

**KNOWLEDGE, ATTITUDES AND
EXPERIENCES OF DIETICIANS IN RELATION
TO TUBERCULOSIS AT THE WORKPLACE**

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**KNOWLEDGE, ATTITUDES AND EXPERIENCES OF DIETICIANS IN
RELATION TO TUBERCULOSIS AT THE WORKPLACE**

By

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for
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DECLARATION

In accordance with Rule G4.6.3,

I, Ingrid Oxley Oxland (student number 214 362 531) hereby declare that this dissertation on the “Knowledge, attitudes and experiences of dieticians in relation to tuberculosis at the workplace”, is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

SIGNATURE:

DATE: 2016

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TABLE OF CONTENTS	PAGE NUMBER
Declaration	iii
Acknowledgements	iv
List of Figures	xi
List of Tables	xii
List of Abbreviations	xiv
Abstract	xvi
 CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.1.1 Aetiology, treatment and strategies to improve management	1
1.1.2 Tuberculosis in South Africa: the past 20 years	3
1.1.3 Tuberculosis in health care facilities	5
1.2 Problem statement	7
1.3 Aims and objectives	8
1.4 The role of the researcher	9
1.5 Value of the study	9
1.6 Chapter outline	10
 CHAPTER 2: AN OVERVIEW OF TUBERCULOSIS IN SOUTH AFRICA	
2.1 Introduction	11
2.2 Transmission, signs and symptoms	12
2.3 Risk factors for TB	14
2.3.1 Immune suppression	14
2.3.2 Malnutrition	17
2.3.3 Vulnerable age groups	19
2.3.4 Social and environment	19
2.3.5 Health care professionals (HCP)	20
2.4 TB case detection and treatment outcomes	21
2.5 Drug-resistant TB in South Africa	23
2.5.1 Risk factors	24

2.5.2 Case detection and treatment outcomes	25
2.5.3 Barriers to management of MDR-TB and XDR-TB	28
2.5.3.1 Delayed diagnosis of drug-resistant TB	28
2.5.3.2 Delayed start of patients with drug-resistant TB on treatment	29
2.5.3.3 Interaction of infectious TB patients with other patients in health care settings	29
2.6 Responses to the TB threat	29
2.6.1 Stop TB Strategy	31
2.6.2 National Tuberculosis Management Guidelines	32
2.6.2.1 Screening for TB	33
2.6.2.2 Diagnosis of TB	33
2.6.2.3 Management of TB	37
2.6.2.3.1 Management of drug-susceptible TB	37
2.6.2.3.2 Management of drug-resistant TB	38
2.7 Role of HCP	40
2.7.1 Role of the dietician	42
2.7.2 Rights of dieticians and HCP	44
2.8 Evaluation of the implementation of the National TB Management Guidelines in South Africa	44
2.8.1 Evaluation of the potential barriers to treatment adherence	47
2.8.1.1 Social and economic factors	47
2.8.1.2 Patient-related factors	49

2.8.1.3 Health system factors	51
2.8.1.4 Therapy related factors	52
2.8.2 Evaluation of training as recommended within the National TB Management Guidelines	53
2.8.2.1 In-service training	53
2.8.2.2 TB Training by NGOs	54
2.8.2.3. Undergraduate TB training	56
2.9 TB infection control measures	57
2.9.1 WHO TB Infection Control measures	57
2.9.2 Evaluation of implementation of TB Infection Control measures	60
2.9.3 South African KAP surveys on TB infection control measures	62
2.9.3.1 Knowledge	62
2.9.3.2 Attitudes	64
2.9.3.3 Practices	65
2.10 Conclusion	68

CHAPTER 3: METHODOLOGY

3.1 Introduction	70
3.2 Methodology	70
3.2.1 Research design	70
3.2.2 Pilot study	71
3.3 Methods	72
3.3.1 Study population	72
3.3.2 Inclusion/ exclusion criteria	72
3.3.3 Sample and size	72
3.3.3.1 Sampling	72
3.3.4 Data collection method	74

3.3.5 Measuring instrument	74
3.3.6 Variables	75
3.3.7 Study procedures	77
3.3.8 Data collection	78
3.3.9 Data processing and analysis	78
3.3.10 Validity and reliability	84
3.3.10.1 Validity	84
3.3.10.2 Reliability	84
3.3.11 Ethics	85
3.3.12 Time frame/ schedule	87
3.3.13 Budget	87
3.4 Limitations	88
3.5 Summary	88

CHAPTER 4: RESULTS

4.1 Introduction	90
4.2 Demographics	90
4.3 Knowledge	92
4.4 Attitudes	95
4.5 Experiences	99
4.6 Personal behaviour	104
4.7 Associations between variables	105
4.7.1 Knowledge, attitudes and experiences according to regularity of exposure to TB patients	105
4.7.2 Knowledge, attitudes and experiences according to work setting	110

4.7.3 Knowledge, attitudes and experiences according to duration of employment in current work setting	115
4.7.4 Knowledge, attitudes and experiences according to training	116
4.7.5 Knowledge, attitudes and experiences according to adherence to infection control measures	120
4.7.6 Attitudes and experiences related to being tested for TB	122
4.8 Summary of associations	122
4.9 Correlations between knowledge, attitudes and experiences of dieticians	126
4.9.1 Summary of correlations	129
4.10 Summary of results	129

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction	131
5.2 Data collection instrument	132
5.3 Demographics	132
5.4 Variables	133
5.4.1 Knowledge	133
5.4.2 Attitudes	135
5.4.3 Experiences	139
5.4.4 Personal behaviour	144
5.4.5 Associations between knowledge, attitudes and experiences	145

5.5 Limitations of the study	146
5.6 Conclusion	147
5.7 Recommendations	149
5.7.1 Recommendations regarding training of dieticians	149
5.7.2 Recommendations regarding infection control practices	150
5.7.3 Recommendations regarding research needs	151
5.8 Conclusion	152
REFERENCES	154
ADDENDA	191

LIST OF FIGURES

Figure 2.1:	Cavitation of a tubercle in the lung	13
Figure 2.2:	MDR-TB case detection and treatment per province: 2012	26
Figure 2.3:	Evaluation of practices regarding the use of personal protective equipment	67
Figure 3.1:	Outline of study procedures	78
Figure 4.1	Frequency with which certain administrative control measures took place	102
Figure 4.2:	Frequency that certain administrative control measures took place (continued)	103
Figure 4.3:	Personal behaviour regarding TB	105

LIST OF TABLES

Table 1.1:	TB incidence in South Africa	3
Table 1.2:	The incidence of hospitalisation	7
Table 2.1:	Symptoms and signs of EPTB	13
Table 2.2:	Incidence of TB and mortality rate according to BMI classification among HIV-infected patients (per 100 person-years)	18
Table 2.3:	WHO estimates of the case detection rate for new and retreatment cases in South Africa	22
Table 2.4:	Treatment success rate of patients started on TB treatment in South Africa	22
Table 2.5:	Side effects of first-line TB medication	38
Table 2.6:	Side effects of MDR-TB medication	39
Table 3.1:	Dimensions of knowledge	80
Table 3.2:	Dimensions of attitudes	81
Table 3.3:	Dimensions of experiences	82
Table 3.4:	Time frame/ schedule	87
Table 3.5:	Budget for the study	87
Table 4.1:	Demographics according to work setting	91
Table 4.2:	Knowledge of administrative control measures	93
Table 4.3:	Knowledge of TB transmission	94
Table 4.4:	Knowledge of TB signs and symptoms	95
Table 4.5:	Attitudes according to its dimensions	97
Table 4.6:	Fears related to TB	98
Table 4.7:	Experiences according to its dimensions	101

Table 4.8:	Associations between dimensions of knowledge and attitudes and the regularity of exposure to TB patients	107
Table 4.9:	Attitudes and experiences according to the regularity of exposure to TB patients	108
Table 4.10:	Significant associations between the dimensions of knowledge, attitudes and experiences and work settings	112
Table 4.11:	Knowledge, attitudes and experiences according to work setting	113
Table 4.12:	Associations between knowledge and previous training	117
Table 4.13:	Associations between attitudes and previous training	118
Table 4.14:	Associations between experiences and previous training	119
Table 4.15:	Knowledge, attitudes and experiences according whether infection control measures were neglected	121
Table 4.16:	Summary of significant associations between variables	123
Table 4.17:	Associations between knowledge and attitudes and experiences of dieticians (continued)	124
Table 4.18:	Correlations between knowledge and attitudes and experiences of dieticians	127
Table 4.19:	Correlations between attitudes and experiences of dieticians	128

LIST OF ABBREVIATIONS:

ACSM	Advocacy, communication and social mobilization
ADR	Adverse drug reactions
ADSA	Association for Dietetics in South Africa
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CPD	Continuing Professional Development
DOTS	Directly Observed Treatment and Standardised recording and reporting
DR	Drug Resistant
DS	Drug Susceptible
DST	Drug Susceptibility Testing
HCW	Health Care Workers
HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
IBD	Inflammatory Bowel Disease
ICT	Information and Communications Technology
IGRA	Interferon gamma release assay
LTBI	Latent Tuberculosis Infection
MDR-TB	Multidrug-resistant TB
MUAC	Mid-Upper Arm Circumference
MUST	Malnutrition Universal Screening Tool
NGO	Non-governmental organization
NMMU	Nelson Mandela Metropolitan University
PEPFAR	The United States President's Emergency Plan for AIDS Relief

PPE	Personal Protective Equipment
PYY	Plasma peptide YY
SAAHE	South African Association of Health Educationalists
TB	Tuberculosis
TST	Tuberculin skin testing
TUFH	Towards Unity For Health
URC	University Research Company
WHO	World Health Organization
XDR-TB	Extensively Drug-resistant TB

ABSTRACT

Tuberculosis (TB) is acknowledged as an epidemic in South Africa. Health care professionals (HCPs), including dietitians, are at an increased risk for TB-infection compared to the general population. Implementation of the World Health Organization (WHO) TB infection control measures can protect HCPs from contracting TB; however, many studies have shown poor adherence to guidelines by HCPs.

The aim of the study was to determine dietitians' knowledge, attitudes and experiences in relation to TB at the workplace.

A descriptive quantitative, cross-sectional research design was employed. Convenience sampling was applied. The online survey was conducted between August 2014 and March 2015. Data analysis included descriptive and inferential statistics. Ethical principles were adhered to.

The sample consisted of 102 registered dietitians in South Africa.

Good knowledge was displayed as two-thirds of dietitians correctly identified the National TB Management Guidelines and the main signs and symptoms of TB. However, a critical knowledge gap regarding TB transmission was identified, as only 42% of dietitians knew that TB could spread by talking.

Favourable attitudes towards TB and infection control measures were present, except towards inadequate staffing levels and being worried about TB. The respondents reported that the fear of contracting TB affected patient interaction. Poor adherence to infection control measures was found. Only 45% of dietitians reported having a written TB infection control plan at their workplace, and only 23% were trained on TB infection control measures. Coughing patients were not always triaged and education material was not always available for TB patients. The availability of N-95 respirators was reported by 76% of dietitians.

Training on TB infection control measures could influence dietitians' adherence to infection control measures, ultimately protecting them from contracting TB at the workplace.

Key words: Tuberculosis, dieticians, knowledge, attitudes, experiences, adherence, infection control measures, training.

CHAPTER 1

INTRODUCTION

1.1 Background

Tuberculosis (TB) is an infectious disease that has become an epidemic in South Africa (Marais *et al.*, 2013; Kasprowicz, Achkar & Wilson, 2011). The World Health Organization (WHO) has identified South Africa as a high-burden country, with an estimated 450 000 cases of TB in 2013 and a mortality rate of 48 per 100 000 of the population (WHO, 2014a). Multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) is part of this health concern (Nathanson *et al.*, 2010) with 1.8% of all TB cases in South Africa during 2013 being drug-resistant (WHO, 2014a).

In order to address this high infection rate, the government implemented the National Strategic Plan (NSP) for HIV, STIs and TB 2012 to 2016 with the long-term vision to reduce TB and ultimately prevent new TB infections in South Africa (SANAC, 2011). The NSP served as a framework regarding strategic directions to inform implementation plans and monitoring of multi-sectoral interventions (SANAC, 2011). In 2014, 16% of the health budget was allocated to the prevention, testing and treatment of TB, HIV and acquired immune deficiency syndrome (AIDS) (National Treasury, 2014), with Government expenditure on TB increasing from approximately R13million in 2012/2013 to R24million in 2013/2014 (National Treasury, 2015).

Tuberculosis screening, diagnosis and treatment is available at the primary health care level throughout the country, yet the incidence of TB in South Africa remains high (WHO, 2014a; SANAC, 2011). It is clear that TB prevention and control needs a multifaceted approach to overcome existing barriers. This includes providing universal access for patients to TB diagnosis and treatment, support of research activities in TB control and addressing social issues such as poverty and other barriers to treatment adherence (Department of Health, 2014a; Lienhardt *et al.*, 2012). Health care professionals (HCP) are also at risk and research indicates that if HCP contract TB at their health care facilities, they may have poor outcomes, which may ultimately lead to a decreased workforce to manage TB (Von Delft *et al.*, 2015; Tudor *et al.*, 2014).

1.1.1 Aetiology, treatment and strategies to improve management

Tuberculosis is caused by a bacterium, *Mycobacterium tuberculosis*, and is spread by droplet nuclei, for instance when a patient with pulmonary TB coughs or during sputum

induction. People who are malnourished, who share housing or who live in overcrowded conditions, and patients with compromised immune systems, as in the case of HIV infection or cancer, have an increased risk for TB-infection (DesJardins & Burton, 2013).

A patient with a TB infection that is susceptible to Rifampicin and Isoniazid, is started on first-line treatment that includes three bactericidal drugs, namely Rifampicin, Isoniazid, Pyrazinamide and one bacteriostatic drug, Ethambutol (Department of Health, 2014a; WHO, 2014a). If resistance to Isoniazid and Rifampicin occurs, the patient is classified as being MDR and the treatment is replaced with treatment that the patient is sensitive to, as determined by drug-susceptibility-testing (DST) (Zumla, Nahid & Cole, 2015; Department of Health, 2014a; WHO, 2014a). Tuberculosis medication has various potential side-effects including hepatitis, nausea and vomiting, hearing loss, peripheral neuropathy, skin rash, renal failure, joint pains and hypothyroidism (Department of Health, 2014a). Apart from these general side-effects, drug-resistant TB medication may cause additional side-effects including painful sterile abscesses at the site of injection (Department of Health, 2014a; WHO, 2010a). The treatment of primary TB usually lasts 6 months (Zumla *et al.*, 2015; Department of Health, 2014a). In the case of MDR-TB, this can increase to 24 months, with completion of the treatment regimen and being cured the desired outcome (Hughes & Osman, 2014; WHO, 2014a; Department of Health, 2011). Once diagnosed, adherence to TB medication directly influences the outcome; therefore it is extremely important to follow up TB patients (Department of Health, 2014a). Since 2004, the implementation of the Directly Observed Treatment and Standardised recording and reporting (DOTS) strategy as part of a global plan of the WHO to control TB, has been very successful in improving patient follow-up (Ershova *et al.*, 2014; Ntshanga, Rustomjee & Mabaso, 2009).

The WHO's vision is to end the TB epidemic by supporting:

- an integrated and patient-centred approach;
- health policies and systems that aim to prevent and end TB; and
- research that will lead to innovative prevention and cure strategies (WHO, 2015a).

However, as is evident from a recent systematic review and meta-analysis, pre-treatment loss to follow-up in Africa is up to 38%, which indicates that barriers/bottlenecks exist that hamper the realisation of the WHO's vision. Physical weakness resulting from the disease, dissatisfaction with the long waiting times at health facilities, logistics of having to return to

the clinic for monitoring on different dates, needing time off from work and a poor understanding of the potential consequences of not taking TB treatment were some of the reasons why patients were not even started on treatment (MacPherson *et al.*, 2013).

Technical support from the WHO guided the development of the National TB Management Guidelines in South Africa. These guidelines were established to reduce the transmission of TB in communities and to guide HCP to effectively manage patients. All HCP should accurately diagnose and register patients with TB, prescribe the appropriate treatment, monitor and support patients to attain drug adherence and evaluate patient outcomes in a standardised manner. Of these, drug adherence is of key importance to successfully treat all patients that start on treatment and so prevent drug resistance (Department of Health, 2014a). To achieve this, quality counselling by trained HCP is invaluable (Dong *et al.*, 2007). The health care professional should provide continuous support and counselling to patients throughout the full course of treatment to overcome any possible barriers to drug adherence.

1.1.2 Tuberculosis in South Africa: the past 20 years

As illustrated in Table 1.1, the incidence of TB per 100 000 of the population in South Africa has dramatically increased over the past two decades.

Table 1.1: TB incidence in South Africa

	1995 ^a	2005 ^b	2010 ^c	2013 ^d
Incidence of TB per 100 000 people	311	669	981	860

^a Department of Health & WHO, 1996; ^b Edginton & Naidoo, 2007; ^c SANAC, 2013; ^d WHO, 2014a

In 1995, the incidence of TB in South Africa was 311 per 100 000 (Department of Health & WHO, 1996). Only 1% of the cases in three of the provinces were MDR (Department of Health, 1999). At that stage, complete incorporation of DOTS, political commitment, an appropriate microscopy service and use of the TB register were identified as important for the prevention of the spread of MDR-TB (Department of Health & WHO, 1996). Therefore, in 1999 the Department of Health incorporated these strategies into the National Policies in order to prevent MDR-TB (Department of Health, 1999).

The concern about MDR-TB became more of an issue after a national survey conducted in 2001 - 2002 revealed that 6% of new cases were resistant to Isoniazid, 2% of new cases were resistant to Rifampicin and resistance to Streptomycin was found in 4% of new cases. The prevalence of MDR-TB was 1.6% in new cases and 6.6% in re-treatment cases. Drug-resistance in new patients was the highest in the Eastern Cape (11%) and most of the re-treatment cases of drug resistant TB were found in Mpumalanga (23%) (Weyer *et al.*, 2004).

Based on case notifications in 2003, South Africa ranked eighth out of 22 high burden TB countries and the Medium Term Development Plan, developed according to the WHO Global DOTS Expansion Plan to control TB, was subsequently endorsed by the national government (WHO, 2005:127). In 2003, only 18% of health facilities in South Africa were involved in community outreach programmes to increase awareness about TB and DOTS. The USAID Technical Assistance and Support Contract, TB (TASC II TB) provided assistance to the South African National TB Control Programme. The TASC II TB is aimed to support linkages between clinics and communities to improve the identification of potential TB suspects and increase TB awareness nationally (Mhlongo-Sigwebela n.d).

In 2004, in reaction to late presentation of patients at health facilities and treatment interruption, the South African National Department of Health released a document for the improved management of tuberculosis with the DOTS strategy established as the standardised management of MDR-TB in South Africa (Department of Health, 2004). Also in 2004, USAID TASC II TB worked towards improving the quality of TB services by increasing the availability of TB treatment, increasing TB awareness in communities, improving the management of support services such as the Electronic TB registers (ETR), expanding DOTS and establishing strong local and international partnerships. The TASC II TB provided training on the basic management of TB to 16 652 HCP (Mhlongo-Sigwebela n.d).

In 2006 the government took further steps to control the TB epidemic and launched the National TB Crisis Plan, followed by the development of the MDR and XDR Action Plan (Mhlongo-Sigwebela n.d.). By 2007 more than half of the newly diagnosed TB cases were HIV-infected (Department of Health, 2014a). The launch of the National TB Strategic Plan 2007-2011 and the development of infection control guidelines for TB (Mhlongo-Sigwebela n.d) were followed by the National Tuberculosis Management Guidelines in 2009 (Department of Health, 2009).

Despite these efforts the incidence of TB continued to increase, from 970 per 100 000 of the population in 2009, to 981 per 100 000 of the population in 2010, to 993 per 100 000 of the population in 2011 (SANAC, 2013). In addition, the number of drug-resistant TB cases in South Africa increased from 7 350 cases in 2007, to 14 161 in 2012, with most cases in 2012 reported in KwaZulu-Natal, the Eastern Cape and the Western Cape (Ndjeka, 2014).

Despite appropriate TB regimens being applied for the majority of patients during 2009 (Ershova *et al.*, 2014), a recent study showed that only about 68% of patients complied with the National TB treatment guidelines and only 49% of patients complied with drug-resistant TB guidelines. The worst overall compliance to the TB treatment guidelines was found in the Eastern Cape (54%) and the best compliance in the Western Cape (80%) (Khaole, 2014).

The National Strategic Plan for HIV, STIs and TB 2012-2016 is currently the main framework describing national priorities regarding TB. Broad goals related to TB include to reduce the number of new TB infections and deaths by 50%, to provide for the support of human rights and to reduce self-reported stigma related to HIV and TB by at least 50% (SANAC, 2011).

Despite the implementation of all these national efforts to decrease the transmission of TB in South Africa, the incidence of TB remained high at an estimated 860 per 100 000 of the population in 2013. However, the recent decrease in the incidence of TB over the past year is a cause for some optimism (WHO, 2014a; WHO, 2013a).

In 2014, the latest National Tuberculosis Management Guidelines were released (Department of Health, 2014a). Without full compliance to the National Tuberculosis Treatment Guidelines, the spread of TB will continue.

1.1.3 Tuberculosis in health care facilities

HCP are trained to screen, test, diagnose and treat TB patients at health care facilities. An audit of the public health care facilities in South Africa (HST, 2013) revealed that there were 3880 public health facilities in South Africa, mostly consisting of clinics (3074), district hospitals (253), community health centres (238) and satellite clinics (125). Tuberculosis treatment was provided at 93% of the primary health care facilities on an outpatient basis and in 35 TB hospitals. A total of 7467 hospital beds were available for TB patients (HST, 2013). Thus, at all these health care facilities TB patients are in close contact with the HCP.

The time delay between collecting sputum for drug-susceptibility-testing (DST) and initiation onto treatment provides the first opportunity for the spread of infective drug-resistant TB to other patients, visitors at health facilities and all HCP (Morrison, Pai & Hopewell, 2008).

Furthermore, a common problem is undiagnosed TB cases who are admitted to hospital but not screened for TB. In KwaZulu-Natal, a post-mortem study of 119 hospital patients that were not on TB treatment at their time of death, revealed that 33 were smear positive and 46 were culture positive for TB and thus posed a health threat to the HCP, hospital staff and patients in contact with them during hospitalisation (Cohen *et al.*, 2010).

In a larger study at 19 hospitals (n=1585), patients who presented with a current cough and ability to produce sputum were selected for TB testing and 543 cases of *M. tuberculosis* were diagnosed. More than a third of these patients were bacteriologically confirmed TB cases not on TB treatment and had spent a median of three days in the hospital at the time of the survey. These undiagnosed patients may possibly infect others in the hospital with TB (Bantubani *et al.*, 2014).

Similar scenarios were observed in the Western Cape, where 82 of 394 patients included in the study were diagnosed with TB in wards that did not deal with TB on a daily basis. Patients were hospitalised for a mean of 13 days and on average transferred twice, remaining infectious throughout their hospital stay (Sissolak *et al.*, 2010). Among 2142 patients treated at the Infectious Diseases Unit at Groote Schuur hospital during 2008 to 2011, TB was the most common diagnosis (Pandie *et al.*, 2012). The number of drug-resistant TB cases treated in hospitals has also increased. At Sizwe Hospital in Gauteng, the number of hospital admissions for MDR-TB increased by 33% and for XDR-TB by 47% within as little as a year (Louw, 2012).

Dieticians form an important part of the health care team responsible for the treatment of TB patients (SANAC, 2013) as their role includes screening and providing nutritional support (Lombardo *et al.*, 2012; Lönnroth, 2010). Dieticians also play a role in the prevention of TB by preventing malnutrition, as patients who have latent TB may develop active TB disease if they become malnourished (Semba, Darnton-Hill & De Pee, 2010; Schaible & Kaufmann, 2007). This may happen in response to other infections, medication, metabolic conditions or other mechanisms related to a person's immune response (Ernst, 2012).

During any patient contact that may include assessment and/or counselling, the dietician can be exposed to undiagnosed infectious TB patients and may be at a greater risk for contracting TB than the general public. This is supported by evidence from a study by O'Donnell *et al.* (2010) who compared the incidence of hospital admission due to TB in HCP and non-HCP. At this public TB referral hospital in KwaZulu-Natal, the incidence of hospitalisation (for MDR-TB as well as for XDR-TB) was higher among HCP than non-HCP (Table 1.2).

Table 1.2: The incidence of hospitalisation (O'Donnell *et al.* 2010).

	HCP	Non-HCP
MDR-TB hospitalisation per 100 000 people	64.8	11.9
XDR-TB hospitalisation per 100 000 people	7.2	1.1

Forty-seven of the 56 cases submitted to the Compensation Commissioner between 2006 and 2009 involved TB (Malangu & Legothoane, 2012). Nursing staff in most provinces were identified as the HCP group most affected by TB (Tudor *et al.*, 2014; Ayuk 2013; Malangu & Legothoane, 2012; Ukpe *et al.*, 2009; Eshun-Wilson *et al.*, 2008).

As nurses, doctors, pharmacists, dieticians, physiotherapists, occupational therapists, speech therapists and audiologists form part of the multidisciplinary team that treat TB patients, the National TB Guidelines 2014 included infection control measures to protect all HCP and requires all HCP to attend training on TB infection control (Department of Health, 2014a).

From the above figures it is clear that if HCP do not adhere to these TB infection control measures, they are at an increased risk to contract TB at the workplace.

1.2 Problem statement

Contracting TB and the subsequent treatment may pose physical and emotional threats to HCP including dieticians, and thus adherence to infection control measures is extremely important (Bauer, Leavens & Schwartzman, 2013; The Aurum Institute, 2013). The WHO policy on TB Infection Control in health care settings recommends that infection control should be implemented at national and subnational level. More specifically, infection control should be addressed by adherence to facility-level controls, administrative controls, environmental controls and personal protective equipment measures (WHO, 2009).

However, many studies in South Africa among HCP have shown that there is a disparity between infection control guidelines and what happens in practice (Engelbrecht & Van Rensburg, 2013; Naidoo, Seevnarain & Nordstrom, 2012).

The WHO advised that Knowledge, Attitude and Practices (KAP) surveys could be valuable to identify knowledge gaps and give insight into behavioural patterns such as adherence to infection control. KAP surveys may reveal specific areas where education or training is needed, and these areas can then be effectively addressed to achieve sustainable behavioural change and prevent the transmission of TB among HCP (WHO, 2008a).

Internationally, a TB KAP survey among HCP has been used successfully to plan interventions and facilitate change (Irani *et al.*, 2015). In addition, its usefulness as a tool to identify potential barriers to the implementation of infection control measures has been highlighted (Tenna *et al.*, 2013).

In the past, KAP studies in South Africa on TB infection control mostly involved nursing staff, counsellors and doctors (Nicol *et al.*, 2014). Although dietitians are in a high-risk group when working with undiagnosed but infectious TB patients in health care settings, limited literature is available on the knowledge, attitudes and experiences of dietitians in relation to TB and the impact of TB on dietitians in the workplace in South Africa.

The research question for this study is: “What are dietitians’ knowledge, attitudes and experiences in relation to TB in the workplace?”

1.3 Aims and objectives

The aim of the study is to determine dietitians’ knowledge, attitudes and experiences in relation to TB at the workplace to identify training needs for future intervention.

Objectives of the study included the description of the following:

- Demographic data (age, sex, frequency of exposure to TB patients, current work setting, employment history, internet accessibility);
- Knowledge of National TB Management Guidelines, TB infection control Guidelines, TB transmission and symptoms and signs of TB;

- Attitudes towards the possibility of contracting TB, adherence to infection control guidelines and policies, human resources, need for more training on TB infection control, fears and the attitude towards others with TB;
- Experiences of TB, both personal as well as work-based experiences; and
- Associations and correlations between the demographic data and knowledge, attitudes and experiences of dieticians.

1.4 The role of the researcher

The researcher:

- Developed the research proposal and applied for ethics approval;
- Communicated with key informants and conducted a pilot study;
- Verified that all participants were registered with the Health Professions Council of South Africa (HPCSA);
- Was responsible for consulting with the Unit for Statistical Analysis at Nelson Mandela Bay Metropolitan University (NMMU) to do the data analysis;
- Conducted the study and collected the research data;
- Analysed and interpreted the data and presented the results;
- Discussed the findings in the context of South Africa's health situation;
- Made recommendations in response to the results of the study; and
- Complied with the ethical principles throughout the research process.

1.5 Value of the study

Results from this study will provide baseline information that can potentially be incorporated into strategies that affect infection control practices of dieticians and help to protect the public health workforce. In addition, in response to the results of this study, more effective training material/methods can be developed to prevent TB in HCP, especially dieticians. Therefore an outcome of the study may be to identify training needs of dieticians regarding TB and make recommendations regarding the content of the training.

The findings of this study will be shared in a comprehensive written report with the Eastern Cape Department of Health. Dieticians will receive a report on this study through the Association for Dietetics in South Africa (ADSA).

The study results, as part of this dissertation, will be available in the Nelson Mandela Metropolitan University (NMMU) library as a resource for possible related studies in the future. Study results were presented at the conference of The Network: Towards Unity for Health (TUFH) and the South African Associations of Health Educationalists (SAAHE) in Johannesburg (12 to 16 September 2015) (Addendum A). An article on the outcomes of the study will be submitted for publication in an accredited journal.

1.6 Chapter outline

Chapter 1 is an introduction to highlight the reason for this study, as well as to describe the context of TB in South Africa and health care facilities. The problem statement, aims and objectives are noted in this chapter.

Chapter 2 provides a literature review on Tuberculosis. Tuberculosis and the impact of TB in South Africa over the past years will be described as well as government responses to this public health threat, the StopTB Strategy and the National TB Management Guidelines. The risk of TB for HCP, including dieticians, in South Africa will be described as well as infection control policies in place to protect HCP from contracting TB at the workplace. HCP' infection control knowledge, attitudes and practices in South Africa are also included. Focus was also placed on the role of dieticians, as part of the health care team, in providing nutritional support to TB patients.

In Chapter 3 the methodology of the study, including the research design, the methods, study population and sample, the measuring instrument and its validity and reliability, data collection, statistical analysis and ethical considerations, are presented. Limitations to the study is also described.

Chapter 4 presents the results of the study, focusing on knowledge, attitudes and experiences of dieticians in relation to TB as well as associations between the variables.

Chapter 5 discusses the results followed by the conclusions and recommendations for the training of HCP with the emphasis on dieticians.

CHAPTER 2

AN OVERVIEW OF TUBERCULOSIS IN SOUTH AFRICA

South Africa is on the WHO's list of high burden countries for TB (WHO, 2014a). In addition, the higher risk of HCP compared to non-HCP who contract drug-resistant (DR-TB) is of concern in South Africa (O'Donnell *et al.*, 2010). This chapter will describe the current situation regarding TB in South Africa, with the focus on the transmission of TB, groups at risk for TB and the detection, treatment and management of TB patients. The role of HCP, including dieticians, in treating TB patients within health care facilities is described. The risk of HCP contracting TB as well as infection control measures within health care facilities, are discussed, with the focus on the knowledge, attitudes and practices of HCP in South Africa regarding these infection control measures.

2.1 Introduction

TB originated approximately 70 000 years ago and research supports the fact that Africa was the geographic origin of this disease (Comas *et al.*, 2013). The first source of infection was from humans but the bacterium adapted and also spread to animals (Comas *et al.*; 2013; Smith *et al.*, 2009; Zink *et al.*, 2007).

The spread of the disease was accelerated as people started living in overcrowded conditions as well as with people migrating and settling along trade routes (Merker *et al.*, 2015; Comas *et al.*, 2013). Different lineages of TB suggest that its spread was specific to the geographical area as similar types of genetic diversity were found in East Africa, Egypt and Saudi Arabia (Blouin *et al.*, 2012). About 6600 years ago the common Beijing lineage of *M. tuberculosis* arose in China, Korea and Japan, (Merker *et al.*, 2015). A review of studies in America suggest that TB spread from Asia to America over 10 000 years ago (Daniel, 2000). DNA from two human skeletons dating back more than 8000 years ago tested positive for *M. Tuberculosis* in the Eastern Mediterranean region (Hershkovitz *et al.*, 2008) while another 37 cases were identified in the same area dating back to 3500 to 500 BC (Zink *et al.*, 2007).

Despite TB being an ancient disease, it is still regarded as a major health threat (WHO, 2014a). In South Africa, the first tuberculosis hospital, namely the Nelspoort

Sanatorium, was opened in 1923 with Doctor Peter Allan as its superintendent (Clark, 1956; Randall, 1953). Nelspoort Sanatorium had about 100 beds and, by 1932, TB cases were also sent to the Duinendal Tuberculosis Settlement. Children with TB contacts were admitted to Preventoriums in KwaZulu-Natal and the Western Cape. According to Morton, the urgent need for more beds for patients with infectious TB was emphasised in 1937 (Morton, 1937).

Thus, TB has been treated in South African health facilities for more than 90 years.

2.2 Transmission, signs and symptoms

The aetiology of *Mycobacterium tuberculosis* was first described in 1882 by Robert Koch (Harries, 2008; Sakula, 1982). TB transmission takes place during inhalation of small droplet nuclei from individuals with active untreated Tubercular disease. Small droplet nuclei containing *M. tuberculosis* can remain airborne for several hours and reach the terminal alveoli of the lungs after inhalation (Behera, 2010; eds. Schaaf & Zumla, 2009). The bacilli subsequently implant in the alveoli in the lungs where they multiply during the period before the host can react to it (Behera, 2010). The body's immune system, using T lymphocytes and macrophages, attempts to kill the bacilli (Pommerville, 2014; Behera, 2010). Inflammation resulting from this process ultimately leads to the alveoli filling with fluid and becoming consolidated. A developing granuloma (tubercle) forms within two to 10 weeks, with the TB bacilli at the centre and an outer wall that contains it (DesJardins & Burton, 2013; Behera, 2010:483).

Most people's immune systems can control the infection before active TB develops, as the immune system responds to the presence of the bacilli; they thus have latent TB infection (LTBI) (O'Garra *et al.*, 2013). In LTBI, the bacilli are isolated and people do not have any signs or symptoms of TB (DesJardins & Burton, 2013).

The LTBI can develop into active disease at any time, especially in people who are immunosuppressed, although the exact role of the immune response regarding the genetics of the host and pathogen is not yet fully understood (O'Garra *et al.*, 2013; Maiga *et al.*, 2012; Young *et al.*, 2009). About 10% of people infected with TB develop the active TB disease (Behera, 2010). In immune compromised patients, the centre of the tubercle's core can break down leaving a caseous lesion or granuloma.

This is indicative of active tuberculosis and results in the person becoming infectious (Orme, Robinson & Cooper, 2015; DesJardins & Burton, 2013; Pommerville, 2014).

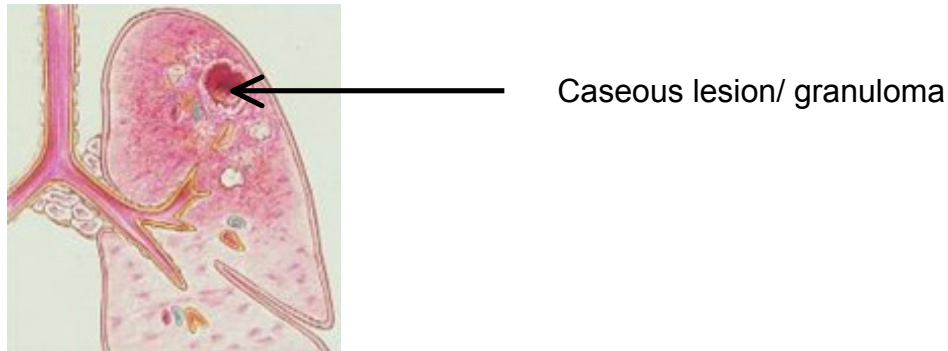


Figure 2.1: Cavitation of a tubercle in the lung (Source: DesJardins & Burton, 2013:251).

Tuberculosis not only affects the lungs; it can also spread to other organ systems via haematological and lymphatic dissemination, called extrapulmonary TB (EPTB) (The Aurum Institute, 2013; WHO, n.d.a). Hence EPTB can occur simultaneously with PTB (Sterling, Pham & Chaisson, 2010). The symptoms and signs of each site of EPTB infection are summarised in Table 2.1.

Table 2.1: Symptoms and signs of EPTB (Department of Health, 2014a; The Aurum Institute, 2013).

EPTB site of infection	Signs and symptoms
Peripheral lymphadenitis	A large, non-symmetrical lymph node, fever, night sweats, cough, scarring
Mediastinal lymphadenitis	Wheezing or coughing
Intra-abdominal lymphadenitis	Abdominal tenderness
TB meningitis	Headache, malaise, drowsiness, coma, vomiting, neck stiffness, seizures, Kernig's sign is present

Disseminated TB	Fever, night sweats, weight loss, shortness of breath, or meningeal signs, pleural effusion, digestive abnormalities and hepatosplenomegaly.
Pleural TB	Non-productive cough, chest pain, shortness of breath, fever. In the elderly: weakness, weight loss, cough and chest pain.
Pericardial effusions	Chest pain, shortness of breath, low cardiac output, tachycardia, right-sided heart failure, hepatosplenomegaly, ascites, peripheral oedema.
Peritoneal tuberculosis	Systemic TB features, ascites, bowel obstruction, abdominal masses
Tuberculous empyema	Similar to a pleural effusion.
TB of the spine	Back pain, localised swelling, cold abscess, weakness, loss of bone density.

Treatment for PTB and EPTB is the same although, in the case of complicated EPTB, treatment may be extended from the usual duration of six months to nine months (Department of Health, 2014a).

The risk of contracting TB depends on many factors which will be described in the following section.

2.3 Risk factors for TB

A person's risk of TB infection can be increased by certain factors, including immune suppression, malnutrition, vulnerable age groups, as well as social and environmental factors.

2.3.1 Immune suppression

After infection with *Mycobacterium tuberculosis*, the innate immune system responds to protect the body and prevent replication and dissemination of *Mycobacterium tuberculosis* (Lerner, Borel & Gutierrez, 2015). This process involves neutrophils,

macrophages, natural killer cells as well as the complement system (Gupta *et al.*, 2012). In addition, the adaptive immune system responds to *Mycobacterium tuberculosis* infection by humoral- and cell-mediated immunity, involving B-lymphocytes and T-lymphocytes (Gupta *et al.*, 2012). However, many individuals still contract TB as their immune responses are insufficient to destroy the infection (Woodworth & Andersen, 2016). Having a compromised immune system can lead to the activation of latent TB, as in cases where patients are on immune suppressive therapy awaiting organ transplantation or are HIV-infected (Ai *et al.*, 2016).

Tuberculosis accounts for a quarter of HIV-related deaths (The Aurum Institute, 2013). In 2013, HIV was the third leading cause of death, accounting for 23 203 deaths (Statistics South Africa, 2014a). The spread of infectious TB among immune compromised HIV-infected patients contributes to the large burden of TB disease and the outcomes may be poor (Basset *et al.*, 2012; Wood *et al.*, 2011). In 2013, 62% of TB patients in South Africa were co-infected with HIV (WHO, n.d.a). Immune compromised patients with HIV who contract TB might also have a greater mortality risk than an HIV-negative person with TB (Osman *et al.*, 2015; Mabunda, Ramalivhana & Dambisya, 2014).

The total number of people living with HIV in South Africa was estimated at 5.51 million in 2014. The highest HIV prevalence occurred in women aged 15 to 49 years (18.5%) and also in adults aged 15 to 49 years (16.8%) (Statistics South Africa, 2014b). According to the South African National HIV Prevalence, Incidence and Behaviour Survey, there was an estimated total of 396 000 new cases of HIV during 2008 to 2012 (Shisana *et al.*, 2014). These new cases of HIV are subsequently more vulnerable to TB (Sester *et al.*, 2014) and an 18% prevalence of TB was found among 361 HIV-infected individuals screened in the North-West Province (Hanifa *et al.*, 2012). HIV-TB co-infection was also emphasised in a recent study in KwaZulu-Natal where 72% of TB cases were HIV positive (Perumal *et al.*, 2014). Oni *et al.* (2015) investigated multiple morbidities at a primary clinic in the Western Cape and found that 80% of the TB patients with multiple morbidities were co-infected with HIV (Oni *et al.*, 2015).

Being HIV-infected increases a person's risk of contracting both EPTB (especially meningeal or disseminated TB) (Naing *et al.*, 2013; Leeds *et al.*, 2012), and PTB

(Pandie *et al.*, 2012; Gupta *et al.*, 2013). HIV infection was found to be significantly associated with having EPTB even if the CD4 cell count was equal to or higher than 500 cells/mm³ (Gupta *et al.*, 2013). A study done in Cameroon revealed that 23% of patients with TB had EPTB as well as PTB, and that being HIV-infected was a risk factor for EPTB (Yone *et al.*, 2013).

The WHO reported that developing TB is 29 times more likely in HIV-infected individuals compared to HIV-negative individuals (WHO, 2014a:83), which confirmed that people with a decreased immune system are at a high risk of contracting TB and spreading infectious TB. Integration of TB and HIV services should thus be prioritised in countries with a high HIV/TB co-infection rate (Howard & El-Sadr, 2010). During 2009, 133 primary health care facilities in five provinces that provided TB and HIV care services were evaluated. In facilities where TB results were available within five days, only 44% of patients were started on TB treatment. One in four TB patients were not started on TB treatment within the first month of diagnosis, thus increasing the risk for TB transmission between these patients and other immune compromised individuals (Claassens *et al.*, 2013a).

Symptom screening for TB at antenatal clinics in peri-urban areas in South Africa among 1 415 HIV-infected pregnant women during 2010 and 2011 was evaluated. TB was newly diagnosed among 2.5% of the sample and 0.9% were already on TB treatment at the time of the study. The majority of these women did not have a history of cough, fever, night sweats or weight loss, bringing to light the importance of testing for TB in susceptible populations such as HIV-infected pregnant women, regardless of whether they experience TB symptoms or not (Hoffmann *et al.* 2013:e62211).

Apart from HIV, immune suppression may also occur in other chronic diseases such as rheumatoid arthritis, inflammatory bowel disease (IBD) and diabetes mellitus. European data showed that patients with rheumatoid arthritis had a significantly higher risk of TB compared to the general population (Arkema *et al.*, 2014). A South African study among 614 patients with IBD, found that patients with severe forms of Crohn's disease were at an increased risk of contracting TB (Deetlefs *et al.*, 2012). Being on immunosuppressive medication was not associated with an increased risk of TB (Deetlefs *et al.*, 2012). However, a meta-analysis of randomised controlled

trials revealed that anti-tumour necrosis factor- α used to treat IBD was significantly associated with an increased risk of TB (Ford & Peyrin-Biroulet, 2013).

According to the WHO, diabetes triples the risk for developing TB and treatment of diabetes and TB is challenging (WHO, 2011). This was supported by a meta-analysis, which found an increased risk for TB among people with diabetes mellitus (Jeon & Murray, 2008:1098). A national survey indicated that among adults older than 55 years, the main reason for their most recent healthcare visit was for chronic diseases (Shisana *et al.*, 2013), which suggests that these older adults may have a decreased immune response and an increased risk for contracting TB (Negin, Abimbola & Marias, 2015).

All individuals with a suppressed immune system who contract LTBI are at an increased risk for the development of active TB.

2.3.2 Malnutrition

Tuberculosis has been associated with a lower Body Mass Index (BMI) and lower mid-upper arm circumference (MUAC) (Lombardo *et al.*, 2012; Lönnroth, 2010). These findings may be partly explained from a physiological level.

A recent study among patients with newly-diagnosed PTB versus healthy controls revealed that normal physiology is disrupted in patients on TB treatment. As a baseline, appetite, BMI and percentage body fat were significantly lower in TB patients than in healthy controls and BMI and body fat remained lower than in controls 60 days after treatment started. Plasma peptide YY (PYY) is a hormone that inhibits appetite through feedback into the hypothalamus from the intestines. The PYY level was elevated in TB patients before starting treatment but decreased by 45% during the first 30 days of treatment. Leptin also caused reduced appetite and increased energy expenditure that contributed to weight loss. Leptin was three times lower in TB patients compared to the controls at baseline level and remained lower in TB patients than controls after two months into treatment. Researchers recommended that future studies should investigate the potential role of PYY inhibitors or receptor antagonists to combat appetite suppression and ultimately prevent cachexia (Chang *et al.*, 2013).

The clinical severity of TB disease affects patients' dietary intake, as dietary energy intake is reported to be significantly lower in patients with moderate to severe TB than those with mild TB disease (Mupere *et al.*, 2012). However, Frediani *et al.* (2015) compared the dietary intake of TB patients with household contacts uninfected with TB and found that the total energy intake was 18% higher among TB patients than in the household group. Dietary intake of protein, fat and carbohydrate was also significantly higher among TB patients compared to the household group, possibly due to advice by doctors for patients to increase their dietary intake. Despite an increased dietary intake, TB patients had a significantly lower BMI compared to the household contact group at baseline, suggesting that catabolism starts early in TB disease (Frediani *et al.*, 2015). Drug-sensitive patients had an increase in body weight, BMI, and fat-free mass over time, but among drug-resistant patients the body weight and fat-free mass did not increase over time. This may be due to ineffective drug treatment after diagnosis with TB, and before initiation onto second-line medication, enforcing catabolic responses in these patients (Frediani *et al.*, 2015).

A BMI below 18.5 kg/m² is associated with an increased risk for the development of active TB disease (Patra *et al.*, 2014). Among HIV-infected patients, underweight was also a risk factor for the increased incidence of TB and increased mortality (Table 2.2) (Waite & Squire, 2011; Hanrahan *et al.*, 2010).

Table 2.2: Incidence of TB and mortality rate according to BMI classification among HIV-infected patients (per 100 person-years) (Hanrahan *et al.*, 2010).

	Underweight ($<18.5 \text{ kg/m}^2$) ^a	Normal ($18.5\text{-}24.9 \text{ kg/m}^2$) ^a	Overweight ($25\text{-}29.9 \text{ kg/m}^2$) ^a	Obese ($\geq 30 \text{ kg/m}^2$) ^a
TB incidence	7.3	6.0	3.2	1.9
Mortality	10.4	3.6	1.7	1.6

^a Lee & Nieman, 2013

Thus, malnutrition is a risk factor for contracting TB.

2.3.3 Vulnerable age groups

The highest incidence of TB is among adults (aged 25 to 64 years old) (Statistics South Africa, 2013). The highest incidence rate for EPTB was among those between the ages of 25 to 44 years old (Karstaedt, 2013). As people of all ages can contract TB, studies have also investigated TB among children and found that children under the age of 14 years are also a vulnerable group for TB. The prevalence of LTBI has shown to peak at the age of 13 years among HIV-uninfected children from townships in Cape Town (Wood *et al.*, 2010a) while in Johannesburg, the prevalence of MDR-TB was higher among children under the age of 14 years (Fairlie *et al.*, 2011). Children aged 12-23 months are also a high risk group for contracting TB (Moyo *et al.*, 2010).

2.3.4 Social and environment

Alcohol use, smoking, a lower level of education, being unemployed and less household wealth have all been associated with a higher risk of acquiring TB in South Africa (Harling, Ehrlich & Myer, 2008). However, results are not consistent. Although a history of smoking and HIV-infection were associated with undiagnosed TB in a South African prison (Telisinghe *et al.*, 2014), smoking was not significantly associated with LTBI or active TB in a resource poor community in Cape Town (Brunet *et al.*, 2011). Among male TB patients in Gauteng, a lower socio-economic status was associated with less social support that led to an increased use of substances, highlighting the link between TB and poverty (Louwagie, Wouters & Ayo-Yusuf, 2014). In Pakistan, risk factors for PTB included drinking, smoking, increased family sizes and living in overcrowded conditions (Khaliq *et al.*, 2015).

Overcrowded living conditions refer to households where more than two people share one room (HDA, 2013). In South Africa, there were over 1.3 million informal dwellings (without a shack in the backyard) in 2013 and the majority of these had only one to three rooms in the dwelling (Statistics South Africa, 2014a). According to the Housing Development Agency, the majority of households living in such a dwelling consisted of only two to three people per household, but 22% of the households were living in overcrowded conditions (HDA, 2013). Households and communities living or working in overcrowded conditions are at an increased risk of contracting TB (Fox *et al.*, 2013; Calver *et al.*, 2010; Baker *et al.*, 2008).

Overcrowded prisons have a high prevalence of undiagnosed TB that warrants routine screening of prisoners for TB (Telisinghe *et al.*, 2014).

Earlier studies in the Western Cape revealed that community transmission of TB was attributed to 58% of TB cases (Verver *et al.*, 2004). Transmission of TB within a community is not limited to household contacts, but includes casual contacts within the community as well as at school, crèches and at work (McCreesh *et al.*, 2016; Johnstone-Robertson *et al.*, 2011). Therefore, the risk of contracting TB from contacts is not limited to households and can include workplaces and other settings.

Household TB transmission affects both adults and children. Studies have established that for children to contract TB from a household member, depends on the length of time spent with an adult with TB, the ventilation in the house and the infectivity of the household member with TB (Middelkoop *et al.*, 2014; Wood *et al.*, 2010b).

Therefore, being in close contact with TB patients, such as sharing a house or workspace where there may be limited ventilation, is a risk factor for contracting TB.

2.3.5 Health care professionals (HCP)

Internationally, HCP from low- and middle-income countries such as South Africa had a higher prevalence of LTBI than HCP from high-income countries (Menzies, Joshi & Pai, 2007). The incidence of TB among HCP exceeds that of the general population by almost double (Tudor *et al.*, 2014; Claassens *et al.*, 2013b).

The risk for contracting TB depends on:

- whether procedures that are high risk for droplet dispersal e.g. intubation, bronchoscopy, sputum induction and irrigation of a tuberculous abscess, are carried out by HCP;
- the duration of exposure to infectious TB disease in health care settings;
- the prevalence of TB in the specific population; and
- the effectiveness of infection control measures (Menzies, Joshi & Pai, 2007:599; CDC, 2005).

A study at Tygerberg Academic Hospital was done among 63 permanent staff diagnosed with TB between January 2008 and June 2012 and found that the areas with a highest incidence were oncology and food services. An increased risk of active TB was also significantly associated with having no previous training on TB and HIV-infection (Ayuk, 2013:8).

In summary, HCP are at an increased risk compared to the general population to contract TB and this risk has been associated with a lack of training on TB and HIV.

2.4 TB case detection and treatment outcomes

Improved TB care and control has decreased TB mortality over the past 20 years. The WHO estimated global deaths from TB at 31 per 100 000 in 1990, which decreased to 25 per 100 000 in 2009 (Glaziou *et al.*, 2011).

In South Africa, however, TB was the leading cause of death during 2011 to 2013 and accounted for 8.8% of deaths in 2013 (Statistics South Africa, 2014a).

As described in Chapter 1, TB in South Africa continues to spread. Based on the number of patients started on treatment in 2013, the national incidence of TB was 689.3 per 100 000. KwaZulu-Natal had the highest incidence of TB, followed by the Eastern Cape, Western Cape, Northern Cape and the Free State (Loveday, 2014).

South Africa had over 109 000 new cases of PTB and over 37 000 cases of EPTB during 2013, indicating that PTB was the most common form of TB among newly diagnosed TB patients (WHO, n.d.a). Data on the incidence of PTB in South Africa between 2004 and 2012 revealed that a total of 404 540 cases of PTB were diagnosed in 2012, mostly from KwaZulu-Natal (121 911 PTB cases). The incidence of PTB was therefore 774 per 100 000 population in 2012 (Nanoo *et al.*, 2015).

The case detection rate, which indicates the proportion of incident cases of TB that are diagnosed, treated and recorded, has increased in South Africa (see Table 2.3) (Loveday, 2014). According to the WHO, this is largely due to the DOTS strategy (WHO, 2013a). This increased case detection rate implies that a reduced number of infectious TB patients will remain in communities potentially spreading TB (Abdool Karim *et al.*, 2009). To improve case detection rates, Abdool Karim *et al.* (2009) proposed screening of all symptomatic TB patients, HIV-infected patients and

household contacts of infectious TB patients, especially in areas and among populations with a high prevalence of TB (Abdool Karim *et al.*, 2009).

Table 2.3: WHO estimates of the case detection rate for new and retreatment cases in South Africa (WHO, 2013a).

	1995	2000	2005	2010
Case detection rate (%)	56	59	61	70

Despite TB patients being correctly diagnosed and started on treatment, not all TB patients are successfully treated (WHO, 2013a). This is especially of concern in South Africa, where a large proportion of TB patients are not successfully treated. Although the treatment success rate (completion of TB treatment or being cured of TB) increased to 77% in 2011, it was still below the National TB Control Programme Target of 80% (WHO, 2013a) (Table 2.4).

Table 2.4: Treatment success rate of patients started on TB treatment in South Africa (Department of Health, n.d.a; WHO, 2013a).

	1995	2000	2005	2010	2011	WHO Target	National TB Control Programme Target
Treatment success rate (%)	58	63	69	53	77	85	80

The cure rate for TB in 2012/2013 was 74%, well below both the 85% target set out by the WHO and of the National TB Control Programme's target. In addition, new TB cases had a default rate of 6.1%, that is above the target of <5% (Department of Health, n.d.a). Without an improved cure rate, the transmission of TB cannot be stopped. It is essential for each health facility treating TB to improve the cure rate by developing a context-specific plan (Abdool Karim *et al.*, 2009).

In summary, the incidence of TB is highest in KwaZulu-Natal, the Eastern Cape, and Western Cape and the spread of TB in these areas is aggravated by factors such as overcrowding, a lack of education, poverty, substance abuse and HIV (Loveday, 2014; Basset *et al.*, 2012; Wood *et al.*, 2011; Harling *et al.*, 2008). Active case finding and starting patients on TB medication can help to reduce the spread of

infectious TB, but ultimately patients with active TB need to be successfully treated to reach both internationally and nationally set targets (Department of Health, n.d.a; Loveday, 2014; WHO, 2013a).

2.5 Drug-resistant TB in South Africa

South Africa has the highest rate of MDR-TB in Africa (CDC, 2012) and the second highest number of diagnosed MDR-TB cases in the world (WHO, 2013a). Drug-resistant TB may occur when patients do not complete their treatment, for instance if the prescribed treatment becomes out of stock, or when a patient fails to adhere to TB treatment (CDC, 2014; Zumla *et al.*, 2013). If HCP fail to do drug-susceptibility testing (DST) and prescribe the wrong treatment, this could also lead to DR-TB (CDC, 2014).

As the DOTS programme initially did not require DST on a routine basis, patients with drug-resistant TB, while on first-line treatment, could remain infectious for a prolonged period of time and increase the risk of infecting others in the community with MDR-TB (Van Rie *et al.*, 1999).

Direct infection with DR-TB strains was described among 613 HIV-infected members of the South African National Defence Force by Hassim *et al.*, (2010), where 21% of new TB cases were MDR-TB cases and 4% were XDR-TB cases. Of those, 12% of MDR-TB cases not having a previous history of TB. Assessment of MDR-TB patients over a three-year period at a hospital in Johannesburg also indicated that 30% of MDR-TB patients had no previous history of TB (Marais *et al.*, 2013). This is supported by data from Andrews *et al.* (2008) who indicated that all MDR-TB and XDR-TB cases were reinfection cases and were not due to acquired resistance from inadequate treatment. Among MDR-TB patients in the Western Cape, 58% had no history of TB, 40% were previously treated for DS-TB and eight percent were previously treated for DR-TB (Médecins Sans Frontières, 2015). These findings were echoed in the Eastern Cape among patients with a history of TB and close contact with known MDR-TB cases. It was found that pre-XDR TB and XDR-TB strains identified were genetically distinct and not due to an acquired resistance. In addition, DST revealed that some isolates were resistant to all first-line and most second-line drugs, evolving to a possible total drug resistance (Klopper *et al.*, 2013).

In South Africa, the policy guidelines for the management of DR-TB states that hospitalisation is required to initiate treatment and adjust the treatment if necessary, to educate the patient on the disease and to increase family social support for optimal treatment adherence (Department of Health, 2013). After discharge from the hospital, a patient with DR-TB should be monitored at a decentralised DR-TB unit such as primary health care clinics, mobile clinics and community health centres (Department of Health, 2013).

Therefore management of DR-TB differs from DS-TB management, as DR-TB patients are managed at decentralised facilities (clinics). DR-TB patients are only re-admitted to TB hospitals if complications exist, or if the patient has a history of non-compliance or substance abuse. If a patient needs care for complications of TB drugs, for instance, acute liver failure, then the patient should be referred to a secondary or tertiary hospital (Department of Health, 2014a).

2.5.1 Risk factors

Similarly to the risk factors for drug-sensitive TB, unemployment, alcohol abuse and smoking were risk factors associated with having DR-TB (Dalton *et al.*, 2012). According to Weyer *et al.*, (2007) risk factors for MDR-TB in South Africa included previous TB treatment, previous treatment default, treatment failure, hospitalisation and HIV-infection. In Europe, being a male, having contact with a drug-resistant TB case, previous treatment for TB and alcohol abuse was associated with a higher risk of drug-resistant TB infection (Ignatyeva *et al.*, 2015).

Although TB disease progression is increased among HIV-infected patients, the WHO emphasised that HIV patients who live in an area where MDR-TB is endemic, may develop MDR-TB. Thus, the risk of MDR-TB is not only reliant on HIV-status, but also on the prevalence of MDR-TB in the area where the HIV-infected individual lives (WHO, 2010b). Suffering from other chronic diseases such as cancer may also be risk factors for primary infection with MDR-TB in China (Li *et al.*, 2015).

A systematic review by Van der Werf *et al.* (2012), reported that incorrect treatment prescriptions were associated with a 27-fold increased risk for MDR-TB. Another risk factor for DR-TB that was identified through a systematic review, was the long history of prescription of isoniazid and streptomycin in sub-Saharan Africa (Lukoye *et*

al., 2015). Poor infection control measures in health facilities can also increase the risk of MDR-TB transmission (Nardell & Dharmadhikari, 2010).

2.5.2 Case detection and treatment outcomes

The Drug Resistance Surveillance Project conducted from 1999 to 2002 found that there was an estimated 3000 cases of MDR-TB in eight of the nine provinces in South Africa (WHO, 2004). Among new TB cases, the prevalence of MDR was highest in Limpopo Province (2.4%), followed by North West (2.2%), Free State (1.8%) and KwaZulu-Natal (1.7%) (WHO, 2004).

Almost a decade later in 2010, KwaZulu-Natal had the highest number of diagnosed MDR-TB cases in South Africa as 2032 patients were diagnosed. The Eastern Cape and Western Cape, with 1782 and 1422 diagnosed cases of MDR-TB respectively, had the second and third most cases of MDR-TB in South Africa, followed by 934 cases in Gauteng (Department of Health, 2013). According to Chihota *et al.* (2011), the strains of MDR-TB found in the Western Cape, Eastern Cape, KwaZulu-Natal and Gauteng were distinct from one another, indicating a lack of strain exchange between different provinces, despite the fact that people travelled and moved to other provinces (Chihota *et al.*, 2011).

Migrant patterns (2001 to 2011) to Gauteng and the Western Cape, may have increased the burden of MDR-TB in these two provinces (Statistics South Africa, 2014b). In 2011, Gauteng had the highest population density in South Africa, followed by KwaZulu-Natal, Mpumalanga, Limpopo Province, the Western Cape and Eastern Cape (Statistics South Africa, 2014b; Health Systems Trust, n.d.). Therefore, population density may have contributed to the burden of MDR-TB in these provinces.

Data showed that the highest burden of MDR-TB during 2012 remained in KwaZulu-Natal, the Eastern Cape and the Western Cape (see Figure 2.2) (Ndjeka, 2014). According to a national survey, in 2012 the HIV prevalence was the highest in KwaZulu-Natal (Shisana *et al.*, 2014). As KwaZulu-Natal also had the highest number of MDR-TB cases, it suggested a possible link between HIV and MDR-TB (Ndjeka, 2014; Shisana *et al.*, 2014).

Most cases of MDR-TB were started on treatment in KwaZulu-Natal, the Eastern Cape, the Western Cape and Mpumalanga (Ndjeka, 2014). In the Western Cape, an increased case detection rate and an increase in the number of patients with drug-resistant TB who were started on treatment have been achieved (Médecins Sans Frontières, 2015). This may be due to DOTS coverage that has been implemented for almost two decades in the Western Cape (Health Systems Trust, 2004). In addition, decentralized models of care that have been implemented since 2007 have contributed to most patients being started on treatment at the primary health care clinics, emphasising the benefit of decentralised health facilities (Médecins Sans Frontières, 2015). Yet, outcomes for MDR-TB cases remain poor in some areas as emphasised by Ndjeka (2014).

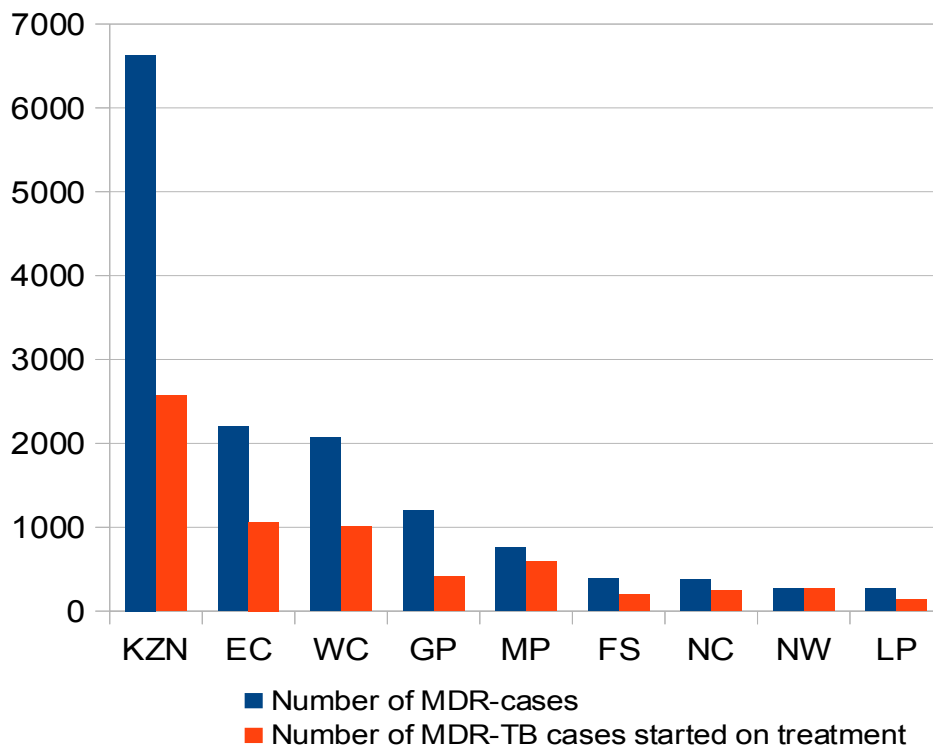


Figure 2.2: MDR-TB case detection and treatment per province: 2012 (Ndjeka, 2014).

In 2012, XDR-TB cases, like MDR-TB cases, were mostly diagnosed in KwaZulu-Natal, the Eastern Cape and the Western Cape (Ndjeka, 2014). In KwaZulu-Natal, the incidence of XDR-TB for the period 2010 to 2012 was 3.5 per 100 000

population, with an increased incidence since 2007 in most districts (Lim *et al.*, 2015).

Despite improvement in the number of cases started on treatment, the desired outcome of completing treatment and being cured of drug-resistant TB is not being achieved in South Africa and drug-resistant TB can continue to spread. In 2010, the proportion of patients who achieved treatment success was highest in the North-West Province, KwaZulu-Natal and the Free State. The proportion of patients who failed MDR-TB treatment was the highest in the Eastern Cape, Northern Cape and Western Cape (Ndjeka, 2014).

A study among 754 patients on the community-based treatment of MDR-TB in Khayelitsha revealed that only 52% achieved successful treatment completion, 31% defaulted, 4% had treatment failure and 13% died. The two-year survival rate was only 65% (Cox *et al.*, 2014). A study by Kendall *et al.* (2013) among MDR-TB patients also in the Western Cape revealed that only 50% of the patients had successful treatment outcomes, 27% defaulted on treatment, 14% died, 5% failed treatment and 4% were transferred out. Recent drug and alcohol use, informal housing, unemployment and younger age were risk factors for defaulting on treatment. Treatment interruption within the first three months was also a factor that may have contributed to poor outcomes. Interruption of treatment was significantly higher among males aged 15 to 25 years old. Survival in 62% of the patients was significantly better among patients who completed more than 12 months of treatment compared to those with less than six months of treatment (Moyo *et al.*, 2015).

Gauteng, as previously stated, has the highest population density in South Africa. As illustrated in Figure 2.2, this province did not succeed in starting most patients with MDR-TB on treatment and, in addition, patient outcomes also seem to be poor. Recently, a study at Sizwe hospital in Johannesburg among HIV-infected MDR-TB patients revealed that only 30% of patients were cured and 17% of patients completed treatment. In this study, 22% of the patients defaulted on treatment, three percent of patients failed treatment and 23% died while on treatment (Umanah *et al.*, 2015). In KwaZulu-Natal, mortality among HIV patients co-infected with drug-resistant TB was higher where 63% of MDR-TB patients and 80% of XDR-TB patients died within two years. Mortality was significantly associated with a CD4

count below 50 cells/mm³ (Gandhi *et al.*, 2012:4). Treatment of HIV with antiretroviral therapy in conjunction with TB treatment provides challenges in patient management. Some drugs interact and may cause sub-therapeutic concentrations that influence outcomes negatively. In addition, adverse reactions such as hepatotoxicity and renal dysfunction may occur (Cohen & Meintjies, 2010; Dheda *et al.*, 2010). However, no statistically difference in treatment outcomes for HIV-infected patients co-infected with XDR-TB compared with HIV-negative patients co-infected with XDR-TB was found in a study done in the Western Cape, Eastern Cape, Gauteng and the Northern Cape (Dheda *et al.*, 2010).

In 2013, South Africa had an estimated total of 26 023 MDR-TB cases, with only 10 663 cases enrolled on MDR-TB treatment (WHO, 2014a). Only 41% of MDR-TB cases were started on treatment (WHO, 2014a). The WHO Global Tuberculosis Report stated that treatment outcomes were only available for 65% of the MDR-TB cases that were involved in a cohort (WHO, 2014a). Only 15% of patients with XDR-TB achieved successful treatment outcomes and 40% of patients died (WHO, 2014a).

Therefore, many patients with MDR-TB are not on treatment. In addition, successful treatment outcomes for all DR-TB patients in South Africa are not achieved, and these patients may pose an increased risk of transmitting TB to the HCP treating them.

2.5.3 Barriers to management of MDR-TB and XDR-TB

Management of MDR-TB and XDR-TB may be hampered by many complex factors that need to be addressed to improve successful treatment outcomes (Nathanson *et al.*, 2010).

2.5.3.1 Delayed diagnosis of drug-resistant TB

Delayed diagnosis of DR-TB may be the most important contributor to suboptimal management DR-TB. The associated risk for spreading DR-TB was emphasised by Gandhi *et al.*, (2013:12) who reported that during 2005 to 2006, there was at least one infectious XDR-TB patient at a time in the district hospital during 661 (91%) of 730 days. Hospitalised XDR-TB patients had a median hospital stay of 15 days while

being infectious (Gandhi *et al.*, 2013:12). During 2006 to 2007, XDR-TB patients were identified at 22% of hospitals at the beginning of the study, and this figure increased to 78% 18 months later at the end of the study. Over 65% of MDR-TB cases were not started on treatment and these patients were a large source of spread of TB infections. The need for improved XDR-TB management in KwaZulu-Natal was therefore highlighted (Moodley *et al.*, 2011).

2.5.3.2 Delayed start of patients with drug-resistant TB on treatment

A delay in starting diagnosed DR-TB patients on the correct treatment is another barrier to effective TB control. During 2010, an average of 100 MDR-TB cases was diagnosed per month at a MDR-TB centre in KwaZulu-Natal. A review of 186 patient files revealed poor documentation of MDR-TB contact history as well as a mean delay of ± 12 weeks between the date of sputum collection for DST and initiation of treatment (Narasimoolo & Ross, 2012). This may contribute to the spread of infective MDR-TB.

Khaole (2014) reported compliance by HCP regarding the prescription of correct TB treatment for patients with drug-resistant TB in six provinces in South Africa in only 50% of cases (Khaole, 2014). Correct prescription of TB regimens and patients who are started on treatment early, are prerequisites for effective DR-TB management.

2.5.3.3 Interaction of infectious TB patients with other patients in health care settings

HCP employed at a drug-resistant TB facility reported that infectious patients were not always isolated and sometimes socialised with other patients in the ward, potentially infecting others (Zelnick *et al.*, 2013).

2.6 Responses to the TB threat

Internationally, the WHO has advised governments to incorporate principles from the Stop TB Strategy in their own National Guidelines and South Africa incorporated these principles into the National TB Guidelines (Department of Health, 2014a; WHO, 2014a). The Stop TB Strategy is the strategy for TB by the WHO for the period 2006 to 2015 (WHO, 2014a, WHO, 2014b). The post-2015 global TB strategy calls for DST as a universal standard of care in DR-TB cases to prevent ineffective

treatment. In addition, the WHO emphasised that improved TB treatment regimens are necessary to improve the outcomes of DR-TB patients (WHO, 2014a).

The South African government set 12 goals that were aimed to transform the life circumstances of all vulnerable groups and help restore their human dignity (Department of Health, n.d.b). One of the goals was that public health care provision should be accessible to all (Department of Health, n.d.b). According to the General Household Survey (2013), public hospitals and public sector clinics serve the majority (70%) of South Africans who seek health care (Statistics South Africa, 2014a).

Health-related aims of the Department of Health include:

- increasing life expectancy;
- decreasing maternal and child mortality;
- combating HIV and AIDS; and
- decreasing the burden of diseases from TB and strengthening health system effectiveness (Department of Health, n.d.b).

The Sustainable Development Goals, set out to lead and manage the country's development, are aligned with government goals as described above (United Nations Development Programme, 2016). With regards to health services, these goals include the combatting of, amongst others, HIV/AIDS, malaria and TB (Republic of South Africa, n.d.a; n.d.b). In order to achieve the Sustainable Development Goals, the government developed the National Strategic Plan on HIV, STIs and TB 2012 to 2016 which aims to:

- reduce tuberculosis;
- have effective infection control strategies and workplace policies;
- prevent DR-TB;
- reduce TB-related stigma; and
- reduce malnutrition (SANAC, 2011).

Government responses to TB in South Africa also included infection control policies, the electronic TB register (ETR) and policies on the management of DR-TB (Churchyard, *et al.*, 2014; Ismail *et al.*, 2012).

In the next section, internationally developed strategies to control TB, such as the WHO's Stop TB Strategy, will be described followed by South Africa's National Tuberculosis Management Guidelines.

2.6.1 Stop TB Strategy

Components of the WHO's Stop TB strategy that was developed in 2006 involved six principles (WHO, 2006), namely;

- developing and improving DOTS;
- addressing challenges such as TB and HIV, MDR-TB and the needs of poor and vulnerable populations e.g. prisoners and refugees;
- contributing to strengthening the health system based on primary health care;
- engaging all public, private and corporate providers and promoting the use of international standards for TB care;
- empowering people with TB and communities through advocacy, communication and social mobilization; and
- enabling and promoting research to develop new diagnostics, drugs and vaccines (WHO, 2014b).

Health care facilities, places of work and homes are all appropriate settings for DOTS as long as the supervision of drug adherence is conducted by trained supporters. The DOTS provider should give the patient his/her daily dose, observe intake, ask the patient about side-effects and provide treatment/advice for minor side-effects. If the side-effects are serious the patient should be referred to a health care professional. Records must be kept of each dose taken and the TB diary must be updated to identify patients who are not adhering to their prescribed TB treatment regimen (Department of Health, 2014a).

The five components of DOTS that are necessary to achieve the desired effect of DOTS are:

- buy-in from the country's political front for commitment to meeting the financial needs to expand and enhance DOTS (WHO, 2006);
- case-detection using sputum smear microscopy and then culture and DST (WHO, 2006);
- standardised treatment for adults and paediatric patients for the country as a whole (WHO, 2006);
- appropriate management of the drug supply to health facilities to ensure an effective system (WHO, 2006); and
- establishing a system for the monitoring and evaluation of the various elements of the impact of TB (WHO, 2006).

The National TB guidelines (2014) emphasised not only the importance of using TB tools such as TB registers, TB treatment records and TB screening tools, but also the importance of surveillance of TB through epidemiological data, reports from health facilities and TB surveys (Department of Health, 2014a).

2.6.2 National Tuberculosis Management Guidelines

The latest National Tuberculosis Management Guidelines were released in 2014. The guidelines describe the process for identifying TB symptoms, using the correct diagnostic tools to diagnose TB, registration of the patient, contact investigation and the principles of TB management, including ways of improving adherence to TB treatment (Department of Health, 2014a). It is imperative that all HCP are sufficiently trained on the relevant TB Guidelines to decrease a delay in diagnosis and initiation onto correct treatment.

2.6.2.1 Screening for TB

According to these guidelines, patients should be screened for TB at health facilities if they have clinical symptoms and signs of TB or had a close contact with a TB patient. A contact is a person who shares “the same air for prolonged periods of time with people who are coughing up the *Mycobacterium TB* into the air” (Department of Health, 2014a). Not all individuals with TB come to a health facility seeking treatment and the National Guidelines also stipulate that health services should plan community outreaches at schools, workplaces and other public places where individuals are screened for TB. Ultimately, each person should be screened for TB annually (Department of Health, 2014a). Screening for TB involves investigating for the presence of TB symptoms. Symptoms of pulmonary TB include:

- a persistent cough for more than two weeks or being HIV-infected with a cough (even if the cough persists for less than two weeks);
- fever for more than two weeks;
- night sweats; and
- unexplained weight loss (more than 1.5kg in one month) (Department of Health, 2014a)

Chest pain, shortness of breath and wheezing may also present in TB patients. Physical signs of TB include fever, a raised pulse rate and chest abnormalities such as dullness due to a pleural effusion (Department of Health, 2014a). Coughing up of blood could also suggest PTB (Sterling, Pham & Chaisson, 2010).

2.6.2.2 Diagnosis of TB

The HCP should use specific diagnostic tests for TB diagnosis. The WHO Stop TB Strategy emphasises that research should be done to develop new and improved diagnostic tests, drugs and vaccines (WHO, 2014b). According to McNerney *et al.*, (2015:85), improved TB diagnostics are “urgently needed” and new tests are being explored. New diagnostic tests will still have to be evaluated and placed within health systems at a point of either screening or diagnosis, where it will have a positive impact on TB control (McNerney *et al.*, 2015).

According to the WHO, TB tests that are needed include a rapid DST test, a sputum-based test to replace smear-microscopy, a non-sputum based test for all forms of TB to be used where a microscopy centre is not available and a triage test that can be used by community health workers (Denkinger *et al.*, 2015).

Diagnostic tests should be used that are suitable to each country's epidemiology and resources such as available laboratory services (WHO, n.d.b). In South Africa, the roll-out of new TB diagnostics will also depend on the burden of TB in each province (Vanleeuw, 2013). Current diagnostic TB tests include the following:

i. Microscopy

Smear microscopy has the strength of indicating very few false positives (high specificity), being cheap and having a short turnaround time of 24 hours. Its weakness is its low sensitivity (The Aurum Institute, 2013; Hepple, Ford & McNerney, 2012). A less favourable specificity and sensitivity has been found for sputum smear microscopy when compared to Xpert[®] MTB/RIF in a recent South African study for diagnosis of pulmonary as well as EPTB (Theron *et al.*, 2014).

ii. Culture

Culture is the current reference standard for TB diagnosis as it has a high sensitivity (Department of Health, 2014a; WHO, n.d.b). It is useful in populations such as HIV-infected individuals or children, as well as for the diagnosis of MDR-TB by doing DST (Department of Health, 2014a). Its weaknesses are a long turnaround time and high cost (The Aurum Institute, 2013).

iii. Xpert MTB/RIF[®]

The use of Xpert MTB/RIF[®] for diagnosis of TB was recommended by the WHO in 2010. This cartridge-based nucleic amplification assay tests sputum for TB (WHO, 2015a). In South Africa, this rapid test is used to identify rifampicin resistance and thereafter culture and drug-sensitivity testing is done to identify the treatment needed (Department of Health, 2014a; Lawn & Nicol, 2011).

A systematic review on the accuracy of Xpert MTB/RIF[®] in different settings revealed that in adults with or without HIV, this test was sensitive and specific for the detection

of PTB. When compared to smear microscopy, it has an increased TB detection among culture-confirmed cases. In addition, MDR-TB treatment can be started earlier as Xpert MTB/RIF[®] is accurate for the detection of rifampicin resistance (Steingart *et al.*, 2014). A study done at hospitals in Cape Town among 452 children with suspected TB revealed that Xpert MTB/RIF[®] as well as smear microscopy, had a higher sensitivity than culture tests and results were available within a median of one day compared to 12 days for cultures (Nicol *et al.*, 2011). A recent study revealed that Xpert MTB/RIF[®] was affected less by contaminating bacteria than culture and could possibly be used for the diagnosis of EPTB (Scott *et al.*, 2014).

In summary, strengths of the Xpert MTB/RIF[®] test are few false negative results (high sensitivity) and rapid turnaround time (two hours). However, it is expensive and doesn't detect INH resistance (The Aurum Institute, 2013).

iv. Line probe assay (LPA)

This is a high sensitivity test for MDR-TB and has the advantage over Xpert MTB/RIF[®] of providing information on rifampicin resistance as well as isoniazid susceptibility (Barnard *et al.*, 2012). It is expensive and not useful as an initial diagnostic test (The Aurum Institute, 2013). Among HIV-infected individuals with TB symptoms but no abnormalities on a chest x-ray, DST or LPA is useful to detect TB (Department of Health, 2014a).

v. Tuberculin skin testing (TST)

TST detects latent TB infection but cannot detect active disease in adults. It requires two visits and false negatives may occur, for example with HIV or malnutrition (The Aurum Institute, 2013). A study by Mahomed *et al.* (2011) found that TST was moderately sensitive to predict disease progression from LTBI to active TB among 5244 South African adolescents. However, a systematic review among adults and children concluded that the sensitivity of a TST is lower than Interferon gamma release assay (IGRA) for active TB (Sester *et al.*, 2011).

vi. Interferon gamma release assay (IGRA)

IGRA also detects LTBI, but cannot detect active disease in adults (The Aurum Institute, 2013). A systematic review by Diel *et al.* (2011) revealed that IGRA had a specificity ranging between 98% and 100% compared to the TST specificity ranging from 55% to 95% (Diel *et al.*, 2011). The review found that IGRA could be used to rule out LTBI (Diel *et al.*). However, this was in conflict with another systematic review that concluded that IGRA could not be used as a test to rule out TB (Sester *et al.*, 2011).

vii. Drug sensitivity testing (DST)

The high sensitivity of DST provides an accurate detection of susceptibility to most TB drugs. However, it is an expensive test that requires a sophisticated laboratory (The Aurum Institute, 2013). In South Africa, the National TB Guidelines state that people with a positive Xpert MTB/RIF[®] result but not susceptible to rifampicin, require DST to ensure that an individual is placed on the correct TB regimen (Department of Health, 2014a).

viii. Ultrasound imaging

This test is non-invasive and has only a few hours turnaround time, but is not specific for TB and requires expensive equipment (The Aurum Institute, 2013). A study has shown that among HIV-infected individuals, ultrasound was an accurate test for EPTB (Heller *et al.*, 2010). Ultrasound can also be used to diagnose pericardial TB (Department of Health, 2014a).

ix. Other tests used to diagnose EPTB

Histological and cytological examinations and investigation of blood culture, tissue or fluid can also be used to diagnose EPTB. A lumbar puncture to extract and test CSF can be used to diagnose TB meningitis. Disseminated TB can be diagnosed by a chest x-ray, full blood count tests, liver function tests, smear microscopy or bacteriological confirmation. For TB of the lymph nodes, fine needle aspirates can be used to diagnose TB and a chest x-ray can detect mediastinal TB lymphadenopathy, pleural effusions, TB empyema and pericardial effusions. Peritoneal TB can be diagnosed through examination of aspirated fluid via an ascitic tap. In cases of TB

empyema, aspiration reveals thick pus in the pleural space, while TB of the spine can be diagnosed through x-rays of the spine and biopsy of the cold abscess (Department of Health, 2014a).

Early identification and early treatment of TB is imperative to attain the Sustainable Development Goal of reducing tuberculosis (SANAC, 2013). After diagnosis with TB, TB patients should be categorized for appropriate treatment and evaluation of treatment outcomes in a standardised manner. Registration should be done according to the site of disease, bacteriology, severity of disease and history of previous treatment of TB (Department of Health, 2014a).

2.6.2.3 Management of TB

The HCP are responsible for managing TB patients according to the National Tuberculosis Management Guidelines (Department of Health, 2014a).

2.6.2.3.1 Management of drug-susceptible TB

Tuberculosis is managed by TB medication. The aims of TB treatment are to cure the patient of TB, to decrease the spread of TB to others, to prevent the development of acquired drug resistance, to prevent relapse and to reduce the risk of death and other morbidities. Drug-susceptible TB patients should be started on treatment within two days of being diagnosed (Pham, Fattal & Tsapis, 2015; Department of Health, 2014a).

Unfortunately, medication used to treat TB has various side-effects (see Table 2.5). First-line TB treatment in adults is used to treat persons with drug-sensitive TB, who are to start on treatment for the first time or who have taken anti-tuberculosis drugs for less than four weeks (Department of Health, 2014a).

Table 2.5: Side-effects of first-line TB medication (Department of Health, 2014a; Hall, Leff & Gumbo, 2009).

TB medication	Side-effects
Rifampicin	Hepatitis, skin rash, thrombocytopenia, yellow discolouration of body fluids (sputum, sweat and urine)
Isoniazid	Hepatitis, skin rash, peripheral neuropathy
Pyrazinamide	Hepatitis, skin rash, joint pain, nausea, vomiting, diarrhoea
Ethambutol	Optic neuritis

During 2013, a study was done at medical wards in the Groote Schuur, Edendale, Cecilia Makiwane and Frere hospitals to investigate adverse drug reactions. Adverse drug reactions (ADR) contributed to 3% of deaths among the 1951 patients in the study, and an expert panel concluded that many of the ADR were preventable. Rifampicin was identified as one of the drugs contributing to the deaths by causing liver injury and diarrhoea. Thus the impact of first-line TB drugs can be life threatening and needs careful monitoring (Mouton *et al.*, 2014).

2.6.2.3.2 Management of drug-resistant TB

Resistance to one of the first-line drugs is called mono-resistant TB, resistant to two or more (not to both isoniazid (INH) and rifampicin (RIF)) is called poly-resistant TB and resistance to both INH and RIF is multi-drug resistant TB. Drugs used to treat MDR-TB and XDR-TB are more toxic and patients often require a longer hospital stay than first-line TB treatment. In 2011, 32% of the total national TB budget was allocated to the diagnosis, monitoring and treatment of drug-resistant TB (Pooran *et al.*, 2013). Drug-resistant TB patients should start treatment within five days of suspicion of their status (Department of Health, 2014a).

MDR-TB drugs and common side-effects are summarised in Table 2.6.

Table 2.6: Side-effects of MDR-TB medication (Department of Health, 2014a; Hall *et al.*, 2009)

TB medication	Side-effects
Kanamycin	Ototoxicity, electrolyte wasting
Capreomycin	Nephrotoxicity, electrolyte wasting
Amikacin	Electrolyte wasting
Moxifloxacin	Psychiatric symptoms
Streptomycin	Vertigo, hearing loss
Ethionamide	Psychiatric symptoms, hypothyroidism, gastrointestinal intolerance, hepatotoxicity
Cycloserine	Peripheral neuropathy, seizures
Terizidone	Peripheral neuropathy, psychiatric symptoms
P-aminosalicylic acid (PAS)	Hypothyroidism, gastrointestinal intolerance
Pyrazinamide	Hepatitis, skin rash, joint pain, nausea, vomiting, diarrhoea
Ethambutol	Optic neuritis

Decreased hearing leading to withdrawal of the injectable was the most frequent adverse reaction seen in MDR-TB patients between 2000 and 2004. After ototoxicity, psychotic side-effects were the most frequent reactions in patients on terizidone/cycloserine with ofloxacin (Van der Walt *et al.*, 2013). Other adverse effects among MDR-TB patients (co-infected with HIV on ART) included peripheral neuropathy among 73% of patients, injection site pain among 66% of patients and 53% of patients had a rash. Complaints also involved joint pain, nausea and vomiting, insomnia, myalgia, abdominal pain and generalized weakness among others. Laboratory tests revealed elevated alanine transaminase (ALT) in 49% of patients, hypothyroidism in 51%, hypokalaemia in 40%, hyperkalaemia in 34%, anaemia in 33% and elevated creatinine in 24% (Brust *et al.*, 2013). Hypokalaemia could be fatal (Shean *et al.*, 2013).

Thus TB treatment has many side-effects, some of which may be severe. If patients are influenced by these side-effects and interrupt their treatment programme, they may remain infectious and potentially infect the HCP treating them (Department of Health, 2014a).

2.7 Role of HCP

The WHO recommends for HCP to be trained to screen people with suspected active TB (WHO, 2013b). Screening can be done among individuals attending a health facility, among high risk groups or mass screening among a wider community, also referred to as active case finding (WHO, 2013b). The HCP can screen for TB by simply asking questions about TB symptoms, and this step of screening is where contact with a potentially infectious TB case could first occur.

After screening, TB diagnosis is confirmed by diagnostic tests such as a culture test, smear microscopy or Xpert MTB/RIF[®] performed by the HCP (WHO, 2013b) and contact investigations should follow (Department of Health, 2014a). Patients should be given a return date for test results and initiation onto treatment. Thus interaction with the infectious TB patient is continued.

Once the diagnostic test results are available, a health care professional's role includes starting the patient on the correct TB treatment. If the Xpert MTB/RIF[®] test reveals that the patient is susceptible to Rifampicin, the patient should be started on

the regimen for DS-TB treatment. If the patient is Rifampicin resistant, the HCP should refer the patient to a MDR-TB initiation site and conduct screening among the patient's contacts. If the Xpert MTB/RIF[®] test is not available, the patient should be started on treatment for DS-TB until culture, DST, microscopy or LPA results are available. If these results indicate MDR-TB, the patient should be referred to a MDR-TB initiation site (Department of Health, 2014a).

Among HIV-infected individuals with symptoms of TB but with a negative result from the Xpert MTB/RIF[®] test, a clinical examination, chest x-ray or alternative diagnostic test should be employed by the HCP to diagnose TB (Department of Health, 2014a).

Providing patient education is part of the health care professional's responsibilities and should take place when the patient is diagnosed and initiated onto treatment. Patients should be educated on their treatment regimen and the HCP should make use of educational material, preferably in the patient's home language and applicable to their context at home. Patients should be given an opportunity to ask the HCP questions regarding TB and TB treatment (Department of Health, 2014a). During this counselling the health care professional is in contact with an infectious TB patient who is yet to start TB treatment.

The patient is monitored after diagnosis and treatment initiation, which involves further patient contact. Monitoring the patient during treatment includes:

- sputum smear and cultures (monthly and one week before the end of the two months intensive phase of treatment);
- chest x-rays (every six months);
- blood samples for: creatinine and potassium (monthly during injectable phase), thyroid stimulating hormone (monthly) and liver enzymes (every 1-3 months); and
- audiometry (monthly during the injectable phase and three months after completion of injectable therapy) (Department of Health, 2014a).

Therefore, regular patient contact occurs during several phases of management of TB patients. While the patient remains infectious, all HCP in contact with them are at risk of contracting TB if infection control measures are not in place to protect them.

2.7.1 Role of the dietician

Dieticians play an important part in providing the best possible nutritional support for TB patients to enhance their immune status and help to improve disease outcome (Miyata, Tanaka & Ihaku, 2013). Drivers associated with a poor nutritional status in TB patients include a decreased appetite, malabsorption and an altered metabolism (Kant, Gupta & Ahluwalia, 2015). As TB is associated with malnutrition, patients are referred to dieticians for nutritional screening according the National Guidelines on nutrition for people living with HIV, AIDS, TB and other chronic debilitating conditions (Department of Health, 2007a).

The WHO recommends that all TB patients should undergo a nutritional assessment and receive appropriate counselling throughout the course of treatment. In addition, MDR-TB patients and moderately malnourished patients should receive nutritional supplements (WHO, 2013c). Evidence supports the provision of nutritional supplements to TB patients (Rudolph *et al.*, 2013; Villamor *et al.*, 2008).

Nutrition assessment is defined as “a comprehensive approach, completed by a registered dietician, to defining nutritional status that uses medical, nutrition, and medication histories; physical examination; anthropometric measurements; and laboratory data” (Gates, 1992). Four different methods are used to determine nutritional status:

- Anthropometry involves measurements of physical dimensions and the composition of the body. Typical measurements taken include height, weight, skinfold thickness, body composition, waist, hip and mid-upper arm circumference (MUAC) (Lee & Nieman, 2013). By doing anthropometrical measures, the dietician is in direct and close contact with a TB patient as the scale must be read, height must be taken and circumferences measured with a measuring tape to give a comprehensive evaluation of anthropometrical status (WHO, 2008a);

- Interpretation of biochemical laboratory measures from a patient's file (Lee & Nieman, 2013). This method of assessment does not involve direct patient contact;
- Clinical evaluation involves gathering information from the medical history and physical examination to detect signs and symptoms of malnutrition. Clinical findings such as deltoid and temporal muscle wasting indicate the presence of malnutrition (Lee & Nieman, 2013). This method involves direct patient contact, which may pose a risk of TB transmission to the dietician; and
- Fourthly, dietary methods collect information by dietary recalls (Lee & Nieman, 2013). This method involves communication with the patient, which is a potential situation for TB transmission. TB can be transmitted while talking to patients with active TB, if infection control measures are not in place.

Thus, a dietician, when conducting a nutritional assessment of an infectious TB patient, is at risk for TB transmission while taking anthropometrical measurements, doing a clinical examination and gathering a clinical history, as well as when collecting a dietary recall from the patient. During these methods of assessment, infection control measures should be in place to protect the dietician from contracting TB.

Thereafter, patient contact does continue, as the dietician is responsible for dietary counselling and the provision of nutritional supplementation when criteria are met. These contact sessions with TB patients may provide further opportunities for TB transmission (Department of Health, 2014a; Mupere *et al.*, 2014; Lee & Nieman, 2013).

Kant *et al.* (2015) emphasised that TB patients also have micronutrient deficiencies such as vitamin A, vitamin D, vitamin E, calcium, zinc and iron resulting from TB disease and exacerbated by TB medication. The role of the dietician in the recovery of TB patients is vital as nutrition supplementation may also support drug adherence to improve treatment outcome, although more research comparing outcomes between patients receiving and those not receiving nutrition supplementation, is needed (Kant *et al.*, 2015; Lutge *et al.*, 2013).

Thus, a dietician is exposed to TB patients at the point of care during assessment as well as the process of monitoring the patient to support the patient's nutritional status.

2.7.2 Rights of dieticians and HCP

The Occupational Health and Safety Act (Act No. 85 of 1993) stipulates the necessity of providing a safe working environment that is without risk to the health of employees. A health hazard that HCP (including dieticians) are at risk for is exposure to bacteria transmittable through the air. Burnout and stress experienced due to overcrowded health care facilities, poor ventilation and an inadequate supply of protective equipment further increase the risk for occupational injuries (South African Government, 1993). Health facilities must implement measures to protect the HCP according to stipulations in the National Health Act (Act No. 61 of 2003). Thus, if these measures are not in place, a health care professional is exempted from his/her duty (South African Government, 2004).

2.8 Evaluation of the implementation of the National TB Management Guidelines in South Africa

The National TB Management Guidelines of 2014 recommended episodic evaluation of the management of the TB programme (Department of Health, 2014a). A recent review of the implementation of the National TB Management Guidelines in South Africa identified the following achievements:

- the guidelines, including algorithms and standard operating procedures, were generally available;
- DOTS was implemented in most cases;
- mobile clinics were effective in reaching areas that are isolated;
- management of DR-TB was decentralised according to the National Guidelines;
- an increase in the number of health facilities that initiate patients onto MDR-TB treatment occurred since 2009;

- treatment with alternative medication for pre-XDR TB could be arranged e.g. Bedaquiline;
- national MDR-TB Guidelines were followed regarding prescribed treatment regimens;
- social support by means of the disability grant was available (Department of Health, 2014b);
- an increase in screening the HIV-infected population occurred (Department of Health, 2014b);
- community health workers provided support to patients and referred TB suspects to be screened for TB;
- the widespread roll-out of Gene Xpert MTB/RIF[®] as the first line of diagnostic test for TB, DST was available and that test turn around times was generally within 48 hours;
- HIV and TB drugs were being prioritised by government with the provision of sustainable funding; and
- laboratory services have expanded and often allowed for online availability of results (Department of Health, 2014b).

Patients' outcomes have also improved as the cure rate and defaulter rates in South Africa have improved. The cure rate among the new pulmonary smear positive patients improved from 73.1% in 2010 to 75.8% in 2012 (Massyn *et al.*, 2014; Massyn *et al.*, 2013). The cure rate among new PTB cases improved from 73.8% in 2012/2013 to 75.9% in 2013/2014, although it was still below the target of 85% (Department of Health, n.d.c.).

The defaulter rate of 6.2% in 2012 exceeded the target set by the South African National TB Control Programme, but improved from 6.8% in 2010 (Massyn *et al.*, 2014).

The incidence of TB in South Africa is still high, but has decreased from 948 per 100 000 in 2010 to 860 per 100 000 in 2013 (The World Bank, 2015). In addition, the incidence of microbiologically confirmed PTB cases has decreased. According to Nanoo *et al.* (2015), the incidence of microbiologically confirmed PTB decreased from 829 per 100 000 population in 2010 to 774 per 100 000 population in 2012, possibly due to the expansion of ART for HIV-infected individuals. Despite these improvements, challenges to the implementation of the National TB Management Guidelines exist.

The review identified the following main challenges:

- a lack in systems to supervise community health workers attending to TB patients and a lack in training on dealing with patients who defaulted on treatment;
- inadequate tracing of patients who defaulted on treatment complicated by migration of patients to other districts or provinces;
- a poor system for reporting or managing side-effects;
- poor supervision of decentralised sites that provide MDR-TB treatment to patients;
- resource constraints such as limited drugs at some sites;
- MDR-TB treatment outcomes remaining poor;
- poor communication between DOTS teams and the clinics;
- community activities not occurring on a regular basis but more as an outreach event (Department of Health, 2014b);
- a lack of training leading to misuse of the guidelines' algorithms which resulted in a failure of DST (Department of Health, 2014b);
- an ineffective system for monitoring TB and HIV cases due to multiple registers that do not link data (Department of Health, 2014b);

- staff shortages that influence waiting times and contributed to burnout experienced by staff (Department of Health, 2014b); and
- a lack of evidence that the social support/disability grants improved treatment outcomes as well as a lack in standardised criteria for receiving grants (Department of Health, 2014b). Also, not all patients who qualified were receiving the grant (Lutge & Friedman, 2010).

The incidence of TB among HCP that exceeded that of the general population as described earlier in this chapter, remained a challenge (Claassens *et al.*, 2013b).

Given the extremely high defaulter rate, investigation of the contributing factors to poor adherence is key in order to provide a way forward that is relevant to TB patients in South Africa.

2.8.1 Evaluation of the potential barriers to treatment adherence

The Department of Health (2014a) identified four factors that influence treatment outcomes namely, social and economic factors; patient-related factors; health system factors and therapy related factors (Department of Health, 2014a). Consideration of these factors is necessary when counselling patients about TB treatment and the importance of treatment adherence.

2.8.1.1 Social and economic factors

The incidence of TB is related to unequal distributions of social determinants of health, including material living conditions, psychosocial circumstances and transport (Hargreaves *et al.*, 2011). Social and economic factors that influence treatment outcome also include extreme poverty, poor support networks, substance abuse and beliefs about TB and TB treatment (Foster *et al.*, 2015; Department of Health, 2014a; Naidoo *et al.*, 2013a; Shasha, 2013; Finlay *et al.*, 2012).

Many studies substantiate these factors identified by the Department of Health. At 14 primary health facilities involving 3107 TB patients, the risks for defaulting included a wide range of causes. Smoking, alcohol abuse, poverty, having co-morbid chronic conditions and also having a partner who is HIV-infected could all be associated with poor adherence (Naidoo *et al.*, 2013a).

In KwaZulu-Natal, factors that were significantly associated with defaulting treatment among TB patients included a low level of education, being unemployed, earning less than a R1000 per month, reportedly going to bed hungry at least three times a week, living in a rural area, smoking, using alcohol and using drugs (Ndwandwe *et al.*, 2014).

A recent study among TB defaulters in KwaZulu-Natal also revealed that a significant association was found between smoking and using alcohol. In addition, half of the patients were unemployed and 55% earned only between R100 and R200 per week while 45% earned R200 to R600 per week. Almost two thirds of the patients received a social grant, mostly used to buy food (Rajagopaul *et al.*, 2014). The food poverty line indicates the level at which individuals are unable to buy food to provide them with an adequate diet, and was set at R321 per person per month in 2011 (Statistics South Africa, 2014c). Although all patients in the study by Rajagopaul *et al.*, (2014) earned above the food poverty line, this income may have been the sole source of income for the entire household, possibly reflecting extreme poverty. More researchers have shown that food insecurity and unemployment were barriers to treatment adherence (Rudolph *et al.*, 2013; Finlay *et al.*, 2012; Human *et al.*, 2010; Naidoo, Dick & Cooper, 2009:62; Ukpe, 2007).

Tuberculosis is associated with weight loss (PrayGod *et al.*, 2011). Weight loss and inadequate weight gain are barriers to treatment adherence and successful treatment outcomes (Warmelink *et al.*, 2010; Krapp *et al.*, 2008). To achieve weight gain, a Cochrane review of randomised controlled trials found that moderate quality evidence exists that the provision of free food or high-energy nutritional products produced a modest increase in weight (Sinclair *et al.*, 2011).

Beliefs about treatment affected adherence as well. A false belief that TB could not be cured was reported as a reason for defaulting on treatment (Shasha, 2013; Human *et al.*, 2010). In areas where doctors explained that TB was a fully curable disease, patients felt hopeful and thus this knowledge improved adherence to treatment (Naidoo *et al.*, 2009).

Interventions such as patient education to influence beliefs about TB as a curable disease, provision of food, money vouchers and nutritional supplementation could help with drug adherence (Lutge *et al.*, 2015).

The HCP employed in health facilities where patients have a high rate of unemployment and poverty may be at risk of contracting TB from patients who defaulted on their treatment. Therefore, HCP should educate patients about TB and TB treatment and apply the other above-mentioned interventions to decrease the number of patients who default on treatment and remain infectious. This, in turn, would result in improved rates of successful treatment outcome and decreased exposure of HCP to infectious patients.

2.8.1.2 Patient-related factors

Stigma, depression, disempowerment and poor knowledge about TB and TB treatment are patient-related factors that can be barriers to treatment adherence (Department of Health 2014a; Shasha, 2013; Finlay *et al.*, 2012). Without addressing these issues, patients who default on treatment could increase the HCP risk of contracting TB, as they would remain infectious.

Stigma regarding TB was present in 95% of households in the Eastern Cape and 51% of households reported believing that if you have TB people don't respect you (Cramm *et al.*, 2010). From research at a DR-TB rural setting in KwaZulu-Natal, one third of 198 HCP reported a fear of stigmatisation for having TB (Kanjee *et al.*, 2012). Similarly, fieldwork conducted during 2005 and 2006 in the Western Cape revealed that beliefs existed that a personal diagnosis of TB would lead to one being stigmatised in the community (Murray *et al.*, 2012). In the Cape Town Metro Region patients reported that they felt stigmatised by their own friends and families (Naidoo *et al.*, 2009). Social support in the form of having regular social interaction with other TB patients has been found to decrease the level of internalised stigma among TB patients (Macq *et al.*, 2008).

Behaviour changing campaigns and community education were advised by the WHO (2009) to decrease the perceived stigma experienced by TB patients attending health facilities (WHO, 2009). In South Africa, not many studies have evaluated the effect of DOTS, community education or community awareness campaigns on

stigma. Without a decrease in stigma, patients may default on TB treatment and remain infectious, which may place the HCP treating them at risk of contracting TB.

A recent South African study among non-compliant TB patients revealed that patients did not know what side-effects to expect and then experienced side-effects such as a change in urine colour and deafness. Although the majority knew that TB was curable, some did not know that and reported feeling depressed due to the diagnosis of TB (Shasha, 2013). Clinical depression was diagnosed in 64% of TB patients in one study, bringing to light the importance of screening individuals with TB for depression as it may influence their overall well-being and treatment outcomes (Naidoo & Mwaba, 2010).

Adherence has also been linked to knowledge. A recent Delphi process identified that healthcare seeking behaviour is key when an individual identifies TB symptoms in him-/herself as this can lead to early diagnosis and starting on treatment at a health facility (Li *et al.*, 2014). Individuals thus rely on having knowledge about TB symptoms and signs to realise that they need to seek health care. Knowledge gaps existed at Tembisa clinic, where some patients were unaware that defaulting on treatment could lead to the development of MDR-TB, thus not knowing the consequences of defaulting on treatment may contribute to non-adherence (Human *et al.*, 2010).

Relief from TB symptoms due to taking TB treatment was found in some instances to be a promoting factor for treatment adherence, yet in other studies it was found to be a barrier to completing TB treatment (Finlay *et al.*, 2012; Naidoo *et al.*, 2009; Ukpe, 2007).

Adequate provision of support and monitoring of patients improved patient adherence in a study among MDR-TB patients in KwaZulu-Natal. For family members, education was given on infection control as well as training on how to support the patient with adherence to treatment. Only 5% of the MDR-TB patients defaulted on treatment, and at the time of the study, 77% of patients were cured or still on treatment, although five patients had demised. The empowerment of family members regarding gaining knowledge of TB as well as nurses' support at patients' homes aided in good outcomes for these patients (Brust *et al.*, 2012).

The HCP should provide TB education to patients to promote treatment adherence (O'Donnell *et al.*, 2014; Finlay *et al.*, 2012). In addition, stigma needs to be addressed so that patients present for TB testing if they recognise symptoms of TB in themselves. Earlier testing and diagnosis of TB would result in fewer undiagnosed individuals with TB within communities and health care facilities.

2.8.1.3 Health system factors

Poor infrastructure is a health system factor that may negatively influence treatment outcomes. Inadequate development of community support and HCP who are poorly trained and do not have good relationships with patients, could also hamper treatment adherence (Department of Health, 2014a).

A recent study among non-compliant patients revealed long waiting times at the clinics as a barrier to drug adherence. Mixed feelings with regards to the relationship with staff and support from staff was reported. Some patients reported having a good relationship with staff, while others felt disempowered and reported being shouted at or told that they were not taking their medication properly when, in fact, they were taking treatment appropriately (Shasha, 2013).

Many other studies also found that barriers to treatment adherence involved suboptimal relationships with nursing staff where patients felt they couldn't ask questions, get support for the management of side-effects or get assistance with making arrangements for close contacts to be screened for TB (Finlay *et al.*, 2012; Human *et al.*, 2010; Govender & Mash, 2009:515). Crucial information that is aimed at improving a patient's outcome might be lost due to a language barrier where the doctor, nurse or caregiver doesn't speak the patient's first language. This could be overcome by sending a patient home with a pamphlet or information sheet on TB, e.g. management of side-effects, in their home language (Dong *et al.*, 2007).

In Gauteng, only 26% of HCP involved in TB treatment in their health facilities were aware of the ototoxic effects of the TB medication and only 36% reported that they refer patients to the audiologist (Khoza-Shangase, 2013). Thus, poorly trained HCP did not provide patients with adequate care and monitoring as per National Guidelines. Patients without successful treatment outcomes due to health system

factors pose a threat of TB transmission to the HCP managing them at the health facility.

However, health system factors, if functioning well, could aid in successful treatment outcomes (Loveday *et al.*, 2014). Successful management of HIV and TB requires leadership and adequately trained staff, TB-DOTS to be functioning, education to be given to patients and family members to support patients, integrated HIV and TB services, and financial support to patients to provide for travelling costs (Loveday *et al.*, 2014; Gandhi *et al.*, 2009).

Drug availability was not conducive to achieving the smear conversion target set nationally, as stock-outs occurred at health facilities in all nine provinces according to a recent study. The proportion of health facilities reporting TB medication stock-outs during the 3 months preceding the survey was 5.0% in Limpopo Province, 4.8% in the Northern Cape, 4.8% in the Free State, 4.0% in the Eastern Cape, 2.2% in the Western Cape, 2.1% in Gauteng, 1.5% in KwaZulu-Natal, 1.3% in Mpumalanga and 0.5% in the North-West Province (Médecins Sans Frontières, 2013). If patients are not provided with TB medication, treatment default could translate into infectious TB patients treated at health facilities potentially spreading TB to HCP.

Therefore, the responsibility to overcome health system related barriers to treatment adherence is not on the patient, but lies with the government. Prioritisation of health system related factors that need to be addressed is crucial as patients could otherwise default on treatment and increase the risk of TB transmission to HCP in close contact with them.

2.8.1.4 Therapy related factors

Large pill burdens, the adverse side-effects of the treatment and its long duration impact on treatment outcomes (Department of Health, 2014a; Castelnovo, 2010). In a recent study, patients who defaulted on their treatment reported that the long period of time that they were expected to continue with treatment was a barrier to drug adherence (Shasha, 2013).

Communication of drug prescription, importance of adherence, management of side-effects and support to a patient has to be effective to promote patient compliance with TB treatment (Munro *et al.*, 2007).

Currently, the post-2015 global TB strategy calls for research in the area of improved TB treatment. TB treatment that is well tolerated and causes less side-effects may help to overcome therapy related factors hindering successful treatment outcomes in all TB patients (WHO, 2014a). Results from recent trials will give insight into whether the standard TB regimens might change, but sufficient evidence is not yet established at this point (WHO, 2014a).

In summary, patients who default on TB treatment would remain infectious, putting their community as well as the HCP treating them at risk for contracting TB and drug-resistant TB. Overcoming these barriers to treatment adherence could help to protect HCP from contracting TB at health facilities. All HCP should know the signs and symptoms of TB as well as the potential side-effects of treatment to provide education and support to patients. Therefore, the National TB Management Guidelines recommended training on these guidelines (Department of Health, 2014a).

2.8.2 Evaluation of training as recommended within the National TB Management Guidelines

According to the National Department of Health Strategic Plan 2010/11 to 2012/13, increasing the number of HCP and health workers who are trained on TB is a priority for TB control and management (Department of Health, n.d.d). In-service training as well as training by non-governmental organisations (NGO) assists in achieving this goal. However, the review by the Department of Health found that not all HCP were trained on the National TB Management Guidelines (Department of Health, 2014b).

2.8.2.1 In-service training

In Limpopo Province 85% of professional nurses (n=72) reported that they had received TB training (Tshitangano, Pengpid & Peltzer, 2010). However, a study done at a tertiary hospital in Cape Town revealed that nurses had not attended any TB-related training in the past year. A chronic staff shortage and work overload were

reported as reasons for neglecting TB-related education (Sissolak, Marias & Mehtar, 2011). A recent report at eight health care facilities where TB patients were treated in the Western Cape revealed that none of the 25 HCP had attended any formal infection control training. Facility managers reported regular in-service training on TB infection control, but no evidence was available e.g. staff attendance/statistics (Mehtar *et al.*, 2013).

Possible explanations for a lack of TB infection control training at health facilities could be that staff shortages existed and therefore staff either did not attend training sessions provided or feel they did not have time to fully adhere to infection control measures (Peters, n.d.; Adeleke, 2012/2013).

2.8.2.2 TB training by NGOs

Apart from policy training at each of the health care facilities nationwide, other training initiatives also exist. International organisations as the Centers for Disease Control and Prevention (CDC) and The United States President's Emergency Plan for AIDS Relief (PEPFAR) provide training on TB infection control. Training was given at 127 health care centres in the Eastern Cape during 2008 to 2009 among health care clinic managers as well as health care staff. Training focused on managerial controls, environmental controls and personal protection controls (Peters, n.d.). Innovative measures were applied, for example stickers on patient folders to remind staff to screen for TB. Outcomes were favourable, as infection control practices improved. Initially, separation of coughing patients was done in 20% of facilities and, 12 months later, in 65% of facilities. Screening patients for TB was initially done in 47% of facilities and, 12 months later, at 80% of facilities. Initially there were no cough etiquette posters but, 12 months later, 80% of facilities had cough etiquette posters on the walls. Tuberculosis infection control officers were appointed to assist the manager at each of the facilities. Findings pointed out the importance of ownership in the process of infection control implementation (Peters, n.d.).

The University Research Company (URC) has worked with the South Africa TB Programme since 2004 to strengthen TB prevention, treatment and control. Its aim is to strengthen TB care initiatives as well as strengthening the health system. The

programme has trained 389 HCP on the South African National Tuberculosis Control Programme (NTCP) Guidelines (URC, 2010).

Infection control educational material has been made available online, such as the free web-based course “TB 101 for Health Care Workers”, which was developed by the CDC in partnership with other international TB Centers. Training sessions on TB transmission, diagnostic tests for TB as well as TB treatment and knowledge quizzes form part of the lesson plans (CDC, 2011).

Tuberculosis training by the Desmond Tutu TB Centre (Stellenbosch University) provides intense and continuous training to post-graduate students as well as professionals and para-professionals in the health sector (Desmond Tutu Centre, 2007). For 2015, The Desmond Tutu Foundation offered an online course on the Clinical Management of TB, covering TB diagnosis, contact management, signs and symptoms of TB as well as TB treatment. It was developed for HCP working at primary health facilities or in rural areas where TB infection control training is not always offered. To pay for these courses, a health care professional can apply for scholarships (Desmond Tutu HIV Centre, Columbia University-SA & UCT, n.d.; The Desmond Tutu HIV Foundation, 2014).

Stellenbosch University offers a postgraduate diploma in infection control (Unit for Infection Prevention and Control, 2011). A basic infection control and prevention course was launched during 2015 with a special focus on TB in South African HCP, TB transmission and infection control measures. During 2014, the Unit for Infection Prevention and Control at Stellenbosch University trained approximately 620 HCP on TB infection control (Cronje, 2015).

The Medical Research Council (MRC) provided a five-day training programme on infection control practices in 2010, but a fee was required. The training aimed to improve infection control practices based on the Stop TB Strategy (MRC, 2012). No infection control course was offered during 2015 by the MRC.

The Foundation for Professional Development planned a short course on infection control for HCP over two days in Pretoria during October 2015 where an interactive workshop would cover the transmission of TB and the importance of infection control

measures to protect HCP from contracting TB. This course however was costly (Foundation for Professional Development, n.d.).

2.8.2.3 Undergraduate TB training

Stellenbosch University offers training on TB infection control to staff and students. Risk reduction guidelines are available and include information for all medical and health sciences students on:

- Risks of TB transmission;
- Importance for immune-compromised students to discuss it with their clinical supervisor if they feel uncomfortable seeing a TB suspect who has not been diagnosed;
- HIV tests are advised for students with diagnosed TB; and
- Infection control measures.

During the training, students are encouraged to open doors and windows in poorly ventilated areas (except for drug-resistant patients in isolation). All students have to undergo fit-testing of their N-95 respirators beforehand (Stellenbosch University, 2015).

In addition, a six-minute video called 'TB Proof shares advice on how to protect yourself from catching tuberculosis', where medical students, doctors and nurses talk about TB and the risk of having TB as a health care professional, measures to protect one against contracting TB and the necessity of adhering to infection control measures within health facilities. TB Proof was founded in 2012 and its main aim was to protect Health Sciences students by providing training on TB infection control (TB Proof, n.d.).

Video clips of medical students as well as HCP who contracted TB are also available where personal experiences with TB are shared (TB Proof, 2014a; TB Proof, 2014b). However, not all universities have a standard guideline on TB infection control for all Medical and Health Sciences students despite them being a vulnerable population.

In-service training, training by non-government associations as well as training of undergraduate students help to protect HCP from contracting TB and help HCP to manage TB patients according to established guidelines.

2.9 TB infection control measures

Health care practitioners can be protected from contracting TB by adhering to infection control measures, which are clearly demarcated within the National TB Guidelines (Department of Health, 2009).

These guidelines emphasised the importance of:

- Training HCP on signs and symptoms of TB for early recognition of TB risk;
- Biannual medical investigations/ screening of HCP for TB;
- Providing voluntary counselling and testing to HCP to know their HIV status (Kranzer *et al.*, 2010; Connelly *et al.*, 2007); and
- Providing precautionary measures for HIV-infected staff members as antiretroviral therapy (ART) and placing HIV-infected staff in low risk areas of the facility to help prevent TB among HCP (Department of Health, 2014a).

In addition, the South African government also implemented set infection control measures according to the WHO recommendations (WHO, 2009).

2.9.1 WHO TB Infection Control measures

The National TB Guidelines of 2009 included measures to protect HCP at health facilities in South Africa from contracting TB at work based on infection control measures established by the WHO (Department of Health, 2009; WHO, 2009). These Infection Control measures are described in the next section (WHO, 2009).

Facility-level managerial and administrative control measures

The management at a facility has to have political commitment, both nationally and at facility level, for a facility to implement infection control measures. Leadership duties include the identification and strengthening of local coordinating bodies and

the development of a facility plan (policies and procedures) for the implementation of the administrative, environmental and personal protective control measures. Therefore, an infection control committee at each health care facility has to develop, monitor and manage the infection control programme (WHO, 2009). In addition, management is responsible for participation in research efforts and on-site surveillance of TB among healthcare staff. Advocacy, communication and social mobilization (ASCM) has to be done by the management at each facility (WHO, 2009).

The WHO advised that administrative control measures should be implemented as a “first priority” (WHO, 2009:9). HCP should be trained on infection control to protect the HCP from contracting TB (CDC, 2012; WHO, 2009).

In-service staff training should reflect the National TB Guidelines and TB infection control policies and procedures and has been required by the Department of Health since 2007 (WHO, 2008b; Department of Health, 2007b). Training should include the early recognition of symptoms associated with TB, early diagnostic testing (without delays in the turnaround time for sputum testing and culture), early initiation on to TB treatment, transmission of TB, infection control measures and screening of HCP for TB and HIV. In-service training as well as pre-service training should be implemented at each health facility (Tuberculosis Coalition for Technical Assistance, n.d.).

Sputum has to be collected in an area away from others, where there is good circulation of air, with hand washing after collection being essential (Department of Health, 2009).

Triage of patients with TB symptoms is of key importance. In addition, the separation of TB patients in well-ventilated areas (planned during the design/reconstruction/use of buildings and rooms) has to be done, especially to protect immunosuppressed patients and HIV-infected patients. Both MDR- and XDR-TB patients have to be isolated from other TB patients and other patients (WHO, 2009). The valuable role of architects and engineers with knowledge of TB infection control when health facilities are being planned is emphasised (Nardell & Dharmadhikari, 2010:1238).

Education on cough hygiene, the covering of the mouth and nose when coughing or sneezing, has to be provided to diagnosed TB patients. Hospital stays need to be minimized to avoid nosocomial transmission of TB. Community-based approaches to managing TB should take place, such as educating other household members and close contacts about TB infection control (Li *et al.*, 2014; WHO, 2009).

The HCP who treat TB patients have to minimize the time spent with these patients if the ward/area is not adequately ventilated (WHO, 2009).

HCP have to be encouraged by management to undergo TB testing if they experience signs and symptoms of TB. The HCP should be advised to go for HIV testing and counselling. An HIV-infected health care professional should not be working with TB patients and should be moved to an area with a lower risk of exposure to untreated TB. Tuberculosis screening of HIV-infected personnel has to be done routinely (Department of Health, 2009; WHO, 2009).

Environmental control measures

Environmental control measures have to be in place to decrease the concentration of droplet nuclei in the air. Adequate ventilation is necessary to prevent transmission of airborne infections and each health facility bases the choice of ventilation system on the specific context (WHO, 2009).

Ventilation systems have to be checked and maintained regularly. Natural ventilation involve opening of windows or locating them opposite each other and using mechanical ventilation involving fans with natural ventilation to obtain adequate air dilution. Upper room ultraviolet germicidal irradiation (UVGI) devices are a complementary intervention to ventilation systems used in settings where adequate ventilation is not possible (e.g. due to building structure/cold weather) (WHO, 2009).

Personal Protective Equipment

Respirators (N95 masks) have to be available for use where there is increased risk of exposure to TB e.g. during sputum induction or when treating patients with infectious drug-resistant TB. Both HCP and visitors have to be wearing respirators when in an enclosed space with TB patients (WHO, 2009).

2.9.2 Evaluation of implementation of TB Infection Control measures

A Knowledge, Attitude and Practice (KAP) survey has been defined as a “representative study of a specific population to collect information on what is known, believed and done in relation to a particular topic” (WHO, 2008c:6). The WHO has advised that KAP surveys about TB should be done to gain insight about the adequacy of the extent to which Infection Control measures are adhered to by HCP. There are numerous benefits of doing KAP surveys about TB among HCP as the results:

- provide baseline information to guide the planning of an intervention (Fautsch Macías & Glasauer, 2014:5);
- can be compared to later stages of a project, to evaluate the effectiveness of an intervention (Fautsch Macías & Glasauer, 2014:5; WHO, 2008c:7);
- provide information for interventions to be steered into a more appropriate or efficient direction for the specific targeted population;
- reveal specific needs so educational material and messages can be targeted; thus information presented to the target population will be more effective and useful (Fautsch Macías & Glasauer, 2014:5; Setswe, 2009:86);
- provide valuable information for governments to make strategic decisions beneficial to their country (WHO, 2008c:6);
- can draw attention to an area which needs improvement for proper management (WHO, 2008c); and
- can be used in social mobilization where a community event can be held to raise awareness, where leaders from an area can be consulted to discuss the way forward (with available resources in the area) and to present information in a relevant and preferred way to the specific group (WHO, 2008c).

KAP studies about TB and TB infection control have been done internationally among HCP. Pakistan adopted the DOTS strategy in 1995 and DOTS coverage was 100% in 2005 in the public sector. However, the private sector was not involved in the National TB Control Programme and a KAP study was performed among 22 private practice practitioners regarding the management of TB patients in 2007. A third of the doctors did not identify the main symptoms correctly for TB suspects. Although 73% of doctors prescribed the correct treatment for new cases for the first two months, only 59% prescribed the correct six-month treatment for the continuation phase. A concerning finding was that no support was organised from a family member or a friend and no system was in place to monitor adherence and defaulting cases. Follow-up of sputum microscopy was not advised by 86% of practitioners (Ahmed *et al.*, 2009).

During 2009, a KAP survey on tuberculosis was carried out in the Republic of Uzbekistan among 124 patients, 56 doctors and 66 nurses (USAID, 2009). The survey revealed that all doctors completed DOTS training and all doctors reported using TB recording and reporting forms. Most doctors performed sputum collection in a separate room away from other patients. Positive indications with regard to doctors' attitudes to training were that a third reported that they would want to learn new information about TB. The majority of nurses (75%) in primary health care settings and 62% of TB service nurses believed TB suspects must be sent to a TB sputum collection room. DOTS was done by the nurse in 99% of cases. The KAP survey results revealed an improvement in successful treatment outcomes compared to the baseline KAP in 2005, from 79% to 88%, indicating a positive impact of the DOTS implementation programme (USAID, 2009).

In 2011, HCP from Ethiopia were enrolled in a TB Study. Less than 20% had received in-service training and only 34% knew that respirators could protect against the inhalation of *M. Tuberculosis* bacilli. Training was a predictor of TB infection control knowledge, which in turn was a predictor for good TB infection control practice (Temesgen & Demissie, 2014).

Knowledge scores from a KAP study in health facilities in Nigeria indicated an average of 49% correct responses for the section on infection control and 49% for the section on TB treatment. Almost a quarter of HCP identified the wrong symptoms

as part of TB symptoms. Only 14% of the participants knew the three types of infection control methods forming part of a TB programme (Ukwaja *et al.*, 2013).

In Lesotho, HCP participated in a KAP survey about TB during 2011. Knowledge gaps were identified; 9% didn't know that TB transmission was airborne and not waterborne or through direct contact and almost half (46%) of the HCP didn't identify fever as a TB symptom. Knowledge gaps also included appropriate sputum collection and screening and prioritising of TB suspects. Only 72% reported they would wear an N-95 respirator despite it being uncomfortable. The majority (98%) of HCP reported they would be willing to complete the TB treatment if diagnosed with TB (Bhebhe, Van Rooyen & Steinberg, 2014).

2.9.3 South African KAP surveys on TB infection control measures

Due to the benefits of a KAP survey as well as its recommendation by the WHO, studies have also been done in South Africa to evaluate the KAP of HCP in relation to TB and TB infection Control measures.

2.9.3.1 Knowledge

Studies found that knowledge gaps existed regarding the National TB Management Guidelines; infection control guidelines; TB transmission and signs and symptoms of TB (Farley *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; Sissolak *et al.*, 2011).

Facility-level managerial and administrative control measures

In KwaZulu-Natal, nurses' knowledge regarding the National TB Management Guidelines was lacking as only 17% of the 41 nurses knew that the turnaround time for sputum microscopy was less than 48 hours (Loveday *et al.*, 2008). Another study in KwaZulu-Natal revealed that over 30% of the sample indicated incorrectly that TB suspects should not be triaged but should wait in the general waiting area. More than 90% of HCP knew that patients should not be giving sputum samples in the waiting room around other patients (Kanjee *et al.*, 2012).

TB transmission (Facility-level managerial and administrative control measures)

Regarding TB transmission, studies found that knowledge gaps did exist (Farley *et al.*, 2012; Kanjee *et al.*, 2012). Almost all (97%) of the HCP knew that TB patients commonly infect others by coughing, but only 72% knew that the likelihood of infecting others is higher when a patient is coughing up a lot of sputum. Eighteen percent of the sample indicated incorrectly that TB could spread to others through the blood. Being more vulnerable to contracting TB if one is HIV-infected was known by 82% of HCP (Kanjee *et al.*, 2012). According to Farley *et al.* (2012), 63% of the HCP working at DR-TB hospitals in South Africa knew that an HIV-infected health care professional should avoid working in DR-TB wards.

TB transmission (Environmental control measures)

Kanjee *et al.* (2012) identified a knowledge gap as 28% of HCP employed at a rural health care setting in KwaZulu-Natal did not know that opening windows if a fan is used in a room provides additional infection control, but 98% knew that opening windows could help prevent the spread of TB (Kanjee *et al.*, 2012).

Transmission (PPE)

A survey among 198 HCP revealed that only 34% knew that a surgical mask does not protect against TB as well as an N-95 respirator. About half (49%) of the sample did not know that the N-95 mask does not provide an airtight seal and had to be checked by the HCP. Most (76%) of the HCP knew that the masks do not work as well when it was visibly dirty or when it was wet. The majority (87%) of HCP knew that they needed to wear an N-95 mask even if TB patients or TB suspects were using surgical masks or using handkerchiefs (Kanjee *et al.*, 2012).

Eleven percent of 57 community health workers incorrectly identified a surgical mask as a N-95 respirator (Kanjee *et al.*, 2011).

Signs and symptoms of TB

According to Farley *et al.* (2012), only 13% of 486 HCP correctly identified all the symptoms of TB while 6% answered incorrectly that a health care professional with

signs or symptoms of TB must also be HIV-infected. Higher knowledge scores were significantly associated with infection control training during the past 12 months.

2.9.3.2 Attitudes

Many studies brought to light that HCP' attitudes were not conducive to adherence to infection control measures (Farley *et al.*, 2012; Kanjee *et al.*, 2012).

Facility-level managerial and administrative control measures

Most (83%) HCP agreed that it is important to ask patients who present at outpatient departments whether they are coughing, and 84% agreed that it is important to minimise the time TB suspects spend around other patients in these departments' waiting areas. Some (22%) HCP reported that it was frustrating to educate patients on cough hygiene when they were busy with other tasks and 23% agreed to a statement that infection control measures are not worth all the effort (Kanjee *et al.*, 2012). Seventy eight percent of the sample agreed with a statement that they had a good understanding of the facility's infection control policy and 69% of the sample agreed with the statement that their hospital provided resources to limit their exposure to TB. Collection of sputum in the ward if it was rainy or cold outside was acceptable to 27% of HCP (Farley *et al.*, 2012).

Environmental infection control measures

Only 5% of HCP agreed that they did not like opening windows at the hospital, yet 28% reported that they would be afraid to leave the windows of the hospital wards open at night (Kanjee *et al.*, 2012).

Personal Protective Equipment

Although Farley *et al.*, (2012) found that 94% of 461 HCP agreed that N-95 respirators must be worn when caring for patients with DR-TB, only 41% of 455 HCP disagreed with the statement that respirators do not protect them from contracting DR-TB. Four percent of the HCP reported that they do not wear a respirator because their patients do not like them to wear it and 11% reported that HCP owe it to their patients to minimise fear by not wearing a respirator. Eleven percent of the HCP

agreed with the statement that properly using a respirator interferes with their work (Farley *et al.*, 2012).

Fears

Health care practitioners employed in MDR/XDR-TB wards faced fears such as being infected with TB and then infecting others, having to take the full course of treatment and suffering from drug related side-effects, concerns regarding cost and family responsibility implications resulting from treatment, childcare responsibilities, social/workplace stigma, not being cured and, above all, dying (Tudor *et al.*, 2013; Sissolak, 2011). The greatest fears were about infecting others (20%) and having to take the TB treatment (20%). Twelve percent of the sample indicated that they feared dying (Tudor *et al.*, 2013).

2.9.3.3 Practices

Adherence to all infection control measures was not achieved at any of the South African health care facilities (Malangu & Mngomezulu, 2015; Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Farley *et al.*, 2012; Kanjee *et al.*, 2012; Naidoo, Seevnarain & Nordstrom, 2012; Kanjee *et al.*, 2011).

Facility-level managerial and administrative level infection control measures

Despite the National TB Guidelines stipulating that TB infection control policies should be in place at health facilities, many health facilities did not have one in place (Naidoo *et al.*, 2012:1602; Kanjee *et al.* 2011:3).

According to a recent study at 127 public healthcare facilities in South Africa, the majority of facilities had the national guidelines on infection control (71%; n=90). However, there was no person responsible for infection control at 11% (n=15) of clinics (Engelbrecht & Van Rensburg, 2013). A TB infection control audit was performed at 121 primary healthcare facilities in South Africa during 2009, and found that less than half of the facilities had an occupational health policy (Claassens *et al.*, 2013b).

Another area of poor compliance was regular screening for TB among HCP (Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Farley *et al.*, 2012). In

KwaZulu-Natal, a study revealed that HCP reported that they would sometimes avoid being screened for TB at the facility and that stigma existed for nurses who worked in TB specialist hospitals. Screening happened every six months in TB hospitals but no regular screening was reported in district hospitals. HCP fear stigma and therefore don't disclose their HIV status, thus, if they were working in a TB ward they wouldn't be redeployed and were at greater risk for contracting TB (Zelnick *et al.*, 2013). Stigma was identified as a possible barrier to the use of occupational health units and also for getting tested for HIV in another study at 27 hospitals in the Free State (Siegel *et al.*, 2015).

At many health facilities, suspected TB patients weren't always triaged and known TB cases were not always separated from other patients (Tshitangano, 2014; Zelnick *et al.*, 2013; Naidoo *et al.*, 2012:1602; Kanjee *et al.*, 2012; Kanjee *et al.* 2011:3). For instance, of the 133 Primary Health Care facilities audited in 2009, only 3% had an area for suspected/confirmed MDR-TB cases. At the time of the study, 36% of facilities had HCP with TB (Claassens *et al.*, 2013b). Space constraints have been identified as barriers to isolation/separation of TB patients in hospital wards and also, patients socialised with other patients during mealtimes despite being isolated (Zelnick *et al.*, 2013).

A recent study evaluated adherence to infection control measures in KwaZulu-Natal at 52 health facilities and revealed poor compliance for having a written TB control plan (23%). However, a register for TB suspects was available at 98% and a designated area for sputum production by patients was available in 87% of facilities. Full adherence at all facilities was reported for the aspect of educating coughing patients on cough etiquette and educating patients about TB symptoms and prevention (Malangu & Mngomezulu, 2015).

Environmental infection control measures

A study by Engelbrecht & Van Rensburg (2013) at 127 clinics revealed that open windows were the only method of environmental control at most (80%) of the clinics and, on the day of the research, field workers observed that there were no open windows at 17 clinics. Thirty facilities had motorised fans to increase the circulation (Engelbrecht & Van Rensburg, 2013: 224). In another study, 21% of HCP reported

that they closed the windows at night as they feared that patients would get sicker (Farley *et al.*, 2012).

HCP employed in health facilities where environmental infection control measures are not adhered to, are at an increased risk of contracting TB from infectious patients.

Personal protective equipment

Many studies have shown that all HCP do not consistently use N-95 respirators when working with TB patients (Farley *et al.*, 2012; Naidoo *et al.*, 2012:1602; Kanjee *et al.* 2011:3).

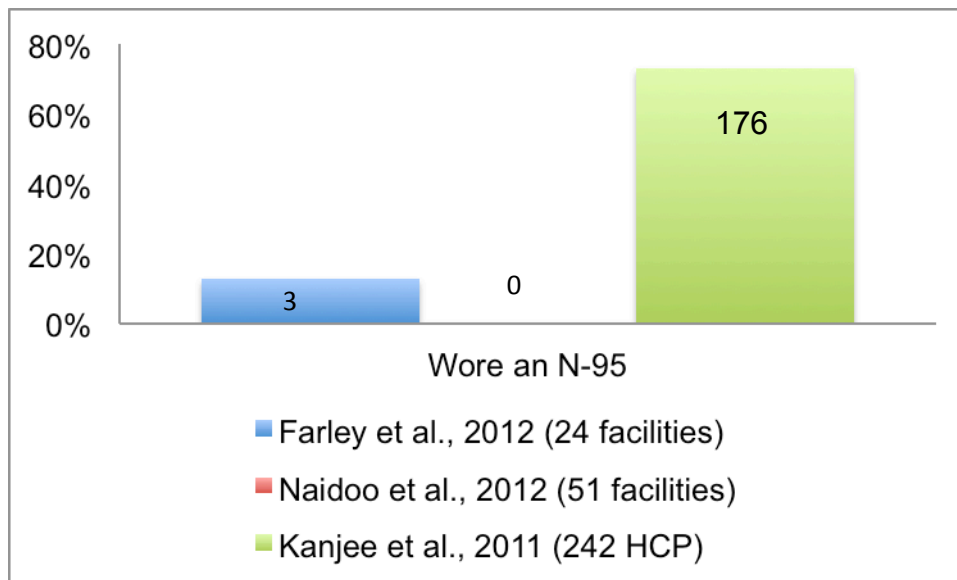


Figure 2.3: Evaluation of practices regarding the use of personal protective equipment

From Figure 2.3 it is clear that HCP were not using PPE as stipulated in the WHO Infection Control guidelines (WHO, 2009). Thus, HCP who do not wear N-95 respirators and who are exposed to drug-susceptible as well as drug-resistant TB, are at an increased risk to contract TB if they are working with infectious TB patients.

Studies have shown that N-95 respirators were not always available at health facilities, thus HCP could not protect themselves against TB (Engelbrecht & Van Rensburg, 2013; Zelnick *et al.*, 2013; Naidoo *et al.*, 2012).

At one health facility in KwaZulu-Natal, nurses reported that they once went on strike at work due to masks not being available (Arjun, Matlakala & Mavundla, 2013). Infectious patients could infect HCP with TB at the health facility if masks are not available to protect HCP against contracting TB.

Personal experiences

Nurses employed at an academic hospital in Cape Town reported that they are not protected from infectious patients as these patients could be lying in the wards for two days before being treated for TB (Sissolak *et al.*, 2011). A study at a high drug-resistance rural setting in KwaZulu-Natal revealed that 66% of HCP reported they felt less willing to work in high-risk areas due to many TB-related deaths among staff and 26% reported being less willing to work as HCP (Kanjee *et al.*, 2012).

Despite having knowledge about TB symptoms, five medical doctors admitted they didn't have early health seeking behaviour when they suspected they had TB (Naidoo, 2013b). Tuberculosis was described by a medical doctor who contracted TB as one of the "most debilitating experiences of my life" (Naidoo, 2013b:178).

According to Tudor *et al.* (2014), many of the 112 HCP in the study who contracted TB did not have successful treatment outcomes as 2% defaulted on treatment and 12% of HCP died (Tudor *et al.*, 2014).

2.10 Conclusion

Not only do TB contribute to most deaths in South Africa (Statistics South Africa, 2014a), affecting households and communities negatively, but studies have shown that TB also affects HCP across most provinces in South Africa (Von Delft *et al.*, 2015; Claassens *et al.*, 2013b; Malangu & Legothoane, 2012; Jarand *et al.*, 2010).

The WHO aims to have a world free of TB (WHO, 2015b). This entails a reduction in the incidence rate of TB as well as a reduction in the number of deaths from TB. The target set for 2035 is to reduce the number of TB deaths by 95% and to reduce the

incidence of TB by 90%, compared to 2015 (WHO, 2015b). The National Strategic Plan for 2012 to 2016 has a specific focus to reduce tuberculosis, prevent DR-TB, have effective infection control policies and reduce TB-related stigma (SANAC, 2011). However, successful treatment outcomes among TB cases were below the targets set both nationally and internationally and the incidence of TB in South Africa remains high (National Department of Health, 2014a; WHO, 2013a). Until these long-term goals of ultimately ending TB are achieved, HCP in contact with infectious TB patients at health facilities remain at risk for contracting TB (O'Donnell *et al.*, 2010).

To protect HCP from contracting TB at health facilities, the South African government incorporated infection control measures developed by the WHO into the National TB Guidelines. However, full adherence to facility and administrative level measures, environmental controls and personal protective equipment controls was not achieved in any of the health facilities where studies were done (Malangu & Mngomezulu, 2015; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011).

Various KAP surveys provide insight into the knowledge HCP have about TB, TB infection control measures and attitudes of HCP towards TB and TB infection control and revealed that practices regarding adherence to infection control measures were not always a reflection of HCP' knowledge, but that other factors such as stigma also play a role (Kanjee *et al.*, 2012; Cramm *et al.*, 2010; Naidoo, Dick & Cooper, 2009).

Stigma could prevent HCP from protective activities such as wearing N-95 respirators and getting tested for TB when they recognise TB symptoms in themselves (Kanjee *et al.*, 2012). Barriers to adherence to infection control measures in South African health facilities need to be overcome to reduce the burden of tuberculosis among HCP as HCP reported that they do fear contracting TB (Tudor *et al.*, 2013; Sissolak *et al.*, 2011).

Dieticians are involved with nutritional screening, assessment and management of TB patients. Limited research is available regarding dieticians' knowledge, attitudes and experiences regarding tuberculosis although they are part of the high risk group for contracting TB at the workplace.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The previous chapter described TB in terms of its effect on the South African population, including health care professionals. The literature review also emphasized dieticians' risk of contracting TB, if infection control measures are not adhered to. The purpose of this study was to determine dieticians' knowledge, attitudes and experiences in relation to TB at the workplace in South Africa.

The purpose of this chapter is to describe the research methodology and methods used to conduct the study. Ethics approval from NMMU Faculty Postgraduate Studies Committee was obtained to conduct this study. A descriptive, cross-sectional research design was used. An online survey using a convenience sample of 102 dieticians was employed between August 2014 and March 2015. Data analysis was done with the assistance of the Unit for Statistical Consultation, NMMU. Descriptive and inferential statistics were applied to present the results. For each variable, data analysis was described according to dimensions. These dimensions were formed after the researcher considered dimensions for similar variables in other studies. The WHO TB Infection Control guidelines were also considered. Throughout the research study, the researcher adhered to ethical principles.

3.2 Methodology

3.2.1 Research design

A descriptive, quantitative, cross-sectional research design was employed to determine the knowledge, attitudes and experiences of dieticians regarding TB at the workplace. These variables were measured by means of an online survey (Addendum B) at a single point in time implemented from August 2014 to March 2015.

3.2.2 Pilot study

The participants in the pilot study functioned as an expert panel and were purposely selected for their competency within the field of tuberculosis or to advise on technical support for the survey (Addendum C). The panel included:

- 16 dieticians in Port Elizabeth;
- an infectious diseases medical specialist employed in the public sector, Port Elizabeth;
- a sister in charge of infection control at a public hospital in Port Elizabeth; and
- an Information and Communications Technology (ICT) specialist from NMMU.

One participant did not complete the survey and a total of 18 final entries were received (One person completed the study twice and the second entry was deleted as the two entries were exactly the same).

The pilot study was conducted to ensure that the research procedures were in place for adequate data collection in the research project and that all questions were clearly understood (Denscombe, 2014). The following changes were made according to the pilot study recommendations regarding:

- Multiple choice answers were listed vertically instead of horizontally.
- Multiple choice options were listed with an added “Don't know” option and a “Not applicable” where necessary.
- The option of working both with children and adults was added at the work setting.
- A clear description of the interpretation of the Likert-scale was presented in the attitudes section e.g. “1” means “strongly disagree”, “2” means “disagree”, “3” means “neutral”, “4” means “agree” and “5” means “strongly agree”.

3.3 Methods

3.3.1 Study population

The study population for this study was all dietitians in South Africa who were registered with the Health Professions Council of South Africa (HPCSA) during 2014 and 2015. South Africa had a total of 2914 dietitians registered with the HPCSA in February 2015 (Daffue 2015a).

3.3.2 Inclusion/exclusion criteria

Only dietitians registered with the HPCSA were included.

Dietitians who were not registered with the HPCSA were excluded and, due to the method of data collection, dietitians without an internet connection were also excluded.

3.3.3 Sample and size

This sample included 102 dietitians. A total of 136 consent forms (Addendum D) were received but only 117 participants completed the survey. After removal of 14 incomplete entries and one duplicate entry, a final number of 102 entries were included in the study.

3.3.3.1 Sampling

Convenience sampling was employed among dietitians who were easy to reach and include in this study (Weathington, Cunningham & Pittenger, 2010:98).

As convenience sampling is a form of non-probability sampling and does not involve random selection, the findings will not be generalised as it will not necessarily be representative of the target population (eds. Schmidt & Brown, 2015: 305). However, findings may be transferrable to other studies as the researcher documented the sampling practices and provided in-depth information about the sampling procedure (Andres, 2012:97).

An invitation to participate in this study was placed in the ADSA newsletters that were e-mailed to dietitians by ADSA (Addendum E). At the time of the study, there

were 1580 registered dietitians with ADSA (Nkosi, 2015a). Thus, 54% of dietitians registered with the HPCSA were part of ADSA.

To improve the response rate and decrease the risk for non-response error, the researcher applied the following recommendations (Engel *et al.*, 2015: 25; Groves *et al.*, 2009: 201, 206):

- The average time it took the members of the pilot study to complete the survey was calculated to inform the study population in the invitation, as response rates may have been affected negatively if the questionnaire took too long to complete;
- Multiple modes of invitation took place. Dietitians were invited via e-mail through ADSA newsletters nationally; invitations were sent via e-mail lists made available by ADSA chairpersons provincially; dietitians employed by two universities sent out invitations in their region via e-mail, dietitians were invited who are known personally to the researcher and an invitation to participate was placed on a social media page by a university;
- Targeting, personalisation and reminders were employed as dietitians were phoned at hospitals and asked for their e-mail addresses, invited to participate when attending Eastern Cape ADSA functions; and reminded in the form of personalised e-mails to those dietitians who had not completed and sent back their consent forms or who had completed their consent forms but had not yet followed the link to complete the survey; and
- An incentive in the form of a R500 Woolworths voucher was offered as part of a lucky draw in which all participants would be entered.

This research study was done among participants who agreed to voluntarily participate. The implication of offering money was considered as it could have influenced an individual's decision to participate and therefore negatively influenced the ethical standard of voluntary participation (Largent *et al.*, 2012). Offering large sums of money could be irresistible to some individuals and could decrease a person's ability to reason soberly about the risks and benefits of the study and could cause a person to continue with a study despite wanting to withdraw (Largent *et al.*

2012; Draper *et al.*, 2009). Therefore, an incentive in the form of a R500 voucher from Woolworths was offered as a lucky draw prize that could encourage an individual to participate, rather than coercing him/her to participate (Fan & Yan, 2010; Draper *et al.* 2009).

As some dieticians in rural areas reported not having a computer and having to access the online invitation only on their phones, the consent form was copied within the e-mail so that their details could be typed in without having to download and save a document.

3.3.4 Data collection method

An online survey (Addendum B) was used to collect data. The survey consisted of closed-ended questions, which ensured that the data could be analysed quantitatively (Andres, 2012:35).

3.3.5 Measuring instrument

An online survey (Addendum B) was used to determine the following:

- Demographics
- Knowledge of TB
- Attitude towards TB
- Fears regarding contracting TB
- Experiences with regards to TB Infection Control practices
- Personal behaviour regarding TB

The survey presented answers in the following formats:

- Demographics: Multiple choice
- Knowledge: Multiple choice (Yes/ No/ Don't Know)
- Attitudes: Likert scale (Strongly disagree to strongly agree)

- Experiences: Multiple choice (Yes/ No/ Don't know/ Not applicable/ Unsure); and a Likert scale (Not applicable, Always, Often, Regularly, Seldom, Never, I don't know)

3.3.6 Variables

The variables measured in this study included:

Demographics

Demographics are defined as the “study of the size and structure of populations” (Bruce, *et al.*, 2008:80). This section had 10 closed-ended multiple choice questions, including the respondent's age, gender, frequency of exposure to TB patients, work setting, period in specific work setting, previous work setting, the period in previous work setting as well as internet accessibility. The work setting referred to whether the dietician was employed in public health service (hospital/clinic), a private health care setting (private hospital/private clinic), in a private practice or any other setting. In addition, a question asked whether the participant worked with adults, children or both adults and children. Internet access had the options of “easily available”, “available but not convenient”, “difficult”, or “no access” (Addendum B). The option of “no access” was included as this study was advertised at ADSA events where dieticians interested in participating could communicate with the researcher to send a hard copy of the questionnaire via e-mail to a dietician for distribution to others with no internet access.

Questions in this section were based on other similar studies and recommendations (Farley *et al.*, 2012; Kanjee *et al.*, 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2008c).

Knowledge of TB

Knowledge of TB was assessed to measure the participant's understanding of the National TB Management Guidelines, TB Infection Control Guidelines, TB transmission and symptoms and signs of TB (Addendum B).

The questions in the questionnaire were based on other similar studies and guidelines (Department of Health, 2014a; Zelnick *et al.*, 2013; Farley *et al.*, 2012;

Kanjee *et al.*, 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2009; WHO, 2008c).

Twenty nine multiple choice questions (Yes/ No/ Don't Know) were included to test dieticians' knowledge.

Attitudes towards TB

For the purpose of this study, the attitude of participants towards TB was assessed regarding their attitudes towards others with TB, possibly contracting TB, the stigma, getting screened for TB on a regular basis, importance of adhering to Infection Control guidelines and policies, willingness to adhere to Infection Control measures, staff availability to implement Infection Control measures, seriousness of TB, TB as a curable disease, wanting more training on TB Infection Control and fears regarding contracting TB at the workplace (Addendum B).

The questions were based on feedback from the Expert Panel/Pilot Study members (Addendum F) and other similar studies (Engelbrecht & Van Rensburg, 2013; Naidoo *et al.*, 2013b; Tudor *et al.*, 2013; Zelnick *et al.*, 2013; Adeleke, 2012/2013; Farley *et al.*, 2012; Kanjee *et al.*, 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011) and recent guidelines (Department of Health, 2014a; WHO, 2008c).

Twenty-six statements were included to which the participant had to record whether they agreed or disagreed according to a 5-point Likert scale. A Likert scale was applied because of its benefit in evaluating a "cluster of attitudes" (Bryman, 2012:165).

Experiences of TB

The 43 questions in this section on personal and work experiences related to TB (Addendum B) were based on similar studies and/or guidelines (Tshitangano, 2014; Engelbrecht & Van Rensburg, 2013; Tudor *et al.*, 2013; Tshitangano, Maputle & Netshikweta, 2013; Zelnick *et al.*, 2013; Adeleke, 2012/2013:198- 199; Farley *et al.*, 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2009; WHO, 2008c).

Questions were presented as multiple choice questions and some options used a 6 point Likert scale.

3.3.7 Study procedures

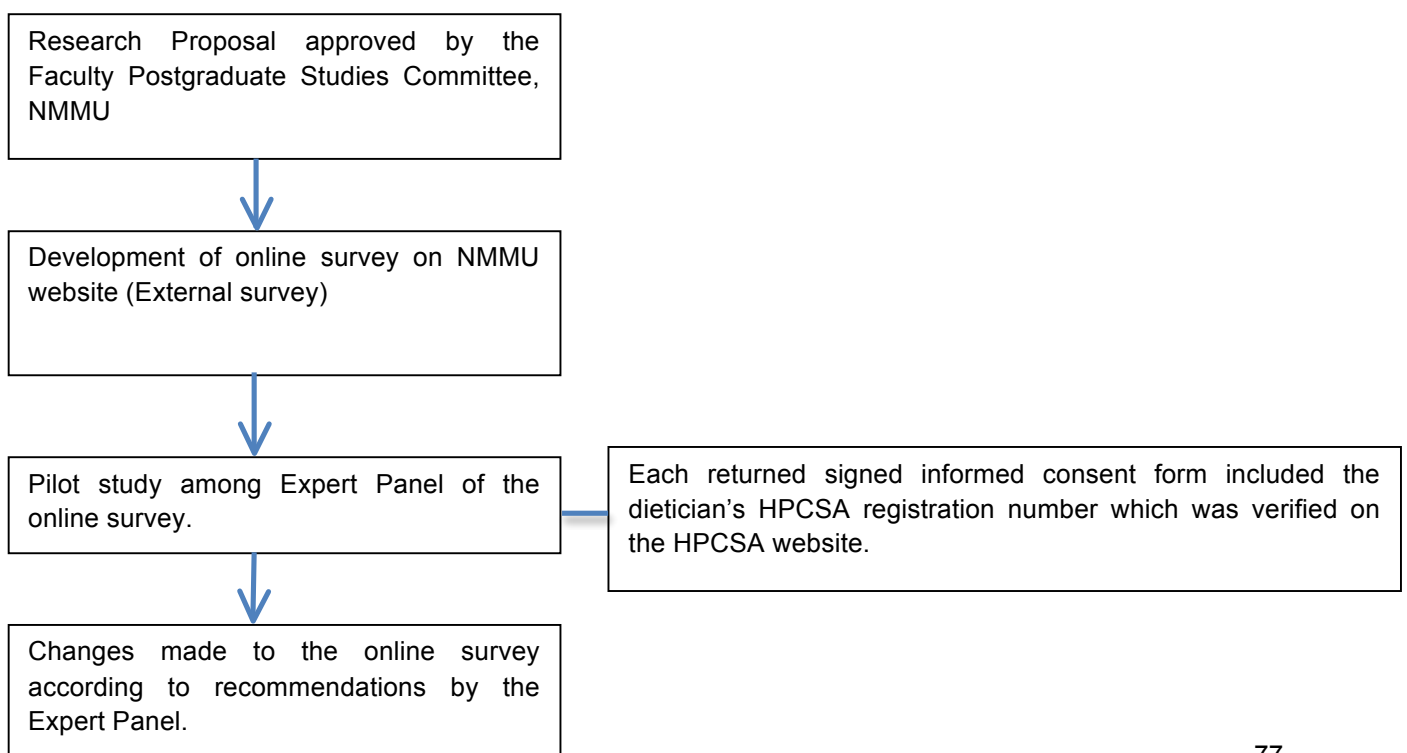
A brief overview of the study procedure is illustrated in Figure 3.1.

The online survey was created as an external survey using NMMU external tools on the staff portal. The study was published at: <http://forms.nmmu.ac.za/websurvey/q.asp?sid=1241&k=gfzaedlkyyv>.

The hyperlink was sent to each of the pilot study members individually via e-mail after informed consent was received. Feedback from this expert panel was applied to adapt the survey.

As stated in the section on sampling (3.3.1.1), invitations to participate were sent out nationally by ADSA via e-mails, as well as provincially in most provinces. The use of social media was also employed to advertise the study on Facebook. E-mail lists at provincial-level and via tertiary institutions were also used to invite dietitians to participate.

An e-mail was sent to each dietitian who gave informed consent and was verified as being registered with the HPCSA. Short instructions on how to navigate to the online survey and the hyperlink to the survey were included in the e-mail. Dietitians were reminded via e-mail to complete the survey. Data was collected from August 2014 to March 2015. The online survey was closed at the end of March 2015.



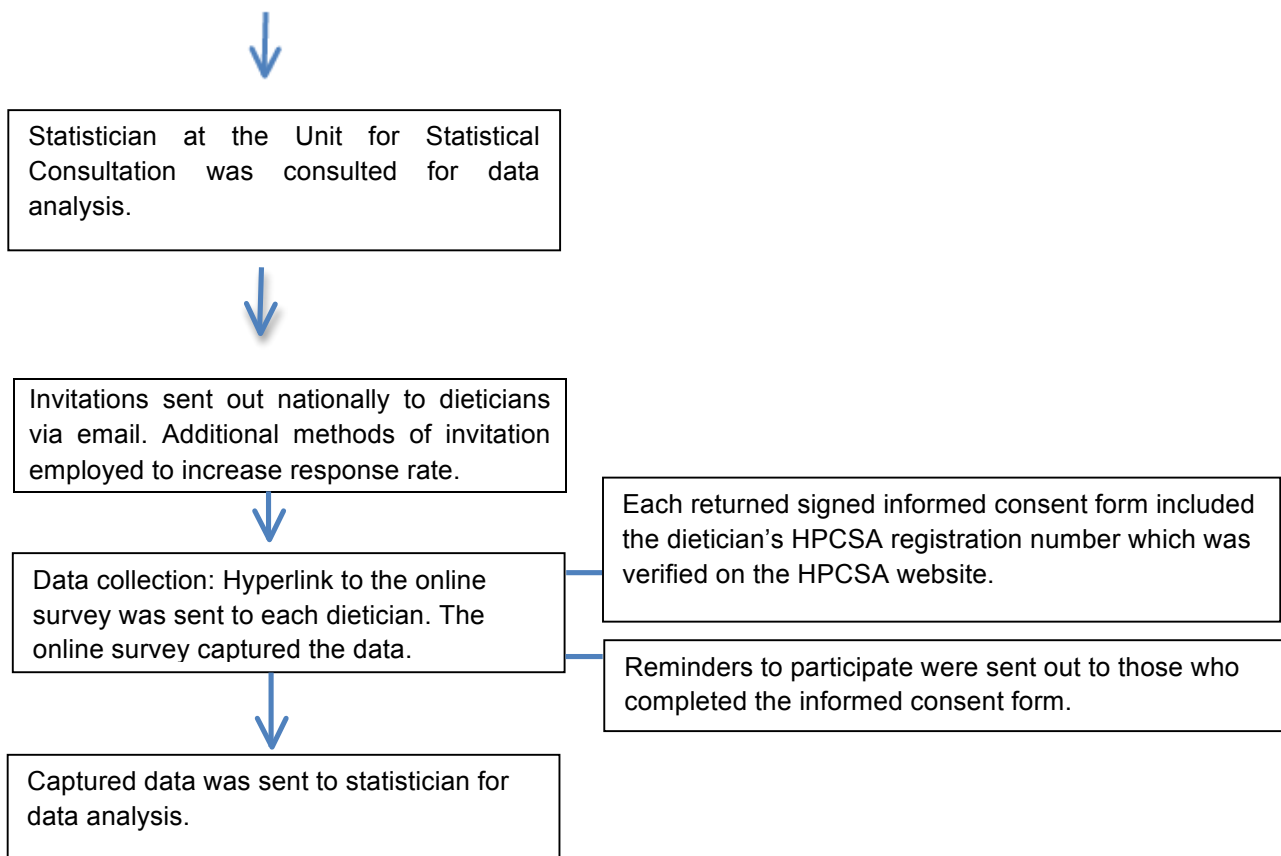


Figure 3.1: Outline of study procedures

3.3.8 Data collection

Each dietician who gave informed consent was verified as registered with the HPCSA. As described in 3.3.7, a hyperlink to the online survey (Addendum B) was sent via e-mail to each dietician included in the sample. Participants could do the survey from any place with internet access. Data collection took place from August 2014 to March 2015.

3.3.9 Data processing and analysis

Data processing and analysis were done with assistance from the Unit for Statistical Consultation, NMMU. Statistica version 12.0 was used.

Data coding were done with the help of the data analyst to ensure that errors were reduced. Coding was done accurately and systematically to minimize errors.

Data cleaning took place where data were checked and one duplicate entry was removed.

Descriptive statistics were used to describe responses to a variable (Jacobsen, 2012). Descriptive statistics for quantitative data included the mean (a measure of central tendency/ centre of the data set) and the standard deviation (description of the dispersion of a set of data) (Rovai, Baker & Ponton, 2014; Jacobsen, 2012).

For categorical data, frequencies and percentages were determined. The Chi-square test was applied to categorical data to determine the significance of associations between groups within the population. Associations were deemed statistically significant at alpha equal to .05. Cramer's V was used to determine the practical significance (effect size) of associations that were found to be statistically significant.

The Pearson correlation coefficient was used to measure the degree and direction of the relationship between two variables. Significant correlations were indicated by a significance level of alpha equal to .05 and r-value greater than or equal to .30 (Gravetter & Wallnau, 2014).

The Student t-test was used to determine the statistical significance based on sample mean values. Cohen's d accompanied the t-test to determine the practical significance (effect size).

Internal consistency of summated scores derived from the responses to the items of the questionnaire was verified with Cronbach's alpha.

Dimensions

Dimensions were formed for each variable to organize the factors in a way that represents an aspect of the variable when grouped together. Each factor consisted of a question in the survey and multiple factors constituted each dimension.

Dimensions were formulated based on other studies that grouped results pertaining to the variables into dimensions, as well as on the WHO TB Infection Control guidelines (See Addendum G).

For the purposes of this research study, dimensions were formed as summarised in Tables 3.1-3.3.

Table 3.1: Dimensions of knowledge

Dimensions	Factors	Question
Administrative control measures (National TB Management Guidelines) (Yes/ No/ Don't Know)	Early recognition of suspected TB cases involves screening for the presence of a cough lasting for more than 2 weeks	2.1
	Educating patients on respiratory hygiene e.g. covering the mouth and nose when coughing	2.2
	Separation of TB patients from the general waiting area	2.3
	Collection of sputum samples away from other people, in a well-ventilated area as well as prompt follow-up of results	2.4
	Hand washing after sputum collection is necessary	2.5
	Educating staff members and patients on symptoms of TB should be done routinely in the health care facility	2.6
	An infection control officer should be responsible for documenting the policy and arranging training for personnel	2.7
	TB infection control measures can prevent TB transmission	2.8
	Finishing TB treatment is critical	2.9
	Family members of TB patients need to know how to protect themselves from getting infected	2.10
Transmission of TB (Yes/ No/ Don't Know)	TB is often spread from person to person through the air	2.11
	HIV-infected patients are more vulnerable to contracting TB than HIV-negative patients	2.12
	Patients with active TB disease are more likely to infect others if they have a cough that produces a lot of sputum	2.13
	Patients with active TB disease can infect people by talking	2.14
	N95s protect health care professionals and visitors by stopping TB particles from being breathed in	2.15

Specific questions represented the different dimensions of attitudes, as summarized in Table 3.2.

Table 3.2: Dimensions of attitudes

Dimensions	Factors	Question
Transmission threat	I would like for all health care professionals to be screened for TB routinely	4.1
	If I recognize TB symptoms in myself, I want to get tested as soon as possible	4.2
	I feel it is important for TB patients in the facility to wear N-95 respirators (masks)	4.6
	If N-95 respirators (masks) were always available in my health facility, I would always wear them when dealing with TB patients	4.7
TB Infection Control	I feel adherence to TB guidelines and policies are important	4.4
	I feel that TB is a major public health threat	4.5
	I view TB as a fully treatable disease	4.11
	I feel that priority should be given to TB infection control measure issues at work	4.12
Stigmatizing attitudes	If I was diagnosed with TB, I would hide it from my colleagues	4.3
Human resources (Facility-level Infection Control measures)	I want to increase my TB knowledge	4.8
	I would like it if more TB training at work took place	4.9
	I feel that in the health care facility where I work there is sufficient personnel to educate TB patients adequately	4.10
Fears	I am worried about getting TB at work	5.1
	My fear of contracting TB at work affects my interaction with patients	5.2
	I am worried about getting drug-resistant TB at work	5.3
	My fear of contracting drug-resistant TB at work affects my interaction with patients	5.4

Specific fears	Infecting my family and friends at home	6.1
	Difficulty to adhere to treatment	6.3
	The long process of recovery	6.4
	Suffering from side-effects caused by TB treatment	6.5
	Neglecting my family responsibilities	6.6
	A long hospital stay	6.7
	Long-term effect on health in future	6.8
	Financial strains from an uncertainty regarding future employment	6.9
	Having to rely on others/ a loss of independency	6.10
	Fear of stigma	I fear the social stigma attached to having tuberculosis at work

For experiences, questions were grouped to constitute the different dimensions of experiences (Table 3.3).

Table 3.3: Dimensions of experiences:

Dimensions	Factors	Question	
Experiences			
Facility-level measures (Yes/ No/ Don't Know)	Control	Is there a written TB infection control plan in place at your workplace?	7.2
		Are infection control audits performed at your workplace?	7.3
		Are health care professionals trained on TB infection control policies?	7.4
		Have you received training on TB infection control?	7.5
		Are there any areas designed to separate MDR-TB suspected or confirmed cases?	9.9
		Is there a written Personal protective equipment infection control plan in the healthcare facility?	10.1

Administrative measures (Yes/ No/ Don't Know)	Control	Is there someone in charge of TB infection control at the healthcare facility?	7.1
		Is early testing, diagnosis and initiation onto TB treatment regarded as important in the facility where you work?	7.6
		Can you get screened for TB at your workplace?	7.7
Administrative measures (Likert scale)	Control	Sputum results are available 48 hrs after collection?	8.1
		Treatment is started within 5 days after diagnosis?	8.2
		How often do you attend TB training?	8.4
		Education on TB infection control to patients is done?	8.5
		Education material is available to give a patient newly diagnosed with TB (e.g. pamphlet on managing side-effects/ importance of adherence to treatment)?	8.6
		At my work facility, MDR- TB patients are kept separate/ isolated?	8.7
		Coughing patients are prioritised to ensure shorter waiting times in general waiting area (Answer if you are employed in a clinic setting)	8.8
Exposure to TB patients (Likert scale)		I work with or have worked with patients diagnosed with TB?	8.3
Environmental measures (Yes/ No/ Don't Know)	Control	The room of a TB patient is well ventilated e.g. open windows, fans, HEPA filters/ UV lights	9.8
		Are environmental controls periodically maintained with results written down in registers?	9.10
Personal Equipment	Protective	Are there N-95 respirators (masks) available for staff to use?	10.2
Personal behaviour			
Personal Risk of TB (Yes/ No)		I am neglecting infection control measures when working with TB patients despite being aware of the risks	11.1
Administrative measures	Control	I have been tested for TB	11.2

(Yes/ No)	I was tested for TB at my workplace	11.3
	I was tested for TB outside my place of work	11.4

3.3.10 Validity and reliability

3.3.10.1 Validity

The aim of the measuring instrument was to have a valid instrument that measured the clearly defined variables.

Face Validity

Face validity was strengthened as the survey looked similar in its format to the TB KAP Questionnaire by the WHO (WHO, 2008c). The results from the pilot study strengthened face validity as participants indicated that the survey was clear and easy to navigate by most participants.

Content Validity

The survey was designed in a way that is comprehensive and logical, taking the full scope of what it was intended to measure into account. Content validity was strengthened by a literature review on the WHO's KAP survey instrument and similar instruments, conducting a pilot study and getting input from the expert (Addendum F).

The conceptualisation of the variables (demographics and knowledge, attitudes and experiences in relation to TB at the workplace) was formed based on similar studies as well as on standards set by the WHO, with the addition of a question on internet access due to the fact that it can influence the response rate. Content validity was further strengthened by basing the survey on these established standards as well as similar published studies among HCPs working in South Africa, (Addendum H).

3.3.10.2 Reliability

Reliability was strengthened by using language in the survey that was neither ambiguous nor confusing to the participants. Common terms were used instead of unfamiliar terms thereby decreasing subjectivity. Questions with possible low

familiarity to participants included “Don’t Know” as an option to prevent participants from answering a question that they did not understand (Fowler, 2009:95). Reliability was strengthened as the panel of experts reviewed the draft survey to prevent inadequate understanding of the questions and the recommended changes were implemented (Addendum F).

Each question was about one single measurement thus phrases did not combine two questions. Each question was carefully phrased in order not to influence the participant’s answer according to a certain perceived social desirability.

The online survey was self-administered, which also increased reliability especially when answering sensitive or personal questions.

Internal Reliability

With regards to inter-observer consistency, due to the online survey not being administered by different people, there was less subjectivity, which strengthened reliability.

3.3.11 Ethics

Ethics approval was obtained from the Faculty Postgraduate Studies Committee and granted the ethics approval number H14-HEA-DIET-002 (Addendum I). No institutional permission was obtained from gatekeepers of dieticians as they participated in their private capacities.

Participation by dieticians was voluntary and electronic informed consent (Addendum D) was a prerequisite for data to be gathered. No direct risk was involved.

The Protection of Personal Information Act (Act 4 of 2013), was adhered to during processing of participants’ personal information (Republic of South Africa, 2013). The privacy of the participant was not infringed on and the data was processed only if informed consent was received. Data was collected directly from the participants hence, the participants were aware that their names, surnames and the registered numbers with the HPCSA were known as they completed the information on the consent form. The researcher kept this information confidential. Participants were able to opt out at any time should they wish to do so. No personal information was used for marketing (Republic of South Africa, 2013).

The researcher complied with the ethical principles as set out in the Declaration of Helsinki developed by the World Medical Association whilst conducting the study (World Medical Association, 2013). The principles of Autonomy, Non Maleficence, Beneficence and Justice were maintained as follows:

Autonomy

Participation in the study was voluntary and no forced participation or hidden data collection took place. The researcher respected the participant's freedom of participation. Those willing to take part did so voluntarily and the invitation to participate in this study clearly indicated that participants could opt out at any time. The online survey provided for high privacy levels as the participant could complete it on his/her own. An electronic consent form (Addendum D) was sent out with the invitation to participate in the study (Addendum E). Confidentiality and anonymity was applied and therefore each participant received a code to enter as an identifier, thus no name or personal details was reflected on the Excel Spreadsheet after the collected data was exported. Informed consent forms were saved by the researcher in a password protected file.

Non Maleficence

Anonymity was maintained during data analysis as the participant's names were not included during data collection or on the exported Excel Spreadsheet. Publication of the findings will be done in a way that will not harm the respondents. No personal information will be published, as each person completed the survey with a code and did not use their names or HPCSA numbers which could be linked to them.

Beneficence

Participants were informed of the aims of the study. Results of the study will be available for participants to view as the dissertation will be available in the NMMU library.

Justice

During the study the researcher maintained the circumstances mutually agreed upon with the participants. The researcher respected each participant's Human Rights.

3.3.12 Time frame/ schedule

The researcher planned the activities that would need to be done within time limits to complete the study within the given time frame (see Table 3.4).

Table 3.4: Time Frame/ Schedule

Part of research process	Time Frame
Proposal writing	January to May 2014
Ethics approval	May 2014
Development of the online survey	June to July 2014
Evaluation by an expert panel and Pilot Study	July 2014
Changes to the questionnaire	July to August 2014
Data collection	August 2014 to March 2015
Data analysis	April to July 2015
Results Chapter	August to October 2015
Discussion and Recommendations	October to November 2015

3.3.13 Budget

Costs were reduced as the survey was made available online and did not require posting. The budget consisted of the following expenses in Table 3.5:

Table 3.5: Budget for the study

Expense	Cost in Rands
Binding	600
Stationary	250
Printing and photocopying articles used for literature review	600
Gathering information by HPCSA regarding demographics of registered dieticians in South Africa	127
Travelling costs (petrol) to NMMU library for resources	2000
Telephone calls to expert panels, chair of ADSA, dieticians	1500
Proof reading by language editor	2200

Lucky draw voucher	500
Internet data bundles for literature review	4000
TOTAL	11 777

3.4 Limitations

As this study relied on internet access for the delivery of the survey, the response rate decreased as not all dieticians in South Africa have internet access. In addition, not all dieticians who gave informed consent completed the study. During the sampling process, no randomisation was done and the results of this study will not be generalized to the study population.

A limitation of the study was that the online survey did not include a question on whether the participant wore an N-95 respirator each time when in contact with a TB patient.

For dieticians whose first language is not English, a possibility for misinterpretation of questions existed. The questionnaire could be translated into different languages to address this limitation.

Social desirability bias can exist where self-reported action and direct measures differed (Prince *et al.*, 2008). Social desirability bias where participants would answer certain questions according to their knowledge of a desired action instead of their actual action was reduced as the questionnaire was anonymous and could be completed from any device and location where the participant had internet access (Beauchair *et al.*, 2013). However, social desirability bias could have influenced reported experiences, as the researcher did not rely on directly observed actions to verify reported experiences.

3.5 Summary

This chapter contained the research design and methods employed to conduct the study. A quantitative, descriptive, cross-sectional research design was applied. The data collection instrument was an online survey. The aim of the online survey was to collect data to ascertain the knowledge, attitudes and experiences of dieticians in South Africa regarding TB at the workplace. For each of the variables, namely,

knowledge, attitudes and experiences, dimensions were formed and data analysis was done within these dimensions. Throughout the research study, the researcher considered and maintained ethical principles. Data analysis was done with assistance from the Unit for Statistical Consultation. A comprehensive description of the results is presented in the next chapter.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter describes the results from the online survey (Addendum B). Data was gathered from a sample of dieticians in South Africa.

Results are presented according to the variables identified through the objectives of this study. The researcher aimed to describe each variable according to the dimensions that constitute the specific variable as described in Chapter 3. A systematic approach was applied when presenting each of the findings.

Descriptive and inferential statistics were applied to present the results. Tables and figures are used to present certain findings. An asterisk was used to indicate significant findings ($p < 0.05$).

4.2 Demographics

The sample consisted of 97% females ($n=99$), with the majority (57%; $n=58$) in the age group 20 to 29 years (Table 4.1). All participants were registered with the HPCSA.

In this sample, 25% ($n=26$) of dieticians were in KwaZulu-Natal, 21% ($n=21$) in Gauteng, 16% ($n=16$) in the Eastern Cape and 16% ($n=16$) in the Western Cape.

Seventy three percent ($n=74$) of dieticians were working in government settings, which included hospitals (67%; $n=68$) and clinics (6%; $n=6$). Other work settings included private practice (10%; $n=10$), private hospitals (6%; $n=6$), private clinics (1%; $n=1$) or other settings (11%; $n=11$).

In this sample, 68% ($n=69$) were employed in their current work setting for less than five years (Table 4.1).

Regarding regularity of exposure to TB, 50% ($n=51$) of the sample reported being exposed to TB patients on a daily basis and 18% ($n=18$) on a weekly basis.

With regards to internet access, results indicated that 79% ($n=81$) of this sample easily accessed the internet, with 14% ($n=14$) reporting that internet access was

available but not convenient, 6% (n=6) reported internet access was difficult and 1% (n=1) reported not having access to the internet.

Table 4.1: Demographics according to work setting (n=102)

	Government (n=74)		Other settings (n=28)	
	n	%	n	%
Gender				
Male	72	71	27	26
Female	2	2	1	1
Age				
20 to 29	49	48	9	9
30 to 39	19	19	8	8
40 to 49	4	4	8	8
50 to 59	1	1	3	3
60 and older	1	1	0	0
Province as registered with the HPCSA				
KwaZulu-Natal	24	24	2	2
Gauteng	12	12	9	9
Eastern Cape	10	10	6	6
Western Cape	12	12	4	4
Mpumalanga	6	6	1	1
Free State	2	2	4	4
Northern Cape	4	4	1	1
North West	3	3	0	0
Limpopo	2	2	0	0
Regularity of exposure to TB				
Daily	50	49	1	1
Weekly	16	16	2	2
Monthly	8	8	10	10
Never	0	0	15	15
Number of years working in current work setting				
0 to 5	56	55	13	13
6 to 10	12	12	7	7
11 or more	6	6	8	8
Patients are usually				
Adults	17	17	12	12
Children	6	6	2	2
Both	51	50	14	14
Previous employment				
Government Hospital	39	38	16	16
Private Hospital	1	1	1	1
Government Clinic	7	7	2	2
Private Clinic	2	2	1	1
None	18	18	1	1
Other	7	7	7	7
Number of years working in previous work setting				
0 to 5	63	62	18	18
6 to 10	6	6	5	5
11 or more	5	5	5	5

4.3 Knowledge

Knowledge is described according to its dimensions as listed in Chapter 3, Table 3.1.

The Cronbach's α coefficients were excellent for administrative control measures (National TB Management Guidelines) (0.82) and signs and symptoms of TB (0.82), but was not acceptable for TB transmission (0.24). Results regarding TB transmission should thus be treated with caution.

Administrative control measures (National TB Management Guidelines)

As reflected in Table 4.2, the knowledge of the dieticians in the sample was good, with most of the sample correctly answering all questions regarding the National TB Management Guidelines.

The majority of dieticians (98%; n=100) knew that finishing TB treatment was critical and 97% (n=99) knew that family members of TB patients need to know how to protect themselves from becoming infected. Most dieticians in this sample knew that infection control measures could prevent TB transmission (93%; n=95), that routine education to staff and patients on symptoms of TB should be done (92%; n=94) and that educating patients on respiratory hygiene should be done (92%; n=94) (Table 4.2).

In the sample, 89% (n=91) knew that hand washing after sputum collection was necessary and only 81% (n=83) knew that collection of sputum samples should be done away from other people, in a well-ventilated area with prompt follow-up of results. Knowledge that early recognition of suspected TB cases involved screening for the presence of a cough lasting for longer than two weeks was displayed by 84% (n=86) of the sample. In addition, 75% (n=76) of the sample knew that an infection control officer should be responsible for documenting the policy and arranging training for personnel while only 67% (n=68) knew that TB patients should be separated from others in the general waiting area.

Table 4.2: Knowledge of administrative control measures (n=102)

Statement	Correct		Incorrect		Unsure	
	n	%	n	%	n	%
Finishing TB treatment is critical	100	98	0	0	2	2
Family members of TB patients need to know how to protect themselves from getting infected	99	97	0	0	3	3
TB infection control measures can prevent TB transmission	95	93	4	4	3	3
Educating staff members and patients on symptoms of TB should be done routinely in the health care facility	94	92	0	0	8	8
Educating patients on respiratory hygiene e.g. covering the mouth and nose when coughing	94	92	1	1	7	7
Hand washing after sputum collection is necessary	91	89	1	1	10	10
Early recognition of suspected TB cases involves screening for the presence of a cough lasting for more than 2 weeks	86	84	4	4	12	12
Collection of sputum samples away from other people, in a well-ventilated area as well as prompt follow-up of results	83	81	2	2	17	17
An infection control officer should be responsible for documenting the policy and arranging training for personnel	76	75	3	3	23	23
Separation of TB patients from the general waiting area	68	67	16	16	18	18

Thus, knowledge gaps existed especially in relation to separation of TB patients from the general waiting area and that an infection control officer should be responsible for documenting the policy and arranging training for personnel.

Transmission of TB

Four of the five questions in this section were correctly answered by over two-thirds of the sample (see Table 4.3). However, only 42% of the sample correctly answered the remaining question.

Of the sample, 96% (n=98) knew that HIV-infected individuals are more at risk to contract TB than HIV-negative individuals and 95% (n=97) of dieticians knew that TB is transmitted through the air.

Knowledge that N-95 respirators protect HCPs and visitors by stopping TB particles from being inhaled was displayed by 71% (n=72) of the sample. Only 68% (n=69) of dietitians knew that patients with active TB disease are more likely to infect others if they have a productive cough that produces a lot of sputum.

Inadequate knowledge was demonstrated for the question on whether patients with active TB disease could infect others by talking, since only 42% (n=43) answered correctly (Table 4.3).

Table 4.3: Knowledge of TB transmission (n=102)

Question	Correct		Incorrect		Unsure	
	n	%	n	%	n	%
HIV-infected patients are more vulnerable to contracting TB than HIV-negative patients	98	96	2	2	2	2
TB is often spread from person to person through the air	97	95	3	3	2	2
N95s protect HCP and visitors by stopping TB particles from being breathed in	72	71	5	5	25	25
Patients with active TB disease are more likely to infect others if they have a cough that produces a lot of sputum	69	68	14	14	19	19
Patients with active TB disease can infect people by talking	43	42	45	44	14	14

Signs and symptoms of TB

The majority of the dietitians in the sample were able to correctly identify weight loss (100%; n=102), tiredness/malaise (97%; n=99) and coughing for more than two weeks (95%; n=97) as signs or symptoms of TB. However, 7% (n=7) of the sample answered incorrectly that fever was not a symptom of TB. They also incorrectly identified dizziness (29%; n=30), having many bacterial infections (31%; n=32), and coughing up blood (82%; n=84) as signs or symptoms of TB (Table 4.4).

Table 4.4: Knowledge of TB signs and symptoms (n=102)

	Correct		Incorrect		Unsure	
	n	%	n	%	n	%
Correct signs/ symptoms						
Weight loss (yes)	102	100	0	0	0	0
Tiredness/ malaise (yes)	99	97	1	1	2	2
Coughing for more than two weeks (yes)	97	95	3	3	2	2
Fever (yes)	89	87	7	7	6	6
Incorrect signs/ symptoms						
Pain with urination (no)	79	77	3	3	20	20
Memory loss (no)	78	76	6	6	18	18
Blurry vision (no)	74	73	6	6	22	22
Watery eyes (no)	73	72	8	8	21	21
Ear pain (no)	72	71	9	9	21	21
Dizziness (no)	57	56	30	29	15	15
Many bacterial infections (no)	47	46	32	31	23	23
Coughing up blood (no)	11	11	84	82	7	7

4.4 Attitudes

Attitudes were described according to its dimensions as listed in Chapter 3 (Table 3.2). Dieticians' attitudes towards most statements were positive based on the mean values, as listed in Table 4.5. The maximum mean value obtainable in this section using Likert scales, was "5" ("strongly agree").

The Cronbach's α coefficient was determined for each dimension. Unacceptable internal consistencies were found for transmission threat (Cronbach's α coefficient=0.38), TB infection control (Cronbach's α coefficient=0.22) and human resources (Cronbach's α coefficient=0.34). Results should thus be treated with caution.

Excellent internal consistencies revealed by the Cronbach's α coefficients were found for fears (0.89) and specific fears (0.86).

Transmission threat

Most dietitians (99%; n=102) reported that if they recognised TB symptoms in themselves, they would want to get tested as soon as possible (Mean = 4.92; SD = 0.44). Results indicated that most dietitians (89%; n=91) would like for all HCPs to be screened for TB routinely (Mean = 4.51; SD = 0.78). Dietitians felt it was important for TB patients in the facility to wear N-95 respirators (Mean = 4.35, SD = 0.96).

Although most dietitians (75%; n=77) strongly agreed or agreed with the statement that if N-95 respirators were always available in their health facility, they would always use them when dealing with TB patients (Mean = 4.30, SD = 1.06), nine percent (n=9) strongly disagreed or disagreed with this statement (see Table 4.5).

TB infection control

All dietitians strongly agreed or agreed that they felt it was important to adhere to TB guidelines and policies (Mean = 4.93; SD = 0.25). Most dietitians (86%; n=88) indicated that they felt priority should be given to TB infection control measure issues at work (Mean = 4.31; SD = 0.76) (Table 4.5).

Dietitians viewed TB as a major public health threat (Mean = 4.64, SD = 0.64), but also viewed TB as a fully treatable disease (Mean = 4.48, SD = 0.73).

Stigmatising attitudes

Disparity existed between two attitudes, both reflecting stigma. Although 87% (n=88) of dietitians strongly disagreed or disagreed with the statement that if they were diagnosed with TB, they would hide it from their colleagues (Mean = 4.54, SD = 0.88), 27% (n=27) strongly agreed or agreed with the statement that they feared the social stigma attached to having TB at work (Mean = 2.58; SD = 1.36) (see Table 4.5 and Table 4.6).

Human resources (Facility-level infection control measures)

Favourable attitudes were also that 91% (n=93) of the sample wanted to increase their TB knowledge (Mean = 4.40, SD = 0.72) and 83% (n=85) indicated that they would like more TB training to take place at work (Mean = 4.27; SD = 0.76). The

question whether there were sufficient personnel to educate TB patients adequately in their health facility scored the lowest, as 29% (n=30) of dieticians disagreed or strongly disagreed with the statement (Mean = 3.09; SD = 1.17).

Table 4.5: Attitudes according to its dimensions (n=102)

Statement	Mean	SD	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
			n	%	n	%	n	%	n	%	n	%
Transmission threat												
If I recognize TB symptoms in myself, I want to get tested as soon as possible	4,92	0,44	1	1	0	0	0	0	4	4	97	95
I would like for all HCP to be screened for TB routinely	4,51	0,78	1	1	1	1	9	9	25	25	66	65
I feel it is important for TB patients in the facility to wear N-95 respirators (masks)	4,35	0,96	1	1	5	5	14	14	19	19	63	62
If N-95 respirators (masks) were always available in my health facility, I would always use them when dealing with TB patients	4,30	1,06	1	1	8	8	16	16	11	11	66	65
TB infection control												
I feel adherence to TB guidelines and policies are important	4,93	0,25	0	0	0	0	0	0	7	7	95	93
I feel that TB is a major public health threat	4,64	0,64	0	0	1	1	6	6	22	22	73	72
I view TB as a fully treatable disease	4,48	0,73	0	0	3	3	5	5	34	33	60	59
I feel that priority should be given to TB infection control measure issues at work	4,31	0,76	0	0	2	2	12	12	40	39	48	47
Stigmatising attitudes												
If I was diagnosed with TB, I would hide it from my colleagues	4,54	0,88	74	73	14	14	11	11	1	1	2	2
Human resources (Facility-level infection control measures)												
I want to increase my TB knowledge	4,40	0,72	1	1	0	0	8	8	41	40	52	51
I would like it if more TB training at work took place	4,27	0,76	0	0	1	1	16	16	39	38	46	45
I feel that in the health care facility	3,09	1,17	11	11	19	19	35	34	24	24	13	13

where I work there are sufficient personnel to educate TB patients adequately												
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Fears

Attitudes regarding the fear of contracting TB and the fear of contracting DR-TB were negative as the mean scores were below 2.6.

In the sample, 46% (n=46) reported that they feared contracting TB (Mean = 3.28; SD = 1.28) and 20% (n=20) reported that this fear affected their interaction with patients (Mean = 2.30; SD = 1.27). Similarly, 45% (n=45) of the sample feared contracting drug-resistant TB at work (Mean = 3.20; SD = 1.40) and 27% (n=27) strongly agreed or agreed that this fear affected their interaction with patients (Mean = 2.51; SD = 1.36) (Table 4.6).

Specific fears regarding TB are summarised in Table 4.6. Results indicated that 83% (n=85) of dieticians feared suffering from the side-effects caused by TB treatment (Mean = 4.10; SD = 1.06), 76% (n=78) feared the long-term effect of having TB on their health (Mean = 4.07; SD = 1.15), 70% (n=71) feared the long process of recovery (Mean = 3.77; SD = 1.23) and 66% (n=67) feared infecting their friends and family at home (Mean = 3.75; SD = 1.43).

Table 4.6: Fears related to TB (n=102)

Statement	Mean	SD	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
			n	%	n	%	n	%	n	%	n	%
Fears												
I am worried about getting TB at work	3,28	1,28	12	12	15	15	29	28	24	24	22	22
I am worried about getting drug-resistant TB at work	3,20	1,40	18	18	13	13	26	25	21	21	24	24
My fear of contracting drug-resistant TB at work affects my interaction with patients	2,51	1,36	30	29	29	28	16	16	15	15	12	12
My fear of contracting TB at work affects my	2,30	1,27	35	34	29	28	18	18	12	12	8	8

interaction with patients													
I fear													
Suffering from side-effects caused by TB treatment	4,10	1,06	5	5	5	5	7	7	43	42	42	41	
Long-term effect on health in future	4,07	1,15	3	3	12	12	9	9	29	28	49	48	
The long process of recovery	3,77	1,23	7	7	12	12	12	12	37	36	34	33	
Infecting my family and friends at home	3,75	1,43	13	13	10	10	12	12	22	22	45	44	
A long hospital stay	3,70	1,23	7	7	12	12	19	19	31	30	33	32	
Having to rely on others/ a loss of independency	3,61	1,24	7	7	15	15	19	19	31	30	30	29	
Neglecting my family responsibilities	3,45	1,35	13	13	12	12	22	22	26	25	29	28	
Financial strains from an uncertainty regarding future employment	3,39	1,36	11	11	20	20	17	17	26	25	28	27	
Difficulty to adhere to treatment	2,64	1,53	37	36	18	18	7	7	25	25	15	15	
Fear of stigma													
I fear the social stigma attached to having tuberculosis at work	2,58	1,36	30	29	22	22	23	23	15	15	12	12	

4.5 Experiences

The Cronbach's α coefficient was determined for each dimension that constitutes experiences as a variable, as described in Chapter 3 (Table 3.3). Where the Cronbach's α coefficient for dimensions was poor or unacceptable, the results should be treated with caution.

Facility-level control measures

The Cronbach's α coefficient indicated that the internal consistency for experiences regarding facility-level control measures was poor (0.53).

Only 45% (n=38) of the sample reported that there was a TB infection control plan in place at their workplace. Infection control audits were reported by 53% (n=46) of dieticians. Having a written personal protective equipment plan in facilities was reported by only 36% (n=32) of this sample. In the sample, 24% (n=20) reported that

no area was designated to separate MDR-TB cases or suspected MDR-TB cases at the health facility (see Table 4.7).

Although 50% (n=43) of dieticians reported that HCP were trained on TB infection control policies, only 23% (n=20) of dieticians reported that they had received training on TB infection control (Table 4.7).

Administrative control measures

Dieticians' experiences of TB in the workplace regarding administrative control measures are summarised in Table 4.7. The internal consistency for this section was excellent (Cronbach's $\alpha=0.80$).

Only 60% (n=51) of the sample reported that there was someone in charge of TB infection control at the healthcare facility. The majority (81%; n=69) of the sample reported that early testing and diagnosis of TB and subsequent initiation onto TB treatment was regarded as important in the facility where they worked, and 75% (n=65) reported that they could get screened for TB at their workplace (Table 4.7).

Environmental control measures

Experiences regarding environmental control measures had an unacceptable level of internal consistency (Cronbach's $\alpha=0.18$).

Natural ventilation was reported by 76% (n=68) of the sample, and 71% (n=64) reported an open windows policy. However, 33% (n=26) of the sample reported that the room of a TB patient was not well ventilated.

Only 14% (n=12) of the sample reported that environmental controls were periodically maintained with results written down in registers and nine percent (n=8) reported that it was not done (see Table 4.7).

Personal protective equipment

Availability of N-95 respirators was reported by 76% (n=69) of this sample. Nine percent of the sample (n=8) reported that N-95 respirators were not available and 15% (n=14) reported that they did not know whether the respirators were available (see Table 4.7).

Table 4.7: Experiences according to its dimensions

Question	n	Yes		No		Unsure	
		n	%	n	%	n	%
Facility-level control measures							
Are there any areas designed to separate MDR-TB suspected or confirmed cases?	83	47	57	20	24	16	19
Are infection control audits performed at your workplace?	86	46	53	7	8	33	38
Are healthcare professionals trained on TB infection control policies?	86	43	50	10	12	33	38
Is there a written TB infection control plan in place at your workplace?	85	38	45	5	6	42	49
Is there a written PPE infection control plan in the healthcare facility?	89	32	36	8	9	49	55
Have you received training on TB infection control?	88	20	23	68	77	0	0
Administrative control measures							
Is early testing, diagnosis and initiation onto TB treatment regarded as important in the facility where you work?	85	69	81	4	5	12	14
Can you get screened for TB at your workplace?	87	65	75	5	6	17	20
Is there someone in charge of TB infection control at the healthcare facility?	85	51	60	7	8	27	32
Environmental control measures							
The room of a TB patient is well ventilated e.g. open windows, fans, HEPA filters/ UV lights	79	53	67	26	33	0	0
Are environmental controls periodically maintained with results written down in registers?	88	12	14	8	9	68	77
Personal protective equipment							
Are there N-95 respirators (masks) available for staff to use?	91	69	76	8	9	14	15

Frequency with which certain administrative control measures took place

The frequency with which certain administrative control measures took place are summarised in Figure 4.1 and Figure 4.2. The internal consistency for this section was good (Cronbach's $\alpha=0.78$).

Aspects of the National TB Management Guidelines that were done "seldom" or "never" included attendance of TB training, availability of education material to give to a newly diagnosed TB patient, education given on TB infection control to patients and triage of coughing patients to ensure shorter waiting times in the general waiting area.

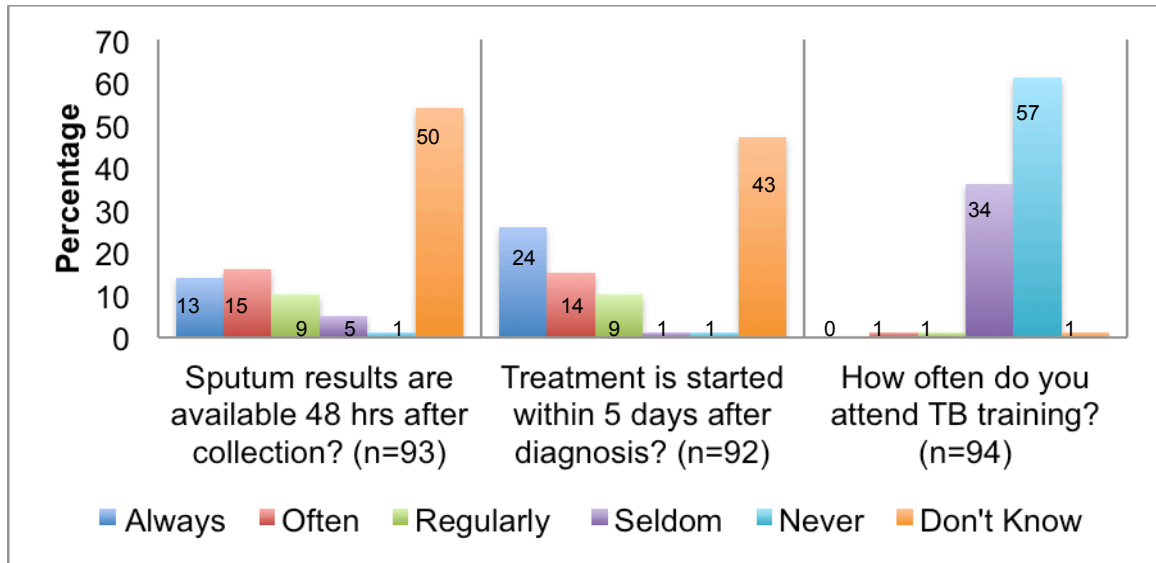


Figure 4.1: Frequency with which certain administrative control measures took place

The frequency that sputum results were available 48 hours after collection was reported by 14% (n=13) of the sample as “always”, 16% (n=15) as “often” and 10% (n=9) as “regularly”. Only five percent (n=5) of the sample reported this occurred “seldom” and one percent (n=1) that it occurred “never”. Results showed that 54% (n=50) of the sample did not know whether results were available 48 hours after collection of sputum.

Almost half of the sample (47%; n=43) reported not knowing whether TB treatment was started within five days of diagnosis. The frequency that treatment was started within five days of diagnosis was reported by 26% (n=24) of the sample as “always”, 15% (n=14) as “often” and 10% (n=9) as “regularly”. Only percent (n=1) indicated this happened “seldom” and one percent (n=1) that it “never” happened.

Regular attendance of TB training was not reported, as 36% (n=34) of the sample reported “seldom” attending training on TB and 61% (n=57) reported that they “never” attended such training.

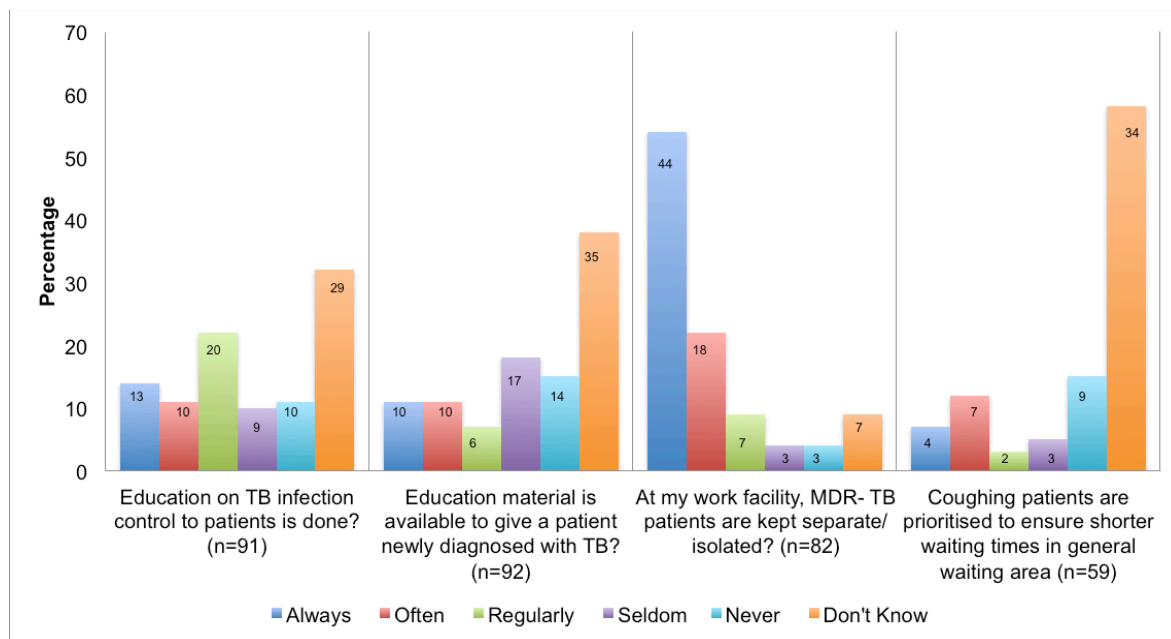


Figure 4.2: Frequency that certain administrative control measures took place (continued)

As illustrated by Figure 4.2, 18% (n=17) of the sample indicated that education material was “seldom” available to give to patients, and 15% (n=14) indicated that it was “never” available. Only 11% (n=10) of the sample reported that education material to give to a patient was “always” available. Results showed that 38% (n=35) of the sample did not know whether education material was available to give to newly diagnosed patients with TB. Almost a third (32%; n=29) of dieticians in the sample reported not knowing whether patient education on TB infection control took place. In the sample, 10% (n=9) reported that education on TB infection control was “seldom” done and 11% (n=10) indicated that it was “never” done.

The majority of dieticians (54%; n=44) reported that MDR-TB patients were “always” kept separate or in isolation. However, four percent (n=3) of the sample indicated these patients were “seldom” kept separate and four percent (n=3) reported that these patients were “never” kept separate.

Of the dieticians in the sample who worked in a clinic setting, 15% (n=9) reported that coughing patients were “never” prioritised to ensure shorter waiting times in the general waiting area. In this sample, 58% (n=34) reported not knowing whether coughing patients were prioritised to ensure short waiting times in the general

waiting area. Only seven percent (n=4) of the sample reported that these patients were “always” prioritised to ensure shorter waiting times (Figure 4.2).

Exposure to TB patients

Regularity of exposure to TB patients was evaluated. In the sample, 32% (n=31) reported that they “always” work with TB patients, 35% (n=34) of dieticians reported that they “often” work with TB patients and 16% (n=16) of the sample indicated that they “regularly” work with TB patients.

4.6 Personal behaviour

The personal behaviour of the sample are summarised according to a personal risk of TB and administrative control measures.

Personal risk

In the sample, 32% (n=28) reported that they neglected infection control measures when working with TB patients despite being aware of the risks (see Figure 4.2).

Administrative control measures

The Cronbach’s α coefficient indicated that the internal consistency for personal behaviour regarding administrative control measures was acceptable (0.60). Approximately half (48%; n=49) of the sample had been tested for TB and 36% (n=37) were tested for TB at their workplace.

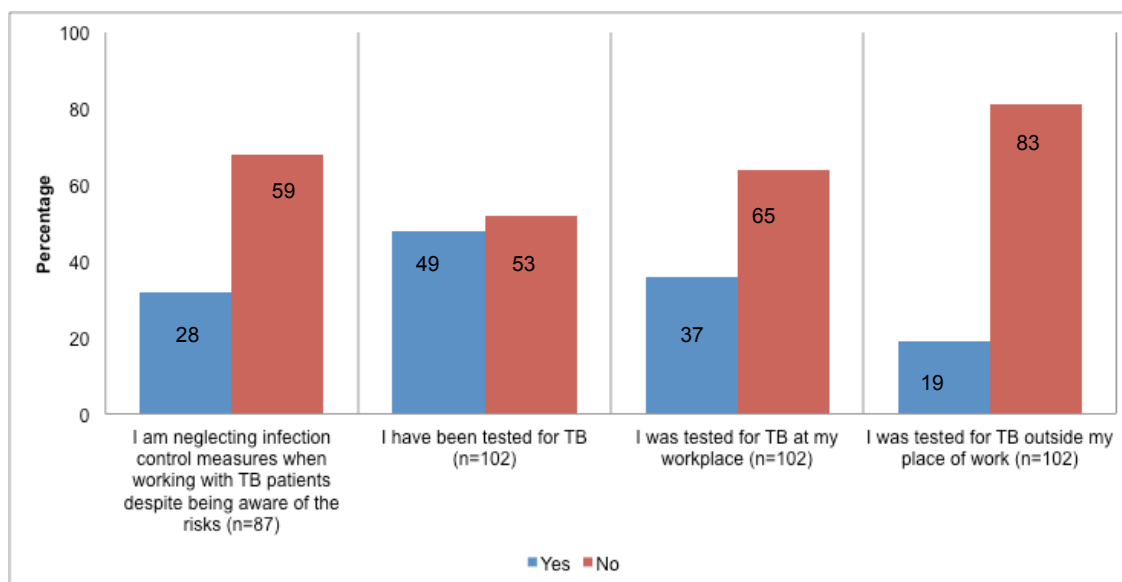


Figure 4.3: Personal behaviour regarding TB

Section 12 of the survey was not completed correctly. This section was intended only for those in the sample with a current or previous diagnosis of TB (n=4), but 28 dieticians completed this section, therefore results were not interpreted.

4.7 Associations between variables

According to the objectives of the study, associations between the variables were also determined and are presented in the following sections. P-values with an asterisk indicate significant findings (Significance level=0.05).

4.7.1 Knowledge, attitudes and experiences according to regularity of exposure to TB patients

Comparison of the variables was done between two groups, namely dieticians in the sample who treated TB patients daily and dieticians who treated TB patients less frequently. Significant associations regarding the dimensions for knowledge, attitudes and experiences based on the regularity of exposure to TB patients are summarised in Table 4.8 on page 107.

Knowledge

Significant differences of medium effect sizes existed between the two groups regarding knowledge of the National TB Management Guidelines (t-test=2.15; p=0.035; Cohen's D =0.59) and knowledge of transmission of TB (t-test=2.06; p=0.044; Cohen's D=0.56). For these two dimensions of knowledge, dieticians who

treated TB patients daily displayed better knowledge than those who treated TB patients less frequently (Table 4.8 on page 107).

No significant difference was found between the two groups regarding knowledge of the signs and symptoms of TB ($p=0.078$) (Table 4.8 on page 107).

Attitudes

A significant difference of medium effect size was found between the two groups regarding human resources ($t\text{-test}=2.47$; $p=0.016$; Cohen's $D=0.68$) (Table 4.8 on page 107). Thus, dieticians who treated TB patients daily had more favourable attitudes regarding wanting to increase their TB knowledge, wanting more TB training at work and having sufficient personnel to educate patients adequately, compared to those who treated TB patients less frequently.

No significant differences were found between the two groups regarding:

- Transmission threat ($p=0.855$);
- TB infection control ($p=0.704$);
- Stigmatising attitudes ($p=0.471$); or
- Fears ($p=0.439$) (Table 4.8 on page 107).

A significant difference was found between the two groups regarding whether they would always use N-95 respirators when dealing with TB patients ($\text{Chi}^2=7.71$, $df=2$, $p=0.021$). Cramer's V ($=0.27$) indicated that the strength of this association was small.

A significantly larger proportion of dieticians who treated TB patients on a daily basis reported being worried about contracting TB compared with those who treated patients less frequently ($\text{Chi}^2=14.16$, $df=2$, $p=0.001$). Cramer's V (0.37) indicated that the strength of this association was medium (Table 4.9 on page 108).

Experiences

No significant differences existed between the two groups regarding:

- Facility-level control measures (p=0.390);
- Administrative control measures (p=0.207);
- Environmental control measures (p=0.247); or
- Personal protective equipment (p=0.675) (Table 4.8 on page 107).

No significant differences were found between the two groups regarding whether they had received TB training ($\text{Chi}^2=0.09$, $\text{df}=1$, $p=0.761$) or whether N-95 respirators were available for staff to use ($\text{Chi}^2=2.70$, $\text{df}=1$, $p=0.100$) (Table 4.9 on page 108).

No significant differences were found between the two groups for personal behaviour regarding personal risk of TB ($p=0.407$) or administrative control measures ($p=0.250$) (Table 4.8).

Table 4.8 Associations between dimensions of knowledge and attitudes and the regularity of exposure to TB patients

Variables	Daily (n=51)		Less frequently (n=51)		Inferential statistics		
	Mean	SD	Mean	SD	t-test	p-value	Cohen's D
Knowledge							
Administrative control measures (National TB Management Guidelines)	90.20	12.41	78.89	31.60	2.15	0.035*	0.59
TB transmission	78.92	22.84	64.58	31.87	2.06	0.044*	0.56
Signs and symptoms	15.49	3.72	13.43	5.38	1.79	0.078	
Attitudes							
Human resources (Facility-level control measures)	62.22	10.72	55.19	9.37	2.47	0.016*	0.68
Transmission threat	72.06	7.95	71.67	7.28	0.18	0.855	

Infection control	70.98	9.85	70.00	7.86	0.38	0.704	
Stigma	71.37	18.44	67.78	17.00	0.72	0.471	
Fears	34.80	19.85	39.17	22.05	-0.78	0.439	
Experiences							
Facility-level control measures	46.57	27.55	39.81	30.99	0.87	0.390	
Administrative control measures	16.21	5.38	14.07	7.88	1.27	0.207	
Environmental control measures	40.20	28.32	30.56	34.89	1.17	0.247	
Personal protective equipment	82.35	38.50	77.78	42.78	0.42	0.675	
Personal behaviour							
Personal risk of TB	66.67	47.61	55.56	51.13	0.84	0.407	
Administrative control measures	38.56	34.24	27.78	32.84	1.16	0.250	

Table 4.9: Attitudes and experiences according to the regularity of exposure to TB patients

Question	Daily TB exposure (n=51)		Less frequent exposure (n=51)		p-value
	n	%	n	%	
Attitudes (Transmission threat): If N-95 respirators were always available in my health facility, I would always use them when dealing with TB patients (n=102)					
Agree and Strongly Agree	38	75	39	76	0.021*
Neutral	5	10	11	22	
Disagree and Strongly Disagree	8	16	1	2	
Attitudes (Fears): I am worried about getting TB at work (n=102)					
Agree and Strongly Agree	32	63	14	27	0.001*
Neutral	12	24	17	33	
Disagree and Strongly Disagree	7	14	20	39	

Experiences (Facility-level control measures): Have you received training on TB infection control? (n=88)					
Yes	11	22	9	24	0.761
No	40	78	28	76	
No and Unsure	9	18	13	33	
Experiences (Personal protective equipment): Are there N-95 respirators available for staff to use? (n=91)					
Yes	42	82	27	68	0.100
No and Unsure	9	18	13	33	
Personal behaviour (Personal risk of TB): I am neglecting infection control measures when working with TB patients despite being aware of the risks (n=87)					
Yes	17	33	11	31	0.785
No	34	67	25	69	
p-Values are for Chi ² tests of independence to test if regularity of exposure to TB patients was related to the reported variables (Significance level=0.05).					

In summary, significant differences of medium importance were found between dieticians who treated TB patients daily compared to dieticians who treat TB patients less frequently. Dieticians treating TB patients daily had better knowledge of the National TB Management Guidelines and TB transmission. As the Cronbach's α coefficient was excellent for knowledge regarding National TB Management Guidelines, this finding is of importance.

In addition, more favourable attitudes regarding human resources were found in the group of dieticians who treated TB patients daily compared to dieticians who treated TB patients less frequently. However, this result should be treated with caution based on the unacceptable Cronbach's α coefficient for human resources.

However, a significantly larger proportion of dieticians who treated TB patients on a daily basis indicated that they were worried about contracting TB at work compared with those who treated patients less frequently.

4.7.2 Knowledge, attitudes and experiences according to work setting

A comparison of the variables was done between two groups, namely dietitians employed in government settings (hospitals and clinics) and dietitians employed in other work settings.

Knowledge

A significant difference was found between dietitians working in government settings compared with dietitians working in other settings regarding the National TB Management Guidelines (t-test=2.04; p=0.044; Cohen's D=0.45). Cohen's D indicated that this was of small practical significance (Table 4.10 on page 112).

Dietitians working in government settings also had improved knowledge of the signs and symptoms of TB compared with dietitians employed in other settings (t-test=2.47; p=0.015; Cohen's D=0.55). Cohen's D indicated this findings was of medium practical significance (Table 4.10 on page 112).

A significantly larger proportion of dietitians working outside of the government settings knew that patients with active TB disease could infect others by talking when compared with dietitians working in government settings ($\text{Chi}^2=5.45$, $\text{df}=1$, $p=0.02$). However, Cramer's V indicated the strength of association was small ($V=0.023$) (Table 4.11 on page 113).

Attitudes

Attitudes regarding human resources (Facility-level control measures) was significantly different between the two groups (t-test=3.16; p=0.002; Cohen's D=0.70) and this finding was of medium effect size (Table 4.10 on page 112).

A significant difference of large practical significance was found between the two groups regarding fears (t-test=-4.79; $p<0.0005$; Cohen's D=1.06). A larger proportion of dietitians in government sector reported being worried about contracting TB at work and that this fear affected their interaction with TB patients, compared with those in other settings (Table 4.10).

A significant difference was found regarding dietitians in government sector who feared the social stigma of having TB at work ($\text{Chi}^2=6.38$, $\text{df}=2$, $p=0.041$) compared

with other work settings, although according to Cramer's V the strength of association was small ($=0.25$) (Table 4.11).

Experiences

Significant differences were found between dieticians employed in government settings compared with dieticians employed in other settings for experiences regarding:

- Facility-level infection control ($p < 0.0005$);
- Administrative control measures ($p < 0.0005$);
- Environmental control measures ($p = 0.001$); and
- Personal protective equipment ($p < 0.0005$) (Table 4.10 on page 112).

Dieticians working in government settings achieved better adherence to these infection control measures than dieticians in other work settings. Based on the Cohen's D values for facility-level control measures, administrative control measures and personal protective equipment, the effect size was large.

A significantly smaller proportion of dieticians working in the government sector (18%) reported that they had received training on TB infection control, compared with dieticians in other work settings (50%) ($\text{Chi}^2 = 7.05$, $\text{df} = 1$, $p = 0.008$). However, Cramer's V indicated the strength of association was small (Cramer's $V = 0.28$) (Table 4.11).

A significantly larger proportion of dieticians employed in government settings were exposed to TB patients, compared with dieticians employed in other settings ($t\text{-test} = -4.83$; $p < 0.0005$; Cohen's $D = 1.15$) and Cohen's D indicated this was of large practical significance (Table 4.10 on page 112).

Personal behaviour

A significant difference was found between the two work settings for dieticians who reported that they neglected infection control measures when working with TB patients ($\text{Chi}^2 = 1.98$, $\text{df} = 1$, $p = 0.16$) (Table 4.11).

Table 4.10: Significant associations between the dimensions of knowledge, attitudes and experiences and work settings.

Variables	Government (n=74)		Other (n=28)		Inferential statistics		
	Mean	SD	Mean	SD	t-test	p-value	Cohen's D
Knowledge							
Administrative control measures (National TB Management Guidelines)	89.32	16.08	80.36	27.42	2.04	0.044*	0.45
TB transmission	74.83	25.38	67.86	31.81	1.15	0.252	
Signs and symptoms	15.00	4.17	12.62	4.75	2.47	0.015*	0.55
Attitudes							
Human resources (Facility-level control measures)	60.63	10.65	52.62	13.25	3.16	0.002*	0.70
Transmission threat	71.82	7.61	71.79	7.10	0.02	0.981	
Infection control	70.95	9.20	69.11	9.33	0.90	0.372	
Stigma	70.81	17.89	70.71	16.76	0.02	0.980	
Fears	37.43	21.10	59.64	20.27	-4.79	<0.0005*	1.06
Experiences							
Facility-level control measures	44.93	29.19	19.05	30.33	3.95	<0.0005*	0.88
Administrative control measures	15.50	6.25	3.10	5.59	9.19	<0.0005*	2.04
Environmental control measures	37.84	30.76	16.07	27.40	3.28	0.001*	0.73
Personal protective equipment	79.73	40.48	35.71	48.80	4.63	<0.0005*	1.03
Exposure to TB patients	18.38	18.36	40.87	22.95	-4.83	<0.0005*	1.15
Personal behaviour							
Administrative control measures	34.23	34.00	34.52	35.70	-0.04	0.970	

Table 4.11: Knowledge, attitudes and experiences according to work setting

	Government (n=74)		Other (n=28)		p-value
Question	n	%	n	%	
Knowledge (Transmission of TB): Patients with active TB disease can infect people by talking (n=102)					
Yes (correct)	26	35	17	61	0.020*
No and Unsure	48	65	11	39	
Attitudes (Transmission threat): If N-95 respirators were always available in my health facility, I would always use them when dealing with TB patients (n=102)					
Agree and Strongly Agree	57	77	20	71	0.180
Neutral	9	12	7	25	
Disagree and Strongly Disagree	8	11	1	4	
Attitudes (Fears): I am worried about getting TB at work (n=102)					
Agree and Strongly Agree	43	58	3	11	<0.0005*
Neutral	20	27	9	32	
Disagree and Strongly Disagree	11	15	16	57	
Attitudes (Stigmatising attitudes): I fear the social stigma attached to having tuberculosis at work (n=102)					
Agree and Strongly Agree	22	30	5	18	0.041*
Neutral	12	16	11	39	
Disagree and Strongly Disagree	40	54	12	43	
Experiences (Facility-level control measures): Have you received training on TB infection control? (n=88)					
Yes	13	18	7	50	0.008*
No	61	82	7	50	
Personal behaviour (Personal risk of TB): I am neglecting infection control measures when working with TB patients despite being aware of the risks (n=87)					
Yes	26	35	2	15	0.16
No	48	65	11	85	
p-Values are for Chi ² tests of independence to test if work setting was related to the reported					

variables (Significance level=0.05).

In summary, significant differences were found between dieticians in government settings compared with the dieticians employed in other settings. Improved knowledge regarding signs and symptoms (medium practical significance) was evident among dieticians in government setting compared with those in other settings. Cronbach's α coefficients were excellent for these dimensions.

A significantly larger proportion of dieticians employed in government settings were worried about contracting TB at work and reported that the fear of contracting TB impacted on their interaction with TB patients. Cronbach's α coefficient was excellent for the dimension on fears. Based on the Cohen's D value, this finding was of important practical significance.

Dieticians in government settings were more frequently exposed to TB patients. Cramer's V indicated a large strength of association.

A marked effect size was noted for experiences regarding facility-level control measures, administrative control measures and personal protective equipment. For these dimensions, improved adherence was achieved by dieticians working in government settings compared with dieticians employed in other settings. As the Cronbach's α coefficient was excellent for administrative control measures, this finding is of large practical significance. Thus, significantly more dieticians in government settings, in comparison to those in other settings, reported they had someone in charge of infection control, that they could get screened for TB at work and that early testing, diagnosis of TB and initiation onto treatment was important in their health facility. Similarly, dieticians in government settings had improved availability of N-95 respirators compared with those in other settings. For facility-level control measures, the Cronbach's α coefficient was poor and therefore the results pertaining to this dimension should be treated with caution.

4.7.3 Knowledge, attitudes and experiences according to duration of employment in current work setting

For the purpose of this study, duration of employment in current setting was used to divide dietitians into two groups. Variables were compared between dietitians who have worked for less than five years, compared with dietitians working longer than five years. In this sample, 68% (n=69) of dietitians were in their current work setting for one to five years and 32% (n=33) for over five years.

Knowledge

No significant differences regarding the dimensions of knowledge was found between the two groups.

Attitudes

More favourable attitudes were found for adherence to infection control measures to decrease the threat of TB transmission among dietitians employed for longer than five years (Mean=75.00; SD=4.84) compared with dietitians working for up to five years (Mean=70.29; SD=7.99) (t-test=-3.12; p=0.002; Cohen's D=0.66). Based on the Cohen's D value (=0.66), this was of medium practical significance. Thus, a larger proportion of dietitians employed for over five years compared to those working less than five years, reported that they would like all HCPs to be screened for TB routinely, that they are tested as soon as possible if symptomatic of TB, that they felt patients should wear N-95 respirators and that they would wear N-95 respirators when dealing with TB patients. However, as the Cronbach's α coefficient for Transmission threat was unacceptable, this finding should be treated with caution.

Experiences

Dietitians working for longer than five years reported an increased frequency of exposure to TB patients (Mean=32.67; SD=23.18) compared with dietitians who were working for less than five years (Mean=19.70; SD=19.85) (t-test=-2.82; p=0.006; Cohen's D=0.62). Cohen's D indicated this finding was of medium practical significance.

In summary, dieticians who were employed for over five years were exposed to TB patients more frequently, compared with dieticians who were working for less than five years. This finding was of medium practical significance based on the Cohen's D value.

4.7.4 Knowledge, attitudes and experiences according to training

Variables were compared between dieticians who had attended TB infection control training and those who were not trained in TB infection control.

Knowledge and Attitudes

No significant difference in knowledge and attitudes were found between dieticians who attended TB infection control training compared with dieticians who did not attend training (see Table 4.12 and 4.13 on pages 117 and 118).

Experiences

Associations between experiences and training are summarised in Table 4.14 on page 119. Significant differences existed between dieticians who had received training compared with the dieticians who had not been trained regarding facility-level control measures (having a written TB infection control plan at the workplace) ($\text{Chi}^2=5.53$, $\text{df}=1$, $p=0.019$) and administrative control measures (having someone in charge of TB infection control at the health facility) ($\text{Chi}^2=6.77$, $\text{df}=1$, $p=0.009$). For both findings, Cramer's V indicated the strength of associations were small (Cramer's $V=0.26$ and Cramer's $V=0.28$, respectively).

A significant association existed between dieticians who had been trained compared with dieticians who had not been trained regarding PPE, as a larger proportion of trained dieticians reported that N-95 respirators were available for staff to use ($\text{Chi}^2=4.01$, $\text{df}=1$, $p=0.045$). Cramer's V of 0.22 indicated the strength of association was small.

A significant difference was found between the two groups regarding whether they neglected infection control measures when working with TB patients ($\text{Chi}^2=6.92$, $\text{df}=1$, $p=0.009$). Cramer's V of 0.29 indicated that the strength of association was small.

No significant difference existed between the two groups regarding the personal behaviour of being tested for TB ($\text{Chi}^2=1.87$, $\text{df}=1$, $p=0.171$).

Table 4.12: Associations between knowledge and previous training

Variable		Received training (n=20)		Did not receive training (n=68)		p-value
		n	%	n	%	
Knowledge (Administrative control measures)						
Separation of TB patients from the general waiting area is within the National TB Management Guidelines (n=88)	Yes (correct)	17	85	43	63	0.066
	No and Unsure	3	15	25	37	
Knowledge (Transmission of TB)						
Patients with active TB disease are more likely to infect others if they have a cough that produces a lot of sputum (n=88)	Yes (correct)	14	70	44	65	0.661
	No and Unsure	6	30	24	35	
Patients with active TB disease can infect people by talking (n=88)	Yes (correct)	10	50	24	35	0.235
	No and Unsure	10	50	44	65	
N95s protect HCP and visitors by stopping TB particles from being breathed in (n=88)	Yes (correct)	17	85	48	71	0.197
	No and Unsure	3	15	20	29	
Knowledge (Signs and symptoms of TB)						
Fever is a symptom of TB (n=88)	Yes (correct)	18	90	63	93	0.701
	No and Unsure	2	10	5	7	
p-Values are for Chi^2 tests of independence to test whether training received was associated with the reported variables (Significance level=0.05).						

Table 4.13: Associations between attitudes and previous training

Variable	Received training (n=20)		Did not receive training (n=68)		p-value
	n	%	n	%	
Attitudes (Transmission threat): If N-95 respirators were always available in my health facility, I would always use them when dealing with TB patients (n=88)					
Agree and Strongly Agree	19	95	48	71	0.072
Neutral	1	5	11	16	
Disagree and Strongly Disagree	0	0	9	13	
Attitudes (Fears): I am worried about getting TB at work (n=88)					
Agree and Strongly Agree	9	45	36	53	0.058
Neutral	3	15	21	31	
Disagree and Strongly Disagree	8	40	11	16	
Attitudes (Fears): My fear of contracting TB at work affects my interaction with patients (n=88)					
Agree and Strongly Agree	4	20	16	24	0.946
Neutral	3	15	10	15	
Disagree and Strongly Disagree	13	65	42	62	
Attitudes (Fears): I am worried about getting drug-resistant TB at work (n=88)					
Agree and Strongly Agree	11	55	32	47	0.790
Neutral	4	20	18	26	
Disagree and Strongly Disagree	5	25	18	26	
Attitudes (Stigmatising attitudes): I fear the social stigma attached to having tuberculosis at work (n=88)					
Agree and Strongly Agree	7	35	18	26	0.381
Neutral	5	25	11	16	
Disagree and Strongly Disagree	8	40	39	57	
p-Values are for Chi ² tests of independence to test whether training received was associated with the reported variables (Significance level=0.05).					

Table 4.14: Associations between experiences and previous training

Variable		Received training (n=20)		Did not receive training (n=68)		p-value
		n	%	n	%	%
Experiences						
Facility-level control measures						
Is there a written TB infection control plan in place at your workplace? (n=84)	Yes	12	71	26	39	0.019*
	No and Unsure	5	29	41	61	
Administrative control measures						
Is there someone in charge of TB infection control at the healthcare facility? (n=84)	Yes	15	88	36	54	0.009*
	No and Unsure	2	12	31	46	
Personal protective equipment						
Are there N-95 respirators (masks) available for staff to use? (n=86)	Yes	18	95	49	73	0.045*
	No and Unsure	1	5	18	27	
Personal behaviour (Personal risk of TB)						
I am neglecting infection control measures when working with TB patients despite being aware of the risks (n=83)	Yes	1	6	26	39	0.009*
	No	16	94	40	61	
Personal behaviour (Administrative control measures)						
I have been tested for TB (=88)	Yes	12	60	29	43	0.171
	No	8	40	39	57	
p-Values are for Chi ² tests of independence to test whether training received was associated with the reported variables (Significance level=0.05).						

In summary, training was significantly associated with having a written TB infection control plan at the health facility, having someone in charge of TB infection control at the health facility and the availability of N-95 respirators. In addition, a smaller proportion of dieticians who attended training were neglecting infection control measures compared to dieticians who did not attend training. Based on Cramer's V, the strength of these associations were small.

4.7.5 Knowledge, attitudes and experiences according to adherence to infection control measures

For the purpose of this study, variables were compared between dieticians who reported they neglected infection control measures and those who adhered to infection control measures.

Knowledge

Knowledge regarding the National TB Management Guidelines ($\text{Chi}^2=0.15$, $\text{df}=1$, $p=0.700$) and TB transmission ($\text{Chi}^2=0.44$, $\text{df}=1$, $p=0.506$) did not differ significantly between dieticians who reported that they neglected infection control measures compared with dieticians who reported that adhered to infection control measures (see Table 4.15 on page 121).

Attitudes

No significant differences were found between the groups reporting their concern about contracting TB at work ($\text{Chi}^2=1.68$, $\text{df}=2$, $p=0.432$) or reporting that they feared the social stigma attached to developing TB at work ($\text{Chi}^2=3.86$, $\text{df}=2$, $p=0.145$).

Experiences

A significant difference was found between the two groups with regards to receiving training, although Cramer's V (0.29) indicated the strength of association was small ($\text{Chi}^2=6.92$, $\text{df}=1$, $p=0.009$).

A significant difference was also found between the two groups with regards to the availability of N-95 respirators ($\text{Chi}^2=14.28$, $\text{df}=1$, $p<0.0005$). Cramer's V indicated a medium strength of association (Cramer's V=0.41). In the group that adhered to infection control measures, 90% (n=52) reported that N-95 respirators were always available. In the group that neglected infection control measures, 54% (n=15) reported that N-95 respirators were always available.

Table 4.15: Knowledge, attitudes and experiences according whether infection control measures were neglected

Variable		Neglecting infection control measures (n=28)		Adherence to infection control measures (n=59)		p-value
		n	%	n	%	
Knowledge (Administrative control measures)						
TB infection control measures can prevent TB transmission (n=87)	Yes (correct)	26	93	56	95	0.700
	No and Unsure	2	7	3	5	
Knowledge (TB transmission)						
N95s protect HCP and visitors by stopping TB particles from being breathed in (n=87)	Yes (correct)	20	71	46	78	0.506
	No and Unsure	8	29	13	22	
Attitudes (Fears):						
I am worried about getting TB at work (n=87)						
Agree and Strongly Agree		12	43	33	56	0.432
Neutral		9	32	17	29	
Disagree and Strongly Disagree		7	25	9	15	
Attitudes (Stigmatising attitudes):						
I fear the social stigma attached to having tuberculosis at work (n=88)						
Agree and Strongly Agree		8	29	17	29	0.145
Neutral		2	7	14	24	
Disagree and Strongly Disagree		18	64	28	47	
Experiences (Facility-level control measures)						
Have you received training on TB infection control? (n=83)	Yes	1	4	16	29	0.009*
	No	26	96	40	71	
Experiences (Personal protective equipment)						
Are there N-95 respirators available for staff to use? (n=86)	Yes	15	54	52	90	<0.0005*
	No and Unsure	13	46	6	10	
p-Values are for Chi ² tests of independence to test whether neglecting infection control measures when working with TB patients was related to the reported variables (Significance level=0.05).						

In summary, neglect of infection control measures was significantly associated with not having N-95 respirators available for use (medium strength of association based on Cramer's V).

4.7.6 Attitudes and experiences related to being tested for TB

In the sample, 48% (n=49) were tested for TB and 52% (n=53) had not been tested for TB.

Attitudes

A significant difference existed between these two groups with regards to fearing the social stigma of having TB at work ($\text{Chi}^2=9.28$, $\text{df}=2$, $p=0.010$) and Cramer's V (0.30) indicated a medium strength of association. Among dieticians who had been tested for TB, 62% (n=32) disagreed or strongly disagreed that they feared the social stigma attached to having TB at work, compared with 38% (n=20) of dieticians who had not been tested for TB. In the sample, 26% (n=7) who had been tested for TB agreed or strongly agreed that they feared the social stigma attached to having TB at work, compared with 74% (n=20) in the group who had not been tested for TB.

Experiences

Among the 87 dieticians who answered whether they could be screened for TB at their workplace, no significant difference was found between dieticians who were tested for TB and dieticians who were not tested for TB ($\text{Chi}^2=2.77$, $\text{df}=1$, $p=0.096$).

In summary, a fear of the social stigma of having TB at work was associated with not being tested for TB.

4.8 Summary of associations

Significant associations between variables are summarised in Table 4.16 and Table 4.17 on pages 123 and 124.

Table 4.16: Summary of significant associations between variables

Variables					Inferential statistics		
	Mean	SD	Mean	SD	t-test	p-value	Cohen's D
Knowledge							
	Daily TB exposure (n=51)		Less frequent exposure (n=51)				
Administrative control measures (National TB Management Guidelines)	90.20	12.41	78.89	31.60	2.15	0.035*	0.59
	Government (n=74)		Other (n=28)				
Signs and symptoms	15.00	4.17	12.62	4.75	2.47	0.015*	0.55
Attitudes							
Fears	37.43	21.10	59.64	20.27	-4.79	<0.0005*	1.06
Experiences							
	Government (n=74)		Other (n=28)				
Administrative control measures	15.50	6.25	3.10	5.59	9.19	<0.0005*	2.04
Exposure to TB patients	18.38	18.36	40.87	22.95	-4.83	<0.0005*	1.15
	0 to 5 years in current employment setting (n=67)		Over 5 years in current employment setting (n=30)				
Exposure to TB patients	19.70	19.85	32.67	23.18	-2.82	0.006	0.062
	Government (n=74)		Other (n=28)				
Personal protective equipment	79.73	40.48	35.71	48.80	4.63	<0.0005*	1.03

Table 4.17: Summary of significant associations between variables (continued)

Question					p-value
	n	%	n	%	
Attitudes (Fears): I am worried about getting TB at work (n=102)					
	Government (n=74)		Other (n=28)		
Agree and Strongly Agree	43	58	3	11	<0.0005*
Neutral	20	27	9	32	
Disagree and Strongly Disagree	11	15	16	57	
	Daily TB exposure (n=51)		Less frequent exposure (n=51)		
Agree and Strongly Agree	32	63	14	27	0.001*
Neutral	12	24	17	33	
Disagree and Strongly Disagree	7	14	20	39	
Attitudes (Stigmatising attitudes): I fear the social stigma attached to having tuberculosis at work (n=102)					
	Tested for TB (n=49)		Did not test for TB (n=53)		
Agree and Strongly Agree	32	62	20	38	0.010*
Neutral	10	43	13	57	
Disagree and Strongly Disagree	7	26	20	74	
Experiences (Personal protective equipment) Are there N-95 respirators available for staff to use? (n=86)					
	Neglecting infection control measures (n=28)		Adherence to infection control measures (n=59)		
Yes	15	54	52	90	<0.005
No and unsure	13	46	6	10	

Knowledge

Regularity of treating TB patients

Cronbach's α coefficient was excellent for knowledge of the National TB Management Guidelines. Dieticians who treated TB patients daily had significantly better knowledge of the National TB Management Guidelines, compared with those who treated TB patients less frequently. This was of medium practical significance based on the Cohen's D value.

Work Setting

Dieticians in government settings displayed significantly better knowledge of the signs and symptoms of TB. Cronbach's α coefficient was also excellent for this dimension of knowledge. Cohen's D indicated this finding was of medium practical significance.

Attitudes

Regularity of treating TB patients

A larger proportion of dieticians who treated TB patients daily reported they were worried about getting TB compared with those who treated TB patients less frequently. Cramer's V indicated a medium strength of association.

Work Setting

A significantly larger proportion of dieticians in government settings reported being worried about TB and that the fear of contracting TB impacted on their interaction with patients, compared with dieticians in other settings. Cohen's D indicated this was of large practical significance and the Cronbach's α coefficient for fears was excellent.

Being tested for TB

A larger proportion of dieticians who were not tested for TB indicated that they feared the social stigma attached to having TB, compared with those who were tested. Cramer's V indicated a medium strength of association for this finding.

Experiences

Work setting

Dietitians in government settings were exposed to TB patients more frequently than those in other settings. Cohen's D indicated this was of large practical significance.

Dietitians in government settings achieved significantly better adherence to administrative control measures such as having someone in charge of infection control and offering TB screening to HCPs, compared with dietitians in other settings. Based on Cohen's D value, this was of large practical significance. The Cronbach's α coefficient for administrative control measures was excellent.

A significantly larger proportion of dietitians in government settings reported the availability of N-95 respirators, compared with dietitians in other settings, and Cohen's D indicated this was of large practical significance.

Duration of employment in current work setting

Dietitians working for longer than five years in their current work setting were exposed to TB patients more frequently in comparison to those working for less than five years. Cohen's D indicated that this finding was of medium practical significance.

Neglecting infection control measures

A lack of N-95 respirators available for use when dealing with TB patients was associated with neglecting infection control measures. Cramer's V indicated the strength of association was medium.

4.9 Correlations between knowledge, attitudes and experiences of dietitians

As described in Chapter 3 (Tables 3.2 to 3.4), dimensions were formulated for each variable. The correlations between the dimensions for each variable are described in this section. Significant results are indicated by $r \geq .300$.

Knowledge

Knowledge of the National TB Management Guidelines, TB transmission and signs and symptoms of TB did not significantly correlate with attitudes or experiences (see Table 4.18).

Table 4.18: Correlations between knowledge and attitudes and experiences of dieticians

Knowledge	National TB Management Guidelines	TB transmission	Signs and symptoms of TB	National TB Management Guidelines and Signs and Symptoms of TB
	r-value	r-value	r-value	r-value
Attitudes				
Infection control	0.274	0.232	0.041	0.265
Stigma	0.032	0.084	0.083	0.013
Transmission threat	0.125	0.122	0.009	0.118
Human resources	0.062	0.066	0.084	0.053
Fears	0.105	0.096	0.045	0.089
Fear of stigma	0.034	0.061	0.150	0.001
Experiences				
Facility-level control measures	0.240	0.253	0.154	0.256
Administrative control measures	0.220	0.213	0.164	0.239
Environmental control measures	0.231	0.144	0.086	0.234
Personal protective equipment	0.101	0.294	0.103	0.116
Personal behaviour				
Personal risk	0.194	0.294	0.083	0.116
Administrative control measures	0.067	0.073	0.091	0.044

Attitudes and Experiences

Correlations between knowledge and attitudes and experiences are presented in Table 4.18. Presentation of the correlations between attitudes and experiences are presented in Table 4.19.

Table 4.19: Correlations between attitudes and experiences of dieticians

Attitudes	Trans- mission threat	Infection control	Stigma- tising attitudes	Human resources	Fears	Fear of stigma
	r-value	r-value	r-value	r-value	r-value	r-value
Experiences						
Facility-level control measures	0.141	0.140	0.088	0.313*	0.004	0.035
Administrative control measures	0.059	0.216	0.158	0.380*	0.252	0.030
Environmental control measures	0.004	0.285	0.162	0.348*	0.164	0.063
Personal protective equipment	0.043	0.102	0.043	0.215	0.250	0.079
Personal behaviour						
Neglecting infection control measures	0.115	0.203	0.004	0.267	0.219	0.086
Administrative control measures	0.156	0.090	0.092	0.142	0.079	0.281

A significant correlation was found between adherence to infection control measures and attitudes regarding human resources such as wanting more TB training and having enough staff to educate TB patients. More specifically, these attitudes correlated with:

- Facility-level control measures (r=0.313) (e.g. having an infection control plan, providing TB infection control training to staff, having designated areas to separate/isolate MDR-TB patients);

- Administrative control measures ($r=0.380$) (e.g. having someone in charge of infection control at the facility, offering TB screening to staff); and
- Environmental control measures ($r=0.348$) (e.g. adequate ventilation of a patient's room, periodic evaluation of environmental controls).

In summary, significant correlations were found between attitudes regarding facility-level control measures and adherence to three of the four main infection control measures. As the Cronbach's α coefficient for attitudes regarding facility-level control measures was unacceptable, these results should be interpreted with caution.

4.9.1 Summary of correlations

Based on the r -value, no significant correlations between knowledge and attitudes, or knowledge and experiences, were found.

Wanting more TB training, wanting to increase TB knowledge and having enough staff to educate TB patients, were significantly associated to adherence to infection control measures based on the r -values. Due to the unacceptable level of internal consistency for these attitudes, these findings should be treated with caution.

4.10 Summary of results

In this chapter, a summary of the results that emerged from the online survey conducted among 102 dieticians in South Africa, was described. Data analysis provided for descriptive and inferential statistics to describe each variable and the dimensions that constitute the variable. The knowledge, attitudes and experiences of dieticians regarding TB at the workplace was described and focus was placed on findings of statistically significant value.

Results revealed that dieticians generally displayed good knowledge about the National TB Management Guidelines, TB transmission and signs and symptoms of TB. However, certain knowledge gaps that form part of infection control measures, were identified, such as not knowing that TB can spread through talking and that TB patients should be separated from others in the general waiting area. Dieticians' attitudes toward TB and infection control measures were favourable as they felt adherence to infection control measures were important and they wanted to be trained on TB infection control. However, a minority of dieticians indicated that they

would not always wear N-95 respirators. A large proportion of dieticians were worried about getting TB. Yet, poor adherence to infection control measures were identified, especially regarding being trained on TB infection control measures and having education material available to give newly diagnosed TB patients.

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

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This dissertation aimed to describe the knowledge, attitudes and experiences of dietitians in South Africa regarding TB at the workplace.

Despite recent successes such as the decrease in the incidence of TB, TB remains a leading cause of death in South Africa and is an expensive disease to manage (The World Bank, 2015; Statistics South Africa, 2014a; WHO, 2014a; Pooran *et al.*, 2013; WHO, 2013a).

The HCP are still at an increased risk of TB transmission (O'Donnell *et al.*, 2010), therefore, the government implemented ongoing infection control measures (WHO, 2015c; Department of Health, 2014a). These infection control measures can prevent HCP, including dietitians, from contracting TB. As TB KAP surveys are used and recommended internationally to identify any areas that need to be addressed, the researcher employed this strategy for data collection (WHO, 2015c; Bhebhe *et al.*, 2014; Temesgen & Demissie, 2014; USAID, 2009; WHO, 2009; WHO, 2008c).

In this chapter, the researcher will discuss findings regarding the data collection instrument as well as findings according to the variables. For each of the variables, knowledge, attitudes and experiences, comparisons were made according to participants' regularity of exposure to TB patients, current work setting, the duration of employment in the current work setting, attendance of TB infection control training, adherence to infection control measures or for TB testing. Significant findings were primarily selected for discussion when the internal consistency for the dimension was acceptable, good or excellent (Cronbach's α coefficient ≥ 0.60); if the Cohen's D indicated that the findings were of medium or large practical significance (Cohen's D ≥ 0.50) or if the Cramer's V indicated a medium or large strength of association (Cramer's V ≥ 0.30) (Gravetter & Wallnau, 2014).

5.2 Data collection instrument

Data was collected by means of an online survey, as described in Chapter 3. The researcher chose this method for data collection based on scientific evidence as returns were immediately updated, the costs were low and sensitive data gathering was more valid as the participants had privacy and it provided time for participants to think before they answered. Secondly, the researcher based the method of survey delivery on evidence from other studies that internet use among dietitians is not limited (Craucamp, 2012; Najaar, 2009; Martin *et al.*, 2008). A previous online study among medical doctors and dietitians in South Africa revealed that the majority of the sample had access to the internet at home and at the workplace (Craucamp, 2012; Najaar, 2009; Martin *et al.*, 2008). Furthermore, the popularity of internet use among dietitians for the purpose of obtaining Continuing Professional Development (CPD) points has increased (Craucamp, 2012; Martin *et al.*, 2008). During 2005 to 2006, eight percent of dietitians reported they gained CPD points by reading internet articles with multiple choice questions (Martin *et al.*, 2008:30). Internet use for CPD activities increased to 39% during 2010 to 2011 (Craucamp, 2012:19).

However, under-coverage of the population due to limited internet access may have existed which is recognised as a possible disadvantage of internet surveys (Engel *et al.*, 2015: 157; Fowler, 2009:83).

5.3 Demographics

According to data from the HPCSA and ADSA, the proportion of females in this sample was slightly higher compared to the study population (Daffue, 2015b; Nkosi, 2015b). A larger proportion of dietitians in this sample fell in the age group of 20 to 29 years old, compared with the study population (Daffue, 2015b). Sampling bias may be due to the incentive, a R500 Woolworths voucher, that may have appealed more to females than males.

The study sample also differed from the study population regarding the province in which they were registered with the HPCSA. In this sample, most dietitians were registered in KwaZulu-Natal and in Gauteng, unlike the

HPCSA data, which indicated that most dieticians were registered in Gauteng and the Western Cape (Daffue, 2015b). As KwaZulu-Natal is the province with the highest incidence of PTB, the larger proportion of dieticians from this province in comparison with the study population may be due to a more frequent exposure to patients with TB.

A comparison of demographical data to data of the study population thus indicated that sampling bias existed (eds. Schmidt & Brown, 2015: 305).

5.4 Variables

5.4.1 Knowledge

Dieticians' knowledge pertaining to the National TB Management Guidelines was good as they scored more than 80% for eight of the 10 questions. As expected, dieticians who treated TB patients daily had better knowledge of the National TB Management Guidelines compared to those who treated TB patients less frequently. Dieticians in this sample displayed better knowledge regarding the National TB Management Guidelines compared to HCP involved in other South African studies. A study involving all DR-TB hospitals in South Africa found that only 66% of HCP could identify the infection control measures that were designed to prevent TB transmission in health facilities (Farley *et al.*, 2012). At a tertiary academic hospital in the Western Cape, none of the nurses knew about the National TB guidelines (Sissolak *et al.*, 2011).

Despite a larger proportion of the sample displaying good knowledge across most questions, dieticians demonstrated knowledge gaps regarding the importance of separation of TB patients from the general waiting area. Similar results were found by Kanjee *et al.* (2012). As this measure of infection control is important in the protection of both HCP and patients, more emphasis is needed on improving awareness of the transmission of TB in health care settings as well as its prevention (Gandhi *et al.*, 2013; Moodley *et al.*, 2011).

Dieticians in this sample displayed better knowledge about the HIV-TB transmission link compared with HCP in other South African studies (Kanjee *et al.*, 2012; Kanjee *et al.*, 2011). However, less than half of the sample knew that TB could spread by talking. Other South African studies also revealed that HCP' knowledge levels for the spread of TB by talking varied between 20% and 58% (Kanjee *et al.*, 2012; Kanjee *et al.*, 2011). Nursing students and professional nurses in another developing country displayed better knowledge as 60% of the staff knew that TB can be transmitted by talking (Mussi, Traldi & Talarico, 2012). A positive finding was that a larger proportion of dieticians in this sample knew that patients with TB should be educated on respiratory hygiene compared with HCP in a South African study (Kanjee *et al.*, 2012). However, dieticians in this sample displayed poorer knowledge that N-95 respirators protect HCP and visitors by stopping TB particles from being breathed in than HCP involved in the study by Kanjee *et al.* (2012).

Knowledge about signs and symptoms of TB is necessary in order for HCP to implement administrative control measures such as separating TB suspects from the general waiting area (WHO, 2015c; Department of Health, 2014a; WHO, 2009). A risk of TB transmission occurs when symptomatic TB patients and infectious TB patients are not timeously identified and separated from the general waiting areas. This may directly impact on dieticians as they may be at risk of contracting TB from infectious patients in the waiting areas when giving educational talks to TB patients. Dieticians who counsel TB patients are also at risk when conducting a nutritional assessment. In this situation, the dietician may be more aware of the need to protect him-or herself if they know that talking to an infectious patient provides for an opportunity for TB transmission (Department of Health, 2014a; Lee & Nieman, 2013; Mash *et al.*, 2012).

Dieticians also displayed a knowledge gap regarding the function of N-95 respirators when compared with other South African studies (Kanjee *et al.*, 2012; Kanjee *et al.*, 2011). However, in another sub-Saharan country, HCP demonstrated even poorer knowledge regarding N-95 respirators (Temesgen & Demissie, 2014). Training dieticians on the function of N-95 respirators

could promote its use and potentially decrease the TB transmission risk among dieticians (Efstathiou *et al.*, 2011).

In this study, the majority of dieticians correctly identified weight loss, tiredness, coughing for longer than two weeks and fever as signs and symptoms of TB. However, a small minority of dieticians answered incorrectly that fever was not a symptom of TB and would subsequently not refer a patient with fever for TB testing. Other South African studies also revealed that many HCP did not identify fever as a symptom of TB (Kanjee *et al.*, 2012; Kanjee *et al.*, 2011). As dieticians employed in government settings had improved knowledge regarding signs and symptoms of TB compared with dieticians in other settings, they would be able to refer patients with TB symptoms for a TB test and be aware of their own risk for transmission when interacting with these patients.

Most dieticians in this study displayed good knowledge, although some critical areas of poorer knowledge were also identified, similar to other national and international studies (Irani *et al.*, 2015; Bhebhe *et al.*, 2014; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011). Narrowing the critical knowledge gaps could benefit dieticians by increasing their awareness of infection control measures that could protect them from contracting TB (Bhebhe *et al.*, 2014).

5.4.2 Attitudes

The majority of dieticians had favourable attitudes towards adhering to TB infection control measures. Given the fact that some knowledge gaps, as described in 5.4.1, existed, it was positive to find that over 80% of dieticians indicated that they would like to receive more TB training at their workplace. Favourable attitudes towards training on infection control were echoed in a recent study among HCP at Tygerberg Children's Hospital (Dramowski, Whitelaw & Cotton, 2015).

Compared to results reported by Kanjee *et al.* (2012), where some HCP felt that TB infection control strategies were not worth all the effort that goes into them, all the dieticians in this study sample felt that adherence to TB guidelines and policies were important. In addition, the majority of the

dieticians wanted TB infection control measures to be prioritised at their facilities.

In this sample, 75% of dieticians reported that they would wear N-95 respirators during exposure to TB patients if N-95 respirators were always available in their facility. Farley *et al.* (2012) reported that 41% of HCP at drug-resistant TB facilities in South Africa felt that N-95 respirators do not protect against DR-TB even if worn all the time and 32% reported that they sometimes do not wear a respirator despite knowing that they should. Reasons for not wearing a N-95 respirator were investigated by Kanjee *et al.* (2012) who found that 45% of the HCP felt that wearing an N-95 respirator was uncomfortable and 30% felt it ruined their appearance. Apart from reporting that the N-95 was uncomfortable, Zelnick *et al.* (2013) reported that HCP were not adequately informed about the effectiveness of personal protective equipment. In addition, HCP reported that no “fit testing” of the N-95 respirators was done, despite that being recommended by the WHO (WHO, 2015c; WHO, 2009). A study done in the United States of America explored HCP’ views on the use of N-95 respirators and revealed that HCP wanted newly developed respirators that were comfortable, could accommodate facial hair and had less heat accumulation (Baig *et al.*, 2010). These aspects were not investigated in this study but may have contributed to the attitudes of those dieticians who indicated that they would not wear N-95 respirators during exposure to TB patients.

Almost a third of dieticians in this study felt that there were not sufficient personnel to educate TB patients adequately. In another study, this finding was mirrored by hospital managers who reported that staff shortages were hindering effective infection control policy implementation (Zelnick *et al.*, 2013).

Wider implications of staff shortages include that it poses a challenge to an optimal functioning health system in South Africa. Nursing staff in Durban reported that reasons for absenteeism from work included staff shortages and an increased workload (Mudaly & Nkosi, 2015). Understaffing was also evident at Pelonomi Hospital in the Free State. Retaining staff and filling of

vacant posts were seen as major challenges, with a 40% vacancy among the 2311 staff members at that time, mostly for doctors (45%) and professional nurses (37%) (Yassi *et al.*, 2009). The recent review of the implementation of the National TB Guidelines in South Africa also indicated that staff shortages contributed to burnout experienced by the staff (Department of Health, 2014b). This challenge is exacerbated by staff taking sick leave for long periods due to a personal diagnosis of TB, forcing the remaining staff to often work overtime (Kerr, Brysiewicz & Bhengu, 2014). Adherence to TB infection control measures at these health facilities that are understaffed may be more difficult, putting HCP at risk for contracting TB.

More than 40% of dieticians in this study reported that they were worried about getting TB at work. According to Farley *et al.* (2012), 80% of HCP were worried about being infected with DR-TB. This might be due to HCP included in the study by Farley *et al.* (2012) being exposed to more severely ill patients, as that study included only drug-resistant TB facilities.

Dieticians who treated TB patients daily were more worried about getting TB at the workplace compared to those who treated TB patients less frequently. Regular exposure to TB does warrant anxiety about getting infected with the disease if infection control measures are not in place. Mathew *et al.* (2013) found that HCP with regular contact with TB patients and a BMI lower than 19kg/m² were more at risk of active TB compare to a control group.

In this study, a larger proportion of dieticians who worked in government settings, compared with those in other settings, reported that they were worried about contracting TB and that it impacted on their interaction with TB patients. Nursing professionals in Brazil also reported that their provision of support to TB patients was affected, as a small percentage of the sample reported that they would try to avoid assisting TB patients (Mussi *et al.*, 2012).

As the outcome for TB patients is related to their nutritional status, these patients need optimal nutritional support (Kant *et al.*, 2015; Lutge *et al.*, 2013; Miyata *et al.*, 2013). If dieticians are worried about getting TB whilst treating TB patients, the quality of care to these patients may be negatively affected which, in turn, may impact negatively on a patient's outcome.

If dietitians decide to resign from their work due to their anxiety about contracting TB, it would create an even larger gap in the workforce (Kerr *et al.*, 2014; Kanjee *et al.*, 2012). This is concerning, as health care staff is vital to optimally care for the South African patients attending public health care, especially in high-burdened TB areas, namely KwaZulu-Natal, Western Cape, Gauteng, the Eastern Cape and Gauteng (Loveday, 2014). Therefore, if one fails to address dietitians' fears of TB, the quality of care and services delivered by dietitians may deteriorate.

Although it varies significantly, HCP' fear of contracting TB has been well established (Tudor *et al.*, 2013; Farley *et al.*, 2012; Kanjee *et al.*, 2012). Dietitians in this study mostly feared suffering from the side-effects of TB treatment and the long-term effect of TB on their health. Similarly, results by Tudor *et al.* (2013) indicated that HCP feared having to take TB treatment, the financial implications of having TB and personal concerns such as separation from family and stigma. The fear of the stigma of TB among HCP has been documented both internationally and by other South African research studies (Siegel *et al.*, 2015; Zelnick *et al.*, 2013; Coreil *et al.*, 2010; Wu *et al.*, 2009).

Nurses involved in a recent South African study emphasised a need for stigma reduction campaigns to ultimately improve the "health and well-being of the health care workforce" (Siegel *et al.*, 2015:10).

In this sample, almost a third of dietitians indicated that they feared the social stigma attached to having TB. Similar findings were reported in a study by Kanjee *et al.* (2012) where a third of the HCP felt that if a health care professional at their facility developed TB, he/she would be severely stigmatised. According to Farley *et al.* (2012), only a minority of the sample agreed that if they developed symptoms of TB they would not tell anyone at work because they might get fired. Similarly, stigma was rated as a fear among only a minority of 363 HCP employed at DR-TB hospitals in South Africa (Tudor *et al.*, 2013). However, the majority of HCP in a study by Kanjee *et al.* (2011) feared potential rejection and stigma if they had TB. Mussi *et al.* (2012) reported that only a minority of professional nurses indicated that if

they found out a colleague had TB, they would like that professional to leave the workplace (Mussi *et al.*, 2012).

5.4.3 Experiences

The WHO recommends that regular training for HCP on TB infection control should take place (WHO, 2015c). A diagnosis of TB among health care staff in South Africa has been associated with a lack of TB infection control training (Ayuk, 2013). Peters (n.d.) reported the positive effect of TB training on HCP' adherence to infection control measures in the Eastern Cape. Similarly, international studies in developed countries also reported a significant association between training and adherence to infection control measures (Nichol *et al.*, 2013; Bouadma *et al.*, 2010). However, a study done in a developing country in sub-Saharan Africa found no significant associations between training and TB infection control practices (Temesgen & Demissie, 2014), suggesting that training alone does not translate into desired practices within developing countries. Allegranzi *et al.* (2013) dismissed this notion and reiterated the WHO recommendation that training accompanied by other steps such as provision of the necessary resources, monitoring adherence and providing feedback, visual reminders and the creation of an adherence culture at the workplace, has favourable outcomes in both developing and developed countries (Allegranzi *et al.*, 2013).

In-service TB infection control training was not done at all health facilities in South Africa. Rather, it varied between 8% (n=51) and 74% (n=121) (Malangu & Mngomezulu, 2015; Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Farley *et al.*, 2012; Naidoo, Seevnrain & Nordstrom, 2012). According to Sissolak *et al.* (2011), none of the nurses reported receiving any training or attending any TB infection control and prevention courses the past year. In the sample of dieticians, the strength of association between training and adherence to infection control practices was small. If a larger proportion had been trained, one might expect larger differences.

There is a paucity of research on the specific content of in-service training on TB infection control in South African health facilities. Although various options for infection control training opportunities exist, not all infection control officers

are equally qualified and this may result in a workforce that is not equally trained (Zingg *et al.*, 2015). Studies comparing the outcome of infection control training should analyse the content of infection control training to ensure valid outcomes.

This sample demonstrated that complete adherence to the WHO infection control measures, namely facility level controls, administrative controls, environmental controls or personal protective equipment, was not achieved. Suboptimal adherence to TB infection control measures was also evident in other sub-Saharan countries (Brouwer *et al.*, 2015; Buregyeya *et al.*, 2013; Reid *et al.*, 2012; Ogbonnaya *et al.*, 2011), as well as in Peru (Escombe *et al.*, 2010) and Georgia (Mirtskhulava *et al.*, 2015).

Tuberculosis infection control plans guide the adequate implementation of infection control measures. Although Farley *et al.* (2012) reported that the majority of facilities had a written TB infection control plan, results from other studies varied. Less positive findings were reported by other South African studies where 19% to 41% of facilities had TB infection control plans or policies (Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Naidoo *et al.*, 2012). Surprisingly, having an infection control plan was not significantly associated with greater knowledge of or more favourable attitudes towards TB and infection control, according to Farley *et al.* (2012). Less than half of the dieticians in this sample reported that there was a written TB infection control plan in place. Having an infection control plan was associated with staff attending training on TB infection control, but the association was of small practical significance. There is paucity of literature confirming clear links between having an infection control plan and adherence to infection control measures in South African health facilities, hence more research may be warranted.

In addition to having an infection control plan, the WHO recommends that there should be a person or committee in charge of infection control and responsible for activities that direct its implementation (WHO, 2015c). In this sample, the majority of dieticians indicated that there was a dedicated person managing TB infection control at their health facilities. In other studies, having

someone in charge of infection control ranged between 20% to 79% (Malangu & Mngomezulu, 2015; Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Farley *et al.*, 2012; Naidoo *et al.*, 2012). As many infection control officers have other primary responsibilities at their health facilities, the available work time may not permit them to carry out all the necessary infection control-related duties (Tshitangano *et al.*, 2013; Farley *et al.*, 2012). For instance, in this study, only 23% of dieticians had attended TB infection control training despite over 40% of the sample reporting that there was a TB infection control plan and someone in charge of infection control at their facilities. In other South African studies, attendance of infection control training varied between eight percent to 85% (Claassens *et al.*, 2013b; Naidoo *et al.*, 2012; Tshitangano, Pengpid & Peltzer, 2010).

In this study, a positive association existed between the frequency of exposure to TB patients and both the work setting and the length of time in their current job. Dieticians who had worked in their current setting for more than five years were exposed to TB patients more frequently compared to those working less than five years. Also, dieticians in government settings were exposed to TB patients more frequently than those in other work settings. Training of all dieticians, especially those who remain in government settings for more than five years, should happen on a regular basis. The WHO guidelines recommend training and retraining of HCP by TB infection control officers at least once every two years (WHO, 2015c).

Other positive outcomes from this study included that a larger proportion of dieticians in government settings compared to those in other settings reported that there was someone in charge of infection control in their facility, that early testing, diagnosis and initiation onto TB treatment was regarded as important at their facility and that they could be screened for TB at their facility. This might be due to the implementation of the National TB Management Guidelines within government settings as reported in the Joint Review of HIV, TB and PMTCT Programmes in South Africa (Department of Health 2014b).

The importance of immediate investigation for TB among staff that experience TB symptoms and signs is well established (WHO, 2015c; Tudor *et al.*, 2014).

Over 70% of this sample reported that they could be screened for TB at their places of work. Similar findings were reported by Engelbrecht & Van Rensburg (2013). However, other surveys have found much lower rates of TB screening available for staff (Claassens *et al.*, 2013b; Farley *et al.*, 2012). If dietitians with infectious TB are not screened and treated for TB, they pose a threat of transmission to other patients they treat as well as to their colleagues who are in contact with them.

The majority of dietitians in this study reported that MDR-TB patients were kept separate or in isolation at their workplaces, echoing findings from Engelbrecht & Van Rensburg (2013). This was in contrast to results from other studies where only a minority of facilities separated infectious patients (Malangu & Mngomezulu, 2015; Claassens *et al.*, 2013b; Farley *et al.*, 2012). Zelnick *et al.* (2013) explained that separation of drug-resistant TB patients and suspected cases was impeded by a lack of space and shortages of beds, emphasising the need for adequate resources.

Triage of patients with TB symptoms is critical to prevent the spread of infectious TB to other patients and HCP in the facility. Studies found that triage of TB suspects ranged between 2% and 88% (Malangu & Mngomezulu, 2015; Engelbrecht & Van Rensburg, 2013; Naidoo *et al.*, 2012). In this study, the minority of dietitians reported that coughing patients were prioritised to ensure short waiting times in the general waiting area. Therefore, dietitians who are in close contact with these undiagnosed and infectious patients could be at risk of TB transmission.

Part of a health care professional's responsibilities towards TB patients is to offer TB information and education material to patients. In this study, more than 10% of the sample reported that education material was not available for newly diagnosed TB patients. Therefore, these patients may not adhere to cough etiquette and pose a threat to patients and dietitians in contact with them.

The majority of dietitians in this study indicated that the room of a TB patient was well-ventilated. South African studies revealed that HCP reported

windows were kept open at 17% to 69% of health facilities (Malangu & Mngomezulu, 2015; Engelbrecht & Van Rensburg, 2013; Kanjee *et al.* 2011).

Zelnick *et al.* (2013) reported that physical infrastructure design hindered adherence to environmental control measures. Dieticians working in health facilities where the building structure hinders adequate ventilation may be at greater risk of contracting TB. Therefore, wearing personal protective equipment is especially vital in such settings where resources do not permit adherence to all infection control measures.

South African studies have reported that the availability of N-95 masks ranged from 22% to 35% (Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Naidoo *et al.*, 2012). In this study, the majority of dieticians reported that N-95 respirators were available. An international study found that the availability of PPE was significantly associated with the use of PPE, emphasising the importance of having resources such as N-95 respirators available at health facilities (Nichol *et al.*, 2013). However, although PPE was always available at all DR-TB facilities in a study by Farley *et al.* (2012), HCP were observed entering DR-TB wards without N-95 respirators at almost 90% of these facilities. In some cases, problems with the procurement system were a barrier to the use of N-95 respirators (Zelnick *et al.*, 2013). In addition, mixed messages regarding the use of N-95 respirators have been reported, such as preserving the stock of N-95 respirators or always wearing an N-95 respirator when dealing with TB patients (Zelnick *et al.*, 2013).

As described in Chapter 2, the National Health Act (Act No. 61 of 2003) exempts dieticians and HCP from duty if infection control measures are not in place. This has serious implications for all health facilities that do not provide HCP with basic personal protection such as N-95 respirators (South African Government, 2004). Dieticians who work at facilities that do not have N-95 respirators available, need to be assertive and insist that personal protective equipment should be made available, thereby contributing to infection control adherence.

Availability of N-95 respirators was significantly better among dieticians in government settings compared to those employed in other settings. In

addition, a significantly larger proportion of dieticians who reported they were neglecting infection control measures also reported that they did not have N-95 respirators available, compared to those who reported adhering to infection control measures. As poor protection against TB transmission is exacerbated by the use of poorly fitted N-95 respirators, future studies should evaluate their availability as well as whether it was fit-tested (Dramowski *et al.*, 2015; Manganyi, 2015; WHO, 2015c).

Findings of this study identified that there was generally poor adherence to infection control measures among dieticians. This highlights the importance of narrowing the gaps between infection control measures and what happened in practice.

5.4.4 Personal behaviour

Almost a third of dieticians admitted that they were neglecting infection control measures when working with TB patients and future studies could explore the reasons for this behaviour. Facilities should provide dieticians with the necessary resources to protect themselves from contracting TB. Apart from that, dieticians should realise that they bear the onus to adhere to infection control measures.

About half of the dieticians in this sample were tested for TB. A fear of social stigma attached to having TB at the workplace was significantly associated with reluctance to be tested for TB in this sample of dieticians. Similarly, Kanjee *et al.* (2011) found that stigma was a barrier to testing for both TB and HIV. If the dieticians who were not tested for TB had undiagnosed TB, they could further spread TB infection to other patients they were treating. Therefore, approaches to reduce stigma are necessary.

In Uganda, Buregyeya *et al.* (2012) reported that many HCP would prefer to be screened for TB at a health facility where they did not know anybody. These HCP feared that being tested for TB might be associated with stigmatisation for possibly having HIV (Buregyeya *et al.*, 2012). Stigma and confidentiality concerns attached to having HIV are well documented and may hinder HCP from testing for HIV (Khan *et al.*, 2015; Mataboge *et al.*, 2014; De

Vries *et al.*, 2011; Kanjee *et al.*, 2011; Pulerwitz *et al.*, 2010; Delobelle *et al.*, 2009; Holzemer *et al.*, 2009). The National TB Management Guidelines state that HIV-infected HCP should be redeployed to work areas with a lower risk of TB, as being HIV-infected increases one's risk for TB. HIV-infected HCP who fear the stigma of HIV and remain untested, may then contract TB if they are working in areas with a high burden of TB. The seriousness of stigma among HCP has led to innovative alternative options. For instance, self-testing for HIV has been investigated among HCP at the University of Cape Town and found to be a feasible option (Pant Pai *et al.*, 2013). Although self-testing for HIV among dieticians may get more dieticians to test, they would still need to disclose the results to their manager in order for them to be redeployed to lower risk areas. However, knowing their HIV status may make dieticians more aware of their risk for TB and indirectly influence their likelihood of adherence to infection control measures.

Despite 99% of this sample reporting they would want to be tested for TB if they experienced TB symptoms, a fear of stigma attached to such a diagnosis was associated with not getting tested for TB. This fear may prevent dieticians who experience symptoms of TB from being tested and infectious dieticians could serve as a source of infection to others.

5.4.5 Associations between knowledge, attitudes and experiences

Associations between dimensions of each variable were determined. In this study, knowledge was not significantly associated with either attitudes or experiences. Kanjee *et al.* (2012) also found no significant associations between knowledge and other variables. However, good knowledge was associated with good TB infection control practices in an international study on TB infection control by Temesgen & Demissie (2014).

Attitudes that were significantly associated with adherence to infection control measures included whether dieticians wanted to increase their TB knowledge, would prefer that TB training took place at the workplace and felt that there were sufficient personnel in the health facility to educate TB patients adequately. However, due to the unacceptable level of internal consistency for this dimension of attitudes, these results should be treated with caution.

5.5 Limitations of the study

Limitations of the study included that the sample size narrowed the results. Due to the method of sampling, findings of the study are only applicable to dietitians who participated in this study and do not allow for results to be generalised (eds. Schmidt & Brown, 2015; Polgar & Thomas, 2013).

Dietitians with previous TB exposure may have been more likely to complete the survey than dietitians without TB exposure, potentially causing sampling bias. As most dietitians in this sample were from KwaZulu-Natal, the province with the highest burden of TB disease, bias may have existed.

No standards for the evaluation of dietitians' knowledge, attitudes and experiences regarding TB at the workplace existed prior to this study. Therefore the researcher based the survey on similar studies and recommendations by the WHO.

Certain questions could have been included in the online survey to provide additional valuable information. This study based the question on whether the dietitian attended training on TB infection control on a national review as well as other studies (Department of Health, 2014b; Engelbrecht & Van Rensburg, 2013; Farley *et al.*, 2012; Naidoo *et al.*, 2012). However, additional information, such as the length of exposure to training (Flores-Lagunes, Gonzales & Neumann, 2007), the content and duration of the training, the last date of attending training, and the qualifications of the person providing the training (Zingg *et al.*, 2015) could have provided the researcher with more insight. Thus, more information on training could have provided the researcher with an opportunity to compare the outcome of training to similar training programmes aimed at other HCP. Another section where additional questions may have been beneficial was to ask whether, in addition to the availability of N-95 respirators, dietitians actually used them during their last interaction with a TB patient and whether the N-95 respirator was "fit-tested".

Unacceptable and poor levels of internal consistency for certain dimensions of the variables rendered that interpretation of these results were made with caution.

Lastly, a limitation of the study was its reliance on self-reporting of practices, which may have resulted in findings that do not reflect actual behaviour (Kanjee *et al.*, 2011).

Despite its limitations, the results of this study hold several implications for dietitians working in South Africa.

5.6 Conclusion

This KAP study was conducted among a sample of 102 dietitians, which consisted mostly of females aged 20 to 29 years old who were employed in government settings (hospitals and clinics). Half of the sample was exposed to patients with TB on a daily basis.

Knowledge outcomes were mostly good, and dietitians who treated TB patients daily had better knowledge of the National TB Management Guidelines compared to those who treated TB patients less frequently. However, some dietitians did not know that TB could spread by talking. Dietitians in government settings had improved knowledge of signs and symptoms of TB compared with those in other settings.

The majority of dietitians had favourable attitudes towards TB and TB infection control measures. All dietitians felt adherence to TB guidelines and policies were important. Dietitians also reported they would be tested if they recognised TB symptoms in themselves. Positive attitudes further included that dietitians wanted to increase their TB knowledge and also indicated they would like to receive TB training. However, many dietitians felt that there was not enough staff to implement some aspects of infection control measures.

Many dietitians were worried about contracting TB, especially those employed in government settings. Of concern was that dietitians reported that this anxiety regarding a personal diagnosis with TB impacted their interaction with patients. This finding emphasised the importance of creating a safe working environment with available resources, and training dietitians on TB infection control to equip them to protect themselves at the workplace.

Outcome measures relating to experiences indicated poor adherence to the infection control measures (WHO, 2015c). Particular areas where poor adherence to infection control were found included the lack of: an infection control plan, a person in charge of infection control, areas to separate MDR-TB suspects and patients, TB infection control training, education material for TB patients, maintenance of environmental control measures and triage of coughing patients. Good adherence was found for the provision of TB screening and availability of N-95 respirators at the facility as well as for isolation of MDR-TB patients. Dieticians admitted they neglected TB infection control measures despite being aware of the risks.

Associations between variables did not reveal practically significant results. An association was found between attitudes regarding human resources, such as wanting more TB infection control training and having adequate staff, and adherence to facility level, administrative level as well as environmental infection control measures. However, the unacceptable level of internal consistency for these attitudes caused the researcher to recommend that these associations be interpreted with caution.

This research study identified that dieticians mostly displayed adequate knowledge, although some critical gaps were identified where training was needed. Positive attitudes towards infection control measures were reported by most of the sample, although many dieticians reported that they did not have sufficient personnel to educate TB patients adequately. Dieticians also reported that they were worried about getting TB at work, which affected their patient interaction.

Poor adherence to infection control measures were of concern, as indicated by a lack of adherence to facility level, administrative level, and environmental level infection control measures as well as regarding personal protective equipment. Certain aspects should be addressed on management-level, such as having an infection control plan, training dieticians on TB infection control, and availability of N-95 respirators and education material for TB patients at all times. Apart from managerial responsibilities, the onus also rests

personally on the dietician to adhere to infection control measures as many dieticians admitted they were neglecting infection control measures.

Several recommendations can be made in order to address these concerns.

5.7 Recommendations

In light of the research findings and limitations of this study, recommendations were developed.

5.7.1 Recommendations regarding training of dieticians

In-service TB infection control training of dieticians needs to take place regularly, and should be documented according to the WHO recommendations (WHO, 2015c). Managers of dietetics departments should ensure that all dieticians are trained at least every two years (WHO, 2015c).

In addition, blended learning CPD activities on TB and TB infection control measures could be developed to provide alternative learning opportunities for dieticians. Dieticians should be encouraged by their managers to attend congresses on TB and TB infection control measures.

Training could start at undergraduate level using existing training resources such as videos available from TBProof to overcome potential barriers to education on TB and infection control measures (TBProof n.d.). This approach is followed at Stellenbosch University for medical and health sciences students (Dramowski, 2015). Training should focus on critical knowledge gaps that were identified in this study.

Stigma-reduction workshops could be targeted at dieticians in health facilities. These workshops should be evidence-based and involve the dieticians with the planning, implementation and design of stigma-reduction activities. Health care professionals with a personal diagnosis of TB should share their experiences with dieticians to help reduce the stigma towards TB.

To lessen the anxiety that dieticians experienced regarding contracting TB, training should focus on scientific evidence on the effectiveness of infection

control measures in protecting against TB transmission. “Fit testing” of N-95 respirators should be part of these sessions to strengthen self-efficacy and a sense of self-protection.

Effective behavioural change strategies should be employed to address the poor adherence to infection control that was identified in this study. Motivation, social support and self-efficacy of dieticians towards infection control adherence need to be strengthened in these sessions. Strategies should incorporate team activities, education, reminders/ visual cues and evaluation and feedback. A platform should be created where dieticians can give feedback to the dietetics manager after the training.

5.7.2 Recommendations regarding infection control practices

Renewed commitment by managers at health facilities is needed to train dieticians on TB infection control periodically as recommended by the WHO and Department of Health (WHO, 2015c; Department of Health, 2014a). Managers at health facilities, including managers of dietetics departments, should receive TB infection control training. A culture of adherence to infection control measures should be created through managers leading by example and adhering to infection control measures and also motivating their staff to adhere to infection control measures. Managers should be informed of their critical role to actively support adherence and communicate its importance to the dietetics team on a regular basis. Managers should have a stance of prioritisation of TB infection control measures to help ensure that policies translate into practice.

Findings of this study should be disseminated to managers at health care facilities to increase their awareness of dieticians’ knowledge, attitudes and experiences of TB. These reports to policy-makers and national authorities should ultimately translate into better design for future health facilities or improved budget allowances for resources such as N-95 respirators and more staff. Therefore, financial commitment by government is crucial.

These findings supplemented the existing body of evidence namely, that poor infection control practices exist among HCP in South Africa (Malangu &

Mngomezulu, 2015; Claassens *et al.*, 2013b; Engelbrecht & Van Rensburg, 2013; Tshitangano *et al.*, 2013; Zelnick *et al.*, 2013; Farley *et al.*, 2012; Kanjee *et al.*, 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011). Managers should insist on and advocate for the implementation of policies.

5.7.3 Recommendations regarding research needs

Assessment of the impact of pre- and post-training programmes for dieticians about TB and infection control should be done. Evaluation could be in the form of direct observation of dieticians' adherence to infection control measures at the workplace.

Dietetic managers should ensure that the 2015 WHO checklist for periodic evaluation of TB infection control in health-care facilities (WHO, 2015c) is completed in their health facility and that dissemination of results to key stakeholders takes place.

Routine surveillance of dieticians' knowledge, attitudes and practices should be done. Similar studies could be done among other allied health care professionals as they are also in direct contact with TB patients. The survey could include questions that give more insight into the training that was offered. Validation of the survey could be done by adapting the survey according to recommendations by an expert panel, including recognised leaders in TB management such as the WHO, as well as input from researchers who have conducted TB KAP studies in South Africa. Thereafter, homogeneity in the data collected through future TB KAP surveys among dieticians and HCP in the workplace provides for more valuable comparison of findings.

Future studies should continue to investigate the availability of resources at all health facilities in South Africa to determine whether managers at facilities are providing staff with the resources necessary for self-protection against TB transmission.

This study identified areas where more insight is needed. Focus group discussions or interviews could be employed to provide more insight into the

extent to which the anxiety of contracting TB impacted on dieticians' patient interaction, determine the reasons why some dieticians indicated that they would not wear N-95 respirators when interacting with TB patients and to provide insight into the training that was provided to dieticians. Based on attitudes that reflected dieticians wanted to increase their TB knowledge and would like more training on infection control, further investigation of reasons why training was not provided for all dieticians should also be done by dietetics department managers and infection control officers. The role of the infection control officer should be explored to determine whether there is a culture of infection control adherence, whether they were trained to be in charge of infection control, and whether they feel that they have the time and competencies to fulfil this role.

5.8 Conclusion

The researcher set out to determine what are the knowledge, attitudes and experiences of dieticians regarding TB at the workplace. The outcomes as described in this chapter indicated that, in general, good knowledge and favourable attitudes towards TB and infection control existed among the majority of participants. Critical knowledge gaps and certain unfavourable attitudes were, however, identified and should be addressed. Poor adherence to infection control measures was also revealed through the results of this study. Health care facilities should provide TB infection control training as per WHO recommendations and provide the necessary resources for the implementation of infection control measures. However, the responsibility of adhering to infection control measures also rests on each dietician individually, and training dieticians on TB and infection control may positively influence their practices. Further research, validation of a KAP tool and regular KAP studies to monitor trends even at undergraduate levels, may be valuable to create more awareness about the risk of TB transmission and the importance of adhering to guidelines.

South Africa has a high burden of TB disease. Dieticians are responsible for the nutritional assessment of TB patients during which they could be exposed to the possible threat of TB transmission if infection control measures are not

in place. The value of regular training of dieticians on TB and infection control measures can not be over-stated as it may contribute to improved adherence. Ultimately, adherence to infection control measures may improve the wellbeing of dieticians by decreasing their anxiety about and risk of contracting TB at the workplace.

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LIST OF ADDENDA

Addendum A:	Poster presentation: TUFH and SAAHE conference, 12 to 16 September 2015	192
Addendum B:	Online Survey of the Knowledge, Attitudes and Experiences of dieticians in relation to tuberculosis at the workplace	193
Addendum C:	Expert Panel contact details	209
Addendum D:	Consent form	210
Addendum E:	A copy of the invitation to participate in the online survey about tuberculosis at the workplace within ADSA newsletters	212
Addendum F:	Feedback from expert panel	213
Addendum G:	Summary of Dimensions for TB Infection Control (IC) used in South African studies and by the WHO	218
Addendum H:	Process by which the researcher aimed to ensure content validity for the survey	223
Addendum I:	Ethics Approval Letter from the Faculty Postgraduate Studies Committee, Nelson Mandela Metropolitan University	225
Addendum J:	Language editing certificate	226

Addendum A: Poster presentation: TUFH and SAAHE conference, 12 to 16 September 2015

TRAINING NEEDS OF DIETITIANS REGARDING TB INFECTION CONTROL GUIDELINES

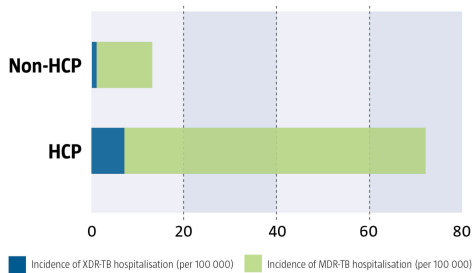
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Background

Tuberculosis is an infectious disease that has become an epidemic in South Africa (WHO, 2014). Dietitians, as part of the health care team are at an increased risk of hospitalisation for TB compared to the general population (O'Donnell et al. 2010).



The government implemented TB Infection Control guidelines to protect health care professionals (HCP) from contracting TB and stipulated that training on these guidelines should be given routinely in the public health sector (Department of Health, 2014; WHO, 2009).



Control measures established by the WHO (2009) to protect the HCP from exposure include:



Aim

The aim of the study was to determine dietitians' knowledge of TB Infection Control guidelines.

Methods

A descriptive quantitative, cross-sectional research design was applied by means of an online survey within a convenience sample (n=102).

Results

Most dietitians knew educating TB patients on coughing hygiene, collection of sputum away from others and hand washing thereafter were aspects of TB Infection Control (see Figure 1). However, 16% of dietitians indicated that TB patients should not be separated in the general waiting area from others, 14% were unaware that patients with active TB are more likely to infect others if they had a productive cough while 44% were unaware that patients with active TB can infect others by talking. Seven percent were unaware that fever was a symptom of TB.

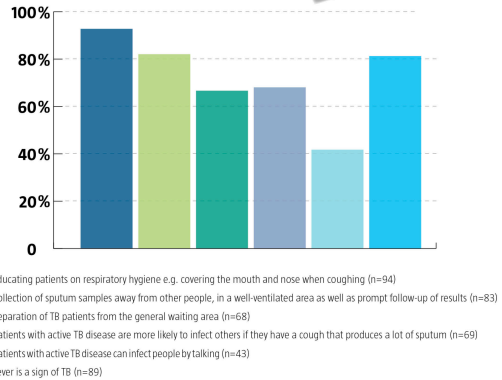


Figure 1: Knowledge of facility and administrative-level infection control measures (n=102)

Dietitians working in government settings had improved knowledge regarding National TB Guidelines, TB transmission, signs and symptoms of TB and infection control measures (Mean=78.54; SD=15.23), compared to dietitians employed in other settings (Mean=68.82; SD=19.94) (t-test=2.63; p=0.010; Cohen's D value=0.58).

Significant differences were found between dietitians who treated TB patients daily compared to dietitians who treated TB patients less frequently regarding overall TB knowledge (t-test=3.12; p=0.002; Cohen's D value=0.62), knowledge of Administrative-level and Facility-level Infection Control measures (t-test=2.00; p=0.048; Cohen's D value=0.40) and knowledge on Transmission of TB regarding PPE (t-test=2.67; p=0.009; Cohen's D value=0.53) (See Figure 2). Dietitians who treated TB patients daily had better knowledge compared to dietitians who treated TB patients less frequently. The Cohen's D value indicated findings were of medium importance.

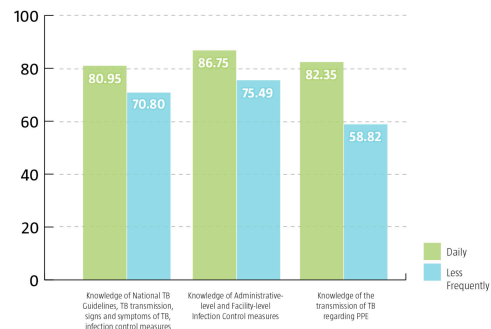


Figure 2: Knowledge according to regularity of exposure to TB patients (n=102)

Conclusion

Inadequate knowledge among dietitians who treated TB patients existed. Although dietitians employed in government settings had improved knowledge compared to dietitians employed in other settings, knowledge gaps regarding TB and TB Infection Control measures were still identified. Dietitians who treat TB patients are at risk of contracting TB if adherence to Infection Control measures is not achieved. Training dietitians on these measures could translate into improved knowledge to ensure that dietitians know how to protect themselves against contracting TB at the workplace.

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- WHO, 2009. WHO policy on TB infection control in health-care facilities, congregate settings and households. WHO, Geneva, Switzerland.
- WHO, 2014, Global Tuberculosis Report 2014. WHO, Geneva, Switzerland.

Addendum B: Online Survey of the Knowledge, Attitudes and Experiences of dieticians in relation to tuberculosis at the workplace

(<http://forms.nmmu.ac.za/websurvey/q.asp?sid=1241&k=gfzaedlkyyv>)

1. Demographics

1.1 CODE

- 1.2 Age in years *
- 20-29
 - 30-39
 - 40-49
 - 50-59
 - 60+

- 1.3 Gender *
- Male
 - Female

- 1.4 Regularity of exposure to TB patients *
- Daily
 - Weekly
 - Monthly
 - Never

- 1.5 Work context *
- Hospital (government)
 - Hospital (private)
 - Clinic (government)
 - Clinic (private)
 - Private practice (no in-hospital patients)
 - Other

- 1.6 Number of years working in this facility or a similar facility *
- 0-5 years
 - 6-10 years
 - 10+ years

- 1.7 Frequency of working with TB patients *
- Never
 - Seldom
 - Regularly

- Often
- Always
- 1.8 I mainly work with:
* Adults
 Children
 Adults and Children
- 1.9 Previous work context
* None
 Hospital (government)
 Hospital (private)
 Clinic (government)
 Clinic (private)
 Other
- 1.1 Number of years worked in this setting
0 * 0-5 years
 6-10 years
 10+ years
- 1.1 Internet access
1 * Easily available (I can use it almost every day)
 Available but not convenient (I have to use the computers at work which are shared/ I can go onto the internet at my friend/ partner's house/ internet cafe/ restaurant with wi-fi)
 Difficult (I don't always have data on my phone or at home to browse on the internet)
 I never have access to the internet

Please answer whether the following seven statements (2.1-2.7) are within the National Tuberculosis Management Guidelines:

- 2.1 Early recognition of suspected TB cases involves screening for the presence of a cough lasting for more than 2
* Yes No Don't know

weeks

- 2.2 * Educating patients on respiratory hygiene e.g. covering the mouth and nose when coughing Yes No Don't know
- 2.3 * Separation of TB patients from the general waiting area Yes No Don't know
- 2.4 * Collection of sputum samples away from other people, in a well-ventilated area as well as prompt follow-up of results Yes No Don't know
- 2.5 * Hand washing after sputum collection is necessary Yes No Don't know
- 2.6 * Educating staff members and patients on symptoms of TB should be done routinely in the health care facility Yes No Don't know
- 2.7 * An infection control officer should be responsible for documenting Yes No Don't know

- the policy and arranging training for personnel
- 2.8 * TB infection control measures can prevent TB transmission Yes No Don't know
- 2.9 * Finishing TB treatment is critical Yes No Don't know
- 2.1 0 * Family members of TB patients need to know how to protect themselves from getting infected Yes No Don't know
- 2.1 1 * Answer the following questions: TB is often spread from person to person through the air Yes No Don't know
- 2.1 2 * HIV-infected patients are more vulnerable to contracting TB than HIV-negative patients Yes No Don't know
- 2.1 3 * Patients with active TB disease are more likely to infect others if they have a cough that Yes No Don't know

produces a lot of sputum

2.1
4 * Patients with active TB disease can infect people by talking Yes No Don't know

2.1
5 * N95s protect health care professionals and visitors by stopping TB particles from being breathed in Yes No Don't know

3. Symptoms and signs of TB

Please indicate whether the following are symptoms of TB

3.1
* Weight loss Yes No Don't know

3.2
* Coughing for more than two weeks Yes No Don't know

3.3
* Coughing up blood Yes No Don't know

3.4
* Memory loss Yes No Don't know

3.5
* Tiredness/ malaise Yes No Don't know

3.6
* Pain with urination Yes No Don't know

3.7
* Ear pain Yes No Don't know

3.8
* Blurry vision Yes No Don't know

3.9
* Watery eyes Yes No Don't know

3.1
0 * Dizziness Yes No Don't know

3.1
1 * Fever Yes No Don't know

3.1 Many bacterial infections Yes No Don't know

4. Attitude towards TB

Please rate the following statements:

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

4.1 I would like for all health care professionals to be screened for TB routinely strongly disagree 1 2 3 4 5 strongly agree

4.2 If I recognize TB symptoms in myself, I want to get tested as soon as possible strongly disagree 1 2 3 4 5 strongly agree

4.3 If I was diagnosed with TB, I would hide it from my colleagues strongly disagree 1 2 3 4 5 strongly agree

4.4 I feel adherence to TB guidelines and policies are important strongly disagree 1 2 3 4 5 strongly agree

4.5 I feel that TB is a major public health threat strongly disagree 1 2 3 4 5 strongly agree

4.6 I feel it is important for TB patients in the facility to wear N-95 respirators strongly disagree 1 2 3 4 5 strongly agree

(masks)

4.7
* If N-95 respirators (masks) were always available in my health facility, I would always use them when dealing with TB patients

strongly disagree 1 2 3 4 5 strongly agree

4.8
* I want to increase my TB knowledge

strongly disagree 1 2 3 4 5 strongly agree

4.9
* I would like it if more TB training at work took place

strongly disagree 1 2 3 4 5 strongly agree

4.1
0 * I feel that in the health care facility where I work there is sufficient personnel to educate TB patients adequately

strongly disagree 1 2 3 4 5 strongly agree

4.1
1 * I view TB as a fully treatable disease

strongly disagree 1 2 3 4 5 strongly agree

4.1
2 * I feel that priority should be given to TB infection control measure issues at work

strongly disagree 1 2 3 4 5 strongly agree

5. Fears regarding contracting TB

Please describe whether you have these fears regarding TB

- 1. Strongly disagree
- 2. Disagree
- 3. Neutral
- 4. Agree
- 5. Strongly agree

5.1 I am worried
* about getting TB at work strongly disagree 1 2 3 4 5 strongly agree

5.2 My fear of
* contracting TB at work affects my interaction with patients strongly disagree 1 2 3 4 5 strongly agree

5.3 I am worried
* about getting drug-resistant TB at work strongly disagree 1 2 3 4 5 strongly agree

5.4 My fear of
* contracting drug-resistant TB at work affects my interaction with patients strongly disagree 1 2 3 4 5 strongly agree

6. With regards to contracting TB, I fear....

6.1 Infecting my
* family and friends at home strongly disagree 1 2 3 4 5 strongly agree

6.2 The social
* stigma attached to having tuberculosis at work strongly disagree 1 2 3 4 5 strongly agree

6.3 Difficulty to
* adhere to treatment strongly disagree 1 2 3 4 5 strongly agree

6.4 The long
* process of recovery strongly disagree 1 2 3 4 5 strongly agree

- 6.5 * Suffering from side-effects caused by TB treatment
 strongly disagree 1 2 3 4 5 strongly agree
- 6.6 * Neglecting my family responsibilities
 strongly disagree 1 2 3 4 5 strongly agree
- 6.7 * A long hospital stay
 strongly disagree 1 2 3 4 5 strongly agree
- 6.8 * Long-term effect on health in future
 strongly disagree 1 2 3 4 5 strongly agree
- 6.9 * Financial strains from an uncertainty regarding future employment
 strongly disagree 1 2 3 4 5 strongly agree
- 6.10 * Having to rely on others/ a loss of independency
 strongly disagree 1 2 3 4 5 strongly agree

7. Infection control practices

Please answer the following

(If you are working in a context where you never see TB patients, choose `not applicable`)

- 7.1 * Is there someone in charge of TB infection control at the healthcare facility?
 Yes No Don't know Not applicable
- 7.2 * Is there a written TB infection control plan
 Yes No Don't know Not applicable

in place at
your
workplace?

- 7.3 * Are infection control audits performed at your workplace? Yes No Don't know Not applicable
- 7.4 * Are health care professionals trained on TB infection control policies? Yes No Don't know Not applicable
- 7.5 * Have you received training on TB infection control? Yes No Not applicable
- 7.6 * Is early testing, diagnosis and initiation onto TB treatment regarded as important in the facility where you work? Yes No Don't know Not applicable
- 7.7 * Can you get screened for TB at your workplace? Yes No Don't know Not applicable

8. Infection control practices

Please indicate how often the following takes place:

- 8.1 * Sputum results are available 48 hrs after collection? Not applicable Always Often

- Regularly
 Seldom
 Never
 I don't know
- 8.2 * Treatment is started within 5 days after diagnosis?
 Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know
- 8.3 * I work with or have worked with patients diagnosed with TB?
 Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know
- 8.4 * How often do you attend TB training?
 Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know
- 8.5 * Education on TB infection control to patients is done?
 Not applicable
 Always
 Often
 Regularly

- Seldom
 Never
 I don't know
- 8.6 * Education material is available to give a patient newly diagnosed with TB (e.g. pamphlet on managing side-effects/ importance of adherence to treatment)?
- Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know
- 8.7 * At my work facility, MDR-TB patients are kept separate/ isolated?
- Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know
- 8.8 * Coughing patients are prioritised to ensure shorter waiting times in general waiting area (Answer if you are employed in a clinic setting)
- Not applicable
 Always
 Often
 Regularly
 Seldom
 Never
 I don't know

9. Environmental controls

Please answer which of the following seven environmental controls are used in the healthcare facility (9.1-9.7)

- 9.1 * Natural Ventilation Yes No Don't know Not applicable
- 9.2 * Open windows policy Yes No Don't know Not applicable
- 9.3 * Cross ventilation Yes No Don't know Not applicable
- 9.4 * Propeller Fans Yes No Don't know Not applicable
- 9.5 * Exhaust Ventilation Systems Yes No Don't know Not applicable
- 9.6 * High Efficiency Particulate Air Filters Yes No Don't know Not applicable
- 9.7 * Ultraviolet Germicidal Irradiation Lights Yes No Don't know Not applicable
- 9.8 * The room of a TB patient is well ventilated e.g. open windows, fans, HEPA filters/ UV lights Yes No Not applicable
- 9.9 * Are there any areas designed to separate MDR-TB suspected or confirmed cases? Yes No Don't know Not applicable
- 9.10 * Are environmental controls periodically maintained with results written down in registers? Yes No Don't know Not applicable

10. Personal protective equipment

10. Is there a written Personal protective equipment infection control plan in the healthcare facility?
1 *
- Yes No Don't know Not applicable
10. Are there N-95 respirators (masks) available for staff to use?
2 *
- Yes No Don't know Not applicable

11. Personal experiences

Please answer the following:

11. I am neglecting infection control measures when working with TB patients despite being aware of the risks
1 *
- Yes No Not applicable
11. I have been tested for TB
2 *
- Yes No
11. I was tested for TB at my workplace
3 *
- Yes No
11. I was tested for TB outside my place of work
4 *
- Yes No
11. I am currently being treated for TB
5 *
- Yes No

11. I previously
6 * had TB Yes No

11. My diagnosis
7 * was made
during a
routine
screening at
my health
care facility Yes No Not applicable

12. IF you have TB/had TB in the past please complete

Complete this section only if you have TB/ had TB in the past

12. I had TB
1 before I
started
working in a
health care
setting Yes No

12. I was
2 diagnosed
with TB within
my first five
years working
in a health
care setting Yes No

12. I was
3 diagnosed
with TB after
5- 10 years of
working in a
health care
setting Yes No

12. I was
4 diagnosed
with TB after
working in a
health care
setting for
more than 10
years Yes No

12. I defaulted
5 my treatment Yes No

12. I suffered
6 severe/
permanent
damage e.g.
hearing loss/
irreversible
peripheral
neuropathy Yes No

12. I was
7 embarrassed
when I was
diagnosed
with TB Yes No

12. I was scared
8 to return to
work as I
feared
contracting
TB again
from working
with TB
patients Yes No

12. TB
9 prevention
and infection
control
measures are
not adhered
to at my work
facility Yes No Unsure

13. Lucky draw

13. If you want to
1 participate in
the lucky
draw please
enter your
cellphone nr
so that you
can be
contacted

14. THANK YOU FOR YOUR TIME!

Addendum C: Expert Panel contact details

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Addendum D: Consent form

CONSENT FORM

Online survey of the knowledge, attitudes and experiences of dietitians in relation to tuberculosis at the workplace

Dear Dietician

2014

I, Ingrid Oxley Oxland, from the Division of Dietetics (Nelson Mandela Metropolitan University) am conducting research among dietitians. The study aims to evaluate dietitians' knowledge, attitudes and experiences in relation to TB in the work place.

If you agree to voluntarily participate, you will need to complete an online questionnaire. The online questionnaire takes about 13 minutes to complete.

Information will be gathered on your knowledge, attitudes and experiences in relation to TB. With the results we hope to enable improved future decision-making with regards to TB support in the health sector.

Participation will be confidential, voluntary, and no personal information to identify anyone will be handled by anybody other than the researchers. E-mail addresses of interested parties will only be handled by the researcher. Although research results may be published for outcomes per group, no personal or individual data will be revealed.

Participants will have the option to opt-out of the study at any time. Confidentiality and anonymity will be maintained at all times during analysis of data and the completion of any reports/ publications.

If you wish to participate in the study please complete the section below and email it back to ingridoxley@gmail.com or fax it to 0862438504.

By completing this form and submitting it you are consenting to participate in this research. Should you need further information/ have questions please contact: ingridoxley@gmail.com

I CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT

Name and Surname:

Registered number with HPCSA (e.g. DT 000 000):

Email address:

Addendum E: A copy of the invitation to participate in the online survey about tuberculosis at the workplace within ADSA newsletters (5 August 2014, 4 November 2014)



Weekly Notices

Participate in an online research study about TB in the workplace

Title of the study:

Development of an online blended learning tool to influence dietitians' knowledge, attitudes and experiences in relation to tuberculosis at the workplace.

Aims:

1. Evaluation of dietitians' knowledge, attitudes and experiences in relation to TB in the work place
2. Development and of an online blended learning tool to influence knowledge, attitudes and experiences of dietitians in relation to TB at the workplace

Why should you consider participating in this study?

The impact of TB on the workplace cannot be underestimated. Gaining a better understanding can help policy makers ensure dietitians are protected against TB transmission.

Having an online blended learning tool available to improve knowledge, attitudes and experiences with regards to TB makes decision-making in the health sector by policy makers/ programme managers more relevant and enables future improvements.

If you are interested, please contact Ingrid Oxley at ingridoxley@gmail.com.

By participating you stand a chance to win a R500 Woolworths voucher as lucky draw prize.

Addendum F: Feedback from expert panel (2014)

Knowledge, attitudes and experiences of dieticians in relation to tuberculosis at the workplace

FEEDBACK FROM EXPERT PANEL (2014)

1. Did you understand all the questions?

Yes: 11

No:1

Comments: Wasn't completely familiar with all the named policies. Except no option for working with "both" adults and paediatrics

2. In your opinion, do the questions measure objectives of the study- in other words, are the questions matching the title of the study?

Yes: 10

No:2

Comments: Not completely- Q7 needs don't know option. Why does it ask the profession 12.3 if it is aimed at dieticians only? I felt some questions were not related to dieticians and did not measure all the components in the title

3. Is the questionnaire appropriate for dieticians?

Yes: 8

No: 2

Comments: Not completely. Dieticians will struggle to answer Q7- needs a don't know option- a lot of procedures in this questionnaire are outside the scope of practice of dieticians/ done by nursing staff. Not everywhere- at Q7 some questions were detailed and didn't provide an "I don't know/unsure" option which could lead to dieticians answering the questions with a guess. Not always. Maybe not all the questions, I'm particularly not familiar with how long TB test results take to come in . We are not always made aware of the policies in place regarding certain areas in hospital e.g. casualty. Some of the questions involve policies/ documents with which I am not familiar as a dietician. Not all the answers were known by me.
2.1 Do dieticians know guidelines?
2.3 Need more clarity when there are side effects treatment is changed but finishing treatment is critical.

7.5 Patient education- how will dieticians know?

4. Is the questionnaire comprehensive enough to collect all the information needed to address the purpose and goals of the study?

Yes: 8

No: 1

Comments: Not sure but I think so. But maybe ask if participant has/had family member who have contracted TB from their own workplace or from the participant. Ask if family members also work in a healthcare facility where they contracted TB. I am not completely sure if experiences of dieticians are successfully explored. Knowledge related questions also seemed relatively vague and at time in my opinion not really relate to dieticians in the workplace.

5. Is the survey/ questionnaire clear?

Yes: 11

No: 0

Comments: Some questions require a comment section. Sometimes

6. In your opinion, is the questionnaire too long?

Yes: 3

No: 9

Comments: Seemed repetitive , was a bit long yes

7. Was it easy to read?

Yes: 11

No: 0

Comments: Most part, yes. Blocks to tick answers are confusing you end up ticking yes instead of no- too closely spaced. Font size for yes and no van be larger. Some categories instead of “not applicable” the option should be “unsure”. There were cases when I wanted to put I don’t know as an opinion and it wasn’t available (especially section 7). Also the section about what one fears, I think a lot of people have not given it much thought, i.e. one does not spend time worrying or stressing about it. For example, it is not that I dont fear giving TB to my family because I suppose I do, but It’s not something that I think or want to think about.

8. Was navigating to different sections of the questionnaire easy?

Yes:12

No: 0

Comments: Except for Q11 where I completed it although not applicable to me. This section must only show if person has had TB before. Q11.9 should be separated from the rest of the string. Need to lock page before person can go the next otherwise people may skip without completing the questions

9. Were there any questions too personal or sensitive?

Yes: 0

No:12

Comments: I think that's the point of the study, personal insight to ones knowledge, attitudes and experiences

10. Was this electronic format user-friendly and self-explanatory for your own needs?

Yes: 10

No: 0

Comments: See comment about section 7- I don't know option.

And convenient

The radio button selection must be very precise. It is easy to think that you have selected an option and only realize later your click was not 'dead centre' on the option.

11. In your opinion, is it user-friendly and self-explanatory enough for the sample population (dieticians nationally)?

Yes:10

No:1

It may be a little bit of a challenge to technologically challenged individuals.

Yes, a warning about ensuring that the answer option was properly selected before continuing might assist to avoid spoiled/incomplete survey returns.

Other comments

How would you prevent someone from completing it more than once?

? Swop strongly agree to strongly disagree around so that strongly agree is first. Almost completed questions 3,4,5 the wrong way around.

I completed it quickly, but am privy to many of the issues in the hospital. There are many straightforward positive answers without any looking at some misconceptions and concepts in IPC - specifically around duration of

infectiousness and extrapulmonary TB. In the Eastern Cape there is a lot of drug resistant TB and my answers to some of the questions around my fears are very much determined by the type of TB - an example is XDR TB and the toxic medications and increased length of stay at Jose Pearson should frighten every person to death, but is not applicable to DSTB particularly. I think a small section on MDR should be included to assess the knowledge and fears of this.

At regularity of exposure, not applicable should be added as some are exposed to TB and don't know it.

An option should be added for dieticians who work with adults and children not just one.

What is N95? A description should be added (mask)

Adherence to guidelines and procedures is important should be "are" important

The question of wearing N-95 masks if they were always available should be moved to the Personal Protective Equipment

2.3 If side effects are reported change of treatment but finishing still critical

2.6 PTB

3. Attitude questions – what is the range in the middle

3.6 Not practical because their lungs are already damaged when these masks are fitted properly they suffocate even healthy person when worn long- they wear them when travelling

3.1 This is why we requested TB focal person in the organogram but presently do not have

6.1 TB focal person N/A

6.7 I'm not sure what guidelines say but what I know people are screened when they have signs or if they were around contact + fear they need to have sputum sent to lab. No routine screening done

7.5 How will they know whether education is done because patients do not sign in the inservice books

8.3 improvise

8.4 Not available

10.6 not answered – previous TB

11 NA whole section

Question 2.1- do dieticians have the guidelines?

Q1.7 what about those working in the clinic dealing with both

Questionnaire too long although relevant- combine 11.1-11.4

Label middle three boxes between strongly agree- disagree

THANK YOU FOR YOUR TIME- YOUR OPINION AND INPUT IS APPRECIATED

Ingrid Oxley (RD) Cell: 076 892 1974

Addendum G: Summary of Dimensions for TB Infection Control (IC) used in South African studies and by the WHO.

	WHO (2009)	Kanjeet al., (2011)	Farley et al. (2012)	Kanjeet al. (2012)	Claassens et al. (2013b)	Engelbrecht & Van Rensburg (2013)	WHO (2015c)
Dimension	Facility level measures		Facility-level infrastructure			Facility-level managerial controls	Managerial
Factors	<ul style="list-style-type: none"> -TB infection control plan (including policies and aspects of human resources) -Use of space to optimize implementation of IC measures -Monitor TB among HCP -Address advocacy, communication and social mobilization -Monitor and evaluate TB infection control -Participate in research 		<ul style="list-style-type: none"> -IC officer -TB training to HCP -TB IC plan -TB Screening for HCP -VCT for HCP 			<ul style="list-style-type: none"> -IC committee -IC policies -IC person in charge of IC -TB screening of staff -TB health education to patients 	<ul style="list-style-type: none"> -TB IC plan -Budget allocated for TB IC activities - Designated IC officer/committee -IC officer received documented TB IC training within the past two years - all clinical staff received TB IC training within the past two years - TB screening for HCP

Dimension	Administrative controls	Administrative Practices	Administrative control infrastructure		Administrative controls	Administrative controls	Administrative
Factors	<ul style="list-style-type: none"> -Triage and separation of symptomatic TB patients -Reduce diagnostic delays, support adherence and ensure completion of treatment -Educate TB patients on cough etiquette -Relocation of HIV-infected HCP -Provide HCP with information and encourage to test for TB if symptomatic 	<p>IC officer, IC policy, separation of TB suspects, triage of TB suspects, cough hygiene, opening of doors and windows, PPE use</p>	<ul style="list-style-type: none"> -Cough hygiene -Sputum collection -Allowing visitors in ward 		<ul style="list-style-type: none"> -Person in charge of IC -Written IC plan -Early detection and initiation onto treatment -Separation of infectious patients -Education to patients and families on TB IC 	<ul style="list-style-type: none"> -Screening TB suspects -Screening of HIV-infected patients -Provision of masks to coughing patients at the clinic -Triage of coughing patients -Education on cough etiquette 	<ul style="list-style-type: none"> - Patients with a cough are educated on cough etiquette, triaged through waiting areas and separated from other patients -All information and educational material is checked for stigmatizing/ discriminatory language -TB information is offered to patients - Resources such as tissues are available for patients to use and are disposed in medical waste bins -HIV testing available for

							<p>HCP at the health facility</p> <ul style="list-style-type: none"> -Register to track time to initiation onto treatment and time from screening to diagnosis - Rapid diagnostics as Xpert MTB/RIF® is first test used for HIV-infected patients -If HIV-infected, time monitored until started on ART
Dimension	Environmental controls		Environmental control infrastructure		Environmental controls	Environmental controls	Environmental
Factors	Ventilation systems		Fans, UVGI, windows.		-Natural ventilation, open windows policy, cross ventilation, fans, exhaust ventilation systems, HEPA filters,	-Opening of windows, natural ventilation, fans, turbine roof vents	<ul style="list-style-type: none"> -The design and triage system complies with TB IC policies - Waiting area is well ventilated -Cough hygiene messages visible in all

					<ul style="list-style-type: none"> UVGI lights -Area designed for separation of MDR-TB patients -Professional available for design, installation, maintenance, evaluation of environmental controls -Controls maintained with results in registers 		<p>areas of health facility that are often used</p> <ul style="list-style-type: none"> - Waiting areas are not crowded - Sputum is collected away from others - Hospitalised TB patients are grouped according to DST in rooms with adequate ventilation
Dimension	Personal Protective Equipment		Personal Protective Equipment		Personal Protective Equipment	Personal risk-reduction controls	Personal Protective Equipment
Factors	Use of N-95 respirators		Availability and use		<ul style="list-style-type: none"> -Personal respiratory protection plan available -N-95 respirators available -Training on PPE 	Availability of PPE, disposable gloves, soap	<ul style="list-style-type: none"> -Respirators are readily available - HCP received training on fit and use of respirators.

Dimension		Knowledge	Knowledge	Information			
Factors		-Symptom identification -Transmission (talking, coughing, airborne, spitting, sharing food, productive cough, HIV-infected population more vulnerable) -Respirators	-Symptoms of TB -IC measures -Duration of infectiousness	-Signs and symptoms of TB -Infection and spread -Respirator use -Cough hygiene -Ventilation -Increased susceptibility of HIV-infected people to TB -Screening/ separation of TB suspects			
Dimension		Barriers to IC		Behavioural skill	Previous IC audits		
Factors		-Cough hygiene -Natural ventilation -HIV testing and redeployment of HCP -HCP getting screened/ tested for TB -Use of PPE		-TB screening and triage -Cough hygiene -Personal TB diagnosis -Natural ventilation	TB IC performed at the health care facility		

Addendum H: Process by which the researcher aimed to ensure content validity for the survey

Conceptualisation of the variables was done based on published studies to strengthen the content validity:

Demographics:

- Setting of the health facility (WHO, 2008c:60)
- Career length/length of experience (Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2008c)
- Regularity of exposure to TB patients (Farley *et al.*; Naidoo *et al.*, 2012)

Knowledge

- Knowledge of national TB Infection Control Guidelines (Department of Health, 2014; Zelnick *et al.*, 2013; Farley *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.* 2011; WHO, 2009; WHO, 2008c: 58)
- Knowledge about TB signs and symptoms (Department of Health, 2014:12; Farley *et al.*; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2008c:53)
- Knowledge about TB transmission (Kanjee *et al.* 2012; Kanjee *et al.*, 2011; WHO, 2008c:53)
- Knowledge about TB treatment (Department of Health, 2014; WHO, 2008c:54)
- Knowledge about the cure of TB (Department of Health, 2014)
- Knowledge of high risk groups for TB (Farley *et al.*; Kanjee *et al.*, 2012; WHO, 2008c: 56)

Attitudes

- Routine screening of HCW (Department of Health, 2014; Engelbrecht & Van Rensburg, 2013; Zelnick *et al.*, 2013; Kanjee *et al.*, 2011)
- Seriousness of TB (Kanjee *et al.*, 2012; WHO, 2008c: 53,59)
- TB as a curable disease (WHO, 2008c: 54)
- Perception of being at risk of getting TB (Zelnick *et al.*; Kanjee *et al.*, 2012; WHO, 2008c:54,59)
- Attitude/stigma towards someone/self with TB (Naidoo *et al.*, 2013; Zelnick *et al.*; Farley *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2008c)
- Wanting more training on TB (Zelnick *et al.*; WHO, 2008c:56)

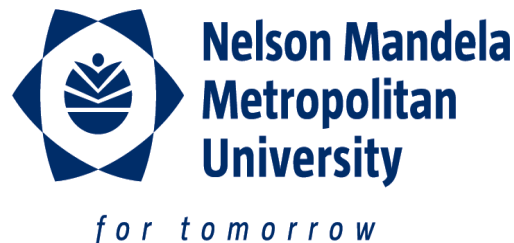
- Importance of adherence to TB Infection Control measures (Zelnick *et al.*; Farley *et al.*; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011)
- Willingness to adhere to Infection Control measures (Zelnick *et al.*; Farley *et al.*)
- Availability of sufficient resources to Implement TB Infection Control measures (Engelbrecht & Van Rensburg; Zelnick *et al.*; Adeleke, 2012/2013; Farley *et al.*; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011)
- Fears regarding the possibility of contracting TB at the workplace (Tudor *et al.*, 2013; Farley *et al.*; Kanjee *et al.*, 2012; Feedback from Expert Panel (Addendum F); WHO, 2008c)

Experiences

- Implementation of Infection Control Measures by the facility (Tshitangano, 2014; Engelbrecht & Van Rensburg, 2013; Tshitangano, Maputle & Netshikweta, 2013; Zelnick *et al.* 2013; Adeleke, 2012/2013:198- 199; Farley *et al.* 2012; Naidoo *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2009)
- Training on TB Infection Control (Engelbrecht & Van Rensburg:223; Zelnick *et al.*; Adeleke; Farley *et al.*; Naidoo *et al.*, 2012; WHO, 2008c:60)
- Availability of resources to implement Infection Control measures (Engelbrecht & Van Rensburg; Zelnick *et al.*; Adeleke; Farley *et al.*; Naidoo *et al.*, 2012; Kanjee *et al.*, 2011)
- Personal adherence to TB Infection Control Measures (Tshitangano, 2014; Zelnick *et al.*; Adeleke; Farley *et al.*; Naidoo *et al.*, 2012; Kanjee *et al.*, 2012; Kanjee *et al.*, 2011; WHO, 2009)
- Previous / current personal diagnosis of TB (Engelbrecht & Van Rensburg)
- Impact of TB on personal life (Tudor *et al.*, 2013)

The questionnaire was reviewed during a pilot study consisting of dieticians, an IT specialist, an infectious disease specialist (medical doctor) and an infectious diseases sister, to strengthen content validity, and feedback was applied to change the questionnaire according to the panel's recommendations (Addendum F).

Addendum I: Ethics Approval Letter
from the Faculty Postgraduate Studies Committee,
Nelson Mandela Metropolitan University



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FINAL RESEARCH/PROJECT PROPOSAL:

KNOWLEDGE, ATTITUDES AND EXPERIENCES OF DIETITIANS IN RELATION TO TUBERCULOSIS AT THE WORKPLACE

Please be advised that your final research project was approved by the Faculty Postgraduate Studies Committee (FPGSC).

Faculty Postgraduate Studies Committee (FPGSC) reference number: **H14-HEA-DIET-002**. FPGSC grants ethics approval.

We wish you well with the project.

Kind regards

pp

Ms N Isaacs
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TO WHOM IT MAY CONCERN

I, Aileen Gail Klopper, declare that I have assessed and edited the dissertation of
INGRID OXLEY OXLAND (Student no: 214362531) with the title:

KNOWLEDGE, ATTITUDES AND EXPERIENCES OF DIETICIANS IN RELATION
TO TUBERCULOSIS AT THE WORKPLACE

submitted in fulfilment of the requirements for the degree M Sc Dietetics in the
Faculty of Health Sciences at the Nelson Mandela Metropolitan University.

Any other queries related to the editing of this treatise can be directed to me at 074
3209463.

Signed at Port Elizabeth on 26 November 2015.

A handwritten signature in black ink, appearing to read 'Aly Klopper', is enclosed in a light grey rectangular box.

Ms AG Klopper (MA HWM)