in TB control.

2.5.4 South African national strategic plan (NSP), 2012-2016

The national strategic plan, 2012-2016 is a five-year strategy developed by the NDoH (2011) in order to

- Address social and structural barriers that increase vulnerability to HIV, STI and TB infection
- Prevent new HIV, TB and STI infections
- Sustain health and wellness

- Increase the protection of human rights and improve access to health care

Despite the NSP 2012-2016 goals, there has been poor tuberculosis infection control in PHC facilities in South Africa which may lead to failure to meet the targets. In a study on TB infection control practices in PHC facilities in three districts of South Africa to explore the extent of training as well as facility-level managerial, administrative, environmental and personal protection, Engelbrecht and Van Rensburg (2013:224) found that many of the participants did not have a screening tool attached to patient files and did not separate coughing patients from other patients.

The findings are supported by Churchyard et al (2014:245) who indicate that the treatment success rate among retreatment cases in South Africa remains poor at 66.3% and that up to 25% of sputum smear-positive TB cases are lost to follow-up before treatment initiation, which may contribute to ongoing transmission and an increased risk of death. The poor infection control practices identified may contribute to the increasing incidence of TB in South Africa, which indicates a clear need for policy-driven interventions, training and support for health care workers (Engelbrecht & Van Rensburg 2013:225).

2.5.5 Millenium Development Goals (MDGs)

Goal 6 of the MDGs aims to “combat HIV and AIDS, malaria and other diseases” and target 8 aims to “halve and begin to reverse the incidence of malaria and other major diseases”. The indicators for this target are much more specific to TB:

- Prevalence and death rates associated with TB
- Proportion of TB cases detected and cured under DOTS

Two targets were previously set for 2005, namely that at least 70% of TB cases should be notified by DOTS programmes, and that 85% of smear-positive patients be cured or have completed treatment. The second target relates to treatment success, which is a combination of cured patients and patients who have completed their treatment, but have no bacteriological confirmation of cure.

2.6 CONCLUSION

This chapter discussed the literature review conducted for the study. The review covered the international and national TB status; preventive measures; policies and current guidelines for TB control, and the HBM as the theoretical framework for the study.

Chapter 3 describes the research design and methodology.

CHAPTER 3

Research methodology

3.1 INTRODUCTION

This chapter describes the research design and methodology of the study (see figure 3.1). The research question determines whether a quantitative or qualitative approach should be used (Babbie & Mouton 2011:75; Houser 2012:391). The approach to the study informs the design which, in turn, determines the type of information to be collected and the data- gathering instrument to be used (Babbie & Mouton 2011:75; Courtney 2009:28). This chapter describes the research approach, the research design, the definitions of concepts and methodology of the study, the data-collection method and instrument, and ethical considerations. The purpose of the study was to describe the perceptions of nurses working in a clinic of the Odi Moretele municipality on the underlying contributory factors in the clinics under investigation that may lead to the spread of TB in the clinics treating TB patients. The objectives of the study were to:

- Describe the perceptions of nurses working in selected Odi Moretele municipality clinics of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients.
- Identify barriers to the implementation of and adherence to tuberculosis preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality.
- Explore the likelihood of compliance with TB preventive measures by nurses working in the selected clinics of the Odi Moretele municipality.

Figure 3.1 illustrates the research process followed in the study.

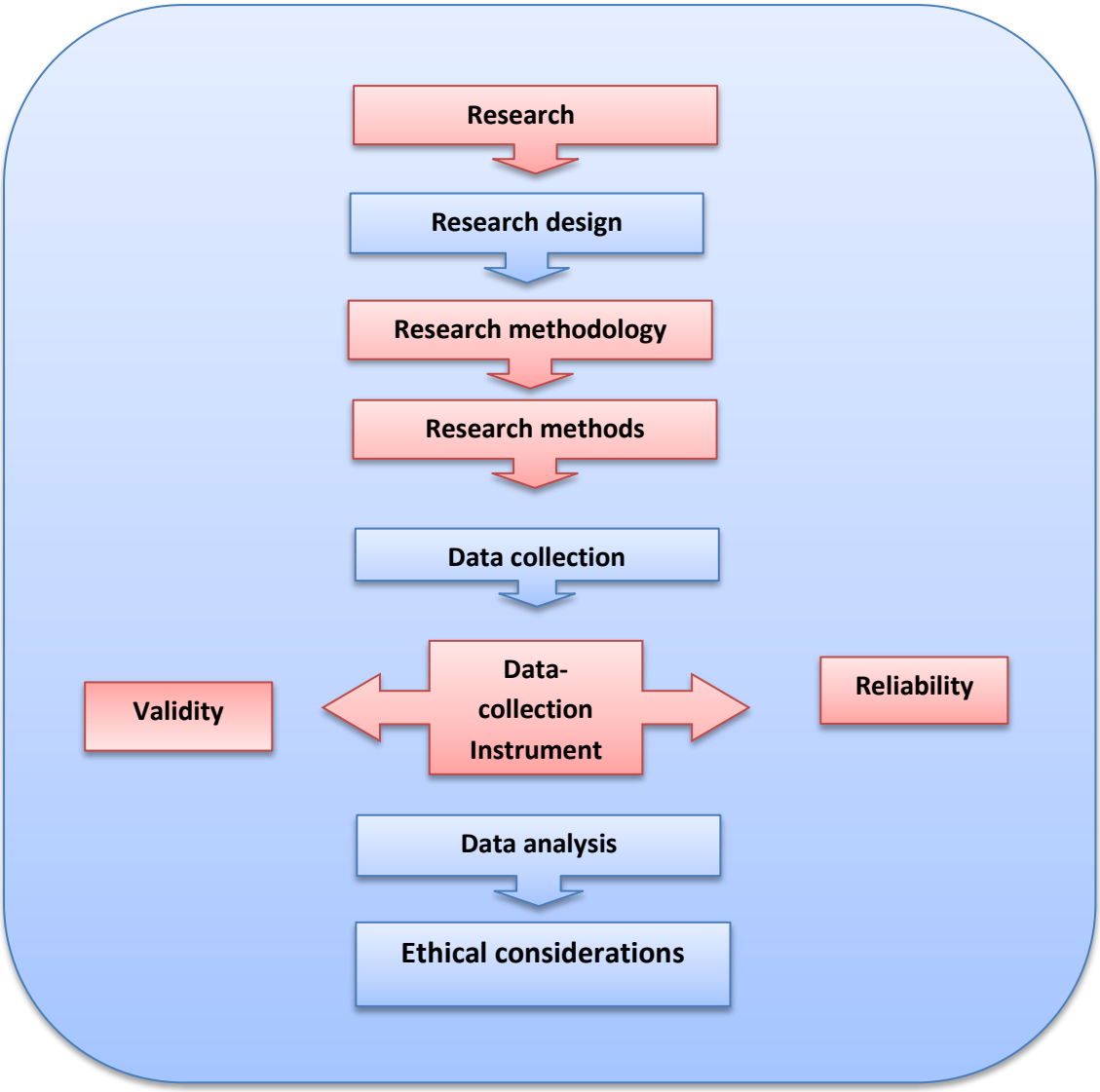


Figure 3.1 Representation of visual steps in the research process

3.2 DEFINITION OF RESEARCH

Research is a process of enquiry and investigation. It is systematic, methodical and ethical, and can help solve practical problems and increase knowledge. Walliman (2011:15) describes research as a process of acquiring knowledge and developing understanding, collecting facts and interpreting them to build a picture of the world surrounding us. Oliver (2010:38) states that research is a process and that there are two basic procedures in research, namely deduction and induction (see table 3.1).

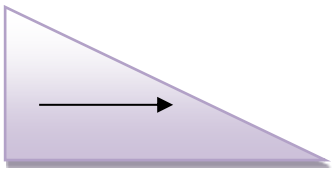
Polit and Beck (2012:3) point out that the ultimate goal of research is to develop, refine, and expand a body of knowledge. In this study the researcher utilized the problem

statement to review the existing knowledge in order to generate new knowledge through the research findings. Brink et al (2006:59) describe the research problem as an area of concern in which there is a gap or a situation in need of solution, improvement or alteration, or in which there is a discrepancy between the way things are and the way they ought to be. These problematic situations or discrepancies stimulate interest and prompt further investigation.

The increasing numbers of TB incident cases in the health care facilities under study despite the availability of current guidelines motivated the researcher to undertake the study and examine nurses' perceptions of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients. Having identified the research problem, the researcher selected the theoretical framework (HBM) to guide the study. The structured self-designed questionnaire for data collection was based on the constructs of the HBM, the research problem and the literature review. The findings should identify the gaps in current practice and assist in improving the current clinical practice related to the TB programme.

The researcher used inductive and deductive reasoning to better understand and explore the phenomenon under study. Table 3.1 presents the application of inductive and deductive reasoning in the study.

Table 3.1 Deductive/Inductive reasoning

Deductive	Inductive
General ideas  **Particular situation** Deductive reasoning begins with general statements and through logical argument and comes to a specific conclusion. It is also called a rationalist approach. The deductive approach is guided theory. Theories are speculative answers to perceived problems and are tested by observation and experiment; move from general to ideas/theories to specific particular and situations. In other words, with this type of reasoning the researcher moves from a general premise (point of departure) to a particular situation or conclusion. In this study, the researcher applied deductive reasoning to generate new knowledge. The literature review enabled the researcher to synthesize what has already been done and acquire information on the phenomenon under study. Based on the literature review, the researcher selected the HBM as the conceptual/theoretical framework for the study. The HBM was then used to develop a structured questionnaire for data collection to achieve the study objectives. The questionnaire was developed with the aim of utilising the study findings to generate new knowledge and find solutions to the problem. The objectives of the study were to: • Describe the perceptions of nurses working in selected Odi Moretele municipality clinics of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients. • Identify barriers to the implementation of and adherence to tuberculosis preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality. • Explore the likelihood of compliance with TB preventive measures by nurses working in the selected clinics of the Odi Moretele municipality.	**Particular situation**  Inductive reasoning starts from specific observations and derives general conclusions from them; moves from particular situations to make or infer broad, general ideas/theories. In other words, with this type of reasoning the researcher obtains facts through observation and makes generalizations based upon these facts. In this study the researcher identified the problem and conducted a literature review to generate the research questions. The study wished to answer the following research questions: • What do nurses perceive as the underlying factors in the selected clinics that may lead to the spread of TB in clinics treating TB patients? • What are the barriers to implementation of and adherence to TB preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality? • What is the likelihood of compliance with TB preventive measures by nurses working in the clinics of the Odi Moretele municipality? The findings from the study will assist in answering the research questions and making recommendations for practice and further study.

Sources: Oliver (2010:38); Polit and Beck (2012:11)

3.3 RESEARCH DESIGN

A research design refers to a plan or blueprint of how the research will be conducted (Babbie & Mouton 2011:74; Grove, Burns & Gray 2013:195; Smith 2010:36). The research design provides a framework for the collection and analysis of data and subsequently indicates which research methods are appropriate (Walliman 2011:13). In this study, the researcher selected a non-experimental, quantitative, exploratory, descriptive and cross-sectional design to answer the research questions and to investigate possible strategies to improve current TB control practices.

3.3.1 Non-experimental

Basavanthappa (2007:149) classifies research designs as experimental and non-experimental, and recommends the use of non-experimental designs for descriptive studies. In such studies the participating units are measured on relevant variables at a point without manipulation. Polit and Beck (2012:223) state that non-experimental research occurs when researchers do not intervene by manipulating independent variable. Brink et al (2006:102) add that the main purpose of non-experimental research is to describe phenomena and to explore and explain relationships between variables.

3.3.2 Quantitative

A quantitative study is a formal, objective and systematic process to describe and test the relationships and to examine cause-and-effect interaction among variables (Grove et al 2013:195). The research design in this study was quantitative because the researcher used structured procedures and a formal instrument to collect data that was then analysed by computer into numerical information through statistical procedures (Brink et al 2006:101).

Quantitative research accepts that the world around us is real, and that we can find out about these realities (Walliman 2011:21).

Quantitative research posits that knowledge is derived using scientific methods and based on sensory experience gained through experiments or comparative analysis; rather than qualitative research, which maintains that the view of the world we see around us is the creation of the mind (Walliman 2011:21).

Table 3.2 depicts the difference between quantitative and qualitative research.

Table 3.2 Difference between quantitative and qualitative research

Quantitative	**Qualitative**
The emphasis of quantitative research is on collecting and analysing numerical data; it concentrates on measuring the scale, range and frequency of phenomena. This type of research, although harder to design initially, is usually highly detailed and structured and results can be easily collated and presented statistically	Qualitative research is more subjective in nature than quantitative research and involves examining and reflecting on the less tangible aspects of a research subject; e.g. values, attitudes, perceptions

Source: Walliman (2011:21-22)

Table 3.3 presents various authors' descriptions of quantitative research and how the design was applied to this study.

Table 3.3 Quantitative research

	Authors		**Application to the study**
Quantitative research design	Polit and Beck (2012:14)	Documents social variations in terms of numerical categories and relies on statistics to summarize large amounts of data.	In this study, the researcher used a structured, self-designed questionnaire to collect data. A statistician analysed the collected data with the use of frequency distribution and presented the results numerically and graphically.
	Babbie and Mouton (2011:78)	Emphasizes the quantification of constructs. The quantitative researcher believes that the best or only way of measuring the properties of phenomena (e.g. attitudes of individuals towards certain topics) is through quantitative measurement, i.e. assigning numbers to the perceived qualities of things.	
	Bowling and Ebrahim (2005:190)	Quantitative research focuses on measuring quantities and relationships between attributes, following a set of scientifically rigorous procedures. It collects highly structured data and is deductive in approach (see table 3.1); i.e., the researcher starts with ideas, develops a theory and testable hypothesis from them, and tests them with data. Quantitative research is appropriate in situations where there is pre-existing knowledge about the phenomenon of interest which permits the use of standardized methods of data collection, such as the survey Quantitative research can be used to measure people's psychological attitude, self-perception and behaviour.	

The rationale for choosing this design was that quantitative research is allied with positivist paradigm. The positivist approach assumes that nature is basically ordered and regular and that an objective reality exists independent of human observation (Polit & Beck 2012:12). For this reason, the positivist approach values objectivity. Objectivity is an important aspect in quantitative research as it ensures that researchers withhold their personal beliefs and biases which may contaminate the phenomena under study. Quantitative research focuses on assigning numerical values to social science research questions and relies on using literature to identify theoretical frameworks (Bouma et al 2012:52). Furthermore, quantitative research relies on findings of previous studies as a guide to build on existing knowledge (Bouma et al 2012:53).

The researcher considered a quantitative appropriate for this study as a structured, self-designed questionnaire was used to collect data from the respondents. The literature review conducted revealed what was known on the phenomenon under study, facilitated selecting the HBM as the theoretical framework and developing the questionnaire for data collection. The theoretical framework assisted the researcher to be objective as the study followed a specific model and not personal beliefs***.***

3.3.3 Descriptive and exploratory

The choice of a research design depends on the problem, purpose and objectives of the study. This study was exploratory and descriptive (see table 3.4) as it wished to “describe the perceptions of nurses working in a clinic of the Odi Moretele municipality of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients”.

Table 3.4 Descriptive and exploratory research

Author	Descriptive	Exploratory
Polit and Beck (2012:17-18)	Offers detailed picture or account of some social phenomenon, setting and experience group. It also pays attention to sampling and measurement	Is typically conducted in the interest of getting to know or increasing our understanding of a new or little known research setting, group, or phenomenon. It is used to gain insight into the research topic.
Walliman (2011:10-11)	The descriptive approach relies on observation as a means of collecting data. It attempts to examine situations in order to establish what the norm is. It can take many forms, depending on the type of information sought: people can be interviewed; questionnaires distributed; visual records made, and/or even sounds and smells recorded. The important point is that the observations are written down or recorded. The written and recorded data are then organized and presented in a clear and systematic way so that valid and accurate conclusions are reached.	It is used when the researcher has no control over events. It can look at situations on different scales, macro (international, national) or micro (community, individual). The approach is also used to test what conditions were necessary to cause certain events, so that it is possible to understand the likely effects of making certain decisions.
Application to the study	The objective of the study is to establish or describe the perceptions of nurses working in a clinic of the Odi Moretele municipality's of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients. The researcher wanted to establish these factors by the administration of the questionnaire to determine the current TB control practices. The findings will identify the knowledge gaps of the population under study and assist the researcher to recommend measures to improve the current practice.	The researcher conducted the study to explore nurses' perceptions on the factors that they might perceive to contribute to the spread of TB in the clinics treating patients with TB, and to determine the current practice on TB preventive measures in the clinics under study. The findings of the study will serve as a learning paradigm for facility managers, TB nurses and other nurses working in the facilities to enhance their insight and knowledge. It will also assist them to plan interventions, prevention programmes and dissemination of vital information addressed to the needs and problems of the TB programme.

3.3.4 Cross-sectional

In a cross-sectional study the researcher obtains all relevant information from the respondents at a single point in time, and no future follow-up contacts are made (Polit & Beck 2012:184). Walliman (2011:11) adds that a cross-sectional design entails the collection of data on more than one case (usually many more than one), generally using a sampling method to select cases in order to be representative of a population. In executing cross-sectional the researcher might ask a series of questions in order to address the topic of interest (Polit & Beck 2012:184). In this study the researcher administered a self-designed questionnaire to the respondents once and there will be no other future contacts with the respondents. The specific time frame in which the data collection took place was 1 October 2013 to 1 November 2013.

3.4 RESEARCH METHODOLOGY

Research methodology focuses on the research process and the kind of tools and procedures to be used (Babbie & Mouton 2011:75; Lues & Lategan 2006:23). Polit and Beck (2012:12) refer to research methodology as the techniques researchers use to structure a study and to gather and analyze information relevant to the research question. Research methodology includes population, sample and sampling, data collection and analysis, and validity and reliability.

3.4.1 Population

A research population is the entire aggregation of cases in which the researcher is interested. It is all the elements (individuals, objects, events, or substances) that meet the criteria for inclusion in a study and from which the sample is selected (Babbie 2010:210; Polit & Beck 2012:273). Polgar and Thomas (2013:33) define a population as the target group of individuals or cases in which the researcher is interested, figure 3.2 above highlights population in relation to sampling frame and sample. In research, a population consists of a target and an accessible population (Polit & Beck 2012:274). Table 3.5 illustrates the characteristics of the population and application to the study.
Table 3.5 illustrates the characteristics of the population and application to the study.

Table 3.5 Characteristics of the population and application to the study

Characteristics	Application to the study
Homogenous – all cases are similar	The population was homogenous as all the nurses in the selected Odi Moretele sub-district PHC facilities who took part in the study were employed full-time to serve suspected or infected TB patients.
Stratified – contains strata or layers	Stratified referred to nurses registered or enrolled with SANC with various roles according to their qualifications although sharing a single goal which is patient care (see table 3.6 on sampling frame)
Proportionally stratified – contains strata of known proportions	This referred to the percentage of different classes of nurses in the selected PHC facilities (see table 3.6). In this study, the participants included professional nurses, enrolled nurses, and auxiliary nurses.
Grouped by type – contains distinctive groups	This referred to different classes of nurses in the selected PHC facilities. Different categories of nurses were selected to participate, including auxiliary nurses, enrolled nurses, professional nurses, and nurse managers.
Grouped by location – different groups according to where they are	The nurses worked on a full-time basis at the selected PHC clinics in the Odi Moretele sub-district.

Sources: Walliman (2011:96); Polit and Beck (2012:274)

3.4.1.1 Target population

Gerrish and Lacey (2010:143) describe the target population as the total population that forms the focus for a study. Polit and Beck (2012:273) refer to a target population as the aggregate of cases about which the researcher would like to generalise. Burns and Grove (2009:351) state that a target population is the entire set of individuals or elements that meet the sampling criteria. In this study, the target population comprised all the nurses working in the PHC facilities of the Tshwane District in Gauteng.

3.4.1.2 Accessible population

The accessible population refers to the subset of the target population from which the sample will be drawn (Gerrish & Lacey 2010:143). Burns and Grove (2009:351) refer to the accessible population as the portion of the target population to which the researcher has reasonable access. Polit and Beck (2012:274) describe it as the aggregate of cases that conform to designated criteria and are accessible as subjects for a study. The accessible population in this study referred to the 86 nurses working in the seven selected PHC facilities of the Odi Moretele sub-district of Tshwane (see table 3.6).

Polit and Beck (2012:274) point out that the researcher must consider the exact criteria on which to classify individuals as members of the population. Thus the researcher should specify characteristics that define the population through eligibility criteria (Polit & Beck 2012:274). To be included in this study, the respondents

- Had to be registered with the SANC.
- Must have been permanently employed at the selected PHC facilities for a period of two years or longer.
- Had to be available during the period of data collection.
- Had to consent to voluntarily participate in the study.

3.4.2 Sampling and sample

Polit and Beck (2012:275) refer to sampling as “a process of selecting a portion of the population to represent the entire population so that inferences can be made”. Burns and Grove (2009:352) state that sampling involves “selecting a group of people, events, behaviour or other elements with which to conduct a study”. The purpose of sampling is to select a set of elements from a population in such a way that descriptions of those elements (statistics) accurately portray the parameters of the total population from which the elements are selected (Babbie & Mouton 2011:174). Polit and Beck (2012:275) define a sample as “a subset of population elements”. Offredy and Vickers (2010:131) describe it as “a group of people who have been selected to act as representatives of a population as a whole”.

In quantitative studies, samples should be selected in a way that will allow the researcher to achieve statistical conclusion, validity and generalization of the findings (Polit & Beck 2012:273). Moreover, the researcher has to develop a sampling plan, which specifies in advance how participants will be selected and how many will be included in the study (Polit & Beck 2012:273). Accordingly, the researcher first identified the population or target population and the accessible population, then developed the sampling frame, and selected the sample. Figure 3.2 illustrates the sampling plan for the study.

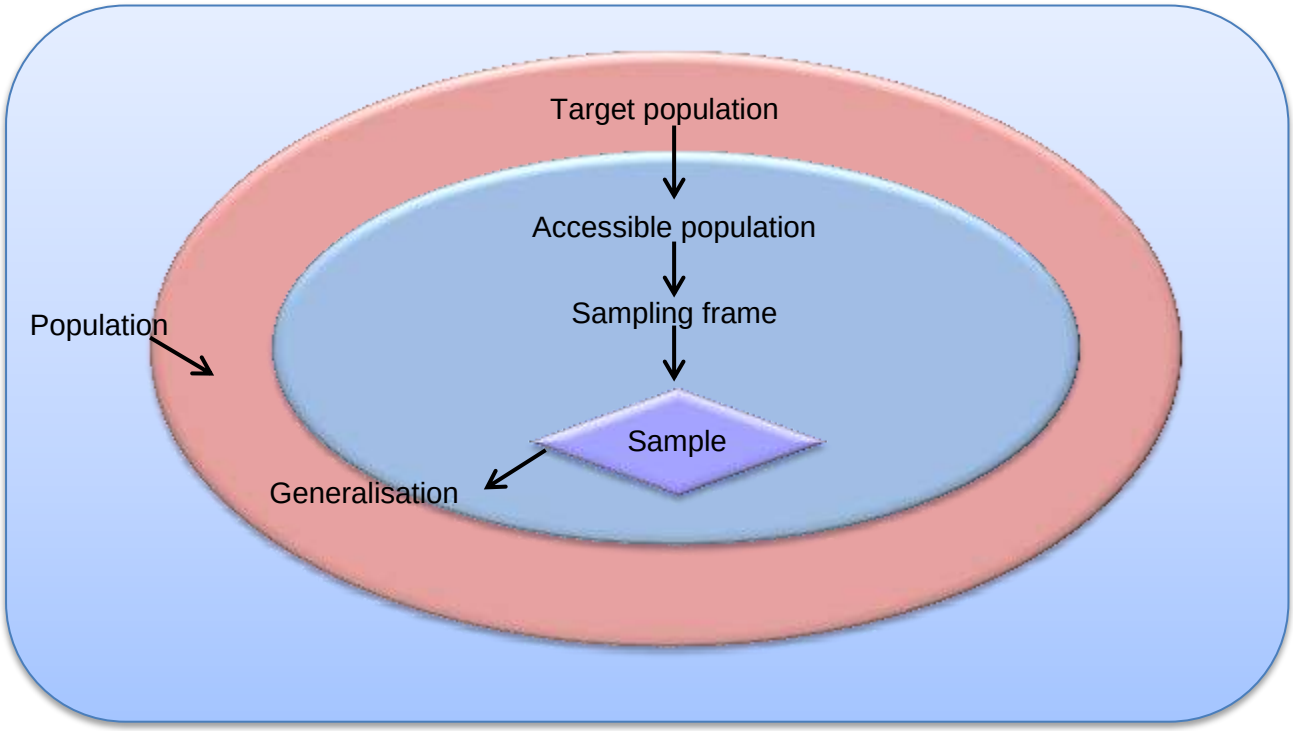


Figure 3.2 Sampling plan for the study

Source: Boswell and Cannon (2014:181)

3.4.2.1 Sampling frame

A sampling frame is a comprehensive, itemised list of all people, elements or events from which the sample will be taken (Walliman 2011:94; Gerrish & Lacey 2010:143). A sampling frame can also include the settings or individuals of interest to the researcher and provides a transparent framework from which to derive a sample (Gerrish & Lacey 2010:143). In this study, the sampling frame consisted of all the nurses working in the selected PHC facilities in the Odi Moretele sub-district of Tshwane. The researcher obtained the names from the Odi Moretele sub-district manager. Table 3.6 presents the

number of nurses in the selected PHC facilities of Odi-Moretele sub-district. A total of 86 nurses were eligible to participate in this study.

Table 3.6 Sampling frame of the study

Number of nurses in the selected PHC facilities of Odi Moretele sub-district eligible for the study					
PHC facility	**Nurse managers**	**Professional nurses**	**Enrolled nurses**	**Auxiliary nurses**	**Total number of nurses**
Gateway	1	11	0	0	12
Mandela	1	10	3	1	15
Ramotse	1	8	2	1	12
Kekana Gardens	1	6	2	1	10
Majaneng	1	7	1	2	11
Dilopye	1	6	1	1	9
Suurman	1	12	2	2	17
Total	**7**	**60**	**11**	**8**	**86**

Following approval to conduct the study from the Tshwane Research Ethics Committee in Pretoria (see annexure C), the researcher obtained the database of all the nurses in the Odi Moretele sub-district from the district manager.

3.4.2.2 Method of sampling

A sample is limited to fewer people and assists the researcher to achieve a much better response rate than when using the whole population which is time consuming (Babbie & Mouton 2011:174). If the sample is representative of the population, the results can be accurate and reliable (Babbie & Mouton 2011:174). A researcher obtains the sample from the accessible population by using a particular sampling method (Burns & Grove 2009:351). Sampling methods are classified as probability or non-probability (Polit & Beck 2012:275). Walliman (2011:96) states that non-probability sampling is based on selection by non-random means and can be used where it is difficult to access the whole population, but it provides a weak basis for generalization. Brink et al (2006:132) point out that non-probability sampling may or may not accurately represent the population and should only be used when access to the study subjects is not possible.

In this study, the researcher used probability sampling as the study subjects were known to her and she was able to obtain the sampling frame of the accessible population.

3.4.2.3 Probability sampling

According to Polit and Beck (2012:275), probability sampling involves the random selection of elements from a population. Brink et al (2006:132), understand probability sampling as the sample that is representative of the population which reflects its variations. In other words probability sampling implies that all elements in the population have an equal chance of being included in the sample (Brink et al 2006:132). In order to obtain a probability sample, the researcher must know every element in the population and this requires a sampling frame (Brink et al 2006:132). Walliman (2006:76) adds that probability sampling gives the most reliable representation of the whole population as the selection of the sample is based on random methods. The selection procedure should aim to guarantee that each element has an equal chance of being selected (Walliman 2006:77).

Walliman (2006:77) states that when selecting a sampling technique the researcher should have insight into the nature of the population (see table 3.5). Taking into consideration the nature of the accessible population, the researcher selected simple random sampling to identify nurses working in the PHC facilities of Odi-Moretele sub-district that treat TB patients, therefore the accessible population shared a common characteristic. In simple random sampling each member of the sampling frame has a known and equal chance of being selected for the sample (Gerrish & Lacey 2010:145; Brink et al 2006:127). Walliman (2006:77) suggests that simple random sampling be used when the population is uniform or has common characteristics in all cases.

3.4.2.4 Sample size

Gerrish and Lacey (2010:143), suggest that researchers recruit respondents who are accessible and meet the inclusion criteria for the study. Boswell and Cannon (2014:188) refer to sample size as “the number of elements to be included in a sample”. Boswell and Cannon (2014:189) emphasise that the researcher should sample as many elements as possible so that the sample is more representative of the population. In this

study, the researcher sampled all the respondents who met the inclusion criteria and consented to participate in the study (see table 3.7). Table 3.7 indicates the sample size drawn for the study.

Table 3.7 Sample size

Respondents in the selected PHC facilities of Odi Moretele sub-district						
PHC facility	**Nurse managers**	**Professional nurses**	**Enrolled nurses**	**Auxiliary nurses**	**Total no of nurses**	**Number of question-naires distributed**
Gateway	1	11	0	0	12	12
Mandela	1	10	3	1	15	15
Ramotse	1	8	2	1	12	12
Kekana Gardens	1	6	2	1	10	10
Majaneng	1	7	1	2	11	11
Dilopye	1	6	1	1	9	9
Suurman	1	12	2	2	17	17
Total	7	60	11	8	86	86

The researcher met with the respondents to select a sample. A total of 86 respondents met the eligibility criteria and consented to participate in the study.

3.4.3 Data collection

Data collection is the precise, systematic process of gathering data or all information from the study subjects that is relevant to the purpose of the study, research questions or hypothesis (Burns & Grove 2009:345). The collection of quantitative data tends to involve highly structured methods in which exactly the same information is gathered from study participants in a comparable and pre-specified way (Polit & Beck 2012:105). Robson (2007:166) maintains that the researcher should use the simplest manner of collecting data to get answers to the research question and not collect any more data than necessary. The data-collection instrument selected for this study was a structured self-designed questionnaire.

Data collection took place between 1 October and 1 November 2013. The researcher distributed 86 structured self-designed questionnaires and 77 completed questionnaires were returned which gave a response rate of 90%.

3.4.3.1 Data-collection instrument

Data was collected by means of a questionnaire. A questionnaire is "a formal, written document in which respondents complete the instrument themselves in a paper-and-pencil format" (Polit & Beck 2012:105). Bhattacharyya (2009:60) describes a questionnaire as the technique of gathering data by asking questions from people who are thought to have the desired information.

Questionnaires may be structured or semi-structured (Bowling & Ebrahim 2005:394). Structured questionnaires involve the use of fixed questions and/or measurement scales which are presented to respondents in the same way, with no variation in question wording and using closed questions (Bowling & Ebrahim 2005:394). Kumar (2011:145) points out that in a questionnaire clear and easy to understand questions should be formulated as there will be no one to explain the meaning should it happen that respondents do not understand. Thus the layout of a questionnaire should be easy to read (Kumar 2011:145). The researcher developed a structured questionnaire on the basis of the theoretical framework (HBM), the study objectives and the literature review.

Bowling and Ebrahim (2005:394) maintain that the strength of structured questionnaires is the ability to collect unambiguous and easy-to-count answers, leading to quantitative data for analysis. The researcher chose the questionnaire as a method of data collection because it is:

- A flexible tool
- Easy and convenient for respondents as it is suitable for participants who cannot express their deep feelings
- Cost and time effective to administer to a large number of people
- Objective and this reduces researcher bias since there is no personal influence of the researcher

3.4.3.2 Pre-test or pilot study

A pre-test or pilot study is a trial run to determine whether the instrument is clearly worded and free from major biases and whether it solicits the desired information (Brink et al 2006:94). It provides an opportunity to try out the technique or instructions that will

be used with an instrument, especially if the instrument has not been used with a specific population, as in the case of this study. Bhattacharyya (2009:65) asserts that a data-collection instrument should be pre-tested under field conditions. Kumar (2011:158) adds that the pretesting of the data-collection instrument should be carried out under actual field conditions on a group of individuals similar to the study population. The purpose is not to collect data but to identify problems that the potential respondents might have in either understanding or interpreting any questions. A pre-test or pilot study can assist a researcher to uncover any weakness in the method used and suggest improvements (Bhattacharyya 2009:65).

Pre-testing the instrument allows researchers to critically examine the questions and their meaning, and identify whether different respondents interpret a question differently (Kumar 2011:158). If the interpretation differs from what the researcher was trying to convey, the questionnaire can be re-examined. According to LoBiondo-Wood and Haber (2014:305), pre-testing identifies problems in the design and sequencing of questions, and determines the instrument's reliability and validity. Accordingly, in order to ensure that the questions measured what they were intended to measure, the questionnaire was tested in a pre-test on 30 respondents (10 nurse mentors for TB and 20 from two PHC facilities outside the Odi Moretele sub-district). During the pre-testing the respondents were timed and completion of the questionnaire took from 20 to 25 minutes. Based on the feedback, the researcher reviewed and refined the questionnaire, then submitted it to the study leader and the statistician for review and approval.

3.4.4 Validity and reliability

The quality of research and research instruments is determined by their validity and reliability.

3.4.4.1 Validity

Validity of the data-collection instrument refers to its accuracy and trustworthiness in research (Bernard 2011:45). The validity of a data-collection instrument can be

determined by using different tests. In this study, the researcher applied face, content, construct and criterion validity (see table 3.9).

- **Face validity.** Face validity involves looking at the operational indicators of a concept and deciding whether or not, on the face of it indicators make sense (Bernard 2011:48). The indicators might be items on an opinion survey, or they might be tests of knowledge and ability (Bernard 2011:45).

- **Content validity.** Content validity is achieved when an instrument has appropriate content for measuring a complex concept, or construct (Bernard 2011:44). Furthermore, content validity concerns the degree to which an instrument has an appropriate sample of items for the construct being measured and adequately covers the construct domain (Polit & Beck 2012:336).

- **Construct validity.** Construct validity is a key criterion for assessing the quality of a study, especially in terms of measurement issues (Polit & Beck 2012:339). An instrument is said to have a high construct validity if there is a close fit between the construct it supposedly measures and the actual observations made with the instrument (Bernard 2011:49).

- **Criterion validity.** Criterion validity involves determining the relationship between an instrument and external criteria (Polit & Beck 2012:337). An instrument has a high criterion validity if there is a close fit between the measures it produces and the measures produced by some other instrument that is known to be valid.

Table 3.8 Validity of the data-collection instrument

Data-collection instrument validity	Measures taken to ensure validity of data-collection instrument
Face validity	Face validity of the data collection instrument was ensured by using the constructs of the HBM to measure the concepts of the study.
Construct validity	The researcher reviewed literature on control measures that have been proven to be successful in the prevention of TB in the health care facilities. The literature review was used to ensure construct validity of the data collection instrument.
Content validity	To ensure content validity instrument items were derived from the DOH policy guidelines and the WHO infection prevention and control manual and transformed into closed and open-ended questions. The questionnaire was given to experts to review for accuracy of content and to the Gauteng Department of Health Infection Control Directorate and the University School of Pathology to check for fact and content clarity and relevance of items.
Criterion-related validity	HCWs' knowledge, attitude, educational level and perception are associated with their likelihood of implementing TB control measures in their health care facilities. To ensure criterion-related validity, then, the researcher included questions that measured the concepts of HCWs knowledge, perception, educational level and attitude.

Sources: Bernard (2011:42-45); Polit and Beck (2012:328-337)

3.4.4.2 Reliability

Reliability of the data-collection instrument refers to the consistency with which it measures the target attributes (Polit & Beck 2012:331). An ideal data-collection instrument should capture a construct in an accurate, truthful and sensitive manner (Polit & Beck 2012:331). Reliability refers to "whether or not you get the same answer by using an instrument to measure something more than once" (Bernard 2011:42).

The questionnaire was pre-tested on a sample of 30 nurses who were not included in the study. The purpose was to identify potential problems, time taken to complete the questionnaire, and whether items addressed the objectives of the study.

3.4.5 Data analysis

Data analysis entails categorizing, ordering, manipulating and summarizing the data and describing them in meaningful terms (Brink et al 2006:170). Data can be analysed using narrative or statistical strategies, in conjunction with graphic or pictorial strategies. The type of strategy depends on the research design, types of variables measured, method of sampling and method by which the data were collected and measured (Brink et al 2006:170). For the purpose of this study, the researcher used a quantitative research approach. Walliman (2006:112) states that quantitative analysis deals with numbers and uses mathematical operations to investigate the properties of data. Furthermore, the levels of measurement used in the collection of data are an important factor in choosing the type of analysis applicable, as is the number of cases (Walliman 2006:112). Brink et al (2006:171) emphasise that the most powerful tool available to the researcher in analyzing quantitative data is statistics. Walliman (2006:112) states that statistical methods are valuable to enable the researcher to present and describe the data and, if necessary, to discover and quantify relationships. In this study, the researcher used descriptive and inferential statistics. Descriptive statistics are used to describe and summarise data (Brink et al 2006:171; Polit & Beck 2012:379). Brink et al (2006:171) point out that descriptive statistics convert and condense a collection of data into an organized, visual representation, or picture, in a variety of ways, so that the data have some meaning. Inferential statistics are used to make inferences about the population and that particular characteristics in a sample exist in the larger population (Polit & Beck 2012:379; Brink et al 2006:171).

A statistician analysed the data, using the SAS computer program and the following statistical methods:

- *Chi-square (x^2) test.* the Chi-square (x^2) test is used to test the hypothesis about the proportion of cases that fall into different categories, as when a contingency table has been created (Polit & Beck 2012:420).
- *Fischer's exact test.* Fischer's exact test is used to test the significance of differences in proportions (Polit & Beck 2012:421).
- *Cramer's V.* Cramer's V is used when both variables are nominal and with positive values (Walliman 2006:119).

- *Phi coefficient.* The Phi coefficient is used when both variables are dichotomous (e.g. yes/no) (Walliman 2006:119).
- *t-test.* A *t*-test refers to the procedure for testing differences in group means (Polit & Beck 2012:427).
- *Analysis of variance (ANOVA*). ANOVA is the procedure for testing differences between means when there are three or more groups (Polit & Beck 2012:416).
- *Wilcoxon rank sum test.* The Wilcoxon rank sum test involves taking the difference between paired scores and ranking the absolute difference (Polit & Beck 2012:416).
- *Kruskal-Wallis test.* The Kruskal-Wallis test is used when the number of groups is greater than two and where a one-way test for independent samples is desired (Polit & Beck 2012:420).
- *Cohen's d test.* Cohen's d test is used primarily to evaluate effect size in research situations comparing two means (Gravetter & Forzano 2012:465).
- *Spearman's rank correlation test.* Spearman's rank correlation is used either when both variables are ordinal, or when one is ordinal and the other is interval or ratio (Walliman 2006:119).
- *Pearson's correlation coefficient (r).* Pearson's correlation coefficient (*r*) is used for examining relationships between the interval/ratio variables (Walliman 2006:119). The r value indicates the strength and direction of the correlation with +1 indicating the perfect positive association and -1 a perfect negative association; zero indicates a total lack of association.
- *Cronbach's α test.* Cronbach's α refers to the proportion of the total variation, or the real difference between respondents (Burglear 2014:146). Cronbach's α is used to test the internal consistency of the data collection instrument especially the questionnaire (Burglear 2014:146).
- *The p-value.* The p-value refers to the level of significance (Polit & Beck 2012:413). The two most frequently used significance levels are 0.05 and 0.01. Polit and Beck (2012:413) explain the two significance levels as follows: "With a 0.05 we accept the risk that out of 100 samples drawn from the population, a true null hypothesis would be rejected 5 times. With a 0.01 significance level, the risk for a Type 1 error is lower: in only 1 sample out of 100 would we erroneously reject the null hypothesis." In this study the 0.05 significance level was followed.

The Chi-square (x^2) test was used to assess the relationships between categorical variables. Fisher's exact test was used for 2 x 2 tables or where the requirements for the chi-square (x^2) test could not be met. The strength of the associations was measured by Cramer's V and the Phi coefficient, respectively. For Cramer's V and the Phi coefficient, the following scale of interpretation was used:

0.50 and above	high/strong association
0.30 to 0.49	moderate association
0.10 to 0.29	weak association
Below 0.10	little, if any, association

The relationship between continuous and categorical variables was assessed by *t*-test (and ANOVA for more than two categories), and where the data did not meet the assumptions of these tests, a non-parametric alternative, the Wilcoxon rank sum test (or the Kruskal-Wallis test for more than two categories) was used. The strength of the associations was measured by the Cohen's d for parametric tests and the r-value for the non-parametric tests. The following scale of interpretation was used:

0.80 and above	large effect
0.50 to 0.79	moderate effect
0.20 to 0.39	small effect
Below 0.20	near zero effect

The relationship between two continuous variables was assessed by Pearson's correlation coefficient (r) or Spearman's rank correlation if the assumptions of the former were not met. The strength of the association was determined by Cohen's d effect size for correlation coefficients:

$\|r\|<0.1$	near zero effect size
$\|r\|$ between 0.1 and 0.3	small effect size
$\|r\|$ between 0.3 and 0.5	moderate effect size
$\|r\|> 0.5$	large effect size

In order to explore the combination of the results from certain questions (by averaging their scores to produce a single measure), the following was done:

The internal consistency (reliability) of the variables making up each proposed scale was assessed by means of Cronbach's α. Cronbach's α is defined as:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

Where K is the number of indicators, the variance of the observed total scores, and the variance of indicator (Gravetter & Forzano 2012:479). Andrew, Pedersen and McEvoy (2011:202) point out that in the social sciences, Cronbach's α should be greater than or equal to 0.70 for adequate reliability. Therefore in this study, the Cronbach's α of 0.70 or greater was used to indicate reliability of the results.

A theoretical scale measured by certain indicators (variables) is valid if it is actually measured by those indicators. Andrew et al (2011:202) point out that there are many types of validity, but most importantly, the researcher needs to establish construct validity as determined by reliability (done above) and unidimensionality. Unidimensionality is assessed by factor analysis thus all the indicators should load on to one factor (Andrew et al 2011:204). However, factor analysis could not be conducted on this data set as the sample size was too small (the minimum sample size for factor analysis is 100 per group) (Andrew et al 2011:251).

The 5% significance level was used throughout, unless specified otherwise. In other words, p-values <0.05 indicate significant results.

3.5 ETHICAL CONSIDERATIONS

Ethics deals with matters of right and wrong. Polit and Beck (2012:336) stress that when research involves humans their rights must be protected. The goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities. The researcher applied the Declaration of Helsinki and Nuremberg Code of Ethics to ensure protection of study respondents. The Declaration of Helsinki was developed by the World Medical Association as a statement of ethical principles to provide guidance to physicians and other participants in medical research involving

human subjects (Ashcroft 2008:131). The Nuremberg Code of Ethics was developed in order to improve the health of the nation after discovering that most medical research in Germany during the Second World War had involved violations of medical ethics (Elnimeiri 2008:94). Accordingly, in this study, the researcher upheld the principles of permission; privacy, confidentiality and anonymity; justice, self-determination and autonomy, and fidelity and respect (see table 3.9).

3.5.1 Permission to conduct the study

The researcher requested and obtained permission to conduct the study from Tshwane Research Ethics Committee and the Research and Ethics Committee of the University of South Africa which included the research proposal. The researcher received the clearance certificate from the Tshwane Research Ethics Committee and the ethical clearance certificate of the University of South Africa (see annexure A and D). The researcher also obtained permission from the sub-district manager and the facility managers of the selected PHC clinics to conduct the study at their facilities and with the respondents.

3.5.2 Principle of justice

The right to fair treatment is based on the ethical principle of justice. In terms of this principle, participants should be treated fairly; be fully informed of the nature of the research, and free to choose to participate or not (Burns & Grove 2009:162). The researcher selected the respondents fair as they were selected for reasons directly related to the research problem.

3.5.3 Privacy, confidentiality and anonymity

The researcher treated the respondents with respect and dignity. The respondents were assured of privacy, confidentiality and anonymity. The researcher explained that the information given was confidential, no names would be mentioned nor could any information be linked to any particular respondent, and no risk or discomfort would be involved (see annexure B and C).

3.5.4 Informed consent

The researcher explained the purpose and objectives of the study and gave them a chance to ask questions. The researcher informed them that participation was voluntary; that they could refuse to participate, and that they had the right to withdraw from the study at any time should they so wish. The respondents then gave informed consent by signing the consent forms provided by the researcher. Only the researcher had access to the signed consent forms and the completed questionnaires.

Table 3.9 Ethical principles and human rights upheld in the study

Ethical principles	Application in research
Principle of veracity	✓ Telling the truth, being honest and sincere ✓ The rights of participants to have full disclosure before participating in research
Principle of justice	✓ Being fair to participants and not giving preference to some over others ✓ Participants' needs must come before the objectives of the study ✓ A duty to avoid discrimination, abuse or exploitation of the participants on the ground of race, religion, sex, age, class and sexual orientation
Principle of beneficence	✓ The researcher should benefit both the individual participant and society in general ✓ A duty to do good and prevent harm (physical, psychological, social and economic) ✓ A duty of care to protect the weak and vulnerable
Principle of fidelity and respect	✓ Building trust where the researcher is obliged to safeguard the welfare of participants ✓ A duty to respect the rights, autonomy and dignity of participants ✓ A duty to promote the well-being and autonomy of participants ✓ The right to self-determination (the freedom to decide whether to participate or not, and to withdraw at any time) ✓ The right to privacy and respect ✓ The right to anonymity and confidentiality

Source: Moule and Hek (2011:36)

3.6 CONCLUSION

This chapter described the research design and methodology in detail, including the population, sampling and sample, data collection and analysis, data-collection instrument, validity and reliability, and ethical considerations.

Chapter 4 discusses the data analysis and interpretation, and the results.

CHAPTER 4

Data analysis and interpretation

4.1 INTRODUCTION

After describing the research design and methodology in chapter 3, this chapter presents the data analysis and interpretation, and the findings.

4.2 PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of the study was to describe and explore the perceptions of nurses working in a PHC clinic of the Odi Moretele municipality of the underlying contributory factors in the selected clinics that may lead to the spread of TB in clinics treating TB patients.

In order to achieve the purpose, the objectives of the study were to:

- Describe the perceptions of nurses working in the selected PHC clinics of the Odi Moretele municipality of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients.
- Identify barriers to the implementation of and adherence to TB preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality.
- Explore the likelihood of compliance with TB preventive measures by nurses working in the selected clinics of the Odi Moretele municipality.

4.3 DATA ANALYSIS

Data collection took place between 1 October and 1 November 2013. The researcher distributed 86 structured self-designed questionnaires and 77 completed questionnaires were returned which gave a response rate of 90%.

Data analysis entails categorizing, ordering, manipulating and summarizing the data and describing them in meaningful terms (Brink et al 2006:170).

A statistician analysed the data, using the SAS computer program and the following statistical methods: Chi-square (x^2) test; Fischer's exact test; Cramer's V; Phi coefficient; t-test; ANOVA; Wilcoxon rank sum test; Kruskal-Wallis test; Cohen's d test; Spearman's rank correlation test; Pearson's correlation coefficient (r); Cronbach's α test, and the p-value (Polit & Beck 2012:413-421; Burglear 2014:146; Walliman 2006:119; Gravetter & Forzano 2012:465). In this study the 0.05 significance level was followed.

The data was summarized by factor analysis, frequency distributions and descriptive statistics, using frequencies and percentages, and presented in tables and pie graphs. Percentages were rounded off to the second decimal point. The data analysis, interpretation and results are discussed according to the eight sections of the questionnaire, namely:

Section A: Biographical data
Section B: Perceived susceptibility to TB infection
Section C: Perceived severity of TB infection
Section D: Perceived benefits of TB preventive measures
Section E: Perceived barriers to TB preventive measures
Section F: Self-efficacy
Section G: Cues to action to TB prevention
Section H: Legislative framework for TB control

4.3.1 Section A: Respondents' biographical data

In section A, descriptive and inferential statistics were used to communicate the results of the study. Descriptive statistics are numerical, graphical and tabular techniques for organising, analysing and presenting data (Polit & Beck 2012:379). Inferential statistics are used to make inferences about the population (Polit & Beck 2012:379).

4.3.1.1 Respondents' gender

Of the respondents, 88% (n=67) were females; 12% (n=9) were males and 1% (n=1) did not answer the question (see figure 4.1).

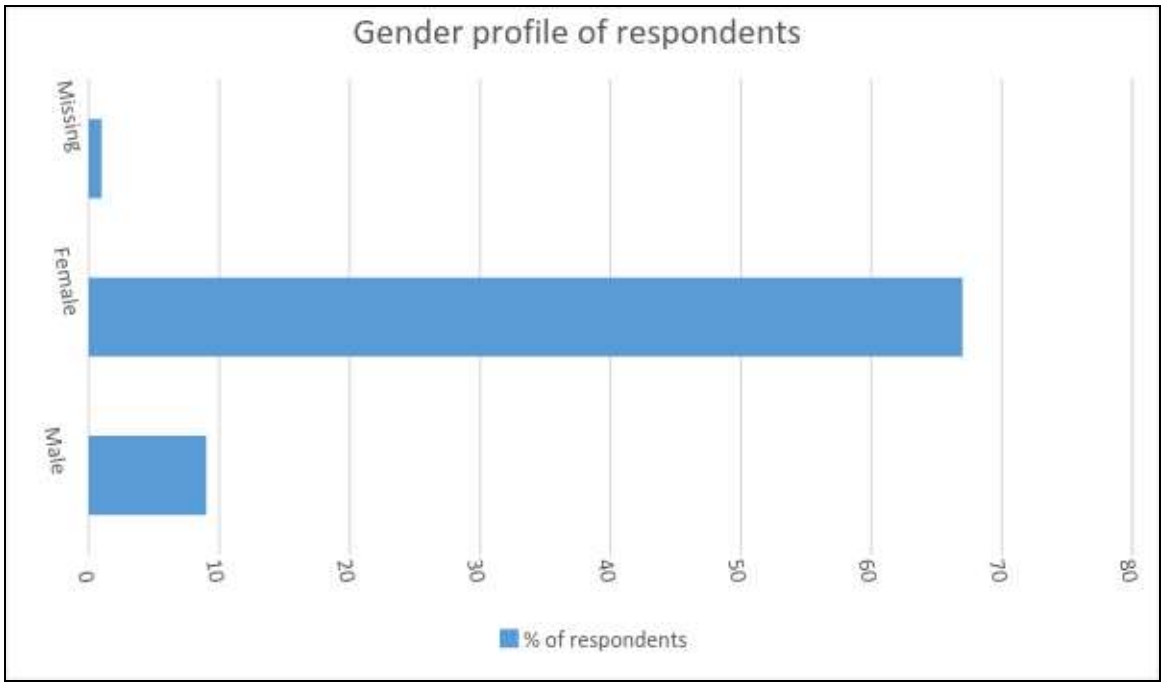


Figure 4.1 Respondents' gender (n=76)

Figure 4.1 indicates that the majority of the respondents were females, and the ratio of male to female respondents was 1:7. This result reflects the current ratio of male to female nurses (SANC 2014:online). Female nurses are 14 times higher than male nurses in Gauteng. Kofman and Raghuram (2006:282) found that mainly women go into what can be broadly classified as the welfare and social professions (education, social work and health), the public face of the global chain of care and social reproduction.

4.3.1.2 Respondents' age

Of the respondents, 2.6% (n=2) were between 20 and 25 years old; 11.7% (n=9) were between 26 and 30; 7.8% (n=6) were between 31 and 36; 13% (n=10) were between 37 and 42; 20.8% (n=16) were between 43 and 48; 22.1% (n=17) were between 49 and 54, and 22.1% (n=17) were above the age of 54 (see figure 4.2).

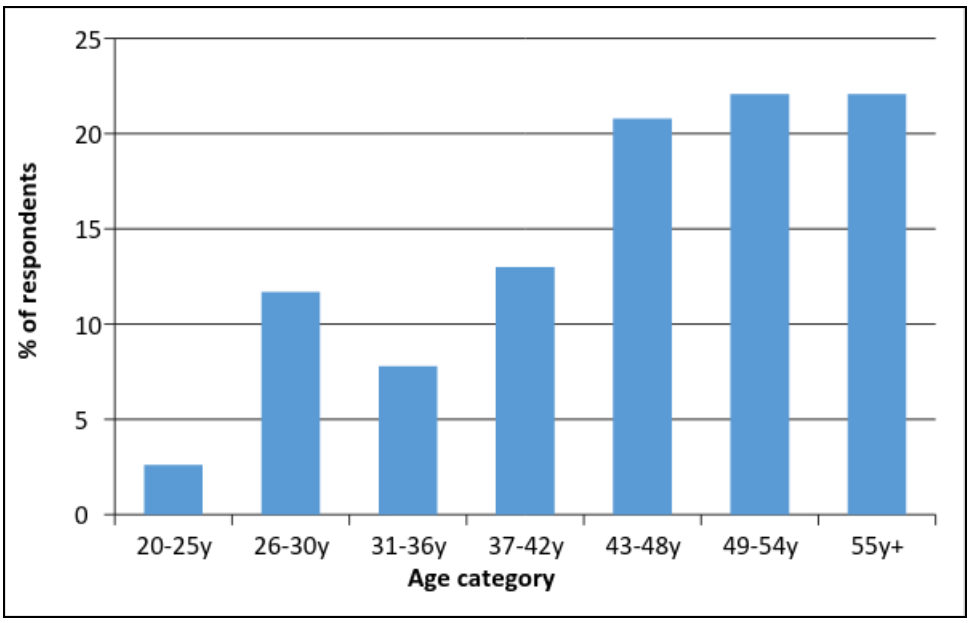


Figure 4.2 Respondents' ages (N=77)

Figure 4.2 indicates that the majority of the respondents were above the age of 40 and the number increased with age as only a small percentage were in their twenties. The SANC (2015a:online) reported that the highest concentration of nurses were between 40 and 49 (27%) with only a small percentage (10%) being in their twenties thus illustrating the small number of young nurses entering the profession, effectively turning nursing into an aging workforce (SANC 2015a:online). In Australia, Fragar and Depczynski (2011:online) found that the average age of nurses in rural health services was 45 years.

4.3.1.3 Respondents' ethnic group

In question 3, the respondents indicated their ethnic group (see figure 4.3).

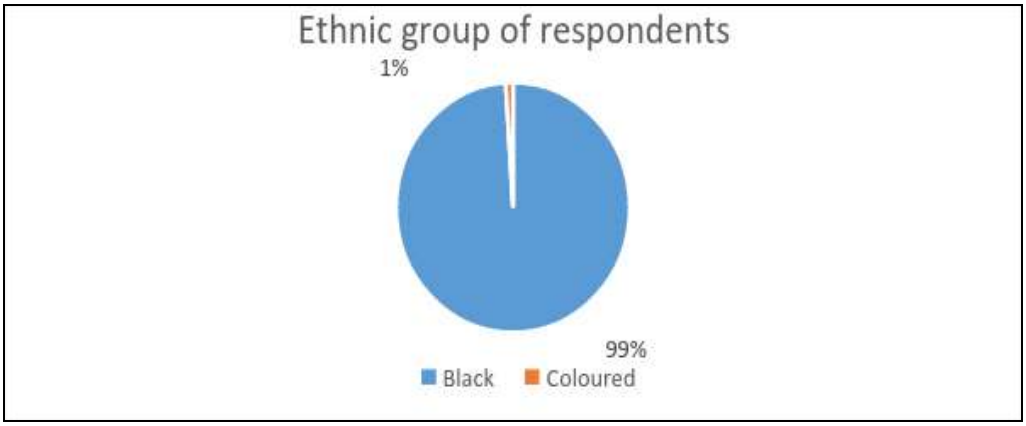


Figure 4.3 Respondents' ethnic groups (N=77)

Figure 4.3 shows that of the respondents, 99% (n=76) were Blacks and only 1% (n=1) was Coloured. The findings may be due to the geographical area where the study was conducted, namely the Odi Moretele sub-district. Moretele is a mainly rural area situated far north of Pretoria in the North West province, with 88% of the population residing in traditional areas, 7.4% in urban areas, and only about 3% residing on smallholdings (Moretele Local Municipality 2014:11). Like Moretele, more than 90% of the population in the North West province are black with only a small percentage from other ethnic groups (Moretele Local Municipality 2014:11; Mwakikagile 2010:69; Seidman 2008:32) .

4.3.1.4 Respondents' language

In question 4, the respondents indicated their first language (see figure 4.4).

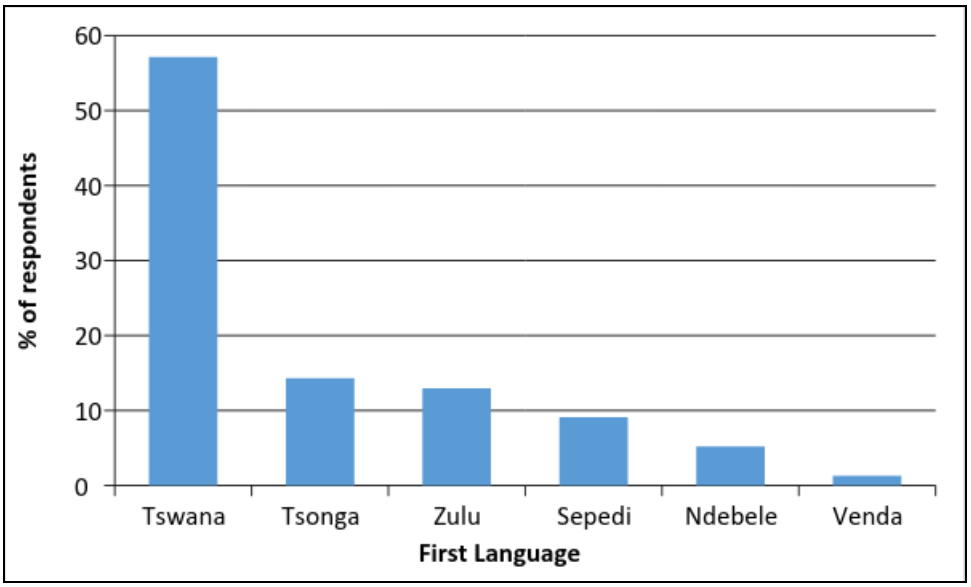


Figure 4.4 Respondents' first language (N=77)

Of the respondents, 57.1% (n=44) spoke Tswana; 14.3% (n=11) spoke Tsonga; 13% (n=10) spoke Zulu; 9.1% (n=7) spoke Sepedi; 5.2% (n=4) spoke Ndebele, and 1.3% (n=1) Venda. According to the report in the draft Integrated Development Plan (IDP) Setswana is the dominant language in the Moretele sub-district (Moretele Local Municipality 2014:13).

According to Mwakikagile (2010:69) and Seidman (2008:69), the main language spoken in the North West province is Setswana and furthermore, more than 65% of the other ethnic groups living there spoke Tswana.

The CNO (2009:2) states that individuals are likely to work in an environment where language will not be a barrier for service delivery, especially in nursing. People's home language is one of the attributes of their culture, and nursing considers culture an important factor (CNO 2009:2). In nursing, the same cultural origin between nurse and patient minimizes racial and ethnic barriers (Hitchcock, Schubert & Thomas 2003:171). Culture refers to the learned values, beliefs, norms and way of life that influence an individual's thinking, decisions and actions in certain ways (Clement 2012:118),.

Castledine and Close (2009:752) and Cang-Wong, Murphy and Adelman (2009:32) emphasise that client-centred care requires that nurses recognize the client's culture, the nurse's culture and how both affect the nurse-client relationship. Nursing is a profession that always focuses on the patient's needs (CNO 2009:4). Nurses enhance their ability to provide patient-centred care by reflecting on how their values and beliefs impact the nurse-patient relationship (Murphy 2011:5; Treas & Wilkinson 2014:321).

4.3.1.5 Respondents' qualifications

In question 5, the respondents were required to indicate their qualifications. In this question the respondents could select more than one option, depending on their qualifications.

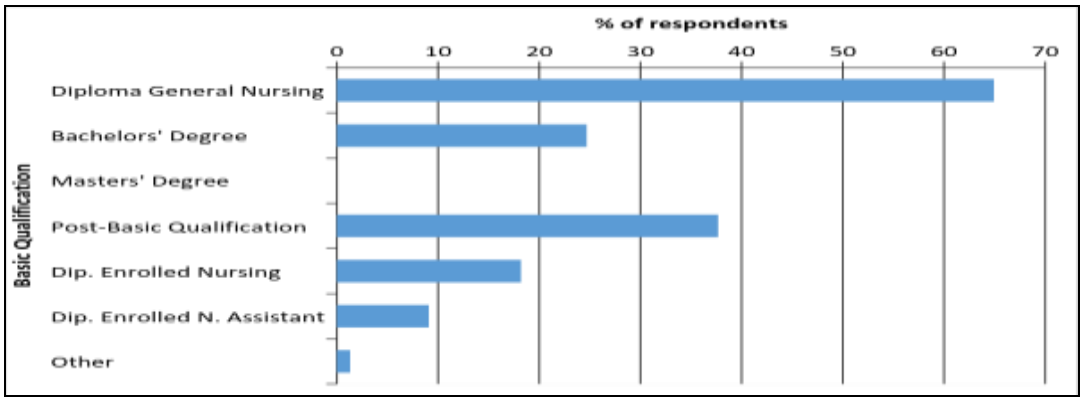


Figure 4.5 Respondents' qualifications (N=77)

Figure 4.5 shows that of the respondents, 64.9% (n=50) had diplomas in general nursing; 37.7% (n=29) had post-basic qualifications; 24.7% (n=19) had a degree in nursing science; 18.2% (n=14) had an enrolled nursing diploma; 9.1% (n=7) an enrolled nursing assistant diploma, and 1% (n=1) indicated “other” as occupational health.

The SANC (2015b:online) reported that 51% registered nurses (i.e., nurses with a diploma and degree in nursing); 22% enrolled nurses, and 27% enrolled nursing assistants were practising in South African health care facilities. Campbell, Longbottom and Pooler (2007:33) add that nurses and health care assistants work at different levels and all make a unique contribution to care. Campbell et al (2007:33) emphasise the importance of identifying the level at which individuals are working as it plays a role in delivering efficient and effective quality health care service. In addition, the CNO (2009:19) states that the complexity of care and the knowledge, ability and skills required determine who should provide care.

4.3.1.6 Respondents’ speciality qualifications

The respondents were asked to indicate their specialty qualifications in question 6 and could select more than one option (see figure 4.6).

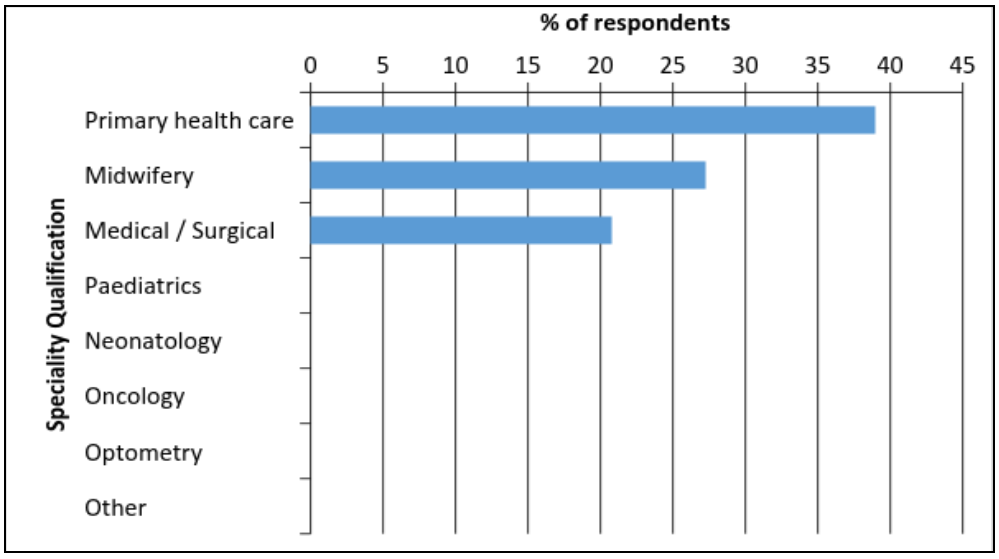


Figure 4.6 Respondents’ speciality qualifications (N=77)

Figure 4.6 shows that of the respondents, 39% (n=30) indicated PHC as their speciality qualification; 27.3% (n=21) indicated midwifery, and 20.8% (n=16) indicated

medical/surgical nursing. Campbell et al (2007:30) state that speciality qualifications are important as health care services are moving from secondary to PHC and this shift requires nurses to gain more skills and knowledge. In addition, the change in delivery of services brings with it responsibility for the practice to ensure that patient needs are met by appropriately qualified and trained staff who have been assessed as competent to undertake the role (Campbell et al 2007:30). From figure 4.6 it appears that the nurses are aware of the need for PHC at their facilities.

4.3.1.7 Respondents' current position

In question 7, the respondents were required to indicate their current position.

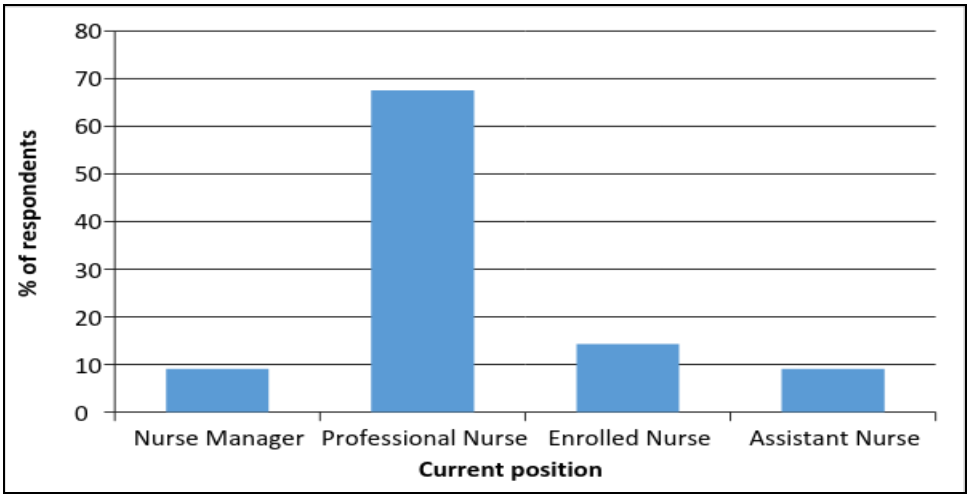


Figure 4.7 Respondents' current position (N=77)

Figure 4.7 indicates that of the respondents, 68% (n=52) were professional nurses; 9.1% (n=7) were nurse managers; 14.3% (n=11) were enrolled nurses, and 9.1% (n=7) were assistant nurses. For further analysis, the nurse managers and professional nurses were grouped together, and enrolled and assistant nurses were grouped together. The results on the positions and basic qualifications confirmed that the enrolled and assistant nurses only had the respective diplomas as basic qualifications. The speciality qualifications were held mainly by the nurse managers and professional nurses. This study was conducted in selected PHC facilities, and in these facilities enrolled nurses and enrolled assistant nurses form part of the supporting structure for professional nurses. The SANC describes different the nursing positions as follows:

- *Assistant/auxiliary nurse.* Assistant/auxiliary nursing is an entry level qualification into nursing. It is a qualification that serves to provide students with the basic knowledge, affective, cognitive and conceptual tools and practical techniques for additional higher education studies in nursing (Regulation R786, Paragraph 9(1)(a-c)). The knowledge emphasises general principles and their application in the provision of basic nursing care (Regulation R786, Paragraph 9(1)(a-c)). In addition the qualification signifies that the student has attained a basic level of higher education knowledge and competence in nursing and is capable of applying such knowledge and competence in the workplace (Regulation R786, Paragraph 10(1)(a-c)). The assistant/auxiliary nurse can practise part of the nursing regimen planned and initiated by a registered nurse or registered midwife and carried out under her/his direct or indirect supervision (Regulation R786, Paragraph 10(1)(a-c)). Therefore for auxiliary nurses to have a PHC qualification, they have to enrol for a professional nursing qualification first then PHC qualification.

- *Enrolled/staff nurse.* Enrolled/staff nurse refers to the nursing qualification that enables the nurse to function as a clinically focused, service oriented and independent health care worker, who is able to render nursing care as determined by the appropriate legislative framework (Regulation R786, Paragraph 6(1)(a-c); South Africa 2005: s 30(3)). This qualification provides a basis for decision-making about what is within and beyond the defined scope of practice, as well as an understanding of the referral system in place for anything outside of the scope of practice (Regulation R786, Paragraph 7(1)(a-f)). Recipients of this qualification will also be able to deal with specified emergencies beyond their scope in case of need (Regulation R786, Paragraph 7(1)(a-f)). The staff nurse in this manner will practise part of the nursing regimen planned and initiated by a registered nurse or registered midwife and carried out under her/his direct or indirect supervision (Regulation R786, Paragraph 7(1)(a-f)).
- *Professional nurse.* Professional nurse according to the Nursing Act 33 of 2005, as amended refers to a professional nurse as one who is educated and competent to practise comprehensive nursing, assumes responsibility and accountability for independent decision making in such practice, and is registered and licensed as a professional nurse under the Nursing Act (South Africa 2005:s

30(1)). A nurse with this qualification is expected to render comprehensive care across all spheres of health, as determined by the appropriate legislative framework (Regulation 786, Paragraph (4)(3)).

- *PHC qualification.* PHC qualification is defined under the Advanced Practice Nurse (APN) which is the umbrella term (SANC 2012:online). The APN refers to a registered nurse who has acquired the expert knowledge base, complex decision-making skills and competencies for expanded practice, the characteristics of which are shaped by the context and/or country in which s/he is credentialed to practise (SANC 2012:online). The APN is further divided into two categories: the Clinical Nurse Specialist (CNS) and the Advanced Nurse Practitioner (ANP).

  The CNS is defined as “a person having a qualification in the area of specializing, in-depth knowledge and expertise that enables her/him to focus on facility care and work closely with medical officers on a consultative basis” (SANC 2012:online).

  The ANP is defined as “a person who focuses on primary care, health assessment, diagnosis and treatment” (SANC 2012:online). This category can work with medical officers on a referral basis. In South Africa, this category is closer to PHC nurse and at time the midwife, psychiatric and paediatric nurse working outside the formal hospital environment.

In summary, the PHC qualification is an advanced postgraduate qualification which requires the nurse to have a diploma or a degree in nursing in order to be considered for enrolment. Therefore enrolled nurses or auxiliary nurses do not qualify for a PHC qualification as they first have to enrol for the diploma or degree in nursing hence the significant moderate association between the position and PHC qualification, which indicated that only professional nurses and nurse managers had the qualification.

4.3.1.8 Respondents’ years of experience as qualified nurse in PHC setting

In question 8, the respondents had to indicate their years of experience as a qualified nurse in a PHC setting.

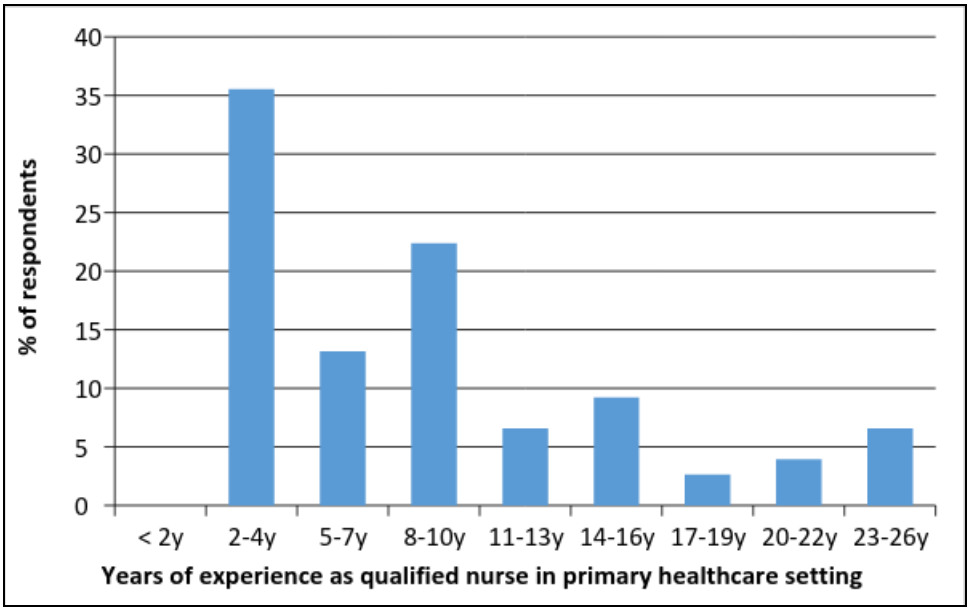


Figure 4.8 Respondents' years of experience as a qualified nurse in PHC setting (N=77)

Figure 4.8 presents the respondents' years of experience. All the respondents had more than 2 years' experience. For further analysis, the following groupings were used: 2-4years / 5-10years / 11years+. The findings indicate that of the respondents, 35.5% had 2-4 years' experience; 35.5% had 5-10 years' experience, and 29% had more than 11 years' experience working as a qualified nurse in a PHC setting.

4.3.1.9 Respondents' years of employment as qualified nurse

In question 9, the respondents indicated their years of employment as qualified nurse. The questionnaire underestimated the years of employment; 60% of the respondents indicated to have more than 11 years of employment as qualified nurses, where the actual years of employment ranged from 12-37 years (see figure 4.9).

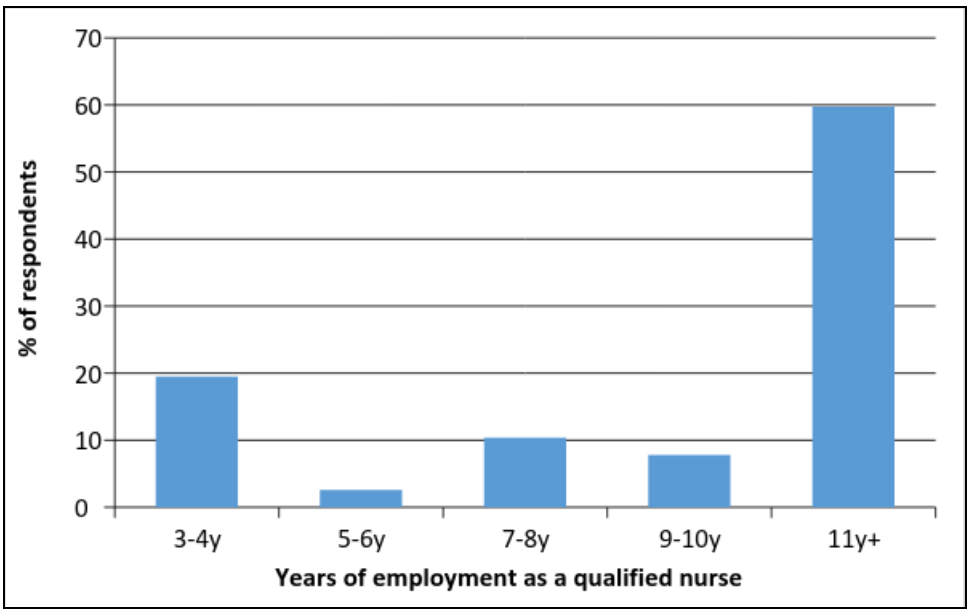


Figure 4.9 Respondents' years of employment as a qualified nurse (N=77)

Cross-tabulation of the raw data for the last two questions revealed no logical inconsistencies; i.e., nurses with more years of experience in a PHC setting than years of employment.

4.4 SECTION B TO G: RESPONDENTS' PERCEPTIONS

Section B examined the respondents' perceptions of the factors that might contribute to the spread of TB in their health care facilities. The HBM framework was used to structure the questionnaire and communicate the research findings.

The underlying concept of the HBM is that health behaviour is determined by personal beliefs or perceptions about a disease and strategies available to decrease its occurrence (Hayden 2013:65). Hayden (2013:65) adds that personal perception is influenced by a whole range of intrapersonal factors affecting health behaviour, such as knowledge, attitudes, beliefs, experiences, skills, culture and religion. In order to present the results in a meaningful manner the questions were guided by the HBM constructs: modifying factors (age, qualifications, experience and beliefs); individual perception (perceived susceptibility and perceived seriousness); likelihood of action (perceived benefits and perceived barriers); cues to action, and self-efficacy.

In this section inferential statistical data analysis was used to communicate the findings. Inferential statistics employ data in order to draw inferences (i.e. derive conclusions) or

make predictions (Kirch 2008:780). In inferential statistics, sample data are employed to draw inferences about one or more populations from which the samples have been derived (Kirch 2008:780). This section discusses the findings, their relationship with the modifying factors, and the P-value used to communicate the significance of the data or to derive conclusions. Thus the *p-value of <0.05 was applied to indicate the significance of the results.*

4.4.1 Section B: Perceived susceptibility to TB infection

Questions B1-B4 explored the HBM construct of perceived susceptibility.

4.4.1.1 Respondents' perceived risk factors of being infected with TB

In question B1 the respondents indicated the perceived risk factors for TB infection (see figure 4.10).

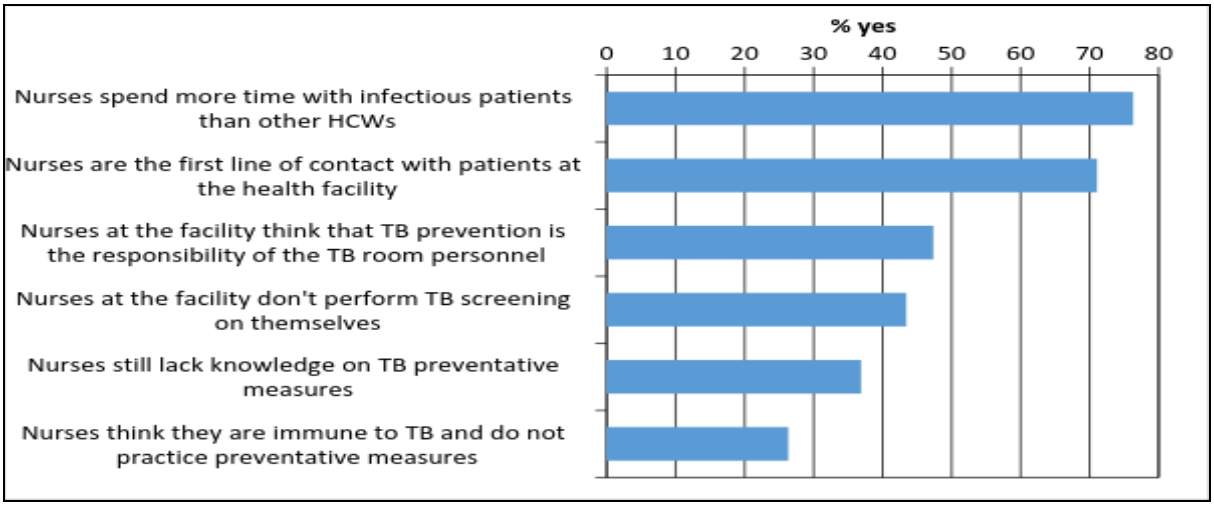


Figure 4.10 Respondents' perceived risk factors of being infected with TB (n=76)

In this question, the respondents could select more than one option. Of the respondents, 76% (n=58) indicated that nurses spent more time with infectious patients than other health care workers; 71% (n=54) indicated that nurses were the first line of contact with patients at the health care facility; 47.4% (n=36) indicated that nurses at the facility thought that TB prevention was the responsibility of the TB room personnel; 3.4% (n=33) indicated that nurses at the facility did not perform TB screening on themselves; 36.8% (n=28) indicated that nurses still lacked knowledge on TB preventive

measures, and 26.3% (n=20) indicated that nurses still thought that they were immune to TB and did not practise preventive measures. The findings were further analysed to determine the relationship between the respondents' perceived risk factors of being infected with TB and the modifying variables (see table 4.1).

The p-value for the test of association was used to test association between each of the perceived risk factors of being infected with TB and each of the modifying factors, and significance relationship highlighted in red. The x^2 test (or Fisher's exact test, where appropriate) was used for categorically modifying factors, while the Wilcoxon rank sum and Kruskal-Wallis tests were used for beliefs (a continuous variable).

Table 4.1 Relationship between respondents' perceived risk factors of being infected with TB and modifying variables (n=76)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Nurses spend more time with infectious patients than other health care workers	0.84	1.00	0.78	0.96	0.61
Nurses are the first line of contact with patients at the health facility	0.58	0.55	1.00	0.38	0.79
Nurses at the facility think that TB prevention is the responsibility of the TB room personnel	0.20	1.00	0.10	0.20	1.00
Nurses at the facility don't perform TB screening on themselves	0.43	0.79	0.24	0.58	0.49
Nurses still lack knowledge on TB preventive measures	0.066	0.77	1.00	0.28	0.72
Nurses think they are immune to TB and do not practise preventive measures	0.84	0.36	1.00	0.48	0.18

Table 4.1 indicates the p-values for the test of association between the respondents' perceived risk factors of being infected with TB and modifying factors. The p-values were all above 0.05, which indicated that there were no significant differences in any of the proportions of the individual risk factors with respect to any of the modifying factors.

The findings concur with other studies on TB as an occupational risk for health care workers (Prado, Galavote, Brioshi, Lacerda, Fregona, Detoni, Lima, Dietze & Maciel 2008:608; Drobniewski, Balabanova, Zakamova, Nikolayevskyy & Fedorin 2007:274; Kompala, Shenoi & Friedland 2013:268; Naidoo et al 2012:1600; Sissolak et al

2011:online). Prior to the 1900s, people could not believe that health care workers involved in the treatment of TB patients were more susceptible to TB infection than the general population. Prado et al (2008:608) conducted a retrospective descriptive study of secondary data on the epidemiological profile of TB cases reported among health care workers in the TB control programme of the Cassiano Antonio de Moraes University Hospital in Vitoria, Brazil between 2002 and 2006. During that period 25 cases of health care workers with TB were reported and of these, 32% (n=8) were nursing technicians; 32% (n=8) were professionals from other categories; 16% (n=4) were doctors; 12% (n=3) were nurses, and 8% (n=2) were radiology technicians (Prado et al 2008:609).

In Norway, Bock et al (2007:109) found that TST conversion revealed that 95% of 220 student nurses had acquired TB infection by their graduation, and 22% developed TB disease.

Ridley (2011:144) emphasises that health care workers or persons involved in patient care, even those with responsibilities not directly related to medical procedures but that merely place them in close proximity to an infected person, are considered to be at risk for contracting TB. Ridley (2011:144) adds that one of the greatest and most unexpected risks of contracting TB occurs when both the clerical and medical personnel are performing admission procedures, as the patient has not yet been diagnosed with TB nor is even suspected of having TB and therefore the personnel take no precautionary measures. Health care facilities are further considered a high risk setting for contracting TB as patients from all walks of life and with various ailments present at these facilities seeking medical attention. Consequently, any possible contagious infection will eventually present itself, including TB (Ridley 2011:144).

Due to their close contact with patients, nurses are always at risk of contracting TB as they may be exposed to those with undiagnosed TB (Odendal 2013:2). In China, Zhang, Liu, Zhang, Deng, Manish and Ajit (2013:2039) conducted a study among 101 participants to compare the performance of the T-SPOT.TB and TST for latent TB infection, evaluated diagnostic concordance and risk factors for latent TB infection, and observed the progression to active TB disease among health care workers in a general hospital in Beijing. The study found that 28.7% (n=29) had a positive T-SPOT.TB and 55.2% (n=53) had a positive tuberculin skin test. Of the participants that had known

direct contact with a sputum smear-positive TB case, 41.2% (n=21) were T-SPOT.TB positive, which was significantly higher than the 16% (n=8/50) without direct contact (Zhang et al 2013:2040).

According to Chatman (2008:90), the level of risk depends on the care setting, level of patient care responsibilities, and prevalence of TB disease in the community. In a Japanese study on nurses with active TB, Chatman (2008:90) found that 80% of the cases were contracted through nosocomial infection. In a study in Georgia to evaluate the rates of and risk factors for latent TB infection prevalence and latent TB infection test conversion among health care workers using the TST and QuantiFERON-TB Gold In-tube assay, Whitaker, Mirtskhulava, Kipiani, Harris, Tabagari, Kempker and Blumberg (2013:1-4) found a higher prevalence of positive QuantiFERON-TB Gold In-tube assay and tuberculin skin testing among participants from TB health care facilities (55%; n=107/194) than from non-TB health care facilities (31%; n=30/125). Health care workers are therefore at risk of TB infection but the risk increases with the nature of the work performed by those in contact with patients assumed to have undiagnosed TB. Nurses are more at risk for TB infection than any other health care workers due to the nature of their work (see figure 4.11).

4.4.1.2 Factors that increase the chance of developing TB disease following infection with the bacilli

In question B2, the respondents indicated perceived factors that increase the chance of developing TB disease. The respondents could select more than one option. Figure 4.11 depicts the results.

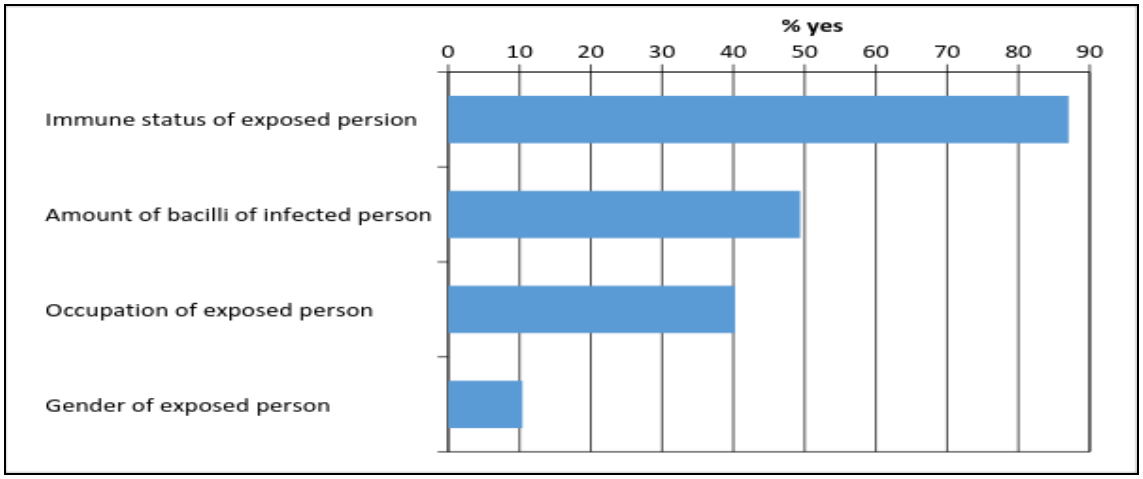


Figure 4.11 Respondents' perceived factors that increase the chance of developing TB disease following infection with the bacilli (N=77)

Of the respondents, 87% (n=67) indicated that the immune status of the exposed person increased the chance of developing TB disease; 49.4% (n=38) indicated that the infected person's amount of bacilli increased the chance; 40.3% (n=31) indicated that the exposed person's occupation increased the chance, and 10.4% (n=8) indicated that the exposed person's gender increased the chance of developing the disease.

According to Porth (2011:550), TB is caused by organisms called mycobacterium TB and that it is a highly resistant bacterium which is expelled and aerosolized in droplet form when an infected person coughs, sneezes, or talks. Sullivan and Krieger (2001:608) add that these droplets are capable of remaining suspended in the air for long periods and have been shown to circulate through ventilation systems and spread into entire buildings. Various factors including the nature of the bacteria, susceptibility of the host, and conduciveness of the environment may affect the ability of the mycobacterium TB organism to spread (Porth 2011:550).

Certain groups of people are more likely to contract TB than others and these include HIV-infected individuals, persons in frequent contact with TB-infected individuals, children less than five years old, persons with other immune-compromising conditions, and health care workers (CDC 2005:8). HIV infection is considered the greatest risk factor for progression from latent TB infection to TB disease (CDC 2005:5). According to the WHO (2009:19), TB is the most common opportunistic infection and a leading cause of death in people living with HIV. Moreover, the risk of developing TB in people

living with HIV is estimated to be between 12-20 times greater compared to those without HIV infection due to their weakened immune system which renders them less able to fight TB infection after exposure (Yirdaw et al 2014:online).

According to the CDC (2005:5), there are certain characteristics in a patient with TB that may increase the risk of infectiousness; for example, the presence of cough, cavitation on chest radiography, positive acid-fast bacilli sputum smear result and respiratory tract disease with involvement of the lung or pleura.

Health care workers, particularly those working with patients with TB, are at a high risk of developing TB as a consequence of the vertical TB management programme, prolonged hospitalisation of TB patients, the lack of isolation facilities, and weak infection control measures (Drobniewski et al 2007:274).

- *Relationship between the factors which increase the chance of developing TB disease following infection with the bacilli and the modifying factors*

Further analysis was done to assess the relationship between the risk factors for developing TB disease with the modifying factors. Table 4.2 represents the measure of association between the risk factor for developing TB disease and the modifying factors. The p-value was used for test of association between the risk factor of developing TB disease and the modifying factors (PHC qualification; experience and beliefs). The significant results are marked in red. Figures 4.12 to 4.14 display the results.

Table 4.2 Relationship between the factors that increase the chance of developing TB disease following infection with the bacilli and the modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Immune status of exposed person	0.28	0.23	0.0054	0.031	0.51
Amount of bacilli of infected person	0.61	0.42	1.00	0.88	0.89
Occupation of exposed person	0.70	0.79	0.64	0.51	0.016
Gender of exposed person	0.79	1.00	1.00	0.35	0.17

- *Risk factors for developing TB disease and PHC qualification as a modifying factor*

Figure 4.12 represents the relationship between the risk factors for developing TB disease and PHC qualification as a modifying factor. The percentages for the responses regarding the risk factors for developing TB disease are displayed vertically while the PHC qualifications of the respondents are shown horizontally.

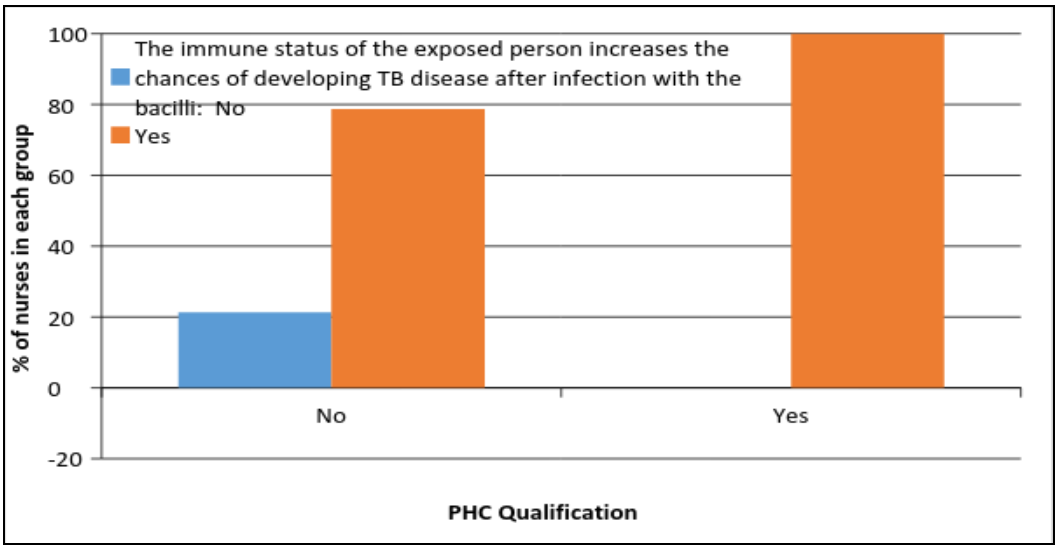


Figure 4.12 Risk factors for developing TB disease and PHC qualification as a modifying factor (N=77)

The results show that the respondents who had completed a PHC qualification indicated that the immune status of the exposed person increased the chances of developing TB disease following infection with the bacilli (100%), compared to 79% of those who did not have a PHC qualification. There was also a moderate relationship between the immune status of the exposed person as a risk factor to developing the TB disease and PHC qualification (X^2 test: p=0.0054; Cramer's V=0.31; P-value 0.0054). Thus the respondents holding a PHC qualification perceived or were more likely to perceive the immune status of the exposed person to be associated with the risk for developing TB disease.

- *Risk factors for developing TB disease and experience as a modifying factor*

Figure 4.13 represents the results of the relationship between the risk factors for developing TB disease and experience as the modifying factor.

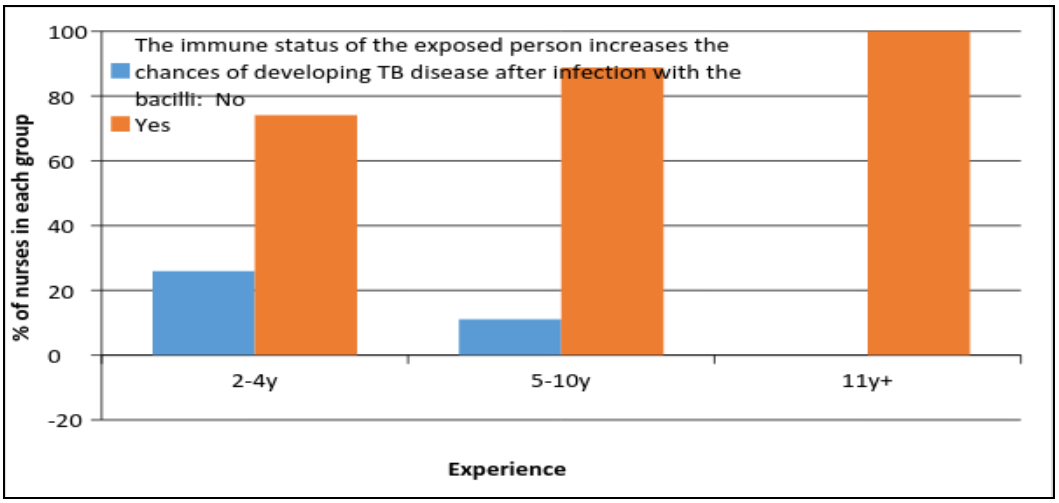


Figure 4.13 Risk factors for developing TB disease and experience as a modifying factor (N=77)

The results show that the proportion of the respondents who indicated that the immune status of the exposed person increased the chances of developing TB disease following infection with the bacilli, increased with added years of experience (Cramer's V 0.31; p=0.031). This indicated a significant result, with moderate effect size indicating that in practice there was a moderate relationship between experience and the perception of the risk of developing TB. The more experienced the health care workers, the more they

were likely to perceive the immune status of the exposed person to be a risk factor of developing TB.

- *Respondents' median belief scores*

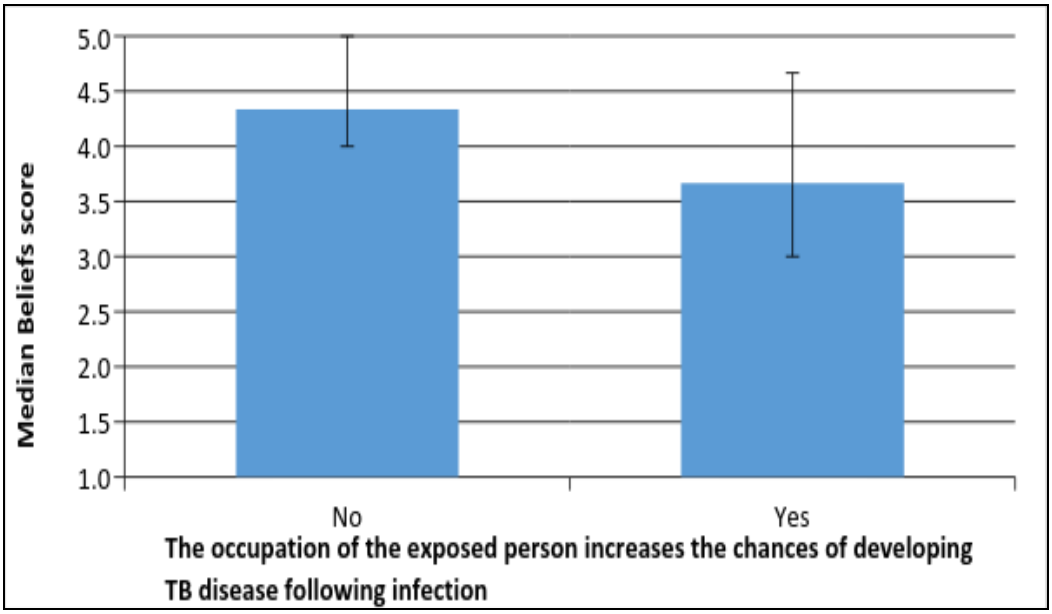


Figure 4.14 Respondents' median belief scores (N=77)

Figure 4.14 illustrates the results of the Wilcoxon rank sum test for a difference between two samples or comparison of two population medians. The results indicate a significant relationship with a small effect size between the risk factors of the occupation of the exposed person and beliefs/perceptions (Wilcoxon rank sum test: p=0.016; r=0.28). The respondents who indicated that the occupation of the exposed person increased the chances of developing TB disease once infected, had a lower median beliefs score than those who had not selected this option. The graphs show the medians, with the error bars denoting the interquartile range (IQR).

4.4.2 Section C: Perceived severity of TB infection

Questions C3 and C4 were based on the HBM construct of perceived severity.

4.4.2.1 Respondents' perceptions of main symptoms of TB

Question C3 examined the respondents' perceptions of the main symptoms associated with TB disease.

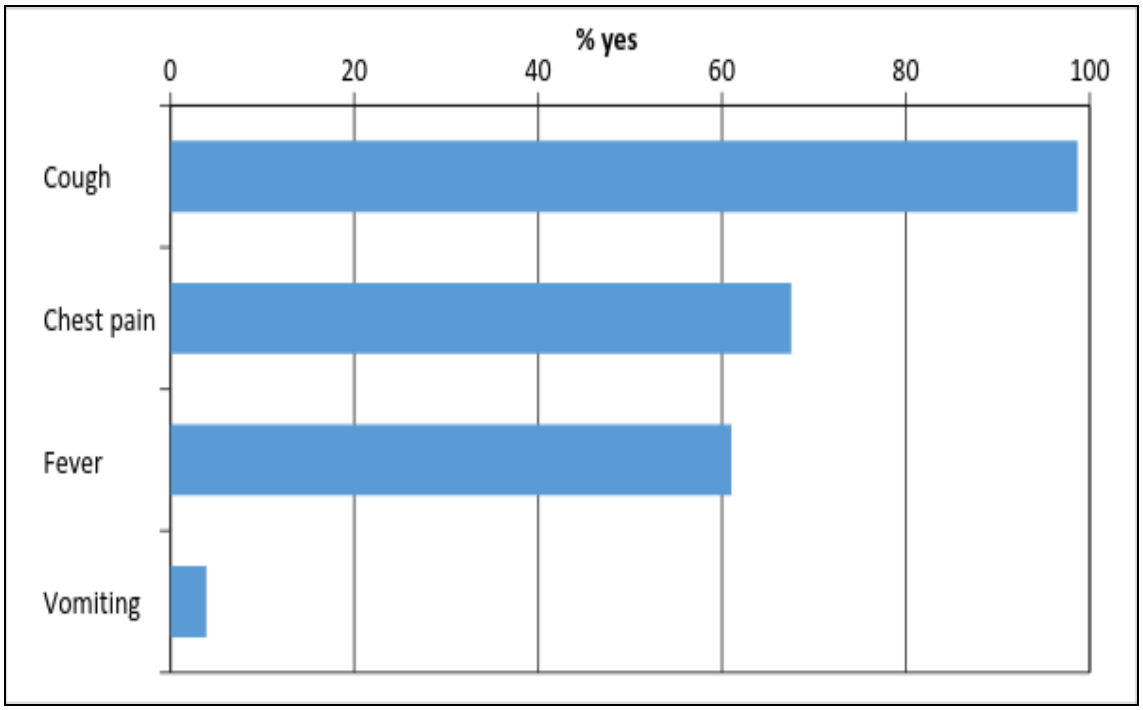


Figure 4.15 Respondents' perceptions of main symptoms of TB (N=77)

Figure 4.15 depicts the respondents' perceptions of the main symptoms of TB. The respondents could select more than one option. Of the respondents, 99% (n=76) of respondents indicated cough as one of the main symptoms of TB; 67.5% (n=52) indicated chest pain; 61% (n=47) indicated fever, and 3.9% (n=3) indicated vomiting as one of the main symptoms of TB.

The responses were further analysed to assess the relationship between the main symptoms and modifying factors. No relationship was observed between the main symptoms of TB and modifying factors.

- *Relationship between the main symptoms of TB and modifying factors*

Table 4.3 indicates the P-value for test of association between the main symptoms of TB and modifying factors.

Table 4.3 Relationship between the main symptoms of TB and modifying factors

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Cough	0.56	0.23	1.00	0.29	0.86
Chest pain	0.94	0.26	1.00	0.55	0.94
Fever	0.92	0.59	0.81	0.51	0.58
Vomiting	1.00	0.13	0.28	0.77	0.34

From table 4.3 it is clear that there were no significant differences in any of the proportions of the individual symptoms with respect to any of the modifying factors.

VanMeter and Hubert (2014:290) describe TB as an infectious disease caused by the bacillus Mycobacterium TB, which typically affects the lungs (PTB) but can affect other sites as well (EPTB). The disease is spread in the air when people who are sick with PTB expel bacteria; for example, by coughing (VanMeter & Hubert 2014:290; Story 2014:137). The signs and symptoms of TB may include a bad cough that lasts 3 weeks or longer, pain in the chest, coughing up blood or sputum (phlegm from deep inside the lungs), weakness or fatigue, weight loss, no appetite, chills, fever and sweating at night. Although a preventable disease, TB still remains a major global health problem (VanMeter & Hubert 2014:292; Story 2014:137). It causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide, after HIV (WHO 2014:1).

Makanjuola, Taddese and Booth (2014:online) refer to TB as the most common opportunistic infection and leading cause of mortality in people living with HIV/AIDS. According to Makanjuola et al (2014:online), people living with HIV/AIDS have 21 to 34 times the risk of developing TB disease than those without HIV infection. The WHO (2014:10) estimated that globally around 0.4 million people were co-infected with HIV and TB in 2013, representing in excess of 10% of the 9 million new cases of TB that same year, and this overall trend differs according to the state of the HIV epidemic in different settings. Makanjuola et al (2014:online) found that in hard hit areas, such as Sub-Saharan Africa (where there is a generalized HIV epidemic), people living with HIV/AIDS represent approximately 39% of new TB cases. Bhardwaj, Kashyap, Bansal, Kumar, Raina, Chander and Sharma (2014:online) maintain that the number of TB

deaths is unacceptably high, given that it is a symptomatic and most preventable disease. TB is also curable if people can access health care for a diagnosis and the right treatment is provided (Bhardwaj et al 2014:online). Odendal (2013:2) adds that it is crucial that health care workers working in the health care facilities understand the signs and symptoms of TB as this is the setting where HIV-infected patients are found. Health care facilities serve patients with different medical conditions and people with suspected and undiagnosed TB may be present among the patients presenting for medical care, which may expose people living with HIV/AIDS to infectious TB (Chai et al 2013: 101).

Buregyeya, Criel, Nuwaha and Colebunders (2014:online) contend that knowledge of the signs and symptoms alone does not lead to the control of TB, adding that health care workers should have knowledge of the risk of undiagnosed TB. In a study of 158 sputum-positive patients to assess the treatment delay of PTB and its determinants in two Uganda districts where TB infection control guidelines were formerly implemented, Buregyeya et al (2014:online) found an unacceptable patient delay in 58% (n=91) patients; a health service delay in 88% (n=140) patients, and a total delay in 90% (n=140). In their study, a health service delay referred to more than one week from the first consultation to the initiation of TB treatment. Buregyeya et al (2014:online) stressed that this long health service delay meant that a significant number of patients remained infectious which placed other patients in the health facilities and health care workers (particularly HIV infected) at risk of getting nosocomial TB.

4.4.2.2 Respondents' perceptions of most infectious patients

Question C4 examined the respondents' perceptions of the most infectious patients. The respondents could select more than one option.

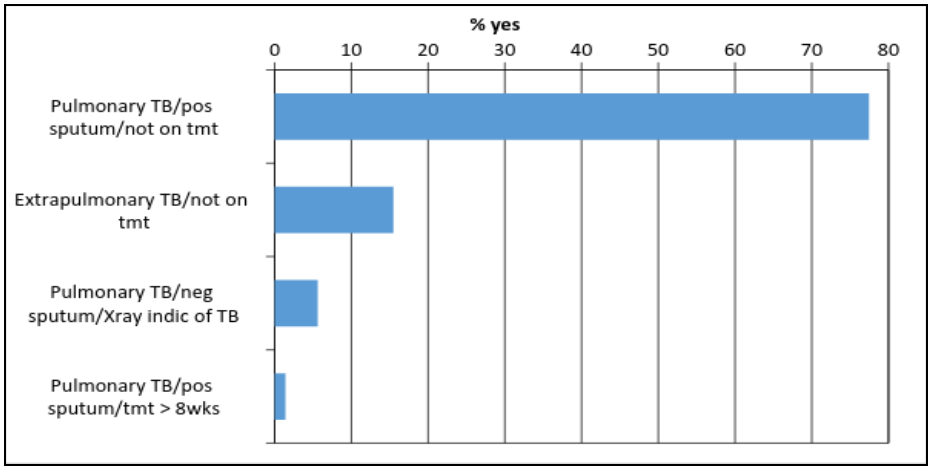


Figure 4.16 Respondents' perceptions of most infectious patients (n=71)

Of the respondents, 78% (n=55) indicated patients who have PTB with positive sputum results and not on treatment as the most infectious; 15.5% (n=11) indicated patients with EPTB not on TB treatment; 5.6% (n=4) indicated PTB patients with negative sputum results and an X-ray indication of TB, and 1.4% (n=1) indicated PTB patients with positive sputum results and on TB treatment for more than 8 weeks as most infectious.

- *Relationship between the most infectious patient and modifying factors*

The findings were further analysed to assess the relationship between the most infectious patient and modifying factors (see table 4.4).

Table 4.4 Relationship between respondents' perceived most infectious patients and modifying factors (N=71)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Most infectious patient	0.33	0.60	0.56	0.078	0.25

Regarding the test of association between the respondents' perceived most infectious patients and the modifying factors, no significant differences were found between the responses and any of the modifying factors.

Long and Schwartzman (2014:25) indicate that sputum AFB positive TB is the infectious form of TB and is mainly responsible for transmitting the disease. In addition, an untreated patient is likely to infect another 10-15 cases each year (Long & Schwartzman 2014:25).

Story (2014:137) states that the macrophages may destroy or inhibit the majority of the bacilli, but a small number may remain and multiply intra-cellularly, which will be released when the macrophages die thereby causing TB disease. Susceptibility of developing tubercular infection depends upon bacillary load, close contact with the patient, and duration of anti-tubercular treatment (Long & Schwartzman 2014:25). Thus persons who expel many tubercle bacilli are more infectious than ones who expel few or no bacilli (Long & Schwartzman 2014:26).

Mota, Carvalho, Valente, Braga and Duarte (2012:75) conducted a study on 136 Portuguese patients with sputum culture proven PTB. The purpose was to identify the factors associated with delayed sputum smear and culture conversion in patients with PTB who were given anti-TB. Mota et al (2012:75) found that the patient smear conversion was associated with the grading of the sputum results and the severity of the lung cavitation on chest radiography. Consequently, patients with lower grade sputum results (1+) were likely to become non-infectious within 24 hours of TB treatment initiation whereas those with high grade sputum results (4+) were likely to convert sputum after 24 days of treatment (Mota et al 2012:75).

In a study on the culture conversion rate at 2 months of treatment according to diagnostic methods among patients with culture-positive PTB, Lee, Chae, Lee, Choi, Lee, Park, Lee, Yoo, Kim, Han and Yim (2014:1-5) found the culture conversion rate at 2 months was defined as negative culture conversion at 8 weeks (or 9 weeks, if results at 8 weeks were unavailable). The time to culture conversion was defined as the number of days from initiation of anti-TB treatment to the date of culture conversion (Lee et al 2014:1-5). Of the 203 patients, 90.1% (n=183) achieved negative culture conversion of sputum at 2 months of anti-TB treatment. The culture conversion rate at 2 months in the smear-positive group (78.7%) was significantly lower than that in the other two groups (94.1% in the culture-positive group; 97.6% in the bronchoscopy group, P=0.001 (Lee et al 2014:4-5).

Patients with PTB who are not on treatment are the most infectious and the sputum grade determines the infectivity of the sputum. Yimer, Bjune and Holm-Hansen (2014:2) state that delay in the diagnosis of the infectious patient and early treatment initiation is associated with increased nosocomial transmission of the disease. Yimer et al (2014:1-9) conducted a study to determine the time to first consultation, diagnosis and treatment of TB patients at a referral hospital in Bahir Dar, Northwest Ethiopia and analyse predictors of patients', health systems' and total delays. The study found that the median health systems' delay was 27 days (interquartile range 8 days, 60 days) and the median total delay was 60 days (IQR 30 days, 121 days), where health systems' delay referred to the first visit to a medical provider and the initiation of treatment (Yimer et al 2014:5). The delay in the diagnosis of TB was associated with repeated visits to the health care facility and difficulty in accessing better managed TB services. Yimer et al (2014:9) emphasise that understanding the magnitude of and factors contributing to delay in diagnosis and treatment among all categories of TB patients is crucial in improving TB control programme performance. Moreover, regular refresher training courses for health care providers about the importance of recognizing symptoms indicative of TB will help to reduce health system delays and consequently the duration of infectiousness (Yimer et al 2014:9).

4.4.3 Section D: Perceived benefits of TB preventive measures

Questions D5-D12 covered the HBM construct of perceived benefits.

4.4.3.1 Respondents' attendance at TB training in the last 12 months (N=77)

In question D5, the respondents had to indicate whether they had attended training on TB in the last 12 months. Of the respondents, only 38% (n=29) indicated that they had attended TB training in the last 12 months.

- *Relationship between TB training attendance and modifying factors*

The results were further analysed to determine their relationship with the modifying variables.

Table 4.5 Relationship between TB training attendance and modifying factors

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Training on TB attended in the last 12 months	0.33	0.78	0.63	0.37	0.23

Table 4.5 represents the results for the relationship between the TB training attendance in the last 12 months and modifying factors. The results indicated that there were no significant differences between the responses to the TB training attendance in the last 12 months and any of the modifying factors.

An estimated two thirds of people with TB are never diagnosed as having the disease and so cannot benefit from treatment thus leaving the epidemic unchecked despite increasing global coverage by treatment programmes (WHO 2013b:26). TB has re-emerged, and an estimated 9 million new cases of TB occur annually, of which approximately 480,000 are MDR-TB (WHO 2013a:1). Although a preventable and curable disease, TB still kills approximately 1.5 million people every year (WHO 2014:1).

The DOTS expansion working group considers the lack of trained staff a major constraint on the control of TB and since nurses are considered the backbone of the health care system, their competency in TB detection, control and care is crucial (Ghebrehiwet 2006:239).

In India, Kaur, Kaur, Singh and Gupta (2014:1-8) conducted a study on the knowledge and attitude of DOTS providers and treatment outcome of TB patients on the Revised National TB Control Programme (RNTCP). The DOTS providers comprised pharmacists, nurses, treatment organisers and radiographers. The study found that 90% (n=47) of the DOTS providers knew about the most common presentation of TB and 100% (n=52) were knowledgeable about spread of infection by droplets; 100% (n=52) knew that cough with expectoration is the symptom of TB and 78% (n=41) knew the other symptoms: evening rise of temperature, blood in sputum, pain chest, weight loss or family history of TB (Kaur et al 2014:6). Kaur et al (2014:7) also found that 84% (n=42) of the DOTS providers had been trained in the RNTCP, and there was a

significant difference in the knowledge about treatment schedule between the trained and the untrained ones (Kaur et al 2014:6).

In Western Uganda, Wynne, Richter, Banura and Kipp (2014:6) explored health care workers and patients' perspectives on challenges to TB care. One of the major problems identified by the health care workers was a need for training (Wynne et al 2014:7). The health care workers indicated a need for more training on TB as only a few were trained and felt that the training might be outdated. Current strategies such as books and posters were said to be ineffective as health care workers were always busy and did not have time to read (Wynne et al 2014:7).

Ghebrehiwet (2006:239) points out that nurses in health care settings carry the bulk of the work in TB prevention, care and treatment, and in order to confront the disease or infection, they need to be trained and mobilised.

4.4.3.2 Health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infection (N=77)

Question D6 required the respondents to indicate whether facilities treating patients with TB should have a person responsible for segregation of patients so that TB infection can be reduced. Of the respondents, 88% (n=68) agreed with this statement.

- *Relationship between having a responsible person at the health care facilities for segregation of patients to reduce TB infection and modifying factors*

The results were further analysed to determine the relationship between having a responsible person at the health care facilities for segregation of patients to reduce TB infection and the modifying factors.

Table 4.6 Relationship between having a responsible person at the health care facilities for segregation of patients to reduce TB infection and modifying factors

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections	0.47	0.20	0.082	0.91	0.021

Table 4.6 represents the results for having a responsible person at the health care facilities for segregation of patients to reduce TB infection and modifying factors. The results show a significant relationship (small effect size) between the response to this question and beliefs (Wilcoxon rank sum test: p=0.021; r=0.27).

- *Respondents' median beliefs scores and having a responsible person at the health care facilities for segregation of patients to reduce TB infection*

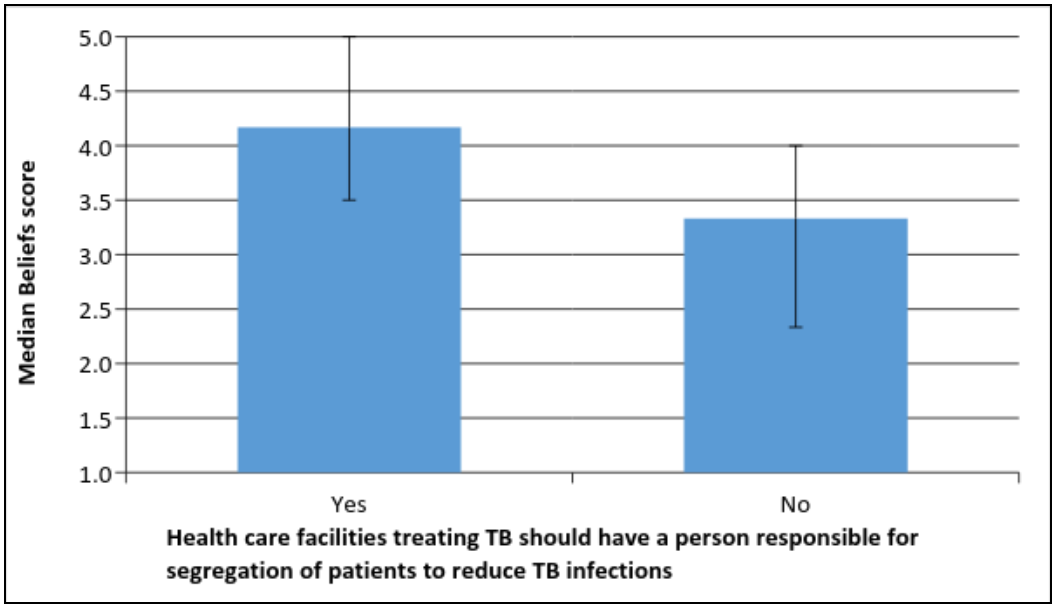


Figure 4.17 Respondents' median beliefs scores and responsible person (N=77)

Figure 4.17 represents the respondents' median beliefs score and having a responsible person at the health care facilities for segregation of patients to reduce TB infection. The results show that the respondents who agreed that there should be a person

responsible for segregation of patients to reduce TB infection had a higher median beliefs score than those who disagreed.

4.4.3.3 Respondents' reasons for needing a person responsible for segregation of patients to reduce TB infections

Question D7 was for respondents who agreed with question D6. Figure 4.19 presents the respondents' reasons for agreeing with question D6

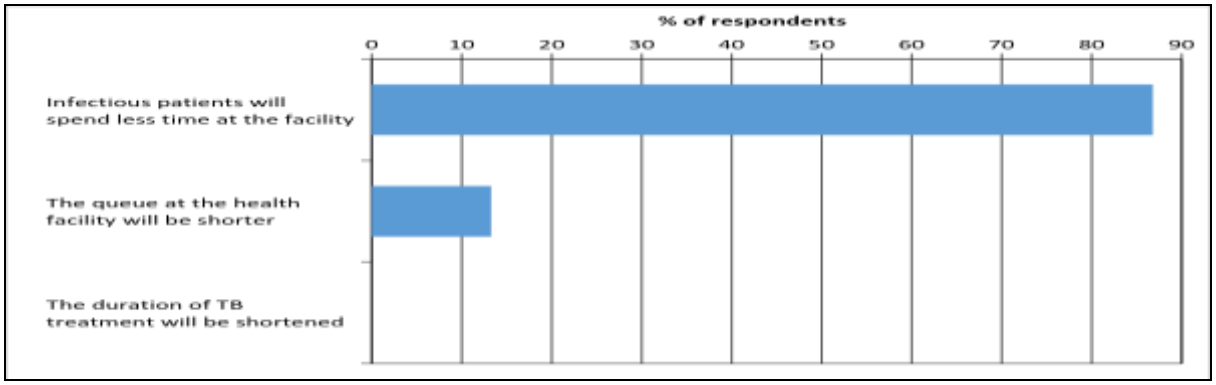


Figure 4.18 Reasons for needing a person responsible for segregation of patients to reduce TB infection (n=68)

Figure 4.18 presents the respondents' reasons for needing a person responsible for segregation of patients to reduce TB infection. Of the respondents, 87% (n=59) indicated that having a person responsible for the segregation of patients would result in infectious patients spending less time at the facility, and 13.2% (n=9) indicated that the queue at the facility would be shorter. None of the respondents indicated that the duration of TB treatment would be shorter.

- *Relationship between the reasons for health care facilities treating TB having a person responsible for segregation of patients to reduce TB infection and modifying factors*

The results were further analysed to determine the relationship between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections and modifying factors.

Table 4.7 Relationship between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infection and modifying factors (n=68)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Reason why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infection	0.74	1.00	0.068	0.046	0.051

Table 4.7 represents the results of the relationship the between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections and the modifying factors. The results with the significance association are marked in red. The results show that there is a relationship between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections and the modifying factors (p=0.046).

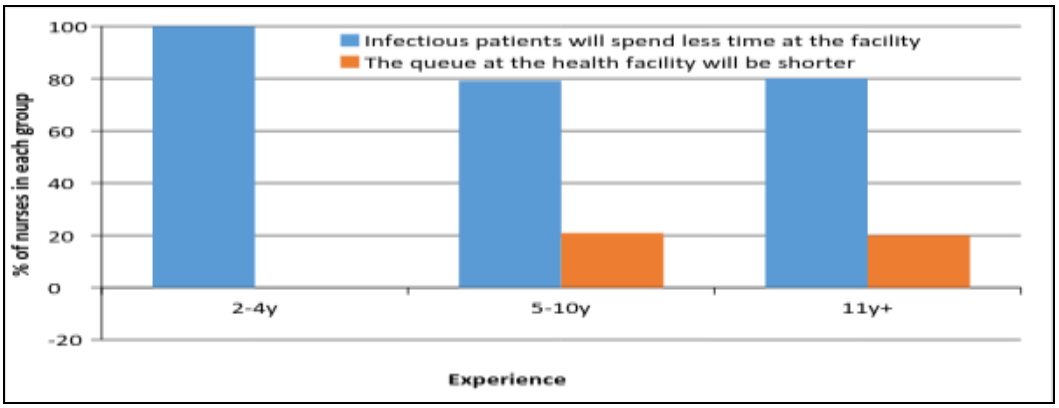


Figure 4.19 Relationship between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections and experience as a modifying factor (n=68)

Figure 4.19 shows that there was a significant, weak, association between the reasons why health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infections and experience (X^2 test: p=0.046; Cramer's V=0.29). The results show that the respondents with more than four years of experience had a

higher proportion of respondents who felt that queues would be shorter, compared to those with less experience.

TB is a disease which is spread from person to person through the air (CDC 2005:4). In places where people are congregated together or crowded, such as clinics and some houses, it is important to prevent the spread of TB from person to person. Odendal (2013:2) states that this is especially important in clinics where people who may have TB are crowded next to people who may not be infected with TB. The CDC (2005:4) reports that crowding and poor ventilation are characteristic in in-patient and outpatient settings.

Kompala et al (2013:264) add that five minutes of talking or one cough produces equivalent numbers of infectious particles, which can remain airborne for 30 minutes. All health-care settings need a TB infection-control programme designed to ensure prompt detection, airborne precautions, and treatment of persons who have suspected or confirmed TB (or prompt referral of persons who have suspected TB disease for settings in which persons with TB disease are not expected to be encountered) (CDC 2005:7). Such a programme is based on a three-level hierarchy of controls, including administrative, environmental and respiratory protection (CDC 2005:7). According to the CDC (2005:7), administrative controls consist of the following activities:

- Assigning responsibility for TB infection control in the setting
- Conducting a TB risk assessment of the setting
- Developing and instituting a written TB infection control plan to ensure prompt detection, airborne precautions, and treatment of persons who have suspected or confirmed TB disease
- Implementing effective work practices for the management of patients with suspected or confirmed TB disease
- Training and educating health care workers regarding TB, with specific focus on prevention, transmission, and symptoms
- Screening and evaluating health care workers who are at risk for TB disease or who might be exposed to mycobacterium TB (i.e. TB screening programme)

The first line of TB infection control is the administrative measures, which include patient triage, separation of suspects, provision of care, and referral of TB suspects to TB programmes (CDC 2005:7).

Albuquerque da Costa, Trajman, Carvalho de Queiroz Mello, Goudinho, Monteiro Vieira Silva, Garret, Ruffino-Netto and Lineu Kritski (2009:57) conducted a study in a university-affiliated, inner-city hospital in Rio de Janeiro on the impact of administrative infection control measures on the risk for latent TB infection among health care workers using a routine serial TST. The following administrative infection control measures were progressively implemented: isolation of TB suspects and confirmed TB inpatients, quick turnaround for acid-fast bacilli sputum tests, and health care worker education in the use of protective respirators (Albuquerque da Costa et al 2009:58). The study found that of the 1336 health care workers who initially participated in the study, 599 got retested (Albuquerque da Costa et al 2009:58). The number of TST conversions per 1000 person-months during and after the implementation of these measures was reduced from 5.8/1000 to 3.7/1000 person-months (Albuquerque da Costa et al 2009:60). Physicians and nurses had the highest reductions (from 7.6 to 0, $P < 0.001$; from 9.9 to 5.8, $P = 0.001$, respectively). Therefore Albuquerque da Costa et al (2009:58) concluded that isolated administrative measures for infection control can significantly reduce latent TB infection among health care workers in high-burden countries and should be implemented even when resources are not available for engineering infection control measures. Correctly implemented administrative measures in health care settings can reduce the risks of nosocomial infection with TB.

4.4.3.4 Measures to be carried out to reduce the risk of TB infections in the health care facilities (N=77)

In question D8, the respondents had to indicate measures that could be carried out to reduce the risk of TB infection in the health care facilities (see figure 4.20). In this question, the respondents could select more than one option.

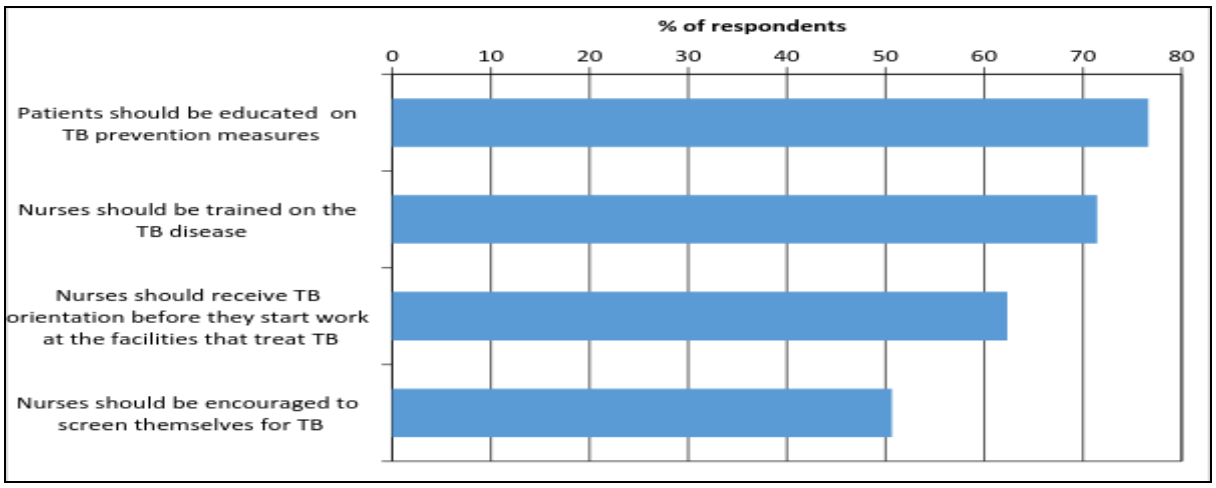


Figure 4.20 Measures to be carried out to reduce the risk of TB infections in the health care facilities (N=77)

Of the respondents, 77% (n=59) felt that patients should be educated on TB prevention measures; 71% (n=55) felt nurses should be trained on TB disease; 62% (n=44) felt that nurses should receive TB orientation before they started work at the facilities that treat TB patients, and 51% (n=39) indicated that nurses should be encouraged to screen themselves.

- *Relationship between measures that can be carried out to reduce the risk of TB infection in the health care facilities and modifying factors (N=77)*

The results were further analysed to determine the relationship between the measures that can be carried out to reduce the risk of TB infection in the health care facilities and the modifying factors.

Table 4.8 Relationship between the measures that can be carried out to reduce the risk of TB infection in the health care facilities and the modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Patients should be educated on TB prevention measures	0.53	0.11	0.78	0.94	0.66
Nurses should be trained on the TB disease	0.64	0.37	0.80	0.31	0.11
Nurses should receive TB orientation before they start work at the facilities that treat TB	0.093	0.58	0.34	0.53	0.98
Nurses should be encouraged to screen themselves for TB	0.72	0.42	1.00	0.78	0.35

Table 4.8 presents the results of the relationship between the measures that can be carried out to reduce the risk of TB infection in the health care facilities and modifying factors. No significant association was found between the measures that can be carried out to reduce the risk of TB infection in the health care facilities and the modifying factors.

Infection control plays a critical and often underappreciated and poorly implemented role in limiting transmission (Kompala et al 2013:264). The CDC (2005:4) mention that the health care settings need a TB infection control programme designed to ensure prompt detection, airborne precautions, and treatment of persons who have suspected or confirmed TB disease; and that such a programme should include training and education of health care workers on TB, with specific focus on prevention, transmission, and symptoms. In addition, health care workers providing care for patients should make it a routine to educate the community and patients to recognize symptoms of TB so that they can seek immediate health care (NDoH 2007:14).

In a survey on attitude, experience and knowledge of epidemiology, diagnosis, and treatment of TB among 183 fifth-year medical students at the Catholic University of Rome (Italy), Laurenti, Federico, Raponi, Furia, Ricciardi and Damiani (2013:866) found a significant association between internship in units and departments and greater knowledge about TB diagnosis (55.9% vs. 51.6%, p=0.02), treatment (48.4% vs. 41.8%, p=0.03), and total score (58.1% vs. 54.5%, p=0.04). Students who reported receiving

the Mantoux test had greater knowledge about TB epidemiology and prevention (65.4% vs. 53.3%, p=0.001), diagnosis (55.2% vs. 48.3%, p=0.005), and total score (58.0% vs. 49.1%, p=0.001). Students who reported observing at least 1 active PTB case had a higher percentage of correct answers about diagnosis (55.5% vs. 51.4%, p=0.03) and total score (57.9% vs. 54.0%, p=0.03). Finally, students who reported observing at least 1 X-ray of a TB patient had a higher percentage of correct answers about epidemiology and prevention (64.7% vs. 57.3%, p=0.02), diagnosis (55.1% vs. 49.5%, p=0.02), and total score (57.7% vs. 51.2%, p=0.004). Laurenti et al (2013:866) concluded that internship was strongly associated with a greater knowledge of TB diagnosis, epidemiology, and prevention. In addition, Laurenti et al (2013:866) also indicated that insufficient knowledge about TB among doctors was one of the reasons for failure to prevent TB. The study revealed that only 63.5% of medical students had knowledge about the epidemiology and prevention of TB; 54.1% for diagnosis, and 45.7% for treatment (Laurenti et al 2013:867).

In a study in Kwa-Zulu Natal, South Africa, to measure knowledge changes among health care workers who participated in TB training using Pre-training and post-training assessment of knowledge of TB, Naidoo, Taylor, Esterhuizen, Nordstrom, Mohamed, Knight and Jinabhai (2011:514) found a significant improvement in mean knowledge post-training; the mean pre-training knowledge for the health care workers was 59.5% ($p<0.001$) and post-training score was 66.5% ($p<0.001$).

Kompala et al (2013:264) emphasise that health care facilities are common sites of TB transmission due to the presence of undiagnosed, untreated, highly infectious patients in waiting rooms and triage areas, and that the risk of mycobacterium TB transmission can be increased if ventilation and other infection prevention and control measures are inadequate.

According to the WHO (2009:11), educating patients to recognize symptoms of TB and to seek health care should be routine in all settings providing care for patients. In addition, patients should be taught how to protect themselves and others from exposure to TB (WHO 2009:11).

Makanjuola et al (2014:online) conducted a study to systematically identify the main barriers to adherence to IPT for TB among people living with HIV/AIDS. Their review

confirms current understanding of adherence to treatment as influenced by patients' understanding of and beliefs about treatment regimens, which is influenced by broader factors, such as poverty and lack of health facilities; level of support available to patients from family and other networks; the stigma emanating from these relationships, and relationships with health care providers (Makanjuola et al 2014:10). Adherence is facilitated by interactions with a clinician, specifically, interactions that include counselling (Makanjuola et al 2014:10). The findings indicate that the completers of IPT were more likely to find counselling helpful (91% vs. 63%, 95% CI 0.0574–0.5086, P,0.007), thus patients who had received information about IPT were 8 times more likely to adhere (Makanjuola et al 2014:11). In Addis Ababa, Berhe, Demissie and Tesfaye (2014:online) assessed adherence to IPT and associated factors among people living with HIV. The study found that individuals who were informed about the reasons for taking IPT by their doctors/nurses were more likely to adhere than those who did not have information why they are taking the treatment (Berhe et al 2014:online).

4.4.3.5 Importance of screening nurses for TB (n=75)

Question D9 focused on the importance of screening nurses for TB. Of the respondents, 95% (n=71) agreed with this statement.

- *Relationship between the importance of screening nurses for TB and modifying factors (n=75)*

The results were further analysed to determine the relationship between the importance of screening nurses for TB and modifying factors.

Table 4.9 Relationship between the importance of screening nurses for TB and modifying factors (n=75)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Nurses should be screened for TB	0.61	1.00	1.00	0.86	0.56

Table 4.9 presents the results of the relationship between the importance of screening nurses for TB and modifying factors. No significant association was found between the importance of screening nurses for TB and any of the modifying factors.

4.4.3.6 Reasons why screening nurses for TB is important (n=68)

Question D10 was asked as a response to question D9, and 68 respondents responded.

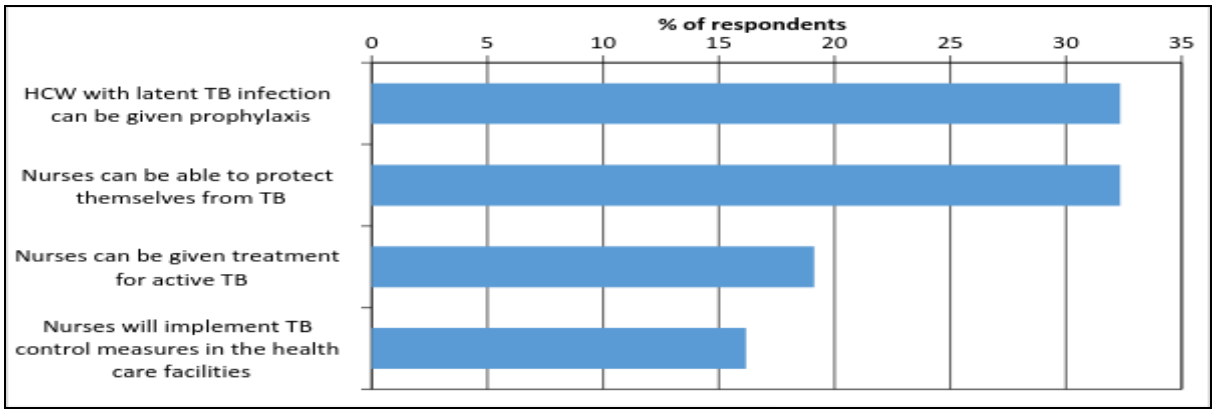


Figure 4.21 Reasons why screening nurses for TB is important (n=68)

Figure 4.21 represents the respondents' reasons why screening nurses for TB is important. Of the respondents, 32% (n=22) indicated the opportunity for prophylaxis; 32% (n=22) indicated protection from TB; 19% (n=13) indicated that nurses can be given treatment for TB, and 16% (n=11) indicated that nurses will implement TB control measures in the health care facilities.

- *Relationship between the reasons for screening nurses for TB and modifying factors*

The results were further analysed to determine the relationship between the reasons for screening nurses for TB and modifying factors.

Table 4.10 Relationship between the reasons for screening nurses for TB and modifying factors (n=68)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Reason why screening for TB is important	0.22	0.70	1.00	0.67	0.24

Table 4.10 presents the results for the relationship between the reasons for screening nurses for TB and modifying factors. The results show that there was no significant association between the reasons for screening nurses for TB and modifying factors.

The risk of TB in health care workers is consistently higher than the general population (CDC 2005:2). Health care facilities are common sites of TB transmission as people with undiagnosed TB are congregated in these settings (CDC 2005:3). Improved implementation of infection control practices appropriate for the local setting and in combination has been associated with reduced transmission (CDC 2005:5). Baussano, Nunn, Williams, Pivetta, Bugiani and Scano (2011:493) assessed the effectiveness of TB control measures essential to protect health care workers, and found that the annual incidence among health care workers may be decreased by as much as 49%, 27%, and 81% in countries with low, intermediate, and high TB incidence, respectively.

The risk of latent TB infection in health care workers increases when airborne protection procedures are not in place in the presence of active PTB, as a result of delayed diagnosis (Muzzi et al 2014:online). The TST was performed twice: first, immediately after exposure to an index patient (T1) and three months later (T2) and the period of time between T0 and T1 was used to calculate the annual rate of TB infection, while the time between T1 and T2 was used to calculate the post-exposure annual rate of TB infection (Muzzi et al 2014: online). The study included all health care workers exposed to a patient with cultural confirmed PTB and not implementing respiratory protection measures (Muzzi et al 2014:online). In analysing the results, all the health care workers who resulted TST negative at T1 were evaluated with TST at T2 and TST at T2 was positive in 3.7% (n=9) health care workers that were TST negative at T1 (6 nurses and 3 physicians), and post-exposure annual rate of TB infection was 26 (95% CI 13.6-50) per 100 person-years (Muzzi et al 2014:online).

IPT should be used for treatment of latent TB as it is effective in the prevention of active TB among HIV-infected patients (WHO 2011:1).

Yirdaw et al (2014:online) conducted a study in Southern Ethiopia to measure the level of uptake and effectiveness of IPT in reducing TB incidence in a cohort of people living with HIV enrolled in HIV care between 2007 and 2010. A total of 5,407 patients were observed, and IPT had been initiated for 39% of eligible patients. The study found 295 incident TB cases during 11,290 person-years of observation, making the overall TB incidence rate 2.6 per 100 person-years of follow-up (95% CI: 2.3–2.9); the TB incidence rate in those who took IPT was 0.7 per 100 person-years and 6.1 per 100 person-years for those who did not. The protective effect of IPT appeared to be persistent irrespective of documented IPT completion (Yirdaw et al 2014:online).

Guwatudde, Debanne, Diaz, King and Whalen (2004:1037) conducted a study to estimate the effect size of TB preventive therapy on the public health problem of TB in contemporary sub-Saharan Africa using the compartmental flow model. The results showed that giving IPT to 25% of HIV-positive individuals with latent TB infection led to a 3.9% reduction in the prevalence of TB in 10 years and a 5.1% reduction in 20 years. This intervention also prevented a cumulative total of 3.0% of TB-associated deaths in a decade and 5.5% in two decades. Doubling IPT coverage to 50% approximately doubled the effect size, suggesting a linear relationship within the 20-year period (Guwatudde et al 2004:1040). Therefore for this efficacy, the WHO (2011:12) recommends that IPT be considered part of a package of prevention and care for nurses and other health care workers exposed to TB.

Churchyard, Fielding, Lewis, Coetzee, Corbett, Godfrey-Faussett, Hayes, Chaisson and Grant (2014:302) contend that treatment for latent TB has no significant effect on TB control. Churchyard et al (2014:303) conducted a cluster-randomized study among 15 clusters with 78,744 miners as either intervention clusters (40,981 miners in 8 clusters) or control clusters (37,763 miners in 7 clusters) to evaluate the incidence of TB during the 12 months after the intervention ended. The study found that the intervention did not reduce the incidence of TB, with rates of 3.02 per 100 person-years in the intervention clusters and 2.95 per 100 person-years in the control clusters (rate ratio in the intervention clusters, 1.00; 95% CI, 0.75 to 1.34; P = 0.98; adjusted rate ratio, 0.96;

95% CI, 0.76 to 1.21; P = 0.71), or the prevalence of TB (2.35% vs. 2.14%; adjusted prevalence ratio, 0.98; 95% CI, 0.65 to 1.48; P = 0.90) (Churchyard et al 2014:306).

4.4.3.7 Importance of nurses working in the clinics treating TB patients to know their HIV status (n=73)

Question D11 focused on the importance of screening nurses for TB. Of the respondents, 85% (n=62) agreed with this statement.

- *Relationship between the importance of nurses working in the clinics treating TB patients to know their HIV status and modifying factors (n=73)*

The results were further analysed to determine the relationship between the importance of knowing HIV status and modifying factors (see table 4.11).

Table 4.11 Relationship between the importance of nurses working in the clinics treating TB patients to know their HIV status and modifying factors (n=73)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Important for nurses working in clinics treating TB patients to know their HIV status	0.70	0.27	1.00	0.55	0.45

Table 4.11 indicates that there was no significant association between the importance of knowing HIV status and modifying factors.

4.4.3.8 Reasons for the importance of knowing one's HIV status (n=62)

Question D12 examined the respondents' reasons for agreeing with question D11 and 62 respondents answered (see figure 4.22).

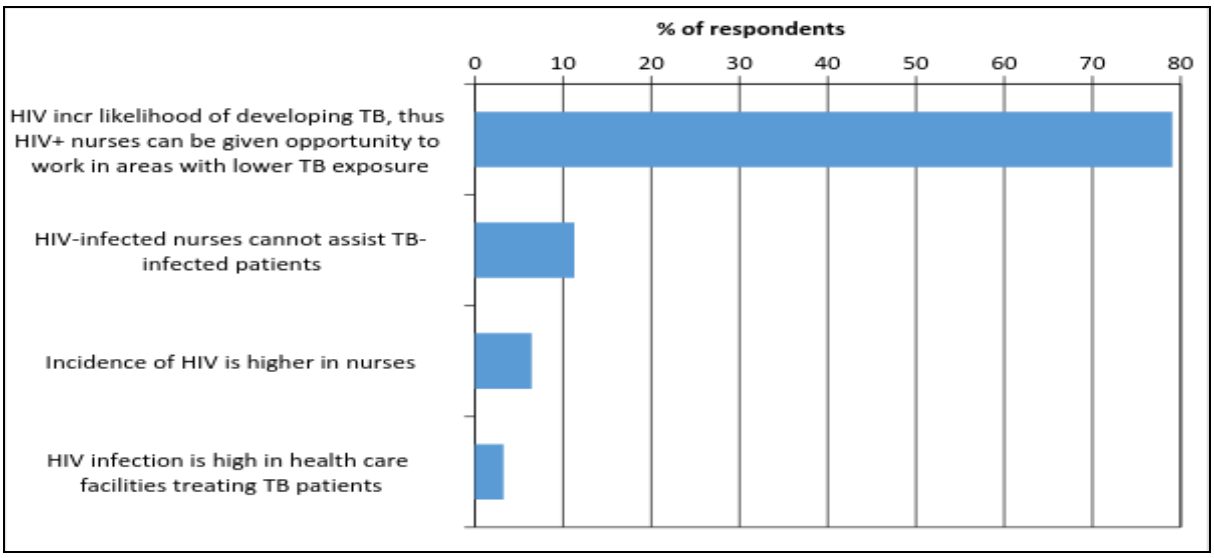


Figure 4.22 Reasons for the importance of knowing one's HIV status (N=62)

Of the respondents, 79% (n=49) indicated that knowing their HIV status would enable HIV-infected nurses to work in areas with lower TB exposure; 11.3% (n=7) indicated that HIV-infected nurses cannot assist TB infected patients; 6.5% (n=4) indicated that the incidence of HIV is higher in nurses, and 3.2% (n=2) felt that HIV infection is higher in health care facilities treating TB patients.

- *Relationship between the reasons for the importance of knowing one's HIV status and the modifying factors (n=62)*

The results were further analysed to determine relationship between the reasons for the importance of knowing one's HIV status and the modifying variables. Table 4.12 indicates the results with the significant results marked in red.

Table 4.12 Relationship between the reasons for the importance of knowing one's HIV status and the modifying factors (n=62)

P-value for test of association	Age	Position	PHC Qualification	Experience	Beliefs
Reason why it is important for nurses working in clinics treating TB patients to know their HIV status	0.32	0.021	0.054	0.62	0.0051

Table 4.12 presents the results of the relationship between the respondents' reasons for the importance of knowing one's HIV status and modifying factors. The significant results are marked in red.

The results show that there is a significant, moderate, association between the reasons for the importance of knowing one's HIV status and modifying factors, namely position and beliefs (p=0.021; and p=0.0051, respectively) (see figure 4.23 and 4.24).

- *Reasons for the importance of knowing one's HIV status and positions (n=62)*

Figure 4.23 depicts the results on the respondents' reasons for the importance of knowing one's HIV status and position. The results show that of the respondents, a higher proportion of the enrolled/assistant nurses chose options other than the first option, compared to the nurse managers/professional nurses.

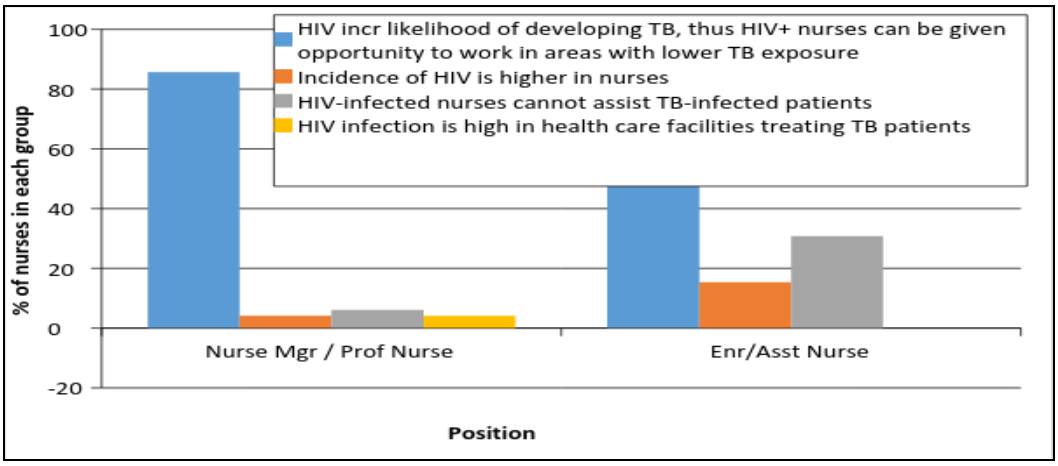


Figure 4.23 Respondents' position and reasons for the importance of knowing one's HIV status (n=62)

- *Reasons for the importance of knowing one's HIV status and beliefs*

Figure 4.24 illustrates the results on the relationship between the reasons for the importance of knowing one's HIV status and beliefs. The p-value for test of association in table 4.12 indicated a significant relationship between the reasons and beliefs (Kruskal-Wallis test: p=0.0051). Figure 4.26 shows the medians, with the error bars denoting the interquartile range.

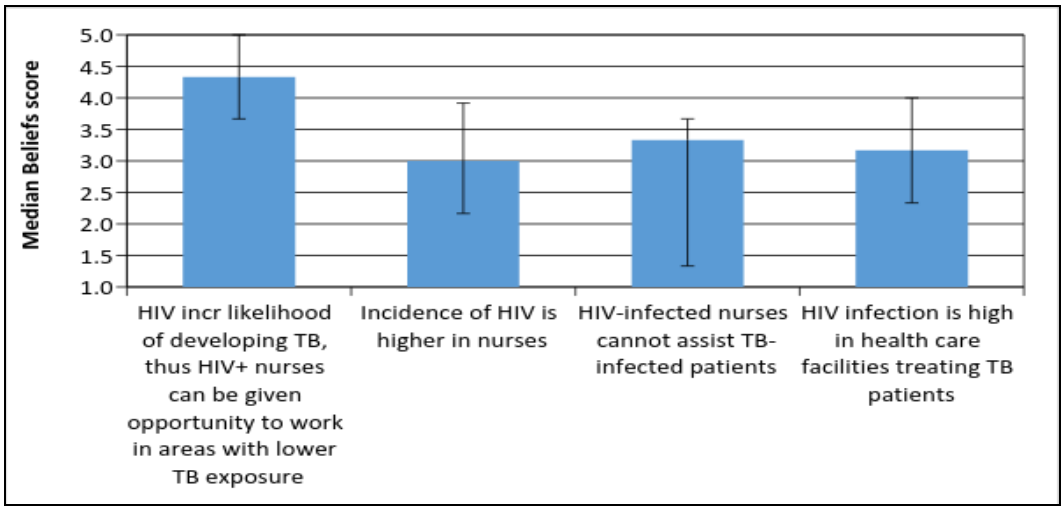


Figure 4.24 Respondents' median beliefs score and responses for the importance of knowing one's HIV status (N=62)

Post-hoc testing showed a significant difference between the first and third reasons in the graph below (small effect size: r=0.39), with those who indicated the reason of the opportunity to work in a lower risk area having a higher median beliefs score than those who indicated that HIV-infected nurses cannot assist TB-infected patients.

HIV is an important driver of the TB epidemic in South Africa, which is classified as a high-burden country for both TB and HIV (Kwan & Ernst 2011:351). Kalibala, Tun, Cherutich, Nganga, Oweya and Oluoch (2014:405) corroborated by Tawfik and Kinoti (2003:online) believe that health care workers in sub-Saharan Africa are at a high risk of HIV infection from both sexual and occupational exposure.

Persons living with HIV should be screened for TB, and those diagnosed with TB started on treatment (NDoH 2014:71). TB is the main cause of mortality and morbidity in HIV-infected individuals (NDoH 2014:70; WHO 2011:1). In Kenya, Yuen, Weyenga, Kim, Malika, Muttai, Katana, Nganga, Cain and De Cock (2014:online) compared incidences of TB among persons with and without HIV and found a persistent high incidence of TB among people living with HIV. The findings revealed that among persons living with HIV, the TB incidence increased during 1998–2004, remained relatively stable until 2007 at approximately 2,750 cases per 100,000 population, then declined to 1,962 cases per 100,000 population in 2012 (Yuen et al 2014:online). Among persons without HIV, the trend was similar, but overall incidence was

substantially lower, peaking at approximately 320 cases per 100,000 population during 2005–2007, and declining to 231 cases per 100,000 population in 2012 (Yuen et al 2014:3).

Kompala et al (2013:264) maintain that health care facilities are common sites of TB transmission. Odendal (2013:2) adds that TB is a disease which is spread from person to person through the air and health care facilities are places where people are congregated together leaving people who may not be infected with TB exposed to people with active TB disease. The risk of TB infection and disease is amplified by the interaction between patients with active TB and those with HIV infection in clinics. HIV immune-suppressed patients may be exposed to infectious TB in health care facilities, with the attendant risks of acquiring infection and of progression to active TB (Bock et al 2007:108: Farley, Landers, Godfrey, Lipke & Sugarma 2014:19). Health care workers and other staff are also particularly at high risk for infection with TB as they may have HIV infection (Bock et al 2007:108).

According to the NDoH (2014:70), encouraging and enabling health care workers to know their status should be a priority in all health care facilities. The rate of HIV infection among health care workers may be similar to the broader community and HIV-infected health care workers can be given the opportunity of working in areas with lower exposure to TB (NDoH 2007:17).

4.4.4 Section E: Perceived barriers to TB preventive measures

Questions E13-E17 were based on the HBM construct of perceived barriers.

4.4.4.1 Nurses' role in TB prevention in their health care facilities (n=74)

Question E13 focused on the role of nurses in TB prevention in their health care facilities. The respondents were asked to indicate with a "yes" or "no", whether they thought nurses have a role in TB prevention in their health care facilities. Of the respondents, 99% (n=73) indicated that they thought that nurses do have a role in TB prevention in their health care facilities. Given that there was only one negative response, the question was not analysed further with respect to the modifying factors.

The African region accounts for approximately one quarter of the world's cases, and has the highest rates of cases and deaths relative to population size (WHO 2014:8). South Africa a country in Africa has the highest incidence rate per capita approximately 1 new case for every 100 people is reported each year (WHO 2013a:6).

TB is considered an occupational hazard for health care workers (CDC 2005:2; Churchyard et al (2014:246). Nurses were the first occupational group identified to be at increased risk for TB and probably have the highest rate of infection and disease of all health care workers (Churchyard et al 2014:246; Oblitas et al 2010:132). Odendal (2013:2) asserts that this is as a result of prolonged and often close contact between hospital nurses and patients. Therefore it is important that measures are taken at the facility to reduce the spread of the disease.

TB infection prevention control (IPC) in health care facilities is based on a three level hierarchy of controls, including administrative, environmental, and respiratory protection (CDC 2005:2; Sissolak et al 2011:online). The TB IPC measures remain the responsibility of individual health care facilities (Sissolak et al 2011:1); IPC can reduce the risk of TB transmission even in settings with limited resources (CDC 2005:2). This is especially important in clinics where people who may have TB are crowded next to people who may not be infected with TB (Odendal 2013:1). Nurses have many roles to play in TB infection control, to protect patients and to protect themselves and their colleagues (Odendal 2013:1). The ICN (2008:42) adds that nurses working in PHC settings are often the first to see people who present with symptoms and so are crucial to the early identification and management of suspect TB. Nurses have four fundamental responsibilities: to promote health, to prevent illness, to restore health, and to alleviate suffering (ICN 2008:43). In relation to TB, nurses promote health in order to prevent people becoming vulnerable to the disease in the first place; they prevent illness by reducing transmission of TB by finding and treating active TB cases; they restore health by ensuring patients receive the treatment they need; and alleviate suffering by organising support for patients according to their individual needs (ICN 2008:42). Nurses have a vital role to play in TB control in terms of identification, infection control, and support of newly diagnosed patients (ICN 2008:42). In this era of HIV and AIDS and TB, nursing competence in detection, control and care is crucial (Ghebrehiwet 2006:239).

4.4.4.2 Types of preventive measures (N=77)

Question E14-E16 focused on the types of preventive measures and the respondents were required to match the correct statements to the appropriate preventive measures.

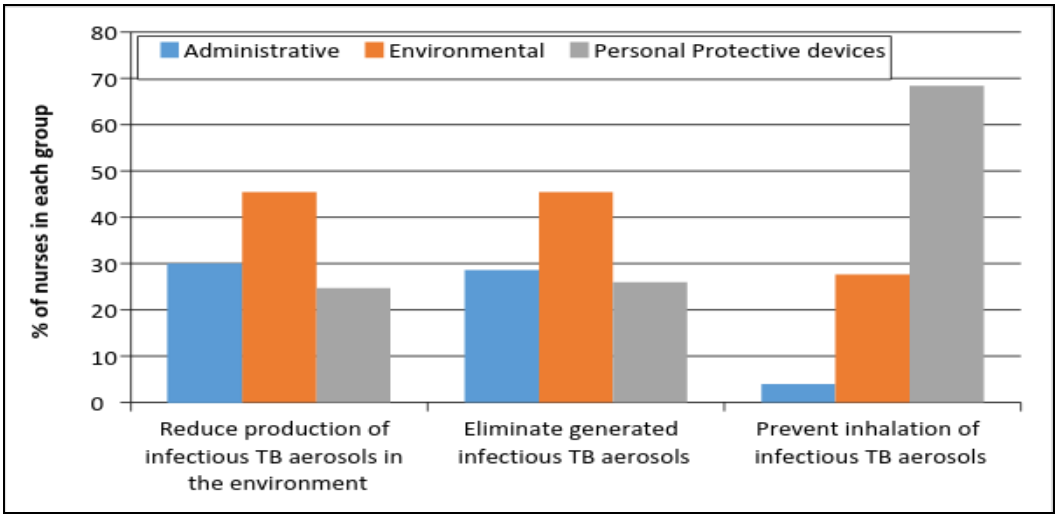


Figure 4.25 Types of preventive measures (N=77)

Figure 4.25 represents the results on the types of preventive measures. Of the respondents, 30% (n=23), 46% (n=35), and 68% (n=52), respectively, answered correctly: Administrative, Environmental, and Personal protective devices, respectively.

- *Composite score for preventive measures (N=77)*

Further analysis was conducted based on a composite score for the three questions: one point was given for each correct answer. Thus the respondents could score between 0 and 3 for these questions.

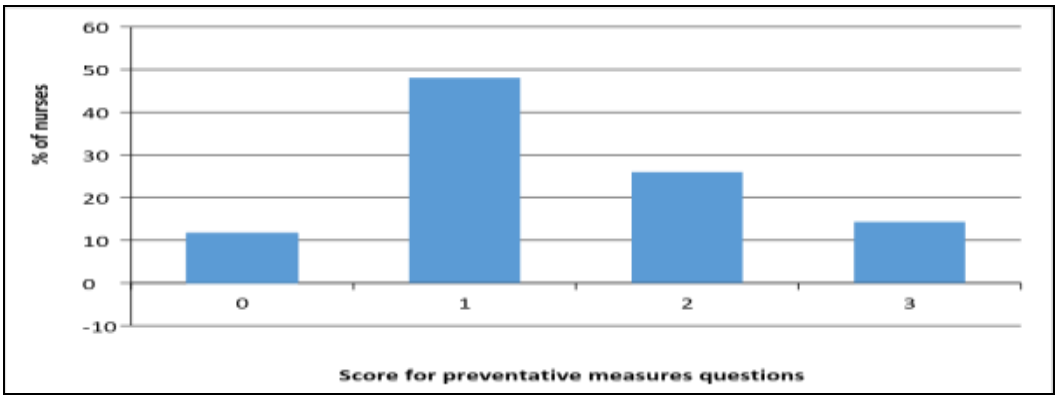


Figure 4.26 Composite score for preventive measures (N=77)

Figure 4.26 represents the composite scores for preventive measures. Of the respondents, 48% (n=37) achieved only one correct answer, and 14% (n=11) answered all three questions correctly.

- *Relationship between the composite score for preventive measures and modifying factors (N=77)*

The results were further analysed to determine the relationship between the preventive measures and modifying variables.

Table 4.13 Relationship between the composite score for preventive measures and modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Score for preventive measures questions	0.83	0.59	0.044	0.92	0.0056

Table 4.13 represents the results for the relationship between the preventive measures and modifying factors. The findings show that there was a significant association (with small effect size) between the score and the modifying factors of PHC qualification (Wilcoxon Rank Sum test: p=0.044; r=0.23) and beliefs (p=0.0056). The results for the preventive scores in relation to PHC qualification and beliefs are further displayed in figure 4.27 and figure 4.28, respectively.

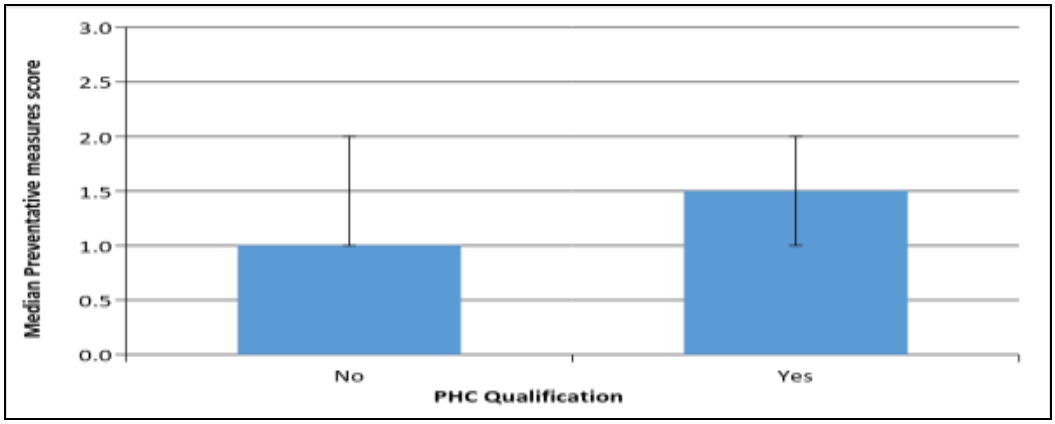


Figure 4.27 PHC qualification and median for preventive measures score (N=77)

Figure 4.28 illustrates the median for preventive measures score and the PHC qualification. The results show that the respondents with a PHC qualification had a higher median score for the preventive measures questions than those who did not have a PHC qualification.

- *Preventive measure score and beliefs*

Figure 4.28 represents the results for the relationship between the preventive measures score and beliefs. The results show that there was a significant, moderate association between the score and beliefs (Spearman's correlation: p=0.0056; rho=0.31) as illustrated in figure 4.28 (the darkness of the data points reflect the number of responses at that combination of values). Higher scores for beliefs were associated with higher scores for the preventive measures questions.

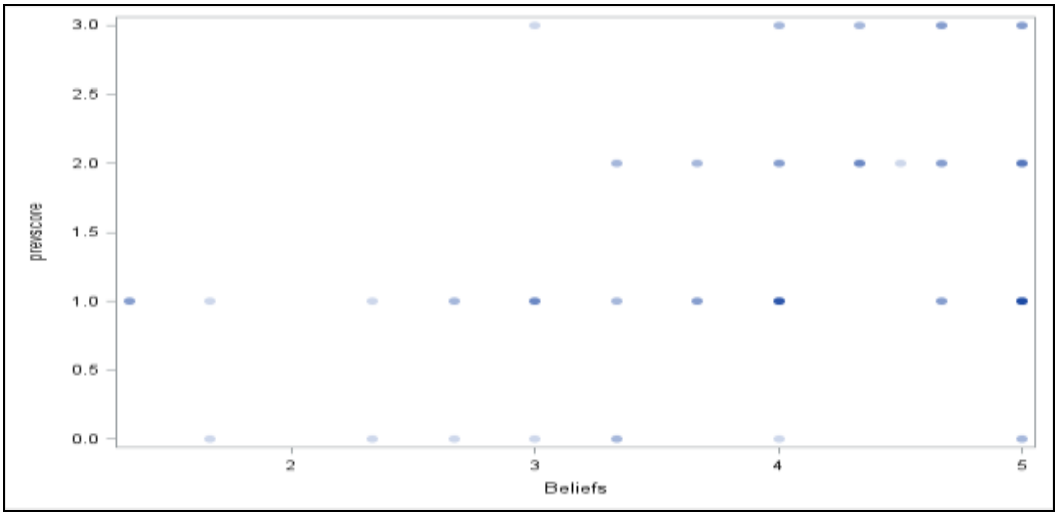


Figure 4.28 Preventive measures score and beliefs (N=77)

The majority of health care-associated infections can be prevented by adequate, though not necessarily sophisticated, surveillance and control measures (WHO 2009:9). A number of international initiatives support developing countries to build and implement infection control effectively in their health care settings (WHO 2009:1). Despite these growing efforts, infection control in most developing countries remains either non-existent or ineffective, posing a significant threat to quality of patient care (WHO 2001:4). TB infection prevention control in health care facilities is based on a three-level hierarchy of controls: administrative, environmental, and respiratory protection (Sissolak et al 2011:online; CDC 2005:2). These TB IPC measures remain the

responsibility of individual health care facilities (Sissolak et al 2011:online). IPC can reduce the risk of TB transmission even in settings with limited resources (CDC 2005:2).

Ider, Adams, Morton, Whitby and Clements (2012:1-12) conducted a study in Mongolia to identify health care workers main perceived challenges and barriers to the effective implementation of infection control. The study found that lack of knowledge on infection control measures was associated with an increased risk of occupational TB infection and the health care workers were not aware of the importance of infection control as they did not have access to the infection control guidelines in their facilities (Ider et al 2012:online). Woith et al (2012:1092) emphasise that lack of knowledge on TB preventive measures increases the risk of nosocomial TB infection.

Woith et al (2012:1092) conducted study in Russia among health care workers (consisting of physicians, nurses, laboratory staff and support staff) to identify barriers and motivators to the use of infection control measures. The study found that despite the health care workers being oriented on TB infection control measures, there was still lack of knowledge among them. Woith et al (2012:1095) point out that the observed gaps in knowledge increased the risk of nosocomial infection as they still existed despite institutionally-based educational requirements for staff.

In a study in Ebonyi State, Nigeria to examine the knowledge of TB among frontline health care workers employed in a DOTS facility, Ukwaja, Alobu and Onu (2013:online) found that only 14% of the participants knew the three types of infection control methods a TB programme should include; 25% indicated natural ventilation technologies to remove airborne TB in clinics, and 25% would, in the absence of a personal protective respirator, give a surgical mask to patients coughing repeatedly in the clinic.

Ider et al (2012:online) stress that policies and active support for training are vital determinants of effective practice and successful change. Infection control regulations, standards and guidelines outline clear descriptions of the roles and responsibilities of individual professionals, committees and organizations (WHO 2001:8). Policies and guidelines enable health care workers to understand and fully implement their roles and responsibilities, and senior level managers enable and support infection control initiatives (Ider et al 2012:online).

In this study, the respondents appeared to lack knowledge on the TB infection control policies, but this did not necessarily imply inadequate implementation of control measures.

4.4.4.3 Main problems associated with inappropriate practice of TB preventive measures at health care facilities (N=77)

Question E17 required the respondents to indicate the main problems that they perceived with inappropriate practice of TB preventive measures in the health care facilities. The respondents could select more than one option. Figure 4.29 presents the results.

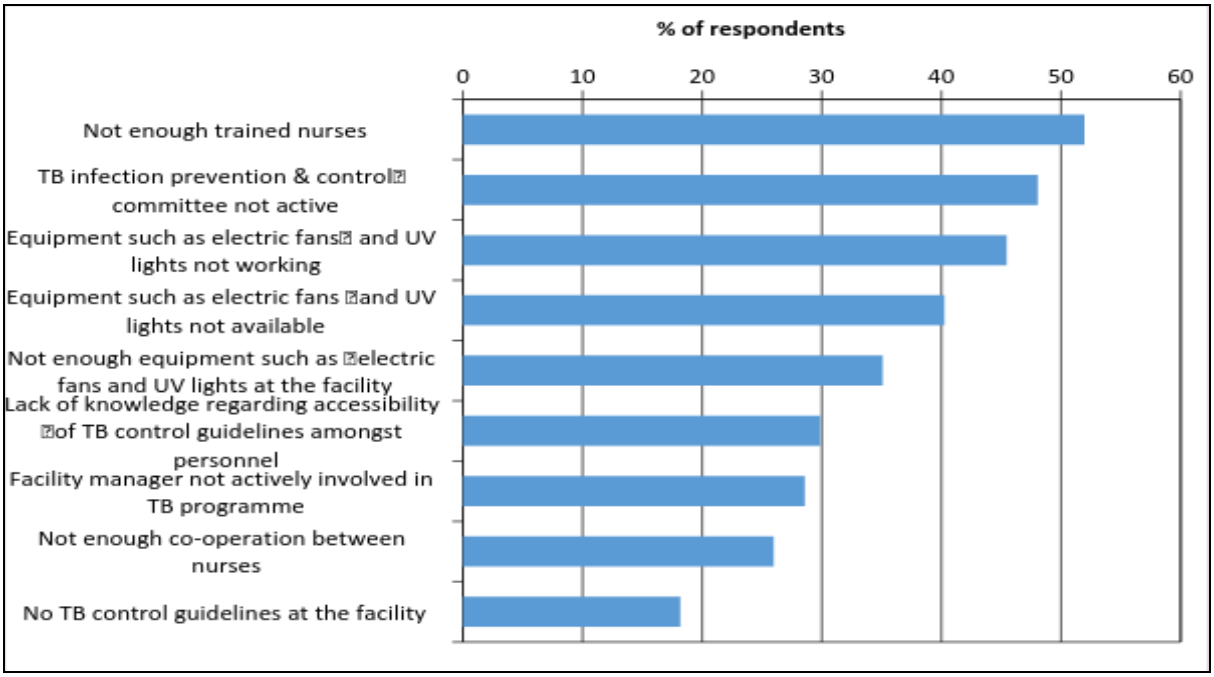


Figure 4.29 Main problems associated with inappropriate practice of TB preventive measures at health care facilities (N=77)

Figure 4.29 represents the responses to the main problems associated with inappropriate practice of TB preventative measures at the health care facilities. Of the respondents, 52% (n=40) indicated not enough trained nurses; 48% (n=37) indicated that the TB infection, prevention and control committee was not active; 46% (n=35) indicated that equipment, such as electric fans and ultraviolet lights, were not working; 40% (n=31) indicated that equipment, such as electric fans and ultraviolet lights, was not available at the facility; 35% (n=27) indicated that not enough equipment, such as

electric fans and ultraviolet lights, was available at the health care facility; 30% indicated that there was a lack of knowledge regarding accessibility of TB control guidelines amongst personnel at the health care facilities; 29% (n=22) indicated that facility managers did not actively participate in the TB programme; 26% (n=20) indicated that there was not enough co-operation between nurses, and 18% (n=14) indicated that there were no TB control guidelines in the health care facility .

- *Relationship between the main problems associated with inappropriate practice of TB preventive measures at health care facilities and modifying factors (N=77)*

The results were further analysed to determine the relationship between the main problems associated with inappropriate practice of TB preventive measures at the health care facilities and modifying factors.

Table 4.14 Relationship between the main problems associated with inappropriate practice of TB preventive measures at the health care facilities and modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Not enough trained nurses	0.56	1.00	0.82	0.025	0.017
TB infection prevention and control committee not active	0.71	0.43	0.11	0.092	0.20
Equipment such as electric fans and ultraviolet lights not working	0.92	0.29	0.060	0.47	0.22
equipment such as electric fans and ultraviolet lights not available	0.81	0.28	0.10	0.19	0.87
not enough equipment such as electric fans and ultraviolet lights at the facility	0.13	0.58	0.48	0.018	0.49
Lack of knowledge regarding accessibility of TB control guidelines amongst personnel	0.90	0.38	1.00	0.82	0.40
Facility manager not actively involved in TB programme	0.87	1.00	0.80	0.082	0.32
Not enough co-operation between nurses	0.21	0.37	0.29	0.16	0.83
No TB control guidelines at the facility	0.73	1.00	0.77	0.78	0.66

Table 4.14 represents the results of the relationship between the main problems associated with inappropriate practice of TB preventive measures at the health care facilities and modifying factors. The significant results are marked in red. The results indicate a significant, moderate, association between main problems of “not enough equipment such as electric fans and ultraviolet lights at the facility” and “not enough trained nurses” with the modifying factors experience (p=0.018) and experience (p=0.025) and beliefs (p=0.017), respectively (see figure 4.31 to 4.33).

- *Relationship between experience and not enough trained nurses*

Figure 4.30 represents the findings on the relationship between the response “not enough trained nurses” and experience. More of the respondents in the 5-10 years of experience category contended that shortage of trained nurses was problematic than those with less or more experience.

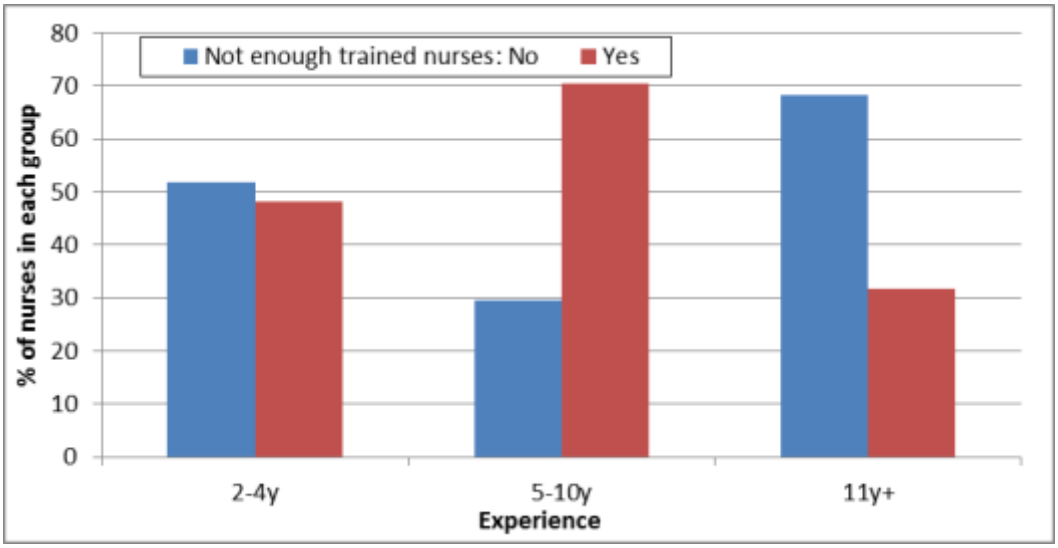


Figure 4.30 Relationship between experience and not enough trained nurses (N=77)

- *Relationship between not enough trained nurses and beliefs (N=77)*

Figure 4.31 illustrates the results of the relation between not enough trained nurses and beliefs.

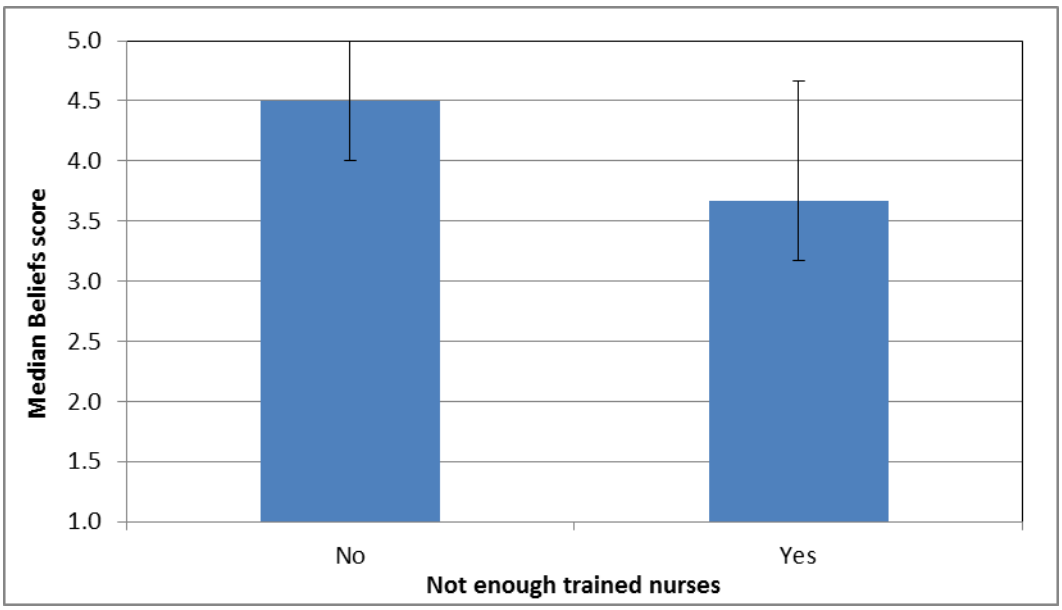


Figure 4.31 Relationship between not enough trained nurses and beliefs

The results show that there was a significant association (with small effect size) between the reason "not enough trained nurses" and Beliefs (Wilcoxon Rank Sum test: p=0.017; r=0.28). The respondents who indicated that there were not enough trained nurses had a lower median Beliefs score than those who did not select this response.

- *Relationship between not enough equipment such as electric fans and ultraviolet lights at the health care facility and experience*

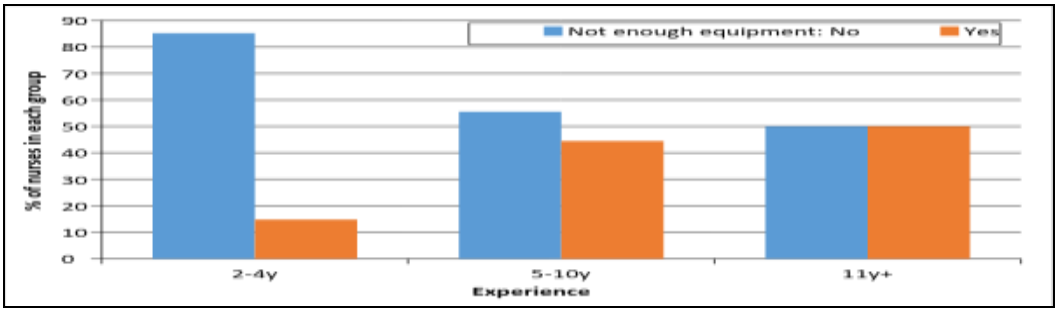


Figure 4.32 Relationship between not enough equipment at the health care facility and experience

Figure 4.32 represents the results on the relationship between not enough equipment such as electric fans and ultraviolet lights at the health care facility and experience. The results show a significant, moderate, association between the reason "not enough equipment" and Experience (X^2 test: p=0.018; Cramer's V=0.32). More respondents

with five or more years of experience noted lack of equipment as a problem, compared to those with less experience.

TB, reported as the second most common infectious cause of death worldwide, is a key mortality contributor in developing countries and globally (Minnery, Contreras, Pérez, Solórzano, Tintaya, Jimenez, Soto & Lecca 2013:1). Woith et al (2012:1092) indicate that TB is an occupational disease of health care workers.

Infection control measures can reduce the risk of TB transmission even in settings with limited resources (Bock et al 2007:109). Bock et al (2007:109) state that work practice and administrative control measures are the first line of defence against TB transmission. Their goals are to prevent exposure of staff and patients to TB and to reduce the spread of infection (Bock et al 2007:109). The highly infectious nature of TB makes it crucial for health care workers to diagnose it immediately, place patients on the appropriate treatment, and have the correct measures in place to avoid transmitting the disease among health staff and the community (Bock et al 2007:110). The components of good work practice and administrative controls include (CDC 2005:4):

- An infection control plan
- Administrative support for procedures in the plan, including quality assurance
- Training of staff

Diagnosis and care of TB patients usually relies on nurses as they are the frontline health care workers around the world. Training nurses to scale up their basic knowledge and skills for TB detection, treatment, awareness, and prevention is therefore essential (Tshitangano 2014:2).

Kiefer, Shao, Carrasquillo, Nabeta and Seas (2009:785) maintain that training of health care workers does not necessarily and always lead to appropriate practice of TB preventive measures. In a study on health care workers' knowledge of and attitudes towards TB management in San Juan de Lurigancho district of Lima, Peru, Kiefer et al (2009:785) found that the scores of the respondents who had attended a TB education class did not reflect improved knowledge. The mean score was 10.1 ± 1.9 among those who took the class, versus 10.0 ± 1.9 among those who did not take a class ($p = 0.86$).

Minnery et al (2013:online) conducted assessments of the knowledge and attitudes about TB amongst front-line health personnel in charge of TB care, in order to identify potential problems, limitations and areas for improvement. The findings showed that the mean knowledge score was 10.1 (+/- 1.7) out of a possible 15 or 67.3% correct. Furthermore, the mean knowledge score was not significantly different in relation to gender; having had training related to TB in the last 12 months; or having had TB and/or having lived with someone who had TB. However, respondents with a higher level of education had a greater average knowledge score, which nevertheless decreased with shorter required education time (Minnery et al 2013:online).

Regarding barriers and facilitators affecting TB infection control practices, Woith et al (2012:1095) found that knowledge and training of TB infection control measures alone did not necessarily lead to appropriate practice by health care workers. Occupational TB is a multifaceted problem and prevention requires understanding health care workers' perceptions of the issues (Woith et al 2012:1095). Consequently, Woith et al (2012:1096) emphasise the need for evaluation of current educational programmes and TB programme administrators to consider implementing curricula based on social cognitive theory, incorporating role models and mentoring.

4.4.5 Section F: Self-efficacy

Questions F18-F19 were based on the HBM construct of self-efficacy (belief in one's own ability to do something).

4.4.5.1 Environmental control measures that nurses can practise to reduce TB in their health care facilities (N=77)

Question F18 required the respondents to indicate the environmental measures that they think nurses can practise to reduce TB in their health care facilities. The respondents could indicate more than one response.

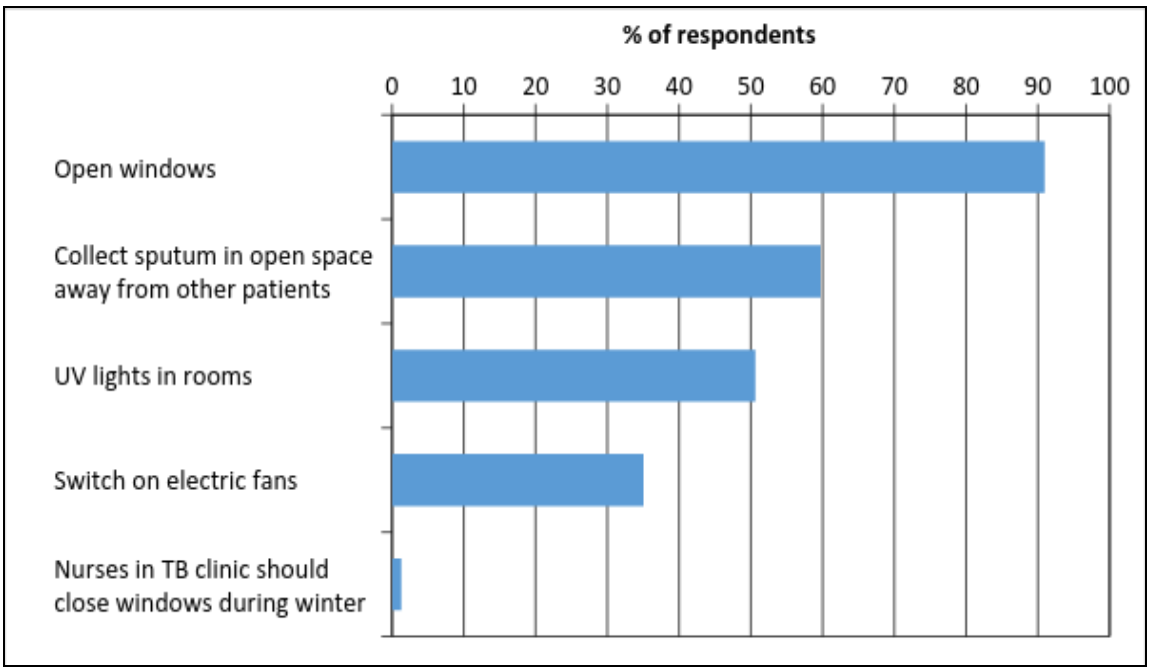


Figure 4.33 Environmental control measures that nurses can practice to reduce TB in their health care facilities (N=77)

Of the respondents, 91% (n=70) indicated opening the windows as an environmental control measure to reduce the spread of TB in health care facilities; 60% (n=46) indicated collecting sputum in an open space away from other patients; 51% indicated having ultraviolet lights in their rooms; 35% (n=27) indicated switching on electric fans, and 1% (n=1) still felt that nurses working in the TB clinic should close their windows during winter.

- *Relationship between the environmental control measures to reduce TB in their health care facilities and modifying factors (N=77)*

The results were further analysed to determine the relationship between the environmental control measures that nurses can practise to reduce TB in their health care facilities and modifying factors.

Table 4.15 Relationship between the environmental control measures to reduce TB in the health care facilities and modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Open windows	0.23	0.66	1.00	0.27	0.73
Collect sputum in open space away from other patients	0.38	0.41	0.35	0.85	0.83
Ultraviolet lights in rooms	0.92	0.60	0.81	0.28	0.95
Switch on electric fans	0.78	0.40	0.81	0.19	1.00
Nurses in TB clinic should close windows during winter	0.56	1.00	1.00	1.00	0.39

Table 4.15 indicates the results for relationship between the environmental control measures to reduce TB in health care facilities and modifying factors. The results show that there was no significant relationship between any of the measures or any of the modifying factors.

Institutional transmission of airborne infections such as TB is an important public health problem, especially in resource-limited settings where protective measures such as negative-pressure isolation rooms are difficult to implement (Singh & Matuka 2015:21; Wilson 2007:online). Natural ventilation may offer a low-cost alternative (Singh & Matuka 2015:22; Wilson 2007:online). Nosocomial TB control programme guidelines include three levels of infection control: administrative controls, engineering or ventilation controls, and protective equipment for health care workers. Current guidelines recommend an indoor air exchange rate of 6–12 air changes per hour (ACH) for health care facilities in high TB risk areas (CDC 2005:37). Fresh air should be constantly drawn into a room and contaminated air removed such that the air in the room is changed at least 6–12 times every hour (CDC 2005:37). The most feasible method in most settings, particularly in tropical low-income countries, is the use of ambient ventilation by opening doors and window (CDC 2005:37).

In a study on the implementation of TB infection control measures at HIV care and treatment sites in sub-Saharan Africa, Reid, Saito, Nash, Scardigli, Casalini and Howard (2012:1605-1607) found that 91% (n=603) of the clinics reported implementing at least one recommended infection control measure, with only 7% (n=46) of the clinics, serving 16% of the patients (n = 148 700), implementing all the measures

included in the analysis (Reid et al 2012:1607). In addition, a written infection control plan was available at 302 clinics (47%, range across countries [RAC] 2–77%); of the 302, 262 (88%) had a person or team responsible for infection control, triage of coughing patients was also done (60%, RAC 5–93%), and sputum collection was done outdoors or in a ventilated room (79%, RAC 66–100%).

Although the CDC (2005:37) recommends the opening of windows and doors to prevent nosocomial transmission of TB, Jiamjarasrangsi, Bualert, Chongthaleong, Chaindamporn, Udomsantisuk and Euasamarnjit (2009:454) argue that opening of windows is not always feasible. Jiamjarasrangsi et al (2009:454) conducted a cross-sectional survey among 323 patients and 42 ancillary areas in public hospitals in central Thailand to examine the adequacy of indoor ventilation for nosocomial TB prevention. The results showed that the indoor ventilation rates were inadequate in almost half of the studied areas (144/323, 44.6%) (Jiamjarasrangsi et al 2009:456). The inadequacy was particularly serious in the emergency rooms and radiological areas, where 73.8% (31/42 each) of the rooms had ACH below the recommended standards (Jiamjarasrangsi et al 2009:456). The study also provided sufficient evidence to demonstrate that this problem was attributable to the installation of air-conditioning, especially window or wall-mounted type, in the buildings (Jiamjarasrangsi et al 2009:457).

Air conditioning systems require that rooms and windows be closed to outside air to maintain constant indoor air conditions and thus leading to insufficient ACH for the high risk TB areas in the health care facilities (Atkinson, Chartier & Pessoa-Silva 2010:21). In these case alternative measures such as mechanical ventilation should be applied, in which air movement is facilitated by the use of fans (Atkinson et al 2010:34).

Escombe, Oeser, Gilman, Navincopa, Ticona, Pan, Martínez, Chacaltana, Rodríguez, Moore, Friedland and Evans (2007:online), in their study carried out in eight hospitals in Lima, Peru; of which five were hospitals of ‘‘old- fashioned’’ design built pre-1950, and three of ‘‘modern’’ design, built 1970–1990 to investigate the rates, determinants, and effects of natural ventilation in health care settings conclude that opening windows and doors maximises natural ventilation. Escombe et al (2007:online), in their study found that opening windows and doors provided median ventilation of 28 ACH/hour, more than double that of mechanically ventilated negative-pressure rooms ventilated at the 12

ACH recommended for high-risk areas, and 18 times that with windows and doors closed. Escombe et al (2007:online), furthermore added that natural ventilation costs little and is maintenance free, and is particularly suited to limited-resource settings and tropical climates, where the burden of TB and institutional TB transmission is highest.

Buregyeya, Nuwaha, Verver, Criel, Colebunders, Wanyenze, Kalyango, Katamba and Mitchell (2013:1) conducted study among the 51 health care facilities of Mukono and Wakiso, Uganda to assess TB infection control practices and barriers to implementation. The study found that facilities that had limited space did not collect sputum of TB suspects in a designated place. Thus the health care workers in the facilities had knowledge that sputum investigation should be done away from other patients, but lack of space to perform such investigation acted as a barrier (Buregyeya et al 2013:6).

The WHO (2009:9) stipulates administrative control measures as one of the principles for TB control. Furthermore, under the administrative control measures, persons attending the health care facility and suspected of having PTB should be "fast-tracked" for rapid diagnosis and expedited services (WHO 2009:11). If possible, they should be directed to a separate (outside) waiting area and be investigated for TB by collecting sputum (WHO 2009:11).

4.4.5.2 Personal protective measures that nurses can use to reduce the spread of TB in their health care facilities (N=77)

Question F19 required the respondents to indicate the personal protective measures they thought nurses can use to reduce the spread of TB in their health care facilities (see figure 4.34). The respondents could indicate more than one response.

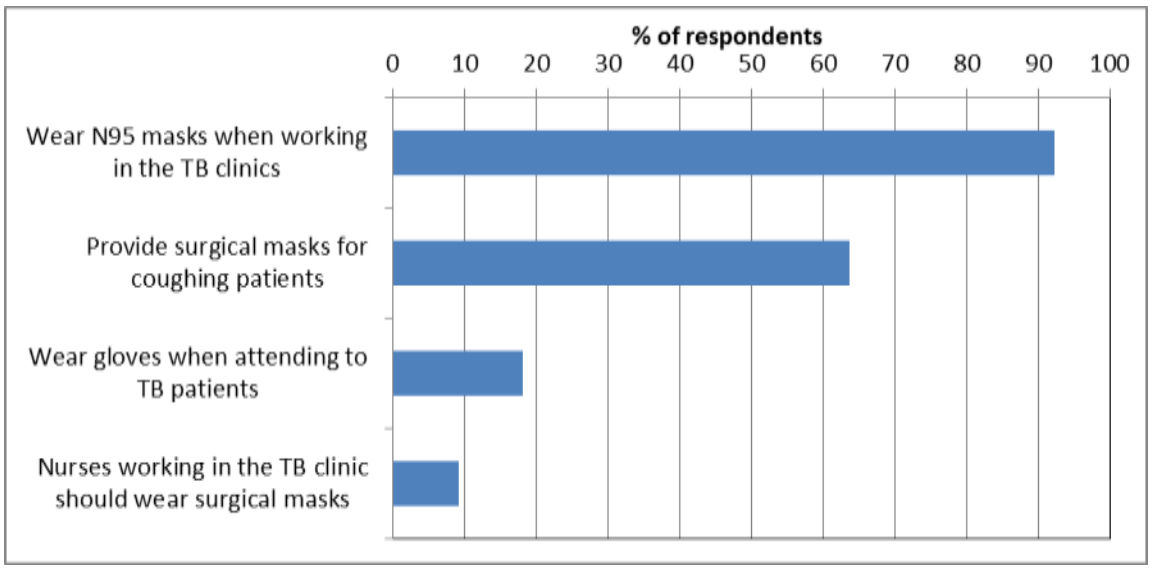


Figure 4.34 Personal protective measures nurses can use to reduce the spread of TB in their health care facilities (N=77)

Of the respondents, 92% (n=71) indicated that nurses should wear N95 masks when working in the TB clinic; 64% (n=49) indicated that nurses should provide surgical masks to coughing patients; 18.2% (n=14) indicated that nurses should wear gloves when attending to TB patients, and 9% (n=7) indicated that nurses working in the TB clinic should wear surgical masks.

- *Relationship between personal protective measures to reduce the spread of TB in their health care facilities and modifying factors (N=77)*

The results were further analysed to determine their relationship with the modifying factors (see table 4.16).

Table 4.16 Relationship between personal protective measures to reduce the spread of TB in their health care facilities and modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Wear N95 masks when working in the TB clinics	0.25	0.14	0.076	0.87	0.54
Provide surgical masks for coughing patients	0.32	0.42	1.00	0.96	0.40
Wear gloves when attending to TB patients	0.44	0.73	1.00	0.82	0.33
Nurses working in the TB clinic should wear surgical masks	1.00	0.66	0.70	0.16	0.081

Table 4.16 lists the results for the relationship between personal protective measures that nurses can use to reduce the spread of TB in their health care facilities and modifying factors. The results show that there was no significant relationship between any of the measures and modifying factors.

Transmission of TB in health care settings to both patients and health care workers is a global problem, regardless of local TB incidence (WHO 2013a:1; NDoH 2014:81; Zungu & Malotle 2011:17). TB transmission occurs through droplet nuclei aerosolised by patients with infectious PTB and inhaled by other people. Transmission is most likely to occur from unrecognised or inappropriately treated TB (Story 2014:137). The control and prevention of TB in the health care settings is best achieved by three approaches, namely: administrative, environmental and personal respiratory protection (CDC 2005:4). Personal respiratory protection refers to the use of filtered masks or face sealing and can vary from 25% filtering face piece (FFP1) to 5% FFP3 total leakage rate (Farrar, Hotez, Junghanss, Kang, Lallo & White 2013:504; Weston 2013:201). Powered or purifying respirators draw air in through a filter mechanically but are expensive (Farrar et al 2013:504; Weston 2013:201). Nonetheless the risks of transmission are generally lowered when all measures are combined together.

Personal respiratory protection can reduce the spread of TB by reducing the number of inhaled TB bacilli (McIntyre, Wang, Rahman, Seale, Ridda, Gao, yang, Shi, Pang, Zhang, Moa & Dwyer 2014:5; Menon 2013:206). The respiratory protection device

required for filtering the bacilli is the N95 disposable respirator, which should be worn by health care workers when caring for patients with suspected or confirmed TB and surgical masks are recommended for patients as they reduce the expulsion of droplet nuclei (Menon 2013:206; Soule, Memish & Malani 2012:55).

However, in a study to assess and describe current practices in infection control, Naidoo et al (2012:1602) discovered that health care workers were not practising personal respiratory protection even though they were aware of the risk of occupational exposure to TB. Woith et al (2012:1094) found that health care workers did not use N95 masks as they believed that the respirators were of poor quality and some reported not wearing them as they were allergic to the device.

A cross-sectional descriptive study in South African hospitals among 24 multidrug-resistant TB and extensively drug-resistant TB and 499 health care workers to conduct operational evaluations of infection control in drug-resistant TB settings, Farley et al (2012:online) found that personal protective equipment was uniformly available in all the facilities. Of the participants, 25 (5%) health care workers at all training levels were witnessed in 21 (88%) facilities entering drug-resistant TB wards without N95 respirators. In addition, nurses only wore their respirators at least 50% of their day, despite being aware of the need for personal respiratory protection (Farley et al 2012:5).

4.4.6 Section G: Cues to action to TB prevention (N=77)

Questions G20-22 focused on the HBM construct: cues to action (signals or reminders that prompt people to do something). Figure 4.35 illustrates the mean responses, together with the 95% CI for the means.

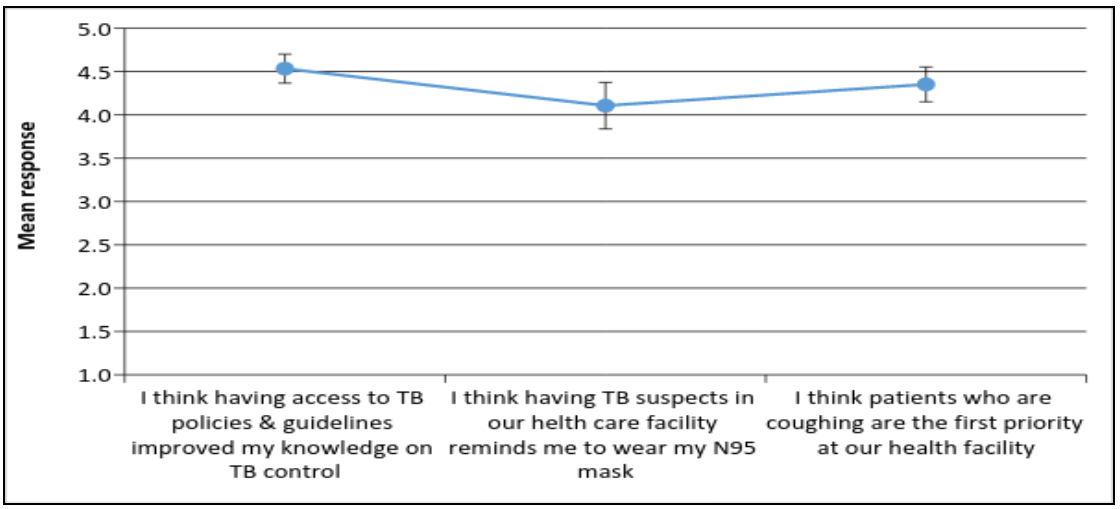


Figure 4.35 Mean responses to cues to action to TB prevention (N=77)

Overall, the respondents 'agreed' (=4) with the three statements. It should be noted that these items could not be combined into a construct (Cronbach's alpha = 0.320, which could not be improved by removing any one item). The mean responses to G20-G22 are tabulated overall, and by modifying factor, in the spreadsheet. Significant results are marked in red.

Table 4.17 Relationship between cues to action to TB prevention and modifying factors (N=77)

P-value for test of association	Age	Position	PHC Qualification	Experience	Beliefs
I think having access to TB policies and guidelines improved my knowledge on TB control	0.024	0.18	0.015	0.99	0.0008
I think having TB suspects in our health care facility reminds me to wear my N95 mask	0.19	0.56	0.90	0.42	0.26
I think patients who are coughing are the first priority at our health facility	0.10	0.75	0.45	0.60	0.85

Table 4.17 indicates the mean responses for the respondents. The results show that there was a significant relationship between age, PHC qualification, beliefs and the response "I think having access to TB policies and guidelines improved my knowledge on TB control" (see significant results in red).

- *Median score for "I think having access to TB policies and guidelines improved my knowledge on TB control" and age group*

Figure 4.36 shows the medians, with the error bars denoting the interquartile range.

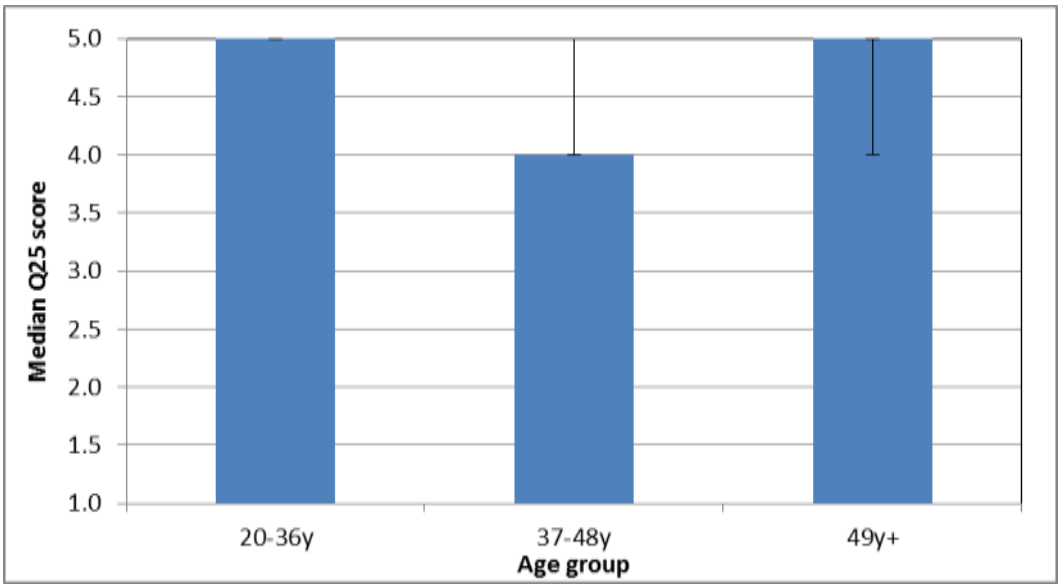


Figure 4.36 Median score for "I think having access to TB policies and guidelines improved my knowledge on TB control" and age group (N=77)

Figure 4.37 illustrates the results of the median score between "I think having access to TB policies and guidelines improved my knowledge on TB control" and age group. Post-hoc tests showed a significant difference (small effect size) between the first two age groups (r=0.35). Those in the 37-48y age group had a lower median score for Q20 than those in the 20-36y age group.

- *PHC qualification and "I think having access to TB policies and guidelines improved my knowledge on TB control" (N=77)*

Figure 4.37 illustrates the relationship between PHC qualification and "I think having access to TB policies and guidelines improved my knowledge on TB control".

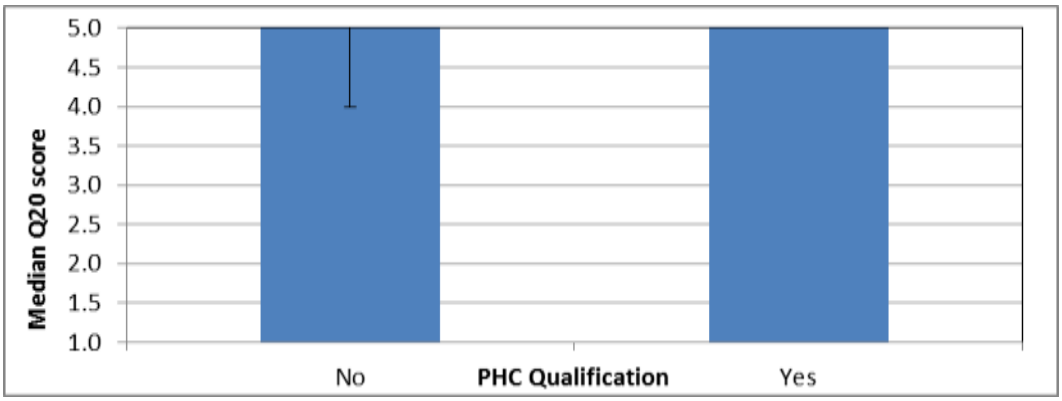


Figure 4.37 Median score for "I think having access to TB policies and guidelines improved my knowledge on TB control" and PHC qualification (N=77)

Figure 4.37 presents the results on the relationship between the median score for "I think having access to TB policies and guidelines improved my knowledge on TB control" and PHC qualification. The results show a significant relationship between PHC qualification and "I think having access to TB policies and guidelines improved my knowledge on TB control" (Wilcoxon Rank Sum test: p=0.015; r=0.28). Figure 4.38 shows the medians, with the error bars denoting the interquartile range. The respondents with a PHC qualification had a slightly higher interquartile range (5-5) for Q20 than those without the qualification (interquartile range 4-5). The effect size was small.

- *Relationship between beliefs and "I think having access to TB policies and guidelines improved my knowledge on TB control" (N=77)*

Figure 4.38 depicts the results on the relationship beliefs and "I think having access to TB policies and guidelines improved my knowledge on TB control".

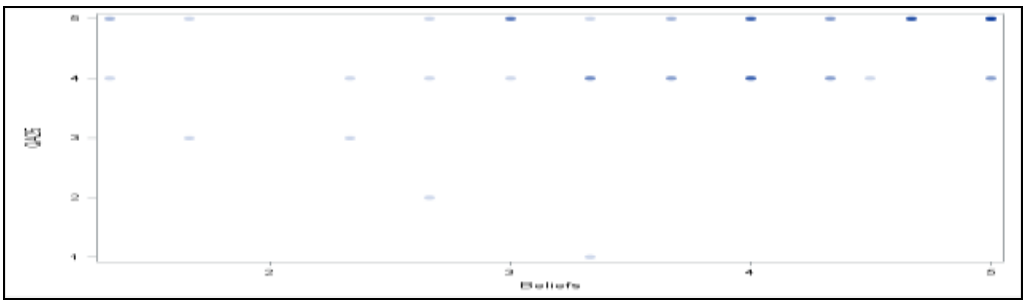


Figure 4.38 Relationship between beliefs and "I think having access to TB policies and guidelines improved my knowledge on TB control" (N=77)

The results show a significant, moderate, association between beliefs and “I think having access to TB policies and guidelines improved my knowledge on TB control” (Spearman’s correlation: p=0.0008; rho=0.37). The darkness of the data points reflects the number of responses at that combination of values. Higher scores for Beliefs were associated with higher scores for “I think having access to TB policies and guidelines improved my knowledge on TB control”.

Current policies and guidelines on TB control in health care settings recommend that health care facilities should have a TB infection control plan that is part of an overall infection control programme (CDC 2005:5; WHO 2009:21). The policies and guidelines also stipulate that the TB infection control programme should consist of administrative controls, environmental controls, and respiratory protection (CDC 2005:5; WHO 2009:9). This is especially recommended for settings in which services are provided to persons who have suspected or confirmed infectious TB (CDC 2005:5). Administrative controls are considered the first and most important level of TB control (CDC 2005:4). The implementation of administrative controls in the health care facilities ensures that there is prompt detection, airborne precautions and treatment of persons who have suspected or confirmed infectious TB.

Another component of administrative control is training and education of health care workers working in health care facilities where patients with suspected or confirmed infectious TB can be found (CDC 2005:4; NDoH 2014:81). Health care worker training and education on infection with mycobacterium TB and TB disease is an essential part of the administrative control programme (NDoH 2007:13). Moreover, this training and education can increase adherence to TB infection control measures and should emphasise the increased risks posed by undiagnosed people with TB in health care settings and the specific measures to reduce this risk (NDoH 2014:81).

Farley et al (2012:online) point out that data from high-income countries demonstrate that a well-designed and managed infection control programme reduces the risk of TB transmission. Farley et al (2012:online) add that applying infection control practices from high-income to low- and middle-income countries is difficult due to limited resources and the limited infection control training of health care workers.

The effectiveness of administrative controls for preventing the spread of TB and respiratory protection for elimination of exposure to TB in health care facilities notwithstanding, it remains unclear whether the measures are implemented by health care workers in health care facilities (Farley et al 2012:online; WHO 2009:1). Farley et al (2012:online) conducted operational evaluations of infection control in drug-resistant TB settings and found that 79.2% (n=19) of the health facilities under study had infection prevention and control committees; 54% (n=13) had a written infection control plan to reduce TB transmission among health care workers and patients; 38% (n=9) held annual infection control training for all levels of staff, and 29% (n=7) implemented the physical separation of smear-positive patients and patients not on TB treatment. Administrative measures were therefore generally poorly implemented in the majority of the health facilities (Farley et al 2012:84).

Farley et al (2012:online) also discovered that the health care workers' perceptions appeared to be different from their practice, as 94.1% (n=469) agreed that N95 masks should be worn, but only 32.2% (n=160) wore the mask in their health facilities to prevent exposure to TB bacilli. The level of clinical training (physicians and professional nurses) was further associated with more appropriate infection control attitude (Farley et al 2012:online). The study showed that infection control attitudes were associated with the participants' level of training.

Engelbrecht and Van Rensburg (2013:221) explored the extent of TB and infection control training, as well as facility-level managerial, administrative, environmental training and personal protection, infection control measures at PHC facilities and found that infection control was largely lacking as only 33.3% (n=120) of the professional nurses and 7.2% (n=55) of community health care workers had received such training (Engelbrecht & Van Rensburg 2013:223). National guidelines on infection control were available at 90 of the clinics and infection control flow charts were only available at 18.1% (n=23) of the clinics; 48.8% (n=62) did not separate coughing patients from other patients, and 34.6% (n=44) of the clinics had N95 respirators (Engelbrecht & Van Rensburg 2013:224). Of the nurses who used N95 masks, 39.7% (n=22) indicated that they wanted to prevent cross-infection; 32.7% (n=19) indicated the masks prevented them from acquiring TB, and 27.6% (n=16) indicated they offered protection against drug-resistant TB (Engelbrecht & Van Rensburg 2013:224).

4.5 SECTION H: LEGISLATIVE FRAMEWORK FOR TB CONTROL

Questions H23-27 focused on the legislative framework for TB control. The respondents were required to match the legislation with the correct statement in the four questions. All the respondents answered the questions. Figure 4.39 depicts the results graphically with the correct answers marked in red. Apart from question H23, the proportion of correct answers was poor, particularly for questions H25 and H26.

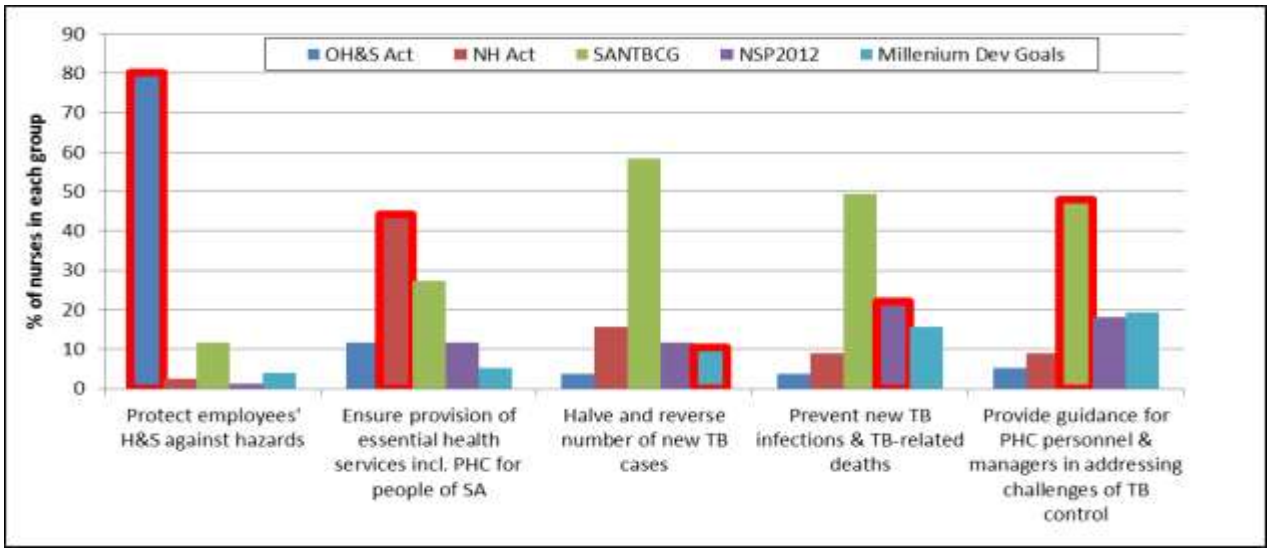


Figure 4.39 Legislative framework for TB control (N=77)

- *Composite score for legislative framework for TB control*

Further analysis was conducted based on a composite score for the responses to the legislative framework. One point was allocated for each correct answer. Thus the respondents could score between 0 and 5 for this group of questions.

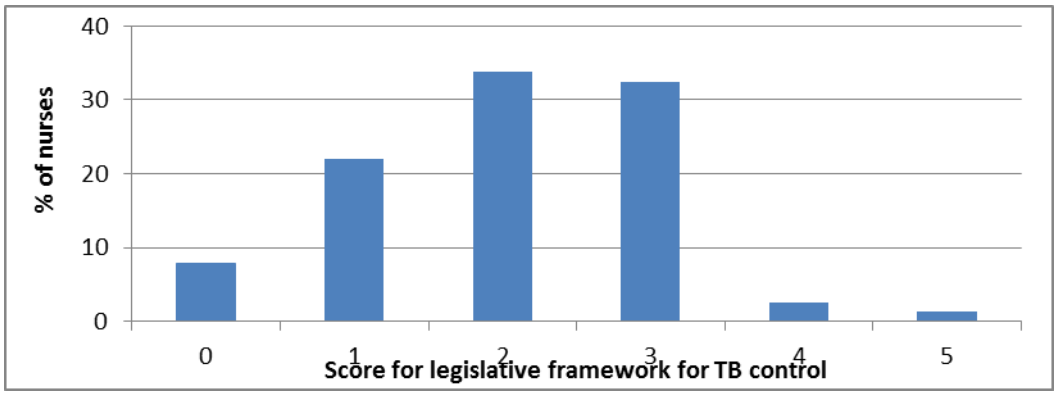


Figure 4.40 Composite score for legislative framework for TB control (N=77)

Figure 4.40 depicts the composite score for the legislative framework. Of the respondents, 66% achieved two or three correct answers, while only 1.0% (n=1) answered all five questions correctly. The mean score was 2.0 (95% CI: 1.8-2.3). The scores are tabulated overall, and by modifying factor in the spreadsheet (see table 4.18).

- *Relationship between score for legislative framework for TB control and modifying factors*

Table 4.18 Relationship between the composite score for legislative framework for TB control and modifying factors (N=77)

P-value for test of association	Age	Position	PHC qualification	Experience	Beliefs
Score for legislative framework questions	0.79	0.35	0.19	0.10	0.0032

The results show a significant, moderate, association between the legislative framework question score and Beliefs (Spearman's correlation: p=0.0032; rho=0.33). Figure 4.41 illustrates the relationship between the legislative framework question score and Beliefs with the darkness of the data points reflecting the number of responses at that combination of values.

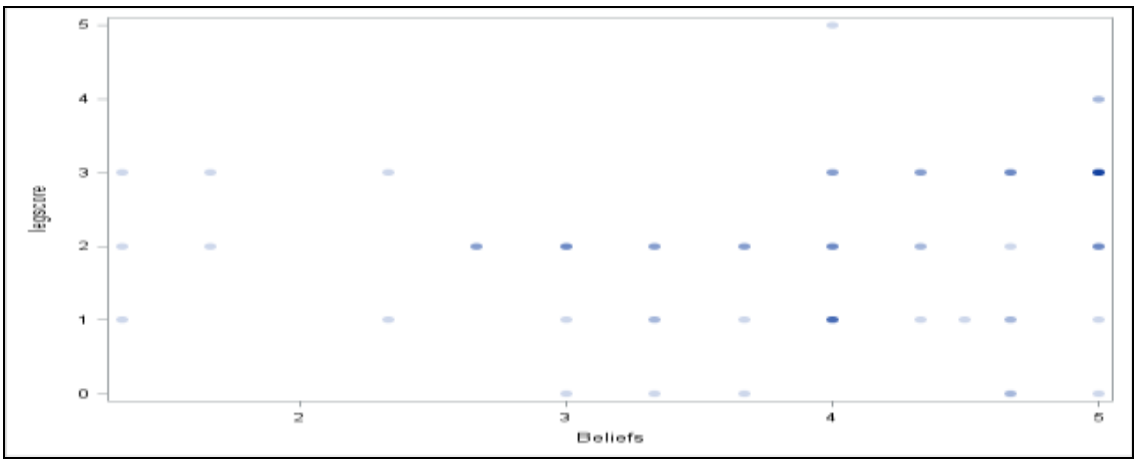


Figure 4.41 Composite score for TB control legislative framework and beliefs (N=77)

The results show that higher scores for Beliefs were associated with higher scores for the legislative framework questions.

4.5.1 Background to the legislative framework for TB control

Health legislation is an effective tool to implement public health goals because it expresses and formulates health policy and provides a framework for its implementation (WHO 2001:14). The overriding aim of TB control regulation is to prevent the transmission of TB infection and the development of the disease following infection (WHO 2001:3). The legislation and regulations together serve to support and sustain a dedicated public health strategy for TB control. However, incorrectly conceptualised and poorly supervised programmes in South Africa have contributed to an increase in the burden of the disease (WHO 2001:4). South Africa is not currently deficient in policy, but rather lacks either the will or the capacity to deliver (WHO 2001:4).

Transmission of TB in health care settings to both patients and health care workers has been widely reported throughout the world, regardless of local TB incidence (Zungu & Malotle 2011:17). Even though PTB in health care workers is known and accepted as an occupational disease, it still poses a serious threat to health care workers in South Africa (Zungu & Malotle 2011:17). Occupational TB in health care settings is a preventable disease through adequate and relatively simple and affordable IC measures, and is a curable disease using standard TB treatment regimens, but with potentially fatal outcomes if inappropriately managed (Zungu & Malotle 2011:17).

In order to address the issues surrounding TB in South Africa several legislative frameworks were developed to assist policy implementers in the development of TB control measures (WHO 2001:3). The policy aims to provide guidance on how to reduce the risk of TB transmission in health care facilities (WHO 2001:3). The following policies were developed as part of TB control strategy, which aims to reduce mortality and morbidity and transmission of the disease until it no longer poses a threat to public health.

4.5.1.1 National Health Act, 61 of 2003

The *National Health Act, 61 of 2003* makes provision for unity in the various elements of the national health system with a common goal to actively promote and improve the national health system in South Africa. Provision is also made for a system of co-operative governance and management of health services, within national guidelines, norms and standards, in which each province, municipality and health district must address questions of health policy and delivery of quality health care services. The Act stipulates that patients should be provided with the best care possible and that health care providers be qualified and skilled to provide health care services.

4.5.1.2 Occupational Health and Safety Act, 85 of 1993

The *Occupational Health and Safety Act, 85 of 1993* makes provision for the health and safety of workers in South Africa. The Act stipulates that an employer is obliged to provide, as far as is reasonably practicable, a safe workplace without risk to the health of its employees. Personal protective equipment should be provided where it is required to mitigate risks and hazards.

4.5.1.3 South African National TB Control Guidelines, 2009

The *South African National TB Control Guidelines, 2009* were developed and introduced by the National Department of Health with the aim of providing guidance to PHC personnel and managers in addressing the challenges of TB control and successfully managing all clients presenting with TB, including those co-infected with HIV as well as early detection of drug resistant TB.

4.5.1.4 Millenium Development Goals

Goal 6 of the MDGs refers to “Combating HIV and AIDS, Malaria and other diseases” and Target 8 aims to “halve and begin to reverse the incidence of Malaria and other major diseases”.

Infection control practices in health care facilities have come under the spotlight as cases of TB morbidity and mortality were reported among South African health care

workers (Naidoo et al 2012:1600). Despite the guidelines for TB infection control in health care facilities, there is still growing evidence of health care facility-acquired transmission of TB to patients and health care workers.

Various factors may contribute to the spread of TB in the health care facilities. Administrative, environmental and personal protective measures have been proven to prevent the spread of the disease in health care settings but inadequate implementation of these measures can lead to uncontrollable spread of the disease (Naidoo et al 2012:1600). Administrative controls include infection control policies, patient triage, ensuring available human resources and training of health care workers; environmental controls include having enough air changes, negative pressure isolation rooms and externally exhausted air; masks with at least 95% filter efficiency are recommended as the respiratory protection of choice (CDC 2005:4).

Inadequacy in the implementation of TB preventive measures has been found in health care facilities in South Africa and elsewhere. In a study to assess and describe the TB infection control practices in 51 health care facilities, Naidoo et al (2012:1602) found that:

22% (n=11) had infection control policies that were clinic specific
20% (n=10) had an infection control committee
12% (n=6) had an occupational TB management policy
8% (n=4) provided in-service training for health care workers
26% (n=13) triaged patients who arrived at the clinic with cough to identify TB suspects
22% (n=11) of the PHC facilities had N95 masks that nurses did not wear.

In a study to identify barriers and motivators to the use of infection control measures among Russian health care workers, Woith et al (2012:1094-1095) found that the participants voiced negative attitudes towards the use of respirators and masks because they perceived them as uncomfortable and therefore would not wear them despite their exposure to the disease. Furthermore, the participants lacked knowledge on TB control policies due to inadequate training.

4.6 CONCLUSION

This chapter discussed the data analysis and interpretation and results. Reference was made to appropriate literature reviewed in relation to the findings. The respondents' demographic profile showed that most were females, black and Tswana speaking. Several statistical tests were used for reliability of the study findings. P-value test of association was used to indicate significance of the results.

Chapter 5 concludes the study and makes recommendations for practice and further research.

CHAPTER 5

Findings, limitations and recommendations

5.1 INTRODUCTION

Chapter 4 presented the data analysis and interpretation and the results of the study. This chapter briefly discusses the findings, conclusions and limitations of the study, and makes recommendations for practice and further research.

5.2 PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of the study was to describe and explore the perceptions of nurses working in a PHC clinic of the Odi Moretele municipality on the underlying contributory factors in the selected clinics that may lead to the spread of TB in clinics treating TB patients.

In order to achieve the purpose, the objectives of the study were to:

- Describe the perceptions of nurses working in the selected clinics of the Odi Moretele municipality of the underlying contributory factors that may lead to the spread of TB in clinics treating TB patients.
- Identify barriers to the implementation of and adherence to TB preventive measures as perceived by nurses working in the selected clinics of the Odi Moretele municipality.
- Explore the likelihood of compliance with TB preventive measures by nurses working in the selected clinics of the Odi Moretele municipality.

5.3 FINDINGS

The findings are presented according to the sections of the questionnaire.

Section A: Biographical data
Section B: Perceived susceptibility to TB infection
Section C: Perceived severity of TB infection
Section D: Perceived benefits of TB preventive measures
Section E: Perceived barriers to TB preventive measures
Section F: Self-efficacy
Section G: Cues to action to TB prevention
Section H: Legislative framework for TB control

5.3.1 Section A: Respondents' biographical data

The study found that 88% (n=67) of the respondents were females; 99% (n=76) were Blacks, and Tswana was the dominant language (57%; n=44). The study was conducted in the area of Odi Moretele sub-district, which is situated north of Pretoria in the North West province and is highly rural and with a population that is mainly Black.

Of the respondents, 64.9% (n=50) had diplomas in general nursing and 37.7% (n=29) had post-basic qualifications. Regarding their current position, 67% (n=52) of the respondents were professional nurses. In PHC facilities, nurses are required to have a basic diploma as entry level and those with a certificate will work as support staff.

The majority of the respondents were over 40 years old: 22.1% (n=17) were between 49 and 54; 22.1% (n=17) were over 54; 20.8% (n=16) were between 43 and 48; 13% (n=10) were between 37 and 42; 7.8% (n=6) were between 31 and 36; 11.7% (n=9) were between 26 and 30, and 2.6% (n=2) were between 20 and 25 years old.
The results were consistent with the respondents' years of experience.

Of the respondents, 60% (n=46) had more than 11 years' experience; 35% (n=27) had two to four years' experience, and 35.5% (n=28) had five to ten years' experience. Moreover, 40% (n=31) had less than 11 years' experience as a qualified nurse. The respondents thus had more years' experience as employed qualified nurses than as

qualified nurses in the PHC setting. This is also supported by 39% (n=30) who indicated the PHC qualification as their speciality qualification. In order to work in PHC facilities, nurses need to have at least PHC as a postgraduate qualification.

5.3.2 Section B: Perceived susceptibility

Section B examined the respondents' perceptions of the risk factors that might contribute to the spread of TB in their health care facilities; that is, their perceived risk factors of being infected with TB.

Of the respondents, 76% (n=58) indicated that nurses spent more time with infectious patients than other health care workers; 71% (n=54) indicated that nurses were the first line of contact with patients at the health care facility; 47.4% (n=36) indicated that nurses at the facility thought that TB prevention was the responsibility of the TB room personnel; 3.4% (n=33) indicated that nurses at the facility did not perform TB screening on themselves; 36.8% (n=28) indicated that nurses still lacked knowledge on TB preventive measures, and 26.3% (n=20) indicated that nurses still thought that they were immune to TB and did not practise preventive measures.

5.3.2.1 Perceived risk factors for TB infection

The findings show that the majority of the respondents perceived nurses to be at risk for TB infection as they spend more time with infectious patients (76%; n=58), and also that they are the first line of contact at the health care facility (71%; n=54) compared to other health care workers.

5.3.2.2 Factors that increase the chance of developing TB following infection with the bacilli

Of the respondents, 87% (n=67) indicated that the immune status of the exposed person increased the chance of developing TB disease; 49.4% (n=38) indicated that the infected person's amount of bacilli increased the chance; 40.3% (n=31) indicated that the exposed person's occupation increased the chance, and 10.4% (n=8) indicated that the exposed person's gender increased the chance of developing the disease.

Of the respondents, 100% of those who had a PHC qualification indicated that the immune status of the exposed person increased the chances of developing TB following infection with the bacilli compared to 79% of those who did not have a PHC qualification. Thus the respondents holding a PHC qualification perceived the immune status of the exposed person to be associated with the risk for developing TB disease.
The study found that the proportion of respondents who indicated that the immune status of the exposed person increased the chances of developing TB following infection with the bacilli, increased with added years of experience: 100% for respondents with 11 and more years' experience; 89% for respondents with 5-10 years' experience; 74% for respondents with 2-4 years' experience. The more experienced the health care workers, the more they perceived the immune status of the exposed person a risk factor of developing TB.

Finally, the respondents who indicated that the occupation of the exposed person increased the chances of developing TB disease once infected, had a lower median Beliefs score than those who had not selected this option.

The responses to perceived susceptibility to TB had several inconsistencies. For example, the respondents perceived nurses to be at risk of TB in their health care facilities but did not perceive the occupation of an exposed person as a risk factor increasing the chances of developing TB. This perception could impact on the implementation of and compliance with the TB preventive measures. The respondents need training on risk factors for TB infection. Their lack of this knowledge could stem from inadequate training, since only 38% (n=29) of the respondents indicated that they had attended training in the last 12 months. This indicates that nurses must be trained on risk factors for TB as a well-educated workforce is essential for reducing nosocomial infection. Such training should be prioritised according to the educational needs, determined according to job categories, and programmes introduced to eliminate misperceptions.

5.3.3 Section C: Perceived severity of TB infection

Section C explored the extent to which the respondents perceived TB as serious.

5.3.3.1 Main symptoms of TB

The study found that of the respondents, 99% (n=76) indicated cough; 68% (n=52) indicated chest pain; and 61% (n=47) indicated fever, and 3.9% (n=3) indicated vomiting as a symptom of TB. The respondents therefore understood the main symptoms of TB. Nurses have the responsibility to prevent illness and promote health for their patients. In this case, their understanding of the signs and symptoms of TB was important for the prevention of nosocomial transmission of TB in their health care facilities. Health care workers need to recognise patients who are at risk and those that pose a risk for infecting others so that appropriate preventive measures can be implemented.

5.3.3.2 Most infectious patient

Of the respondents, 78% (n=55) indicated a pulmonary TB patient who has a positive sputum result and is not yet on treatment as the most infectious patient. This showed that the respondents were likely to implement proper TB preventive measures and prioritise their patients according to the level of infectiousness. Knowledge on the symptoms of TB also leads to proper implementation of TB preventive measures.

The respondents identified the symptoms of TB and the most infectious patients, which indicated that they perceived the disease to be serious. However, one would have expected a full (100%) response rate to effectively control TB and prevent nosocomial TB to both patients and health care workers. Nurses treating TB patients should be equipped to control its spread. Accordingly, ongoing facility in-service training should be offered to nurses in health care facilities to equip them with up-to-date information and improve patient outcomes. Facilities should also have a person responsible from the infection control committee who will conduct the skills audit for the personnel so that training can be offered according to the needs identified.

5.3.4 Section D: Perceived benefits of TB preventive measures

This section explored the respondents' perception of the value or usefulness of measures that can be carried out to prevent and thereby reduce the spread of TB.

5.3.4.1 Respondents' attendance of TB training in the last 12 months

The results indicated that only 38% (n=29) of the respondents had attended TB training in the last 12 months. The results did not reveal training attendance according to the respondents' categories.

5.3.4.2 Need for assigning a person to segregate patients to reduce TB infection

The majority (88%; n=68) of the respondents agreed that health care facilities treating TB should have a person responsible for segregation of patients to reduce TB infection. In addition, the respondents who agreed with the statement had a higher median Beliefs score (4.2) than the respondents who responded in the negative (3.3).

5.3.4.3 Respondents' reasons for needing a person responsible for segregation of patients to reduce TB infection

Of the respondents, 87% (n=59) indicated that a person responsible for segregation of patient was needed so that infectious patients would spend less time at the facility; 13.2% (n=9) indicated so that queues at the facilities would be shorter, and none (0%, n=0) indicated so that the duration of TB treatment would be shortened.

5.3.4.4 Respondents' perception of how to reduce the risk of infection in health care facilities

Of the respondents, 77% (n=59) indicated educating patients on TB prevention measures; 71% (n=55) indicated training nurses on TB; 62% (n=48) indicated that nurses should receive TB orientation before starting to work at facilities treating TB, and 51% (n=39) indicated that encouraging nurses to screen themselves for TB could reduce the risk of TB infections in health care facilities.

5.3.4.5 Perceptions of whether screening nurses for TB was important

The study found that of the respondents, 95% (n=71) indicated that it is important to screen nurses for TB.

5.3.4.6 Respondents' reasons for screening nurses for TB

Of the respondents, 32% (n=22) indicated that nurses should be screened for TB so that nurses with latent TB infection can be given prophylaxis and also protect themselves; 19% (n=13) indicated that screening nurses for TB will enable them to implement TB control measures in the health care facilities, and 16% (n=11) indicated that nurses can be given treatment for active TB.

5.3.4.7 Respondents' perceptions of nurses knowing their own HIV status

The findings showed that 85% (n=62) of the respondents thought that nurses working in clinics treating TB patients should know their HIV status.

5.3.4.8 Respondents' reasons for the importance of nurses working in clinics treating TB knowing their HIV status

The study found that of the respondents, 79% (n=49), it is important for nurses working in clinics treating TB patients to know their HIV status as HIV increases the likelihood of developing/contracting TB and HIV-infected nurses can be given the opportunity to work in areas with lower TB exposure; (11.3%, n=7) indicated that HIV-infected nurses cannot assist TB-infected patients; (6.5%, n=4) thought it important for nurses to know their HIV status as the incidence of HIV is higher in nurses, and (3.2%, n=2) thought that HIV infection is high in health care facilities treating TB patients. Further analysis revealed that among the respondents, 15.4% of the enrolled nurses and assistant nurses compared to 4.1% of the nurse managers and professional nurses indicated that it is important for nurses working in clinics treating TB patients to know their HIV status as the incidence of HIV is higher in nurses. Moreover, 30.8% of the enrolled nurses compared to 6.1% of the nurse managers and professional nurses indicated that HIV-infected nurses cannot assist TB-infected patients.

There was thus a significant, moderate, association between the respondents' reasons and position (Fishers exact test: p=0.021; phi coefficient=0.39). The Beliefs median was also higher among the respondents who indicated that nurses with HIV can be given the opportunity to work in areas with lower exposure as HIV increases the likelihood of developing TB (4.3) than those who indicated that HIV-infected nurses cannot assist

TB- infected patients (3.0).

The findings emphasise the need for comprehensive TB infection and prevention training for the respondents and all nurses. Only 38% of the respondents were trained in the 12 months preceding the study which is not in line with the current guidelines on TB training which recommend that nurses should receive TB training on an annual basis. The facility managers should assess training needs to identify who needs training on TB. Nurses should also have access to TB control guidelines, especially since several of the respondents were not aware of treatment for latent TB.

5.3.5 Section E: Perceived barriers to TB preventive measures

This section explored the respondents' perceptions of the obstacles to the implementation of TB preventive measures.

5.3.5.1 Perception on the role of nurses in TB prevention in the health care facilities

Of the respondents, 99% (n=73) think that nurses have a role in TB prevention in their health care facilities.

5.3.5.2 Preventive measures

The results showed several knowledge gaps among the respondents regarding the types of preventive measures: administrative, environmental and personal protective devices. Of the respondents, 46% (n=35) indicated that environmental measures eliminate generated infectious TB aerosols, and 30% (n=23) indicated that administrative control measures reduce the production of infectious TB aerosols in the environment. Of the respondents, 68% (n=52) indicated that personal protective devices are measures that can be implemented in the health care facilities to prevent the inhalation of infectious TB aerosols. The results were further analysed to determine a composite score and it showed that 48% of the respondents achieved only one correct answer and only 14% answered all three questions correctly. The respondents with a PHC qualification had a higher median score than the respondents with no PHC qualification. The respondents who obtained higher scores for preventive measures also

had higher Beliefs scores (Spearman's correlation: p=0.0056; rho=0.31).

5.3.5.3 Main problems with inappropriate practice of TB preventive measures at the health care facilities

Of the respondents, 52% (n=40) associated inadequate number of trained nurses with inappropriate practice of TB preventive measures at the health care facilities; 46% (n=35) indicated the inactive TB infection, prevention and control committee, non-working equipment such as electric fans and ultraviolet lights; 40% (n=30) indicated unavailability of equipment such as electric fans and ultraviolet lights; 35% (n=27) indicated inadequate equipment such as electric fans and ultraviolet lights; 30% (n=23) indicated lack of knowledge regarding accessibility of TB control guidelines among personnel; 26% (n=20) indicated inactive participation of the facility manager in the TB programme, and 18% (n=14) indicated inadequate co-operation between nurses, and absence of TB control guidelines. The findings further showed a significant association between the first option and experience (x^2 test: p=0.025; Cramer's V=0.31).

The respondents who indicated that inappropriate practice of TB preventive measures at the health care facilities was associated with inadequate number of trained nurses had a lower median Beliefs score (3.7) than the respondents who did not select this option (4.5).

The study found that knowledge of preventive measures is a barrier to the implementation of the TB preventive measures at the selected PHC facilities which could also affect compliance. The finding that there was a gap in the respondents' knowledge of the three preventive measures is of concern given the integral role of front-line TB personnel in the control of TB in their health care facilities. This should therefore be considered an area for future improvement among front-line TB personnel and the national TB programme as a whole. It is recommended that nurses be trained on the guidelines for TB control as part of their induction programme followed by quarterly facility in-service training as recommended by the CDC guidelines. This can be implemented through the responsible person to conduct ongoing facility training among health care workers.

5.3.6 Section F: Self-efficacy

This section explored on the respondents' perception of their ability to implement TB preventive measures in their PHC facilities.

5.3.6.1 Environmental control measures that nurses can practise to reduce TB in their health care facilities

The results indicate that of the respondents, 91% (n=70) perceived opening windows as an environmental control measure that can be practised in the health care facilities to reduce TB; 60% (n=46) indicated that sputum collection should be done in an open space away from other patients; 51% (n=39) indicated that rooms should have UV lights; 35% (n=27) indicated that switching on electric fans could be practised, and 1% (n=1) perceived closing windows during winter as a measure to reduce TB in health care facilities.

5.3.6.2 Personal protective measures that nurses can use to reduce the spread of TB in their health care facilities

Of the respondents, 92% (n=71) indicated that nurses should wear N95 masks when working in TB clinics so as to reduce the spread of TB in health care facilities; 64% (n=49) indicated that coughing patients should be provided with surgical masks; 18% (n=14) indicated wearing gloves when attending to TB patients, and 9% (n=7) indicated wearing of surgical masks among nurses working in the TB clinic to reduce the spread of TB in their health care facilities.

These findings stress the necessity of nurses being trained on the TB control guidelines to implement preventive measures.

5.3.7 Section G: Cues to action to TB prevention

This section focused on the respondents' perception of factors that prompt them to implement the TB preventive measures.

5.3.7.1 Access to TB policies and guidelines improves knowledge on TB control

Of the respondents, 100% (N=77) agreed that having access to TB policies and guidelines in their health care facilities improved their knowledge on TB control. There was also a significant difference between the first two age groups: respondents aged 37-48 had a lower median Beliefs score than those aged 20-36. This indicated that respondents aged 37-48 did not feel as strongly about it as the ones aged 20-36. Furthermore the findings showed that respondents with a PHC qualification had a higher interquartile range (IQR 5-5) than those without the PHC qualification (IQR 4-5).

5.3.7.2 TB suspects in the health care facilities are a reminder to wear N95 mask

According to the findings, 100% (N=77) of the respondents agreed that having TB suspects in the health care facilities reminded them to wear N95 masks.

5.3.7.3 Coughing patients at the health care facility are the first priority

Of the respondents, 100% (n=77) agreed to giving first priority to coughing patients at their health care facilities.

The findings emphasise that nurses without a PHC qualification must be trained in TB preventive measures. The TB infection and prevention control committee should make it their responsibility to ensure that nurses at PHC facilities are trained on and are compliant with the TB preventive measures.

5.3.8 Section H: Legislative framework for TB control

This section focused on the legislative framework surrounding TB, because legislation is an effective tool to implement public health goals.

In general, there was a significant association between the legislative framework and Beliefs. The respondents who indicated correct answers had higher Beliefs scores than those who did not. However, the respondents generally displayed little knowledge of the legislative framework except for the Occupational Safety Act, which 80% (n=62) of the respondents indicated was developed to protect employees' health and safety against

hazards.

Regarding the respondents' knowledge of the legislative framework on TB control, 44% (n=34) indicated that the National Health Act, 61 of 2003 was developed to ensure provision of essential health services including PHC for the people of South Africa; 48% (n=37) indicated that the South African National TB control guidelines were developed to provide guidance to PHC personnel and mangers in addressing the challenges of TB control; 22% (n=17) indicated that the National Strategic Plan, 2012-2016 was developed to prevent new TB infections and TB-related deaths, and 10% (n=8) knew that the Millennium Development Goals (MDGs) were developed to halve and reverse the number of new TB cases.

Further analysis revealed that 66% (n=51) of the respondents achieved two or three correct answers, and only 1% (n=1) answered all five questions correctly. The mean score was 2.0 (95% CI: 1.8-2.3). The results of the study furthermore showed that the respondents who obtained higher scores for the legislative framework had higher Beliefs score than the ones who obtained lower scores.

It is evident from the results that the respondents had insufficient knowledge on the legislative framework for the control of TB. The WHO (2009:5) recommends that medical professionals know about national and international expansion of the TB burden and national TB prevention policies, such as control strategies. The CDC (2005:141) proposed curricula which offer the basics of training to undergraduate medical students on the fundamentals of TB prevention, diagnosis, and treatment. The results of the study highlight the need to develop educational tools using active learning strategies to improve knowledge and to ensure accountability among the respondents and all nurses in PHC facilities. Moreover, PHC facilities should conduct facility skills audits regularly in order to ensure that problem-based in-service training is offered. The selected facilities should also conduct ongoing competency-based programmes to improve and assess the level of knowledge among nurses. This could also form part of their job description so that their performance can be monitored to ensure individual accountability, commitment and ownership.

5.4 CONCLUSIONS

The findings of this study provided the researcher with valuable information on the current practice in the selected clinics. The study identified the respondents' perceptions of underlying factors contributing to the spread of TB in PHC facilities. The key contributory factors identified were the lack of TB training for staff and of knowledge of TB legislative framework and TB policy directives. This led to ineffective implementation of preventive TB measures. The findings indicate the need for a comprehensive TB infection prevention and control policy, with associated standards for provision and practice. PHC facilities must ensure that clear TB control guidelines are available and accessible and that nurses adhere to them. Regular guideline review should be done and results filed.

The findings show further that the availability of the TB control guidelines in the selected PHC facilities has not assured effective implementation of the infection control programme. The current infection control system, then, might in all likelihood remain ineffective unless the underlying barriers and challenges are tackled. The researcher also established that the nature of the barriers and challenges are complex and individualised to clinical experience, qualifications and beliefs and thus require appropriate assessment to enable an effective and encompassing approach in improving the current infection control practices.

5.5 LIMITATIONS OF THE STUDY

The study was limited to nurses working in selected clinics of Odi Moretele sub-district who were registered with the SANC and had two or more years' experience of working as a qualified nurse. The sample size was small therefore the findings cannot be generalised to nurses in the other sub-districts of Odi in Tshwane or other clinics in the province or the country. The study was further restricted to nurses' perceptions and experience. The perceptions of other members of the multi-disciplinary team involved in the care of patients with suspected or confirmed TB were thus excluded.

5.6 RECOMMENDATIONS

Based on the findings, the researcher makes the following recommendations for practice and further study.

5.6.1 Practice

- **Management**

In order to ensure health care workers' compliance with and effective implementation of TB preventive and control measures and identify underlying factors in the spread of TB in the health care facilities, facility managers should ensure that:

- TB prevention and control policy is in place in health care facilities working with suspected or confirmed TB patients.
- Ensure that health care workers in their facilities have access to and understand TB prevention and control policies.
- Ensure that the facilities have facility-specific standard operating procedure for TB prevention and control in each consulting room.
- Ensure that clear guidelines for TB prevention and control are prominently displayed in a visible area.
- There is a graphical presentation of the incidence and prevalence of TB in the geographic area surrounding the health care facility.
- A policy is in place to screen health care workers for TB and also assign a person responsible for this activity.
- There is access to a confidential HIV voluntary counselling and testing (VCT) programme for employees so that health care workers found to be infected with HIV can be given prophylaxis and an opportunity to work in areas of low risk for TB.
- There is an active TB prevention and control committee and be actively involved.
- Skills audits are determined for health care workers of different categories and clinical experience to determine individual training needs.
- Health care workers practise according to the latest guidelines for TB prevention and control through in-service training for newly appointed employees, followed

by six-monthly refresher training.

5.6.2 Clinical practice

Working in clinics managing patients with suspected or confirmed TB can be a contributory factor to nosocomial transmission of the disease as a result of prolonged exposure to these patients. The study found that nurses are at risk for contracting TB in their health care facilities due to their prolonged exposure to patients with suspected or confirmed TB. Therefore to ensure that this transmission is reduced to both nurses and patients, the following measures are recommended for clinical practice:

- Nurses working in PHC facilities treating patients with suspected TB must know the signs and symptoms and protective measures that should be taken to prevent TB. This will enable them to reduce the transmission of TB to other patients, their family and community, as well as nurses and other health care workers.
- Nurses working in PHC facilities treating patients with suspected TB should make use of TB control guidelines, and make it their responsibility to know the contents of the guidelines. The seriousness of contracting TB from patients should be understood.
- Nurses working in PHC facilities treating patients with suspected or confirmed TB should be familiar with the legislative framework on TB prevention and control so that they are equipped to protect themselves and their patients
- All nurses in the facility should be responsible for the prevention of nosocomial transmission of TB and follow strict enforcement of rules and guidelines.
- The TB prevention and control committee should comprise and include health care workers from different disciplines so that a standardised guideline for TB prevention and control is followed.
- All health care workers working with suspected or confirmed TB patients should receive training prior to carrying out assessments and treatment of patients. The training should consist of the pathogenesis, signs and symptoms, and types of TB; TB preventive control measures, and legislative framework on the control of TB.
- Health care workers should meet monthly to review their compliance with TB

preventive and control guidelines and policy and give feedback on any policy changes or suggestions to improve them.

5.6.3 Education

The findings indicate that lack of training is associated with poor knowledge of the TB control programme and subsequently inadequate implementation of and compliance with TB preventive measures. Therefore it is recommended that the measures for TB prevention and control be included as part of the undergraduate nursing curricula with the practical part forming their final year assessments to ensure that nurses are ready to tackle the TB pandemic. The following problem-based learning intervention should be integrated in an undergraduate traditional curriculum:

- TB should be covered as a separate module from other infectious diseases and include the definition, causes, pathophysiology, mode of transmission, prevention and control of the disease.
- Undergraduate nursing students should also be assessed on the contents of the legislative framework on TB prevention and control.
- Practical exposure at the PHC settings should also include TB prevention and control accompanied by the portfolio of evidence submitted for clinical competency.
- A system should be in place that is designed to evaluate the training of medical students and to identify inadequacies in their education prior to their placement in health care facilities following completion of their undergraduate qualifications.
- Ongoing in-service training on TB prevention and control should take place in health care facilities treating patients with suspected or confirmed TB.

5.6.4 Further research

The researcher conducted a quantitative study, using a questionnaire, to describe and explore nurses' perceptions of the underlying contributory factors in the selected clinics that may lead to the spread of TB in clinics treating TB patients. More research - qualitative, quantitative, mixed method - is needed on this disease. The researcher recommends that research be conducted on the following topics:

- An investigation into the perceptions of members of the multidisciplinary team of factors that contribute to the spread of TB in PHC facilities involved in the care of patients with suspected or confirmed TB.
- Knowledge, experience, and attitudes of nurses on the factors contributing to nosocomial spread of TB in municipal PHC clinics treating TB patients in Centurion, Gauteng/the Odi Moretele sub-district of Gauteng/North West province/Limpopo/ or any other specific area.
- Knowledge of TB and infection control measures among health care workers in the Odi Moretele sub-district of Gauteng.
- Health care professionals' perception of the main challenges and barriers to effective TB preventive measures in the clinics of the Odi Moretele sub-district of Gauteng.
- A comparative study of the knowledge, perceptions and observations of doctors, nurses and social workers on the factors contributing to the spread of TB in clinics treating TB patients.
- An exploration of the community's knowledge, understanding and views on TB and its spread.
- An exploration of the awareness and knowledge of health care professionals and the community of TB, control and preventive measures, policy and the MDGs.

5.7 CONCLUSION

The researcher has several years' experience as an HIV/TB nurse mentor with a multi-disciplinary team of health care workers involved with clients who have contracted TB and their families. The researcher's role involves networking, consulting and collaborating on TB issues with the nurses, other health care workers and NGOs. This involvement with the TB programme and interaction with the patients, their family members and the community motivated her to undertake the study. Corvalan, Hales and McMichael (2005:13) maintain that "the environment is partly the result of human interventions, which are themselves the outcome of the growing epidemic in health care facilities and a country as whole".

It is hoped that this study may serve as a learning paradigm for and enhance the insight and knowledge of facility managers, all health care personnel, and nurses working in

clinics where patients suffering from TB receive assessment and treatment. The findings of the study should be of benefit to policy makers; nurse educators in reviewing and developing curricula, and facility managers, as the ones responsible for running the clinics, and provide leaders in health care with information to facilitate commitment to control measures for the prevention of TB in PHC clinics.

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Annexure A

Letter of approval from the University

UNISA university of south africa

UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE

HSHDC/139/2013

Date: 6 February 2013 Student No: 4643-155-1

Project Title: Nurses' perceptions of the factors contributing to the spread of tuberculosis in a clinic in the Odi Moretele sub district of Gauteng.

Researcher: Mahlodi Annah Molele

Degree: MA in Nursing Science Code: MPCHS94

Supervisor: Prof SP Hattingh
Qualification: D Litt et Phil
Joint Supervisor: -

DECISION OF COMMITTEE

Approved [√] **Conditionally Approved** [ ]

Prof L Roets
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE

Dr MM Moleki
ACTING ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

Annexure B

Information leaflet for respondents: Gauteng Department of health, Tshwane District

Information leaflet for respondents

I would like to thank you for agreeing to take part in the study. This information sheet explains what the study is about and how I would like you to take part in it.

The purpose of the study is to describe and explore the perceptions of nurses working in a PHC clinic of the Odi Moretele municipality on the underlying contributory factors in the clinics under study that may lead to the spread of TB in clinics treating TB. In order to elicit your views I would like you to give responses to the questionnaire that will be provided to you. If you agree to take part in the study the questionnaire will take approximately 45 minutes of your time. The data will be collected during the afternoon when the facility is not busy to refrain from interfering with patient care. Consent from your manager to conduct data collection has already been granted. The information provided by you in your responses will be used for research purposes. The questionnaire is anonymous and therefore your individual response will not review your identity. The study has been considered by an institutional ethics committee at the University of South Africa and has been given a favourable review by a panel of experts.

Once again I would like to appreciate your effort for agreeing to participate in the study, and if you have any questions regarding the research at any stage please do not hesitate to contact me

Researcher: Mahlodi Molele

Contact Number: 071 223 8119

Address: 4450 Unit D

Ext 6

Temba

Email address: mmolele12@gmail.com

Annexure C

Letter seeking consent from the Department of Health: Gauteng province, Tshwane district

Informed consent form

Tuberculosis is a life threatening illness and a challenge to healthcare professionals that have to deal with it on a daily basis, as it is their duty to protect the patients and community from contracting this disease at all cost.

I hereby invite you to participate in my research study on *"Nurse's perceptions of the factors contributing to the spread of tuberculosis in a clinic in the Odi Moretele sub district of Gauteng"*. The information obtained will benefit both the facilities, personnel and the community, as the results will be used to determine what can be done to improve the situation. There is no risk of discomfort in sharing your information and you need not attach your name, surname, address or telephone number.

To participate in the study you will be required to respond to the questionnaire that will be provided to you by the researcher. If you do not understand feel free to ask and clarification will be made and questions will be answered to you by the language of your choice.

Participation is totally voluntary; you are under no obligation to participate in the study. You have the right to opt not to take part in the study without any penalties.

Researcher	Date

I confirm that I have received and understand all the information regarding the study. It was also explained to me that my participation is voluntary and that I may refuse to participate or give consent to the study without any penalty.

I hereby freely consent to take part in this research study.

Signature of respondent	Signature of witness	Date

Annexure D

Letter of approval: Department of health, Tshwane district

Kuyasheshwal Gauteng Working Better

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

427 Hilda Street, The Fields Building, Pretoria 0001 South Africa. Tel: +27 12 451 9000 Fax: +27 12 451 9125
Enquiries: Dr. K. E. Letebele-Hartell
e-mail: Mangi.Letebele@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE

CLEARANCE CERTIFICATE

Meeting: N/A

PROJECT NUMBER: 27/2013

Title: Nurse's perception of the factors contributing to the spread of tuberculosis in a clinic in the Odi Moretele sub-district of Gauteng.
Researcher: Mahlodi Anna Molele
Co-Researcher:
Supervisor: Prof. SP. Hattingh
Department: Nursing Science

DECISION OF THE COMMITTEE

Approved

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

Date: 15th July 2013

.....
Dr. K.E Letebele-Hartell
Chairperson Tshwane Research Committee
Tshwane District

.....
Mrs. M Morewane
Acting Chief Director: Tshwane District Health
Tshwane District

NOTE: Resubmission of the protocol by researcher(s) is required if there is departure from the protocol procedures as approved by the committee.

Annexure E

Questionnaire

	For office use only	
Respondent number	**A0**	

QUESTIONNAIRE

INSTRUCTIONS FOR COMPLETING THE QUESTIONNARE ON:
"NURSES PERCEPTIONS OF THE FACTORS CONTRIBUTING TO THE SPREAD OF TUBERCULOSIS IN A CLINIC IN THE ODI MORETELE SUB DISTRICT OF GAUTENG"

1. All questionnaires are completed anonymously. We would appreciate it if you answer ALL the questions and answer as honestly as possible.
2. Answer each question by indicating the chosen option/s with a tick (√) in the appropriate block OR fill in the information asked in the provided space. In some questions more than one answer may be required.
3. The questionnaire consists of eight (8) sections and you are required to complete **ALL** the sections.
   SECTION A: Biographical data

   SECTION B: Perceived susceptibility to TB infection

   SECTION C: Perceived severity of TB infection

   SECTION D: Perceived benefits of TB preventative measures

   SECTION E: Perceived barriers to TB preventative measures

   SECTION F: Self efficacy

   SECTION G: Cues to action to TB prevention

   SECTION H: Legislative framework for TB control
4. It will take you approximately 20 minutes to complete the questionnaire.

SECTION A: BIOGRAPHICAL DATA	
1. Gender	
Male	1
Female	2
2. Age	
20-25 years	1
26-30 years	2
31-36 years	3
37-42 years	4
43-48 years	5
49-54 years	6
55 years and older	7
3. Ethnic group	
Black	1
Coloured	2
Indian	3
White	4
Other, please state.....	5
4. First language	
Afrikaans	1
English	2
Sepedi	3
Tsonga	4
Tswana	5
Zulu	6
Other, please state.....	7
5. Indicate your qualifications. (Mark all that apply)	
Diploma in General Nursing	1
Bachelors' Degree	2
Masters' Degree	3
Post Basic Qualification	4
Diploma in Enrolled Nursing	5
Diploma in Enrolled Nursing Assistant	6
Other, please state.....	7
6. Indicate your speciality qualifications. (Mark all that apply)	
Medical/Surgical	1
Midwifery	2
Paediatrics	3
Neonatology	4
Oncology	5
Optometry	6
Primary health care	7
Other, please state.....	8
7. Current position	
Nurse Manager	1
Professional Nurse	2
Enrolled Nurse	3
Assistant Nurse	4
Other, please state	5

8. Indicate years of experience as a qualified nurse in a primary health care setting	
Less than 2 years	1
2-4 years	2
5-7 years	3
8-10 years	4
11-13 years	5
14-16 years	6
17-19 years	7
20-22 years	8
More than 23 years, please state.....	9
9. Years of employment as a qualified nurse	
Less than 1 year	1
1-2 years	2
3-4 years	3
5-6 years	4
7-8 years	5
9-10 years	6
More than 11 years, please state.....	7
SECTION B: PERCEIVED SUSCEPTIBILITY TO TB INFECTION	
1. In your opinion, what do you think puts nurses at risk of being infected with TB in the health care facilities? (Mark all that apply)	
Nurse are the first line of contact with the patients at the health facility	1
Nurses spend more time with infectious patients than other health care workers	2
Nurses think that they are immune to TB and do not practice TB preventative measures	3
Nurses still lack knowledge on TB preventative measures	4
Nurses at the facility do not perform TB screening on themselves	5
Nurses at the facility think that TB prevention is the responsibility of the personnel working in the TB room	6
2. What do you think increases the chances of developing TB disease following infection with the bacilli? (Mark all that apply)	
The immune status of the exposed person	1
The amount of the bacilli of the infected person	2
The occupation of an exposed person	3
Gender of an exposed person	4
SECTION C: PERCEIVED SEVERITY OF TB INFECTION	
3. What do you think are the main symptom/s of TB? (Mark all that apply)	
Cough	1
Fever	2
Vomiting	3
Chest pain	4
4. TB is an infectious disease that can be transmitted by inhalation of droplet nuclei of an infected person. Who do you think is the most infectious patient below? ((Mark only one)	
A pulmonary TB patient who has a positive sputum results not yet on treatment	1
A pulmonary TB patient who has a positive sputum results and on TB treatment for more than 8 weeks	2
A pulmonary TB patient with a negative sputum results and an X-ray indication of TB	3
A patient with extra pulmonary TB not on TB treatment	4

SECTION D: PERCEIVED BENEFITS OF TB PREVENTIVE MEASURES	
5. Have you attended training on TB in the last 12 months?	
Yes	1
No	2
6. Do you think that health care facilities treating TB should have a person responsible for the segregation of patients to reduce TB infections?	
Yes Go to question 3	1
No Go to question 4	2
7. If you have answered "yes" to the previous question, please indicate the reason why you have responded thus? (Mark only one)	
Infectious patients will spend less time at the facility	1
The queue at the health facility will be shorter	2
The duration of TB treatment will be shortened	3
8. In your opinion, what do you think can be done to reduce the risk of TB infection at the health care facilities? (Mark all that apply)	
Nurses should be trained on the TB disease	1
Nurses should receive TB orientation before they start to work at the facilities that are treating TB	2
Nurses should be encourage to screen themselves for TB	3
Patients should be educated on TB prevention measures	4
9. Do you think that screening nurses for TB is important?	
Yes Go to question 10	1
No Go to question 11	2
10. If you have marked "yes" to the previous question, please indicate the reason why you have responded thus (Mark only one)	
Nurses and other health care workers with latent TB infection can be given prophylaxis such as Isoniazid Preventative Therapy (IPT)	1
Nurses will implement TB control measures in their health care facilities	2
Nurses can be given treatment for active TB	3
Nurses can be able to protect themselves from TB	4
11. Do you think it is important for nurses working in the clinics treating TB patients to know their HIV status?	
Yes Go to question 12	1
No Go to question 13	2
12. If you have answered "yes" to the previous question, please indicate the reason why you have responded thus (Mark only one)	
HIV increases the likelihood of developing/contracting TB and therefore HIV infected nurses can be given the opportunity to work in areas with lower TB exposure	1
The incidence of HIV is higher in nurses	2
HIV infected nurses cannot assist TB infected patients	3
HIV infection is high in health care facilities treating TB patients	4

SECTION E: PERCEIVED BARRIERS TO TB PREVENTIVE MEASURES	
13. Do you think nurses have a role in TB prevention within their health care facilities?	
Yes	1
No	2
14. Which preventative measure do you think nurses can implement to reduce the production of infectious TB aerosols in the environment? (Mark only one)	
Administrative control measures (e.g. TB policies, written TB infection control)	1
Environmental control measures (e.g. natural or mechanical ventilation)	2
Personal protective devices (e.g. wearing of masks)	3
15. Which preventative measure do you think nurses can implement to eliminate generated infectious TB aerosols? (Mark only one)	
Administrative control measures (e.g. TB policies, written TB infection control)	1
Environmental control measures (e.g. natural or mechanical ventilation)	2
Personal protective devices (e.g. wearing of masks)	3
16. Which preventative measure do you think nurses can implement to prevent inhalation of infectious TB aerosols? (Mark only one)	
Administrative control measures (e.g. TB policies, written TB infection control)	1
Environmental control measures (e.g. natural or mechanical ventilation)	2
Personal protective devices (e.g. wearing of masks)	3
17. What do you consider to be the main problems associated with inappropriate practice of TB preventative measures at the health care facilities? (Mark all that apply)	
There are not enough trained nurses	1
There is not enough co-operation between nurses	2
The facility manger is not actively participating in the TB program	3
The TB infection, prevention and control committee is not active	4
Equipments such as electric fans and ultraviolet lights are not working	5
Equipments such as electric fans and ultraviolet lights are not available at the facility	6
There are not enough equipments such as electric fans and ultraviolet lights at the health care facility	7
There are no TB control guidelines in the health care facility	8
There is a lack of knowledge regarding accessibility of TB control guidelines amongst personnel at the health care facilities	9
SECTION F: SELF EFFICACY	
18. Which environmental control measures do you think nurses can practice to reduce TB in their health care facility? (Mark all that apply)	
Having ultraviolet lights in their rooms	1
Switching on electric fans	2
Opening of windows	3
Collecting sputum in an open space away from other patients	4
Nurses working in the TB clinic should close their windows during winter season	5
19. Which personal protective measures do you think nurses can use to reduce the spread of TB in their health care facilities? (Mark all that apply)	
Nurses should wear N95 masks when working in the TB clinics	1
Provision of surgical masks for coughing patients	2
Nurses should wear gloves when attending to TB patients	3
Nurses working at the TB clinic should wear surgical masks	4

SECTION G: CUES TO ACTION TO TB PREVENTION						
For the following statements please indicate if you strongly agree, agree, disagree strongly disagree and neither agree nor disagree.						
		Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
20	I think having access to TB policies and guidelines improved my knowledge on TB control	5	4	3	2	1
21	I think having TB suspects in our health care facility reminds me to wear my N95 mask	5	4	3	2	1
22	I think patients who are coughing are the first priority at our health facility	5	4	3	2	1

SECTION H: LEGISLATIVE FRAMEWORK FOR TB CONTROL	
23. Which of the following legislation do you think was developed to protect employees' health and safety against hazards? (Mark only one)	
Occupational Health and Safety Act, 85 of 1993	1
National Health Act, 61 of 2003	2
South African National TB control guidelines	3
National Strategic Plan 2012-2016	4
Millennium Development Goals	5
24. Which of the following legislation do you think was developed to ensure provision of essential health services including primary health care for the people of South Africa? (Mark only one)	
Occupational Health and Safety Act, 85 of 1993	1
National Health Act, 61 of 2003	2
South African National TB control guidelines	3
National Strategic Plan 2012-2016	4
Millennium Development Goals	5
25. Which of the following legislation do you think was developed in order to halve and reverse the number of new TB cases? (Mark only one)	
Occupational Health and Safety Act, 85 of 1993	1
National Health Act, 61 of 2003	2
South African National TB control guidelines	3
National Strategic Plan 2012-2016	4
Millennium Development Goals	5
26. Which of the following legislation do you think was developed to prevent new TB infections and TB related deaths? (Mark only one)	
Occupational Health and Safety Act, 85 of 1993	1
National Health Act, 61 of 2003	2
South African National TB control guidelines	3
National Strategic Plan 2012-2016	4
Millennium Development Goals	5

27. Which of the following legislation do you think was developed to provide guidance to primary health care personnel and mangers in addressing the challenges of TB control? (Mark only one)	
Occupational Health and Safety Act, 85 of 1993	1
National Health Act, 61 of 2003	2
South African National TB control guidelines	3
National Strategic Plan 2012-2016	4
Millennium Development Goals	5

Thank you for taking your time to participate in my research study.

Mahlodi Annah Molele