AN INVESTIGATION INTO THE KNOWLEDGE OF NURSES ABOUT TUBERCULOSIS IN THE SOUTHERN REGIONS OF NAMIBIA

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DECLARATION

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ABSTRACT

Background: Tuberculosis (TB) is a communicable disease of major public health proportions in Namibia and one of the most frequent causes of hospitalization and attendance in outpatient clinics. Nurses are the primary care providers who play an active role in the management of TB. Thus, they must have adequate knowledge about TB aligned with evidence-based guidelines. Although all nurses working with TB patients are supposed to be trained on the TB management guidelines, not all receive formal training. Besides, there is no formal evaluation of the knowledge level of the nurses about TB management.

Aim: The study aimed to investigate the knowledge of nurses about TB in public healthcare facilities in the southern regions of Namibia.

Objectives: The objectives of the study were to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the assessment, diagnosis, treatment and infection prevention and control of TB.

Methods: The study applied a quantitative descriptive research design. The target population was registered and enrolled nurses working in public healthcare facilities from Hardap and Karas regions. The total population was 304 nurses working in these regions. A convenient sample of 152 nurses was recruited and n=132 (87.7%) of the participants completed the questionnaire. Data was collected with a self-developed, validated, self-administered structured questionnaire. The study was approved by the Health Research Ethical Committee at Stellenbosch University, ref. no. S20/07/179, including from the Namibian Ministry of Health and Social Services, Ethical Health Committee; ref.no.17/3/3ANS and individual informed consent. A pilot study of 15 (10%) participants was conducted in the Omaheke district, which supported the validity and reliability of the study. The researcher collected the data and adhered to ethical principles of informed consent, right to anonymity and confidentiality of participants.

Descriptive and inferential statistics, which included the Kruskal Wallis and Mann Whitney U tests, were applied to determine any statistical differences between the knowledge scores and demographical data. A p-value of ≤0.05 indicated statistical significance. For this study, the competence level was based on a score of ≥80%.

Results: Most (89.8%) of the participants had adequate knowledge about the assessment of TB. Results showed inadequate knowledge of the nurses about the diagnosis (78.0%), treatment (77.2%) and infection prevention and control (IPC) (58.5%) of TB. Statistically

significant differences were shown between the scores obtained for the diagnosis of TB and the qualification (p=0.041) and duration (p=0.023) of employment of participants. The participants who worked less than a year in the current position showed a knowledge gap (median=37.5) about the infection prevention and control of TB.

Conclusion: To improve the knowledge of nurses about TB, the following are recommended: mandatory training to newly recruited nurses, submission of a brief report to the Nursing colleges and University, continuous refreshment on job training, funding and introduction of quality improvement programmes are needed to enhance the knowledge of nurses about TB.

Keywords: Nurse, knowledge, tuberculosis, diagnosis, treatment, TB infection control.

OPSOMMING

Agtergrond

Tuberkulose (TB) is ‘n oordraagbare siekte met grootskaalse afmetings in Namibië en een van die mees gereelde redes vir hospitalisasie en besoeke aan buitepasiënt-klinieke. Verpleegsters is die primêre gesondheidversorgers wat ‘n aktiewe rol speel in die hantering van TB en moet oor voldoende kennis wat in ooreemstemming is met bewys-gebaseerde riglyne beskik. Alhoewel alle verpleegsters wat met TB pasiënte werk, veronderstel is om volgens die hanteringsriglyne van TB opgelei te wees, ontvang nie almal formele opleiding nie. Buitendien, daar is geen formele evaluering oor die kennisvlak van die verpleegsters oor die hantering van TB nie.

Doel

Die doel van die studie is om die kennnis van verpleegsters aangaande assessering, diagnose, behandeling en infeksievoorkoming, asook die hantering van TB in openbare gesondheidsorgfasiliteite in die suidelike streke van Namibië te ondersoek.

Metode

Die studie het ‘n kwantitatiewe, beskrywende navorsingsontwerp toegepas. Die teiken populasie was geregistreerde en ingeskrewe verpleegsters wat in openbare gesondheidsorgfasiliteite van die Hardap- en Karasstreke werk. Die totale populasie is 304 verpleegsters wat in die streke werk. ‘n Gerieflike steekproef van 152 verpleegsters is gewerf en n=132 (87.7%) van die deelnemers het die vraelys voltooi. Data is ingesamel met ‘n selfontwikkelde, gevalideerde, selfgeadministreerde, gestruktureerde vraelys. Die studie is goedgekeur deur die Gesondheidsnavorsingsetiekkomitee aan Stellenbosch, verwysingsnommer S20/07/179, asook die Namibiese Ministerie van Gesondheid en Maatskaplike Dienste, die Etiese Gesondheidsdienste met verwysingsnommer 17/3/3ANS, wat individuele ingeligte toestemming insluit. ’n Loodsprojek van 15 (10%) deelnemers is uitgevoer in die Omaheke-distrik wat die validiteit en betroubaarheid van die studie ondersteun het. Die navorser het die data ingesamel en het aan die etiese beginsels oor ingeligte toestemming voldoen, asook die reg tot anonimiteit en vertroulikheid van deelnemers. Beskrywende en afleibare statistiek wat Kruskal Wallis en Mann Whitney U toetse insluit, is toegepas om enige statistiese verskille tussen die puntetellings oor die kennis van verpleegsters en demografiese data te bepaal. ‘n P-waarde van ≤0.05 het ‘n statistiese beduidenis aangedui. Vir hierdie studie is die bekwaamheidsvlak gebaseer op ‘n puntetelling van ≥80%.

Resultate

Die meeste (89.8%) van die deelnemers beskik oor voldoende kennis ten opsigte van die assessering van TB. Resultate het voldoende kennis van die verpleegsters oor die diagnose (78.0%), behandeling (77.2%) en infeksie-voorkoming en beheer (IVB) (58.5%) van TB getoon. Statistiese beduidende verskille is bewys tussen die puntetelling wat gewerf is met die diagnose van TB en die vlak van opvoeding (p=0.041) en die tydperk van indiensneming van deelnemers (p= 0.023). Die deelnemers wat minder as ‘n jaar in die huidige betrekking gewerk het, het ‘n kennisgaping (mediaan=37.5) oor die infeksie-voorkoming en beheer van TB getoon.

Slotsom

Om die kennis van verpleegsters aangaande TB te verbeter, word die volgende aanbeveel: verpligte opleiding aan nuut aangestelde verpleegsters, indiening van 'n kort verslag na die Verpleegkolleges en Universiteite, deurlopende opknapping en indiensopleiding, befondsing en instelling van kwaliteitsverbeteringsprogramme word benodig vir die verbetering van verpleegsters se kennis van TB.

Sleutelwoorde

Verpleegster, kennis, tuberkulose, diagnose, behandeling, TB infeksie-beheer

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ABBREVIATIONS

BCG	Bacilli Calmette-Guérin
CNR	Case notification rate
DOTS	Direct Observed Treat-Short course
EN	Enrolled nurse
FAST	Find cases Actively, Separation safely, Treating effectively
FDC	Fixed dose combination
HbA1c	Glycaemic haemoglobin
HCW	Healthcare worker
HIV	Human Immunodeficiency Virus
IPC	Infection prevention and control
IPT	Isoniazid preventive therapy
LPA	Line probe assay
MTB	Mycobacterium tuberculosis
MTB/RIF	Mycobacterium tuberculosis rifampicin assay
TBL MTP-III	Third Medium Term Plan for Tuberculosis and Leprosy
NMHSS	Namibian Ministry of Health and Social Services
NTLP	National Tuberculosis and Leprosy Programme
OSCE	Objective structured clinical examination
PHC	Primary Health Care
QIC	Quality improvement committee
RN	Registered nurse
SPSS	Statistical Product and Service Solutions
TB	Tuberculosis
UNSDG	United Nations Sustainable Development Goal
WHO	World Health Organization

CHAPTER 1: FOUNDATION OF THE STUDY

1.1 INTRODUCTION

TB is among the top ten causes of death globally (World Health Organization (WHO), 2018:1). TB has caused an estimated 1.3 million deaths among Human Immunodeficiency Virus (HIV) negative people and 3.0 million TB deaths to people living with HIV (WHO, 2018:38). From the estimated 10 million people who were diagnosed with TB, 72% resided in Africa (WHO, 2018:1). The TB burden in Namibia was 8,108 cases notified which translate to the case notification rate (CNR) of 336/100, 000 population in 2018 (Namibian Ministry of Health and Social Services (NMHSS), 2019:1).

In a country with a high HIV prevalence rate of 12. 6% such as Namibia, HIV is indeed a driver of the TB epidemic (NMHSS, 2017:1). Many factors contribute to the development of TB, including the knowledge of the nurses managing these patients. Thus, in this study, the researcher aimed at investigating the knowledge of nurses about TB which focused on the assessment, diagnosis, treatment of TB and IPC.

The United Nations Sustainable Development Goal 3 (UNSDG) and WHO's End TB strategy target to end the global TB epidemic by 2030. The following goals were set for this purpose: decreasing the TB incidence by 90%, reducing TB mortality by 95% and eliminating the catastrophic cost faced by TB patients (WHO, 2018:14). To achieve these goals, components of early diagnosis of TB, universal susceptibility testing, screening of contacts and high-risk groups, as well as treatment of all people with TB should be implemented (Houben, Menzies, Sumner, Huynh, Arinaminpathy, Goldhaber-Fiebert et al., 2016:806).

According to the NMHSS (2014:3), the guidelines on TB infection control indicate that the Ministry is obligated to protect the nurses from acquiring TB infection during the course of their professional practice. Furthermore, the Ministry should protect patients from acquiring TB infection when seeking medical care at healthcare facilities (NMHSS, 2014:3). Poor implementation of TB IPC measures in healthcare facilities may result in TB transmission to healthcare workers and patients (Claassens, Van Schalkwyk, Du Toit, Roest, Lombard, Enarson et al., 2013:5).

Obstacles to the implementation of IPC include a lack of knowledge and inadequate infection control practices by healthcare workers. Knowledge deficits, inadequate practices of triage and poor patient education about infection control practices further lead to the spreading of TB infection in healthcare facilities (Shrestha, Bhattarai, Thapa, Basel & Wagle, 2017:2).

1.2 RATIONALE

The WHO (2018:222) Global report estimates that sixty people per 100,000 population died of TB in Namibia. According to the Namibian National Guidelines for the management of TB, Omaheke, Hardap and Karas are among the regions that reported TB with the highest per capita disease burden (NMHSS, 2019:1). Krithika, Jayanthi and Subramanian (2018:153) indicated that nurses need continuous educational programmes regarding the treatment and control of TB. She further reported that the improvement of the nurses' knowledge about the diagnosis and management of TB will contribute to effective TB control and will assist in achieving the goal of End TB.

Evidence from good TB programmes may achieve treatment success rates up to 95% when TB treatment is provided according to the national guidelines and when healthcare workers fully adhere to the implementation of the national TB treatment guidelines (NMHSS, 2019:28). According to Texeira (2018:18), TB is a communicable disease of major public health proportions in Namibia. She further indicated that the disease is one of the most frequent causes of hospitalization and attendance in outpatient clinics.

Nurses are the primary care providers and therefore it is essential that they have adequate knowledge aligned with evidence-based guidelines (Phetlhu, Bimerew, Marie-Modeste, Naidoo & Igumbor, 2018: 877-883). Nurses play an active role in TB screening programs, Direct Observe Treatment-Short course (DOTS), implementation of sputum collection and administering of anti-TB vaccines (Yükseltürk & Dinç, 2013:47). Nurses should comply with the principles of administering the correct medication and dosage at the correct time (Yükseltürk & Dinç, 2013:47). Yükseltürk and Dinç (2013:47) further indicated that nurses need knowledge about TB treatment to effectively execute their responsibilities towards patients who are diagnosed with TB. The Namibian TB guidelines (NMHSS, 2019:46) further emphasise that nurses are in contact with the patients from diagnosis to the end of TB treatment and must ensure that patients who are lost are traced and restarted on TB treatment.

Singer-Leshinsky (2016:25) indicated that due to the increase in drug resistant TB among immune-suppressed patients, all healthcare workers should apply infection control measures, in order to reduce TB transmission. Furthermore, the medium-term strategic plan for TB and leprosy of 2017- 2022 for the NMHSS (2017:31) emphasises screening and surveillance for TB among healthcare workers. TB is not recognized as an occupational disease in Namibia (NMHSS, 2017: 31). This makes it difficult for the ministry to have occupational health systems that actively follow up and monitor TB infection at all levels (NMHSS, 2017:31).

1.3 PROBLEM STATEMENT

Predominantly, registered and enrolled nurses manage TB in Namibia through specialised TB management guidelines. Although all nurses working with TB patients are supposed to be trained on the TB management guidelines, not all receive formal training. Each year, a few nurses are sent for formal training from different healthcare facilities and are expected to train the rest of the nurses. Regardless of whether the nurses have received training or not, they are expected to assess, diagnose and treat patients with TB. In addition, there is no formal evaluation of the knowledge level of the nurses about TB management. The researcher, who is in a managerial position, has observed that during TB data review meetings and support visits, the knowledge about TB is a concern. The researcher assumed that a gap thus exists about what is the nurses' knowledge about the assessment, diagnosis and treatment of patients with TB, including the infection prevention and control of TB.

The National Tuberculosis and Leprosy Programme (NTLP) (2018: 21) revealed in 2017 that the TB death rate was between 9%-10% for Namibia. In addition, the number of new and relapsed TB cases notified in 2018 (NTLP, 2018:18) in the two regions, Hardap and Karas under study revealed 30%-40% relapsed cases. A knowledge gap regarding TB management among nurses may result in substandard care, late diagnosis and poor treatment outcome (Alotaibi, Yassin, Mushi, Maashi, Thomas, Mohamed et al., 2019:9). Training of nurses about TB case management is needed to reach and sustain situations where nurses at all levels of health systems have knowledge about TB (NMHSS, 2019: 3). Generally, nurses need updated information with recent scientific literature and standard treatment for drug-sensitive TB patients. The researcher has identified that there are no studies conducted that focused on the knowledge of nurses about TB with specific reference to assessment, diagnosis, and treatment in Namibia. However, a few literature reviews focusing on the assessment of the effectiveness of IPC of TB by organizational performance has been acknowledged (Mulokoshi, 2019.43. This has prompted the researcher to investigate the knowledge level of nurses about TB as a factor that may contribute to the successful management of patients diagnosed with TB.

1.4 RESEARCH QUESTION

The research question that gave guidance to this study was: "What is the knowledge of nurses about TB in public healthcare facilities in the southern regions of Namibia?"

1.5 RESEARCH AIM

The aim of the study was to investigate the knowledge of nurses about TB in public healthcare facilities in the southern regions of Namibia.

1.6 RESEARCH OBJECTIVES

The objectives of the study were to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about

1. The assessment of TB
2. Diagnosis of TB
3. Treatment of TB
4. Infection prevention and control of TB
5. Determining the association between demographical data and the knowledge scores of nurses working in the public healthcare facilities in the southern regions of Namibia.

1.7 CONCEPTUAL FRAMEWORK

The researcher applied the Patricia Benner's nursing theory (1982:402), known as from "Novice to Expert". The theory was based on the Dreyfus model of skill acquisition in the clinical nursing practice. She explained that the concept of expert nurses is about developing knowledge and skills through education and a multitude of experiences. According to American Nephrology, Nurses Association (ANNA) (2017:7) practical knowledge relates to skills that are acquired from theoretical knowledge. This further explained that in the Benner theory, knowledge is developed and or enhanced through experience (Benner, 1982:402).

Benner (1982:402) describes nurses as progressing in ascending five levels of nursing expertise from novice to advanced beginner, competent, proficient and expert.

1. **Novice:** The nurse is a beginner with no experience prior to clinical environment. The nurse is taught what to do, in order to perform a given task. Novice nurses rely on the rules and principles to guide the achievement of attributions (Benner, 1982:402). In the context of the knowledge about TB, the newly appointed nurse has no experience in TB management. She requires induction and orientation on the subject matter regarding the availability of TB guidelines, circulars about TB and standard operating procedures on IPC of TB at the healthcare facility.

2. **Advanced beginner:** The nurse starts to demonstrate improved skills after one year of clinical experience. During this stage, the nurse needs support regarding setting priorities about patients' care in the clinical situation (Benner, 1982:404). At this stage, the healthcare worker needs guidance to enhance knowledge on how to assess, diagnose, treat and prevent TB disease by applying infection control measures. For example, the nurse could diagnose a TB patient correctly if

she/he follows the diagnostic flowchart for pulmonary TB as per TB guidelines (NMHSS, 2019:16).

3. **Competent stage**: Benner's theory (1982:403) explains that as the nurse enters the competent stage of expertise, she/he has been on the job for two to three years in the same working environment, for example, managing TB patients at the clinic, health centre and hospital level. Nurses who are working in the hospital environment may reflect the ability to assess, plan and evaluate patient care through nursing care plans (Ahamed, Khilall & Woods, 2017: 6-24). Similarly, nurses who are working in clinics and health centres may be better at organizing and planning the time effectively. These nurses map off areas where TB cases with positive sputum smears are reported, to do targeted contact tracing (Kigozi, Heunis & Engelbrecht, 2019: 2). This will require immediate action to ensure contact investigation to reduce the further transmission of TB (Ho, Fox & Marais, 2016:377).

4. **Proficient**: Benner's theory (1982:405) claims that exposure to experience, teaches the proficient nurse what typical events to expect in given circumstances and how to adjust plans in response to these events. In the context of knowledge about TB, the proficient nurse understands how to manage a TB patient holistically. At this level, the nurse who works in a remote clinic without a medical doctor makes independent decisions by identifying TB contacts and do contact tracing of eligible patients, collecting sputum for diagnosing and monitoring, initiates treatment and provides a treatment outcome. Medical doctors are responsible for diagnosing complicated forms of TB, commonly extrapulmonary and drug-resistant TB. Nurses working at health centres and clinics should have the capacity to identify and refer these cases to the hospitals (NMHSS, 2019:4).

5. **Expert nurses** no longer require principles, rules and guidelines to connect situations and determine actions. These nurses are independent critical thinkers and require minimal guidance in their practice. Nurses who are at an expert stage of development would anticipate complications that could rise from incorrect administration of TB treatment such as treatment failure and or death. RNs and ENs are expected to manage patients, which include assessing, diagnosing, treating and preventing TB. Thus, nurses should be competent and have the required knowledge about TB in performing these tasks.

For this study, the competence level was based on a score of ≥80%, as guided by the Department of Nursing and Midwifery Stellenbosch University (2014) and the University of Namibia (2018:29), that all nursing students completing an objective structured clinical examination (OSCE) or any demonstrations in the clinical field should obtain ≥80%.

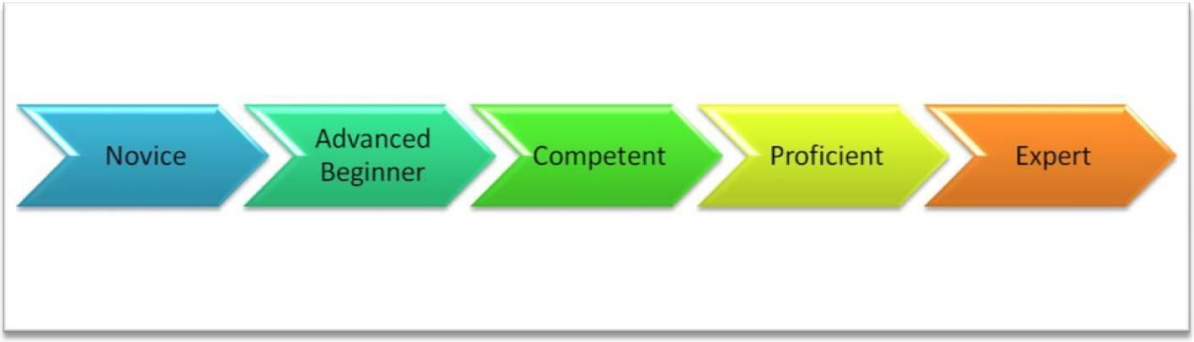

Figure 1.1: Benner's (1982:402) levels of nursing expertise from novice to expert

1.8 RESEARCH METHODOLOGY

This chapter provides a brief overview of the study methodology.

1.8.1 Research design

A quantitative approach with the descriptive design was applied to determine the nurses' knowledge about the assessment, diagnosis, treatment and IPC of TB in the southern regions of Namibia.

1.8.2 Study setting

The study was conducted in the public healthcare facilities in the southern regions of Namibia.

1.8.3 Population and sampling

The target population for this study was ENs and RNs who were on duty at the time of data collection.

1.8.4 Instrumentation

The self-designed, structured questionnaire based on objectives, literature and conceptual framework was used for the data collection.

1.8.5 Pilot study

A pilot study was completed before the commencement of the actual research to pilot the methodology that included the testing of the instrument.

1.8.6 Validity and reliability

1.8.6.1 Validity

The content of the instrument was based on the objectives, literature and conceptual framework. Construct and content validity were supported through consultation with experts in the field of TB, researcher's experience, supervisor and the biostatistician.

1.8.6.2 Reliability

Cronbach's alpha was used to test reliability and found a low (0.634) alpha coefficient because multiple questions, quizzes, true and false questions were applied. Only the pilot study supported the reliability of this study.

1.8.7 Data collection

The researcher, as the principal investigator, collected the data. The data were collected during December 2020 and January 2021.

1.8.8 Data analysis

The raw data was captured onto a Microsoft Excel spreadsheet and analysed by applying the Statistical Package for Social Science (SPSS 27) by the researcher and biostatistician of Stellenbosch University.

1.9 ETHICAL CONSIDERATIONS

The researcher obtained ethics approval from the Health Research Ethical Committee at Stellenbosch University, reference number, S20/07/179 (Appendix 1). Thereafter, the permission to conduct the study in Namibia was obtained from the NMHSS, Ethical Health Committee in Namibia, reference number 17/3/3ANS (Appendix 2). After permission was granted, further permission to conduct the study at the selected hospitals, health centres and clinics was obtained from the regional directors, nurse managers, and primary healthcare supervisors of the involved regions and districts.

1.9.1 Informed consent

To ascertain that the study adhered to ethical principles of informed consent, the right to anonymity and confidentiality of participants, an appropriate form for participants is attached (Appendix 3). This is the element of adequate disclosure, providing the participants with enough information for them to make a voluntary decision and comprehend, namely ensuring that participants understand the information provided and is free from coercion (Fain, 2017:46). In this study, the researcher provided each participant with the essential information about the research study and the benefit of taking part in the research before obtaining consent. As explained in the Nuremberg code (Eastwood, 2015:9), participants were told that

participation was voluntary and that they had the right to withdraw from the study at any time if they wish to without any penalty (Grove & Gray, 2019:93). It was further explained that the results of the study would further help to generate knowledge for science and may benefit the patients of the southern regions of Namibia with recommendations made for future improvement. All participants completed an informed consent letter before participating in the study. The consent form was written in English only, as participants use English as the official language of communication in the public health sector. All documents were completed in English. After both the participant and researcher had signed the informed consent, a copy of the signed informed consent was given to the participant.

1.9.2 Right to anonymity and confidentiality

According to Fain (2017:37), anonymity means keeping participants nameless and prohibiting access to information that is gathered about the study. Data collected from the participants was protected and anonymity was always ensured. Actions to ensure this included non-disclosure of names of all nurses who participated in the study and ensured that the completed data collecting tools were handed back to the researcher. Confidentiality refers to protecting the data by not divulging information gathered in the study without individual permission to do so (Fain, 2017: 38).

1.9.3 Data security

The security of the data was access-controlled and limited to the biostatistician, supervisor, and researcher for a minimum of six years (Health Professions Council of South Africa, 2016:4). As a means to avoid loss of data, the researcher ensured the availability of a backup system. An external hard drive secured with a password and placed in a locked cupboard was used to store the data. All signed consent forms and questionnaires completed by the participants were stored in a lockable cabinet only accessible to the researcher.

1.9.4 Right to protection from discomfort and harm (Beneficence)

The right to be protected from discomfort and harm due to a study supports the ethical principle of beneficence, which states that one should do well and prevent harm (Grove & Gray, 2019:101). It was further explained that the results of the study would further help to generate knowledge for science and may benefit the nurses of the southern regions of Namibia with recommendations made for future improvement. The research topic did not lend itself to cause an emotional response and therefore, there was low risk and had no potential harm during data collection. Participants were provided with refreshments for their time spent filling in the questionnaire.

1.10 OPERATIONAL DEFINITIONS

Registered Nurse: A registered nurse is a person in terms of section 20 of the Nursing Act 8 of 2004 of Namibia, is registered to practice nursing or midwifery (Government Gazette of the Republic of Namibia, 2004:6). In this study, the registered nurse should have undergone an orientation or formal training or attended the workshop on TB.

Enrolled Nurse: In this study, an enrolled nurse is a person enrolled in a category under section 20, or who is regarded to be enrolled in terms of section 64 of the Nursing Act 8 of 2004 of Namibia (Government Gazette of the Republic of Namibia, 2004:6) and has undergone an orientation or formal training on TB.

Knowledge: Knowledge refers to the information that the target population has about the given topic (Mohd & Malik, 2017:5). In this study, the knowledge of the nurses refers to knowledge about the assessment, treatment, diagnosis of TB and IPC measures of TB.

Investigation: The process of carrying out a systemic or formal inquiry to discover and examine the facts or gain information (Cambridge Academic Content Dictionary, 2017:762).

Competence: The ability of an individual to demonstrate the knowledge, skills, judgement and attitudes needed to perform activities successfully within a given job (Fukada, 2018:1). In this study, competency relates to the ability of nurses to assess, diagnose and treat patients with TB disease and the ability to reduce the transmission of TB among patients and in the healthcare settings.

Assessment: American Nurses Association (2021:1) describes assessment as a systematic process of obtaining clients' information from many sources, in order to make appropriate health decisions. In this study, assessment is based on obtaining patients' medical history, assessing for TB contacts and identifying who is at risk of acquiring TB.

Diagnosis: This is described as a process of identifying the disease based on a person's signs and symptoms, a person's health history, physical examination and laboratory results (NMHSS, 2019:10). In this study, diagnosis refers to the nurses' ability to identify whether the patient contracted TB or not.

Treatment: Refers to the use of anti-TB medicine for the control of TB in any population (NMHSS, 2019:28). In this study, "treatment" is based on the assessment of the nurses' knowledge about anti-TB medicines for drug-susceptible TB among TB patients, which emphasises the type of TB medicines, dosages, duration of treatment and medicine side effects.

Tuberculosis: An infectious disease caused by mycobacterium tuberculosis (MTB), which mostly affects the lungs but also manifests in other parts of the body (Wahab, Abdullah, Abdullah, Jaafar, Noor, Mohammad et al., 2016:26). In this study, the term tuberculosis is used to include pulmonary TB.

Infection prevention and control measures consist of administrative, environmental and respiratory protections (WHO, 2019:vi) that are effective in reducing and preventing the risk of transmission and exposure of TB**.**

Southern regions of Namibia: These include the Hardap and Karas regions (Namibian Planning Commission, 2015:24).

1.11 DURATION OF THE STUDY

Ethics approval for the study was obtained at the Stellenbosch University on 02 October 2020 and the permission to conduct the study was obtained from the Ethics Committee of the NMHSS on 11 November 2020. Data was collected in December 2020 until 08 January 2021. Data analysis was conducted in February 2021 and submission of the thesis was submitted in December 2021 for examination.

1.12 CHAPTER OUTLINE

Chapter 1: Chapter 1 describes the background, the rationale and the problem statement, research question, aim, objectives and a brief overview of the research methodology, ethical considerations and operational definitions.

Chapter 2: **The literature review is** described, which include TB disease burden, etiology, assessment, diagnosis, treatment and TB infection prevention and control.

Chapter 3: **The research methodology** is an in-depth description of the research methodology applied in this study is provided.

Chapter 4: **The results** chapter describes the analysis of the data obtained.

Chapter 5: **Discussion, conclusions and recommendations** are discussed in chapter 5.

1.13 SUMMARY

In this chapter, the researcher discussed the rationale for the study, the problem statement, the research aim and objectives of the study, as well as the conceptual framework that gave guidance to the study. A brief overview of the research methodology was described, concluding with the ethical considerations and operational definitions related to the study.

1.14 CONCLUSION

TB is one of the world's most deadly diseases, killing an estimated 1.3 million people each year, particularly those living with HIV. Namibia is no exception, having a high HIV prevalence rate of 12.6%. This is compounded by healthcare workers' lack of expertise and ineffective infection control measures, as well as their lack of understanding, ineffective triage techniques, and poor patient education. The study's major goal is to look into nurses' understanding of TB in public healthcare facilities in Namibia's southern regions, using Patricia Benner's Novice to Expert nursing theory as a conceptual framework.

According to the theory, nurses progress through five levels of nursing expertise: from novice, to advanced beginner, to competent, to proficient, and ultimately to an expert. Studies have shown that nurses play a vital role in the management of TB. The healthcare workers are the key to TB screening, diagnosis, treatment and control. It is imperative that nurses comply with the implementation of the TB guidelines when managing patients with TB disease. It was, therefore, important to investigate the knowledge of nurses about TB in the Southern regions of Namibia. In the next chapter, a literature review based on the study is discussed.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

TB continues to be a major public health concern in Namibia and around the world. TB control involves screening, diagnosis, treatment and prevention of TB aimed at reducing transmission and TB death (Kim, De los Reyes & Jung, 2020:15). In this chapter, the literature is described regarding the knowledge of nurses about the management of TB, specifically assessment, diagnosis, treatment and IPC of TB. The review concludes the findings of previous researched topics, identifies gaps and concludes what the study aims to address. The literature review was based on the objectives of the study in which the researcher investigated the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about assessment, diagnosis, treatment and IPC of TB. The researcher has discussed the phases of the nursing process related to the study objectives of assessment, diagnosis, treatment and IPC of TB.

2.2 ELECTING AND REVIEWING THE LITERATURE

The purpose of the literature review is to help with understanding the research topic, identifying gaps in the research topic and helping the researchers to connect their ideas to the research topic (Grove & Gray, 2019:160). During the literature review, the researcher included published articles and dissertations. Search engines such as Google Scholar, bibliographic databases such as Nursing and Allied Health Literature (CINAHL), PubMed, MeSH thesaurus and Cochrane library were used to find current literature between 2011 and 2021. Keywords such as ‘tuberculosis or TB’, ‘assessment OR screening’, ‘diagnosis’, ‘management OR treatment’, ‘tuberculosis AND nurses’ management’ were searched. Information from grey literature such as textbooks, guidelines and circulars were searched to obtain information regarding the research topic. The researcher did not find any published research on the nurses’ knowledge about TB in Namibia. On the contrary, only a few Namibian published studies were found on patients’ knowledge about TB.

2.3 EPIDEMIOLOGY OF TB

According to Yuen, Amanullah, Dharmadhikari, Nardell, Seddan, Vasilyeva et al. (2015:2334), to end the global TB epidemic, the transmission must be stopped to prevent new infections and new TB cases through identification of people with TB and prompt initiation of effective treatment. In 2018, an estimated 10.0 million people had TB with a decrease of 2% from 2017. During the same year, an estimated 1.5 million TB related deaths occurred with a 5% decrease from 2017 (MacNeil, Glaziou, Sismanidis, Date, Moloney & Floyd, 2020:1). A similar report

indicated that the incidences and prevalence of TB remained highest in the WHO South-East Asia and African regions. During the same period, 7.0 million persons globally were notified with TB positive results from the 64% notification in 2017 (MacNeil et al., 2020:1).

The WHO (2019:2) explains that despite the increase in TB notification, a large gap exists between 7.0 million cases reported with the estimated incidence of 10.0 million cases in 2018. This gap was a result of underreporting of detected cases of TB and under diagnosing. To close the gap, intensified efforts are needed to improve the case detection, diagnosing, and treating patients with TB (WHO, 2019:2).

Namibia has the 11th highest TB incidence rate of 423 per 100 000 population in the world (WHO, 2018:35). Drug resistance TB is a major threat with 3.4% for new and 26% for relapse TB cases amongst notified pulmonary TB in Namibia that is showing resistance to key first-line TB treatment, which requires complex and expensive treatment (WHO, 2018:224).

The WHO (2018:52) reported that since the 1990s, the HIV epidemic drives the TB incidence in Southern Africa. In 2017, the estimated proportion of incident TB cases co-infected with HIV ranged from 36% in Namibia to 71% in Lesotho (WHO, 2018:52). The 2018 NMHSS report (2019:1) revealed that the HIV prevalence rate among TB patients was 35% and the TB case notification rate was 336 per 100 000 population for Namibia (NMHSS, 2019:1).

TB is a global and local concern and healthcare workers have a key role to play by ensuring that they have adequate knowledge of IPC (WHO, 2018:1). However, Sissolak, Marais and Mehtar (2011:5) found that knowledge was not adequate about the use of masks and respirators. Akande (2020:4) surveyed the knowledge of nurses regarding IPC of TB in Ibadan, Nigeria and found that their knowledge was poor. To date, no studies have been conducted in Namibia about the knowledge of nurses about assessment, diagnosis, treatment and IPC of TB among nurses.

2.4 THE NATIONAL GUIDELINES FOR THE MANAGEMENT OF TUBERCULOSIS

The National Tuberculosis and Leprosy Program for tuberculosis (NTLP) in Namibia started in 1991 under the Primary Health Care (PHC) directorate and later moved to the directorate of a special programme in the ministry of health in 2004 (NMHSS, 2019:1).

Namibia published its first edition of the TB guidelines in 1995 to guide all healthcare workers managing patients with TB. The second edition was published in 2006 and the third edition in 2012. The implementation of the fourth edition, published in 2019 was based on the updates of the World Health Organization recommended guidelines. These guidelines are implemented within the framework of the third Medium Term Plan for TB and Leprosy (TBL

MTP-III) of 2017-2022 (NMHSS, 2017:5). NTLP's mandate is to ensure that the technical staff, at national and regional levels implement the guidelines correctly. The coordination includes providing orientation of newly recruited staff, student nurses and in-service training and supervision of healthcare workers. The guidelines include information on the organization and programme management, principles of TB care and prevention, diagnosis of TB, management of TB, TB in children, TB and HIV, TB infection control and prevention.

2.5 ETIOLOGY, MODE OF TRANSMISSION OF TB AND RISK FACTORS

2.5.1 Etiology of TB

TB is an infectious disease caused by bacteria called mycobacterium tuberculosis (Nardell, 2016:2; Murphy, 2015:12).

The TB bacteria that affect mainly the lungs is called pulmonary TB, however, extrapulmonary TB occurs in other organs such as the kidneys, spine and brain (Glaziou, Floyd & Raviglione, 2018: 271).

A cross-sectional study conducted by Minnery, Contreras, Perez, Solorzano, Tintaya, Jimenez et al. (2013:4) on the knowledge and attitude towards TB among frontline TB personnel in Peru, showed that 98.9% of nurses knew the bacteria that causes TB.

In South Africa, Bhebhe, Rooyen and Steinberg (2014:3) in their study aimed to assess the knowledge, attitudes and practices of HCWs regarding healthcare-associated TB infection and infection controls, they indicated that 90.7% of healthcare workers including nurses recognised airborne spread as a mode of transmission. It was further indicated that (89.2%) of respondents had appropriate knowledge of transmission of TB.

2.5.2 Mode of transmission of TB

Nardell (2016:1) states that TB is transmitted through airborne infectious droplet nuclei that are one to five microns in diameter. These are produced when individuals who have pulmonary TB disease cough, sneeze, shout or sing. The tiny particles remain suspended in the air and transmission occurs when a person inhales droplet nuclei containing mycobacterium tuberculosis bacilli (Nardell, 2016:2; Chandrasekaran, Saravanan, Bethunaickan & Tripathy, 2017:2). The droplet nuclei cross the mouth or nasal passages, upper respiratory tract, bronchi and enter into the alveoli of the lungs. When a person is exposed to the TB infection, in 90% of cases, individuals with a strong immunity will fight the TB bacteria and not become infected (Ahmad, 2011:10). If the person is unable to fight the infection due to weakened immunity, the infection can progress to active TB disease (Chandrasekaran et al., 20217:8). Active TB is a

condition in which mycobacterium tuberculosis causes infection, commonly in the lungs (Jilani, Avula, Gondai & Siddiqui, 2020:1).

Ngo, Manabe, Vu, Chu, Vu, Tran et al. (2019:6) indicated that nurses had clinical and general knowledge about the method of spreading TB. It was indicated that persons with active TB disease can infect others by coughing and that TB often spreads from person to person through the air. Similarly, Wondimu, Yosef, Gebremdhin and Hailemariam (2021:3) presented that 96% of health professionals responded that TB is an airborne particle disease.

2.6 RISK FACTORS CONTRIBUTING TO THE DEVELOPMENT OF TB

2.6.1 Socio-environmental factors

2.6.1.1 Overcrowding

Overcrowding contributes to the spread of TB infection. As supported by Ramaliba, Tshitangano, Akinsola and Thendele (2017:185) in their study, which aimed to describe the risk factors for TB in the Lephalale local municipality of Limpopo province in South Africa, which showed that about 23% of the registered patients with TB, were living in an overcrowded household with more than three people in one single room. Moreover, the study indicated that about 49% of TB cases had shared a single room in the past. Ramaliba et al. (2017:186) proposed that intensive community education aimed at changing the perception of TB regarding ventilation might yield beneficial outcomes.

A case control study conducted to assess the risk factors for TB in Addis Ababa in Ethiopia confirmed that individuals who lived in the house with no window or one window were two times more likely to develop TB compared to people who had multiple windows (Shimeles, Enguselasse, Aseffa, Tilahun, Mekonen & Hailu, 2019:9). Subsequently, an overcrowded environment affects the concentration of the TB bacteria organism and increases the probability of transmitting TB infection (Lygizos, Shenoi, Brooks, Bhushan, Brust, Zelterman et al., 2013:2).

2.6.1.2 Indoor-air pollution

The prevalence of health outcomes reported by Piabuo and Puatwoe (2019:3) showed that India had a substantial prevalence of active TB in persons using wood and dung for cooking. Exposure to this smoke emits carbon monoxide and nitrogen oxide that are deposited in the alveoli and can cause damage to the lungs (Narasimhan, Wood, MacIntyre & Mathai, 2013:5). Consequently, the susceptibility to TB infection increases and the progression of active TB disease (Turner, Chiu, Churchyard, Esmail, Lewinsohn, Gandhi et al., 2017:636). Government support is needed to develop modern bioenergy specifically gas stove infrastructure for the

vulnerable population (Piabuo & Puatwoe, 2020: 8). This finding may support the government to assist persons living in overcrowded houses, exposure to smokes and pollution to better their living conditions.

2.6.1.3 Smoking

In a multi-centric prospective cohort study conducted on newly diagnosed adult patients with pulmonary TB in Namibia, of 455 enrolled patients, 326 (76%) were never smokers, 94(20%) were current smokers and 35 (8%) were past smokers (Thomas, Thiruvengadam, Kadam, Ovung, Sivakumar, Shivakumar et al., 2019:2). This study revealed that poor TB treatment outcomes were significantly high (p=0.002) amongst past smokers and current (p=0.007) with TB deaths (p=0.028) between smokers compared to the TB patients who never smoked. It was further concluded that past and current smoking affect the increase of TB reoccurrence and unfavorable TB treatment outcomes. Narasimhan, Wood, MacIntyre and Mathai (2013:5) explain that nicotine in the cigarette damages the lungs, resulting in inadequate oxygen supply to the lungs and weakens the immunity of an individual, risking the person to TB.

The audited medical records of patients with pulmonary TB done by Kanda, Nagao, Van Tho, Ogawa, Murakami, Osawa et al. (2015:8) showed that smoking prolongs the time to sputum culture conversion in patients with pulmonary TB. This study proposed that a multidimensional approach would be required to effectively control TB, including early detection, timely anti-TB treatment, and appropriate interventions to lower cigarette smoking.

2.6.1.4 Malnutrition

Bhat, Rao, Sharma, Muniyandi, Yadav and Bhondley (2017:2) showed that malnutrition (56%) was associated with an increased risk to TB. This study further indicated that the main contributor was undernutrition. Furthermore, it was suggested that nutritional supplements given to patients with TB and integrated approaches in improving living conditions were needed to control TB in the community. Chandrasekaran et al. (20217:1316) explain that poor nutrition leads to a macro and micronutrient deficit that increases a person's susceptibility to the progression of TB infection. TB disease itself can lead to malnutrition because of a decreased appetite, nutrient malabsorption and altered metabolism (Narasimhan et al., 2013:2). Furthermore, patients with active TB experience loss of appetite, nausea and abdominal pain leading to poor food intake and eventually leading to malnutrition. A study conducted on malnutrition and mortality among 284 adult patients in Ethiopia by Seid and Ayele (2020:7) found that almost half of patients with TB who were malnourished at the time of registration for TB, after receiving nutritional supplements together with TB treatment had a reduction of underweight by 21.5%. The study concluded that proper nutrition counselling with nutritional support should be integrated into TB care and treatment of patients with TB disease.

2.6.1.5 Alcohol consumption

Nicole (2021:2) explains that heavy drinking of alcohol can lead to liver damage, impaired memory and malabsorption of nutrients. In the context of TB care, this means patients with TB may forget to take their medication, miss their follow-up appointment dates and may experience nausea and vomiting while taking their TB medicine.

The study done by Robert (2016:62) aimed to determine the factors that contributed to the cross infection of TB among newly diagnosed patients in Katutura hospital in Namibia. In this study it was found that 72.5% of the participants indicated that they do not drink alcohol. The study concluded that alcohol was a minor contributing factor in contracting TB. A meta-analysis study on alcohol consumption as a risk factor for TB showed that alcohol attributed TB incidences five times more, found to be higher in African regions - Liberia, Angola, South Africa, Lesotho, Gabon, Namibia than the global average (Imtiaz, Shield, Roerecke, Samokhvalov, Lonnroth & Rehm, 2017: 6).

The study conducted by Volkmann, Moona, Miramontes and Oeltmann (2015:114) in the United States examined the relationship between excess alcohol and TB treatment outcomes and the markers for increased TB transmission. The rate of culture conversation was higher among TB patients without excess alcohol use. This study concluded that alcohol abuse during TB treatment leads to TB death.

2.6.2 Individual factors

2.6.2.1 Diabetes mellitus

Beukes (2019:46) discovered that the prevalence of diabetes mellitus among TB patients in the Khomas region in Namibia was 42% based on the glycaemic haemoglobin (HbA1c).

Alebel, Wondermagegn, Tesema, Kibret, Wagnew, Petrucka et al. (2019:254) reported that diabetes mellitus was found to be significantly higher than the pooled prevalence of 9% reported in a meta-analysis of 16 studies conducted among patients with TB in Nigeria (15%), Tanzania (11%) and Ethiopia (10%). Workneh, Bjune, and Yimer (2016:4) revealed that diabetes mellitus was associated with a high mortality during TB treatment as the treatment outcome showed a 13.8% death rate among TB diabetic patients compared to 3.5% for non-diabetic TB patients. The same study indicated that at the baseline of treatment, the signs and symptoms of persistent cough (72.5%) and weight loss (86.2%) were highly significant among patients with diabetes mellitus compared to the persistent cough (65.1%) and weight loss (78.8%) of TB patients without diabetes mellitus. Further suggestions were that those patients

with TB should be screened for diabetes mellitus for early diagnosis and treatment of TB diabetes mellitus comorbidity (Workneh et al., 2016:9; Restrepo, 2016:3).

Muttamba, Kirenga, Ssengooba, Sekibira, Katamba and Joloba (2018:390) revealed that the prevalence of diabetes mellitus was 0.7% among bacteriologically negative clients and 0.9% among the bacteriologically confirmed TB patients. This means that TB patients with diabetes mellitus compared with TB with no diabetes mellitus are more likely to remain sputum smear positive after the completion of two months of treatment that predict early signs for treatment failure or may synergize resistant TB (Restrepo, 2016:5). High blood sugar levels weaken the person's immune system, making the individual more prone to infections, including to mycobacterium TB (WHO, 2016:1).

2.6.2.2 HIV coinfection

HIV infection alters the course of mycobacterium tuberculosis infection and significantly increases the risk of TB (Jurado & Palacios, 2018:39). Jurado and Palacios (2018:39) explain that the risk of developing TB is 3% to 16% per year for people with untreated HIV infection and with no latent TB infection treatment. HIV weakens the immune system making it possible for the latent TB infection to progress to TB disease in an individual with a weak immune system (Centers for Disease Control and Prevention, 2016:2).

A study conducted by McLaughlin (2018:29) found that 81% of nurses and doctors agreed that there is a strong association between TB and HIV. Screening for signs and symptoms of TB of all people living with HIV is crucial during all clinical encounters and similarly, patients with TB should be tested for HIV as HIV weakens the person's immune system making the person prone to TB disease (Owiti, Onyango, Momanyi & Harries, 2019:9).

2.7 THE NURSING PROCESS

The American Nurses Association (2021:1) describes the nursing process as a systematic, problem-solving approach to nursing that involves the interaction with patients to assess the needs and problems of patients and make decisions about the identified needs and problems. "The use of the nursing process helps in making and planning a clear and effective nursing care that potentiates improvement of the quality of patient care" (Shiferaw, Akalu, Wubetu & Aynalem, 2020:1).

Tony-Butler and Unison-Pace (2020:1) indicate that the nursing process comprises of five phases: assessment, diagnosis, planning, implementation and evaluation.

The research study done in a public hospital in Northern East Ethiopia, on determinants of the nursing process implementation has identified that more than half (56.9%) of nurses

implement the assessment phase as part of the nursing process (Miskir & Emishaw, 2018:7). Miskir and Emishaw (2018:7) concluded that the lack of training and absence of on the job training of the nursing process were factors that hindered the implementation.

2.7.1 Nursing assessment

Ahamed, Khilall and Woods (2017:8) describe assessment as a systematic data collection, monitoring and providing information about the health of the individuals with a disease. Tony-Butler and Unison-Pace (2020:1) describe that the purpose of the nursing assessment plays a role in identifying the patients' problems and guides the healthcare workers to develop nursing care plans or programmes.

During the assessment phase, the nurse gathers all information about the patient's health status. The nurse collects the data using a variety of sources to identify the patient's needs and problems and formulate the nursing diagnoses based on the findings of the assessment (American Nurses Association, 2021:1).

2.7.1.1 Types of assessment

2.7.1.1.1 Initial assessment

The takes place at the first encounter with the patient at the healthcare facility, during home visits or hospitalisation (Ahamed, Khilall & Woods, 2017:8). During this phase, the nurse collects the subjective and objective data (Hashem 2021:1), explains subjective data as verbal information given by the patient. In the context of the assessment of TB, the data gathered include the demographic data, medical, social and family history relevant to the present problem. Objective data refers to the information that the nurse obtains independently from the patient (Hashem, 2021:1), by assessing the patient's ability to communicate, perform a physical examination and do some tests. For example, healthcare workers working with TB patients routinely perform blood pressure, temperature, weight, examine patients for injuries and performs urine and haemoglobin tests (Thomas, 2017:1).

The findings from the research of Mamseri (2012:114) on the nursing process as a means of improving patient care demonstrated that 80% of nurses knew that assessing and interpreting observations was the main activity of the assessment phase. York and Kane (2013:8) indicate that nurses working in high care units at the hospital level must maintain a high degree of suspicion to identify patients with active TB. Given that critically ill patients may have differential diagnoses, it may make early identification of TB difficult. Thus, nurses should possess a high level of knowledge in obtaining a detailed history of TB, recent and past exposure to TB (York & Kane, 2013:8).

According to Ho, Fox and Marais (2016:377) identifying active cases with TB leads to earlier diagnosis, treatment of TB and reduces the period of infectiousness and therefore TB transmission.

The NMHSS (2019:50) TB guidelines outline the past and present medical data that should be included in history taking:

- Contact history of household or other contacts with a person with TB as this will determine the possible risk factors associated with TB.
- Previous TB treatment and the outcome of treatment will predict the effectiveness of the treatment.
- Previous TB Isoniazid Preventive Therapy (TPT). This will help to determine whether the patient will need preventive treatment or not.
- Current illness suggesting signs and symptoms of TB.

When assessing the signs and symptoms of TB, the nurses should know that, the patients who present at the health facility with the following signs and symptoms suggest pulmonary TB (NMHSS, 2019:16; Murphy, 2015:13).

- Cough for two weeks or more
- Fever
- Night sweats
- Shortness of breath
- Loss of weight
- Lymph node enlargement

Van Rensburg, Engelbrecht, Kigozi and Van Rensburg (2017:4) in their study on TB prevention, knowledge, attitude and practices of primary healthcare nurses found most respondents knew the signs and symptoms of TB. The assessment done by Shrestha et al. (2017:3) about the knowledge of healthcare workers about TB, affirmed that the knowledge level was relatively associated with educational status, job category and TB training received by nurses.

A study by Shiferaw and Zegeye (2019:6) on the assessment of TB among patients taking TB treatment in North Shoa in Ethiopia discovered that 43.2% of TB patients were not screened for symptoms of TB at the first visit. The same study revealed that until the TB disease was diagnosed, patients had repeatedly visited the healthcare facility on average three times.

Another study conducted at randomly selected primary healthcare clinics with a high TB burden in South Africa revealed that of the 607 patients seeking care with TB-related

symptoms, 79.1% were screened for TB signs (Kweza, Van Schalkwyk, Abraham, Uys, Claassens & Medina-Marino, 2018:268). Of those that were screened, sputum of 370 patients were collected of which 7% were diagnosed with TB. The same study concluded that low rates of TB screening by healthcare workers result in missed TB patients. Kweza et al. (2018:271) recommend that to minimize the risk of a missed opportunity for screening of patients visiting the healthcare facilities, all patients seeking healthcare should be routinely screened for TB regardless of whether they have symptoms or not.

2.7.1.1.2 Ongoing assessment

An ongoing assessment occurs at each patient encounter. Directly observed therapy visits and monthly appointments at the healthcare facilities are needed to evaluate the patients' health progress (Ahamed, Khilall & Wood, 2017:15). Ongoing activities include, monitoring clinical response to treatment and TB treatment regimen and providing patient education about TB (Ahamed, Khilall & Wood, 2017:17).

The findings of the study by Herlambang and Dharmansyah (2019:666) in Bandung, showed that of the 18 nursing care plans analysed on health education provided to TB patients were educated to continue taking medicine until cured 100%, fluid intake 71.24% and the use of a mask 63.86%.

2.7.1.1.3 Discharge assessment

A discharge assessment includes determining the functional status of the patient, discussing medication intake and instructions, determining the accompaniment of the patient, dates for follow-ups and referrals (Tony-Butler & Unison-Pace, 2020:8).

2.7.2 Nursing diagnosis

Mamseri (2012:29) refers to the second step of the nursing process in which the nurse requires to use the assessment information to formulate a nursing diagnosis and make a clinical judgement about the patient’s response to actual or potential health conditions or needs. In the context of TB, the nurse obtains information about the patients' health status, interpret the findings and formulate a nursing diagnosis (Mutshatshi, Mothiba & Mamogobo, 2020:6).

The study of Murphy (2015:12) on how nurses can support early diagnosis of TB demonstrated that early diagnosis of patients with TB is vital because it allows the nurse to select nursing interventions to achieve patient care outcomes.

2.7.2.1 Notifications of presumptive or patients with TB

In Namibia, the notification and registration of all TB patients are mandatory (Republic of Namibia, 2015:12), and the Namibian government is providing TB diagnostic services to

Namibian citizens for free at all public healthcare facilities (Government Gazette of the Republic of Namibia, 2010:11). McLaughlin (2018:29) aimed to determine the knowledge of clinicians (doctors and nurses) about the management of TB and indicated that 90% of participants agreed that TB was a notifiable disease.

Presumptive, previously known as a suspected TB case refers to the person who presents with a cough of two weeks or more with or without other symptoms or signs suggestive of TB (Kumar, Singarajipura, Naik, Patel, Shastri, Kumar et al., 2017:12). In this study, the word presumptive and suspected case are used interchangeably.

Afshar, Carless, Roche, Balasegaram and Anderson (2019:3) describe that a relapse case is a patient who reported a previous diagnosis of TB, either with a history of complete, cured or no TB. NMHSS (2019:31) refers to a new case as the patient who has never been treated before for TB or who has taken TB treatment less than one month. Based on the definition of "new case" patients, one understands why all notified cases are registered.

2.7.2.2 Diagnostic tests for mycobacterium tuberculosis

2.7.2.2.1 GeneXpert mycobacterium tuberculosis (MTB)/ rifampicin (RIF) assay

The GeneXpert MTB/RIF assay detects mycobacterium tuberculosis, as well as rifampicin resistance-conferring mutations (Cudahy & Shenoi, 2016:7).

A study conducted by Alotaibi et al. (2019:5) revealed that only 12% of healthcare workers, including nurses recognize GeneXpert MTB/RIF assay as a diagnostic tool for TB. The study thus revealed deficiencies in the knowledge of TB screening and diagnostic testing. A study done in India by Krithika et al. (2018:155) on the awareness about TB among nurses found that among the study population, 71.8% of nurses were aware that pulmonary TB is infectious and 79.9% knew the causative organism of TB.

In Pakistan, Rasoo, Khan, Mohy-Ud-Din and Riaz (2019:1) undertook to evaluate the effect of GeneXpert MTB/RIF assay and mycobacterium culture for the detection of mycobacterium tuberculosis in sputum smear negative pulmonary TB suspects. The findings of the study revealed that from the smear microscopy negative sputum, (28.57%) specimen, were confirmed mycobacterium positive through GeneXpert MTB/RIF assay and 71.43% suspected TB cases were confirmed mycobacterium negative through GeneXpert MTB/RIF assay. Rasoo et al. (2019:5) concluded that GeneXpert MTB/RIF assay was found to be a rapid and accurate tool for mycobacterium detection in smear negative sputum specimens. In Namibia, GeneXpert MTB/RIF assay is used as the first diagnostic test for all suspected TB cases (NMHSS, 2019:13).

Chihota, Gininadza, McCarthy, Grant, Churchyard and Fielding (2015:11) shared an experience from the extended trial done at 40 primary health clinics in South Africa. The objective of the study determined whether healthcare workers do screen and test clients with TB symptoms after the introduction of GeneXpert MTB/RIF assay from smear microscopy. The findings revealed that healthcare workers failed to request GeneXpert MTB/ RIF assay for clients who presented with cough symptoms. Moreover, this study concluded that, alongside adherence to the diagnostic algorithm for TB, sputum collection for GeneXpert MTB/RIF assay is vital for diagnosing TB.

Current knowledge on NMHSS (2020:2), TB in a circular of 2020 on the amendment to an algorithm for the laboratory diagnosis of TB in Namibia, the guidance is that healthcare workers can now obtain one sputum specimen for laboratory diagnosis.

A study by Phetlhu, Bimerew, Marie-Modeste, Naidoo and Igumbor (2018:880) indicated that 75% of participants' knowledge were adequate to know the process to confirm TB diagnosis, followed by 6.8% of participants knowing that a third sputum is to be collected when diagnosing TB.

Noe, Ribeiro, Anselmo, Maixenchs, Sitole, Munguambe et al. (2017:3) aimed to determine the level of knowledge, identify attitudes and assess practices regarding TB care and control among healthcare workers of the district of Manhiça in Mozambique. They found that less than 30% of the healthcare workers had heard of GeneXpert MTB/RIF assay. It was further indicated that of the 50 participants that were aware of GeneXpert MTB/RIF assay, 35% indicated that the test is used to diagnose TB. Furthermore, the study conducted by McLaughlin (2018:29) in Metro Health Service primary healthcare facilities, found that doctors and nurses knew that GeneXpert MTB/RIF assay was the preferred sputum test for diagnosing TB.

2.7.2.2.2 Sputum smear microscopy

Sputum smear examination known as direct microscopy provides reliable evidence of mycobacterial in the lungs (Ahmed, Shukla, Fatima, Varshney, Shameen & Tayyaba, 2019: 46). For patients with negative sputum results who do not improve on antibiotic treatments, chest x-rays should be done to support evidence of pulmonary TB. Direct microscopy is essential for monitoring of treatment and evidence of infection of patients with TB (Ahmed et al., 2019:45).

Krithika, Jayanthi and Subramanian (2018:15) reported that 96.2% knew that a sputum sample was used for diagnosis of TB. The same study affirmed that there was a lack of knowledge about the infectiousness of TB patients with negative sputum smears.

The study conducted in Kenya (Orina, Mwangi, Githui, Ogaro, Kiptoo, Sang et al., 2019:33) highlighted that the 44% saliva sputum examined, had a lower diagnostic yield than mucoid sputum specimen using GeneXpert/RIF assay.

Similarly, Aparna, Aparna, Sarada and Ram (2017:3) found in their study that sputum samples containing pus cells tested positive to mycobacterium compared to specimens containing saliva using direct microscopy. The findings of the study concluded that proper patient education before obtaining sputum specimens and timely monitoring during sputum collection would assist in obtaining good quality sputum and enhance the diagnosis of the TB disease (Orina et al., 2019:33).

Herlambang and Dharmansyah (2019:668) audited 119 medical records in Indonesia and recommended that nurses require effective cough training on how to teach patients to expel quality sputum from the lungs. Shen and Sergi (2020:2) indicated that cough exercise helps patients in providing quality sputum needed for laboratory tests.

2.7.2.2.3 Mycobacterial Culture

As demonstrated by Varaine and Rich (2017:n.p.), culture allows diagnostic confirmation mainly for the patients with TB treatment failure, patients with smear negative results when diagnosis is in doubt and when monitoring treatment and outcome for patients with drug resistant TB. According to Kanabus, (2020:1) culturing bacteria to test TB is much more complex, as it requires specific equipment and is more expensive than sputum smear microscopy. It is further explained that testing for and diagnosing TB using culture results take more than two weeks because of the slow growth of TB bacilli, that may delay diagnosis and initiating patients on TB treatment

2.7.2.2.4 Line probe assay

Line probe assay (LPA) is used for rapid detection of drug resistant TB, specifically for isoniazid and rifampicin, from acid fast bacilli smear sputum results or from the culture sputum sample of the TB patient (Cudahy & Shenoi, 2016:8). Studies conducted in South Africa (Maningi, Malinga, Antiabong, Lekalakala & Mbelle, 2017: 1), Botswana (Mogashoa, Melamu, Derendinger, Ley, Streicher, Iketleng et. al., 2019:8) and India (Madhuri, Despande, Dharmashale & Bharadwaj, 2015:63) found that LPA is an efficient and reliable rapid drug sensitivity assay for rapid susceptibility screening of drug resistant TB.

2.7.3 Planning

Hashem (2021:1) describes planning as the third stage of the nursing process, whereby the nurse develops a nursing strategy to address the patient's health problems or needs. During planning, the nurse prioritizes problems, formulates goals, selects nursing actions and documents the nursing actions (Mamseri, 2012:30; Semachew, 2018:3). In the context of TB, the nurse draws up a nursing care plan for the patient with TB disease (Vera, 2019:1).

2.7.4 Implementation

Toney-Butler and Thayer (2021:3) refer to implementation as the fourth phase of the nursing process that involves actions or the process of carrying out nursing interventions as outlined in the nursing care plan. These interventions, for example, include a collection of sputum from patients suspected of TB, administer TB medicines, monitor side effects, and provide health education about direct observed therapy short course treatment to patients. The findings by Herlambang and Dharmansyah (2019:665) showed that the most frequent written interventions by nurses in TB patients were: teach patients to continue taking TB medicines until they are cured (100%), encourage more fluid intake (71.24%), educate patients to cover their mouths with a tissue or handkerchief (63.86%).

2.7.4.1 Treatment of TB

2.7.4.1.1 Types of anti TB medicines

Kanabus (2020:1) indicates that the medicines that are recognized as first line medicines for the treatment of active pulmonary TB are isoniazid (H), rifampicin (R), pyrazinamide (Z), and ethambutol (E). A study conducted by Yükseltürk and Dinç (2013:50) aimed to assess the knowledge of nurses about anti TB treatment, revealed that 93.8% of nurses knew that isoniazid, rifampicin, pyrazinamide and ethambutol are the first line medicines used in TB treatment. In Vietnam, Ngo et al. (2019:4) found that most nurses indicated not to treat patients suspected of TB, preferably their primary initial nursing actions were moving the patient to a room with airborne infection control (64.4%), educating the patient and patient's relatives about TB (55.3%), isolating the patient (46.0%) and informing their supervisor (43.5%).

2.7.4.2 Duration of TB treatment

The WHO (2017:xi) recommends that patients with susceptible pulmonary TB should receive six months of treatment. According to Kanabus (2020:1), these medicines are combined in one tablet known as Fixed Dose Combination (FDC). She further explains that the number of months that the medicine is given, is denoted by prefix, 2HREZ/4HR meaning isoniazid, rifampicin, ethambutol and pyrazinamide daily for two months called an initial phase, followed by the continuation phase of four months of isoniazid and rifampicin.

Alotaibi et al. (2019:6) assessed the knowledge of healthcare workers including nurses regarding TB and its management. They identified inadequate knowledge among the participants related to the length of standard treatment for drug sensitive TB. Only 25% of healthcare workers, including senior nurses reported attending a workshop or seminar on TB in the past twelve months (Alotaibi et al., 2019:6). Noe et al. (2017:3) in their study revealed that over 58% of healthcare workers, including nurses could not identify the medicines or the period for the maintenance of treatment.

2.7.4.3 Holistic care for patients with TB

Jesemi, Valizadeh, Zamanzadeh and Keogh (2017:72) refer to holistic care as the comprehensive model for care that considers the physical, social, mental and spiritual aspects of the patient from the time of diagnosis, admission for care until discharge. According to Carlsson, Johansson, Eale and Kaboru (2014:5) the role of nurses involves enhancing the patients' knowledge about TB; providing health education, treatment, prevention and patient self-management while on TB treatment.

A qualitative study conducted in Brazil about nurses committed to the care of TB patients noted that nurses provide treatment to patients with TB holistically (Cavalcante & Da Silva, 2016:7).

2.7.4.4 Directly observed therapy-short course (DOTS)

Karumbi and Garner (2015:1) describe that directly observed therapy is a specific strategy endorsed by the WHO to improve treatment adherence by requiring healthcare workers, community volunteers or family members to observe and record patients with TB taking each dose of TB medicine.

A study conducted by Taati, Kalemeera and Kibuule (2019:77) in Namibia aimed at assessing the quality of DOTS adherence counselling among patients with TB. The study revealed that only 40% of patients received DOTS treatment adherence counselling in the past three months and 16% had not received counselling since admission. This study concluded that the quality of DOTS adherence counselling among hospitalised patients were substandard. It was proposed for a standard operating procedure and guidelines for effective adherence counselling among TB patients to optimize treatment outcomes. According to Calsson et al. (2014:6), nurses in Burundi had expert knowledge about TB treatment adherence. It was further identified that nurses educate patients with TB, provide DOT and related follow-up and motivate patients to complete TB treatment. In China, the systematic and meta-analysis review conducted by Zhang, Ehiri, Yang, Tang and Li (2016:16) to critically appraise the impact of community-based DOTS on treatment outcomes, concluded that community-based DOTS

improved TB treatment outcomes and recommended that the strategy could be scaled up to low-income countries with a high burden of TB.

2.7.4.5 Common side effects of TB medicines

As indicated by Navarro (2019: 15) common side effects of skin rash are reported across all first line drugs. She indicated that most of the TB medication side effects are manageable and do not require stopping the medication. However, the NMHSS (2019:42) standard guidelines on the management of TB propose that major side effects such as deafness caused mainly by streptomycin, isoniazid causing skin rash and jaundice caused by rifampicin requires cessation of treatment. Navarro (2019:18) explains that peripheral neuropathy is the tinkling, prickling and burning tips of toes associated with patients receiving isoniazid. These patients should be given pyridoxine to prevent peripheral neuropathy (Bhargava & Bhargava, 2018:1).

A case report presented by Rachid, Benjelloune and Bouchentouf (2019: 455) in Morocco, reported on a patient with renal failure who experienced generalised rash with erythroderma. Test doses done on the medicine revealed that isoniazid caused the skin rash. The case report study concluded that evolution at nine months was favourable after changing from six months of isoniazid, rifampicin, pyrazinamide to nine months of rifampicin, pyrazinamide and ethambutol.

A study done by Nicholson (2021:167-172) to determine factors associated with safe medication administration provided by nurses for the elderly within the Northen Metropolitan area of the Westen Cape Province, revealed barriers such as insufficient knowledge on medicine interactions and side effects, and unclear handwriting were factors that hinder the safe administration of medication. Du Preez (2016:10) concluded that registered professional nurses have a vital role to play in reducing medication administration errors, as they are the key role players in the medication administration process. Nurses are anticipated to supervise and monitor TB treatment, to educate patients on the effectiveness and side effects of TB medicines and how to manage these side effects (Yükseltürk & Dinç, 2013:52).

Yükseltürk and Dinç (2013:52) showed that the nurses' knowledge scores about the administration route of TB medicines were (92.3%) and the side effects of streptomycin (81.2%). It is further indicated that if the side effects of medicines are not recognised on time and managed properly, they can lead to treatment interruption or can be life threatening (Yükseltürk & Dinç, 2013:50).

2.7.5 Evaluation

Evaluation is the fifth step of the nursing process in which the nurse evaluates progress towards the attainment of goals and outcomes to ensure that nursing interventions were implemented and expected outcomes were met within a specified time frame (Toney-Butler & Thayer,2021:1; Mamseri, 2012:98-101; Davidson, 2021:1). In the circumstances of TB care, the nurse continuously evaluates the patient care provided by the health workers. For example, assessing whether the sputum that was collected at two or five months of treatment has changed from positive to negative and whether the patient is gaining weight while on treatment or not. In the event where that the patient's health status is not improving, the nursing actions in the nursing care plan should be modified (American Nurses Association, 2021:1).

2.7.6 Treatment outcomes for TB

According to Tanue, Nsagha, Njamen and Assob (2019:3); Duarte, Gualano, Magis-Escurra, Rumetshofer, Skrahina and Spinu et al. (2017:1222) with accordance to NMHSS (2019:37) explain the definition of treatment outcomes for TB as follows:

- Cured refers to patients with smear positive confirm pulmonary TB at the beginning of treatment who was sputum smear or culture negative in the last treatment and at least one previous occasion.
- Treatment completed: a patient who completed anti TB medicines without evidence of failure but for whom sputum smear or culture results are not available in the last month of treatment and on at least one previous occasion.
- Died refers to a patient who died from any cause before starting a treatment or during treatment (NMHSS, 2019:37). Lost to follow-up refers to TB patients who did not start treatment or whose treatment was interrupted for eight weeks or more consecutive months.
- Failure refers to a patient with TB whose sputum smear or culture is positive at month five or later during treatment.
- The treatment success rate is the sum of patients who were cured and those who completed treatment.

The WHO (2019: 15) guidance for TB programme managers indicates that the target treatment success rate for new and relapse drug sensitive TB is 90% or more, an indication that the End TB Strategy target has been met.

Izudi, Semakula, Tamwesigire and Bajunirwe (2019:6) completed a systematic review and meta analysis which revealed the treatment success rate of 76,2% in Sub-Saharan Africa i.e. South Africa, Ethiopia, Uganda, Zimbabwe and Nigeria. The review concluded that to achieve

the goal of ending the global TB epidemic by 2030, interventions are needed to improve the performance of national TB programmes in Sub-Saharan Africa.

2.8 INFECTION PREVENTION AND CONTROL OF TB

The World Health Organization (2019:3) has identified administrative, environmental and respiratory protection control interventions that are effective in reducing and preventing the risk of transmission and exposure to mycobacterium tuberculosis. Singer-Leshinsky (2016:25) suggests that due to the increase of drug-resistant TB amongst patients with reduced immunity, all clinicians should implement infection control measures to reduce TB transmission.

The study conducted by Shrestha et al. (2017:6) in Nepal, indicated that the overall knowledge of healthcare workers, including nurses about the infection control of TB was not satisfactory. This knowledge deficit and practices of healthcare workers on IPC of TB were the major barriers to implement infection control measures resulting in the risk of TB transmission in the healthcare facilities (Shrestha et al., 2017:6).

According to Ajayi and Isiyaku (2018:41) with the aim of assessing the knowledge and practice of healthcare workers in Nigeria showed that 83.3% of healthcare professionals, including nurses had good knowledge of TB infection control.

Ekuma and Oridota (2016:9) showed that healthcare workers in DOTS centers revealed significant gaps on knowledge and practice of IPC of TB. Training, an adequate supply of N95 respirators and human resources were needed for effective implementation of IPC of TB.

Wondimu et al. (2021:4) in Ethiopia found that 70.2% of health professionals had good knowledge about TB infection control. The study concluded that the knowledge of nurses about TB infection control are important for an effective TBIPC programme.

Tshitangano Maputle and Netshikweta (2013:1) conducted a study on the availability of TB infection control plans at rural hospitals of Vhembe district, Limpopo Province of South Africa. They identified that healthcare workers were unaware of the content in the TBIPC plan, thus could not implement TB IPC measures adequately. Similarly, the study conducted by Gyem, Ahmad and Mahendradhata (2020:5) aimed to assess the implementation fidelity with a major focus on adherence, knowledge, and responsiveness to TB IPC practices by exploring its barriers, and enablers revealed that none of the facilities had a written TB IPC plan.

2.8.1 Administrative control measures

Administrative control measures are methods that reduce the chances of exposure to healthcare workers and uninfected patients aimed to reduce the concentration of droplets nuclei in the air (NMHSS, 2014:11). According to Varaine and Rich (2017), the following are examples of administrative controls.

2.8.1.1 Patient triage

A study conducted by Ganesh (2011:25) in Mount Ayliff hospital in South Africa, found that 46.2% of nurses and doctors occasionally screen for TB in patients who present with TB for two or more weeks when patients enter the facility. It is further indicated that 50% of the participants, mostly nurses do not educate patients on cough hygiene. The study concludes that effective triage of all patients on entry by separating coughing patients from no-coughing patients, educating patients on cough hygiene and providing masks or tissues to patients. The NMHSS (2014:12) guideline for infection prevention and control indicates that to reduce the transmission of TB, upon entry into the health facility nurses should identify patients with a cough and provide them with tissues or facemasks or ask them to cover their mouth and nose when coughing.

2.8.1.2 Separation for hospitalized patients with TB

During hospitalization patients with symptoms, suggestive of TB should be separated from patients without symptoms suggestive of TB, for example within the TB department and from other patients, such as children and immune compromised patients (Jo, 2017:23).

Barrera, Livchits and Nardell (2015:381) describe screening as part of TB IPC measure as defined in the acronym FAST: "*F*ind cases *A*ctively, *S*eparation safely and *T*reating effectively" based on the rapid drug susceptibility testing. Knowledge about the implementation of the FAST strategy leads to prompt effective treatment and reduction in the transmission of TB infection (Barrera, Livchits & Nardell, 2015:381).

2.8.2 Environmental control measures

Lee (2016: 235) explains that environmental control measures are natural and mechanical ventilation systems allow adequate air exchange and control of airflow in a closed area. The purpose of ventilation systems is to dilute and remove contaminated air and to control the direction and patterns of airflow in rooms so that the concentration of TB bacteria in the air is reduced. Gizaw, Alemu and Kibret (2015:4) revealed that the majority (96.4%) of healthcare workers, including nurses knew that the door and windows of a room should be open whenever a TB suspect or confirmed patient is in the room.

The WHO (2019:9) refers to ultraviolet germicide irradiation (UVGI) as an air-cleaning technology that consists of the use of special lamps that give off germicidal ultraviolet irradiation to inactivate the tubercle bacilli contained in the droplet nuclei. It is further guided that ultraviolet germicide irradiation lamps may be used when ventilation cannot be achieved particularly in drug resistant TB wards.

Waheed, Khan, Fatima, Yagoob, Mirza, Qadeer et al. (2017:30) indicated that the non-utilization of germicidal ultraviolet (GUV) was due to a deficit in knowledge and the lack of clarity of roles.

2.8.3 Personal protection equipment

Lee (2016:237) clarifies that environment and administrative control alone do not reduce the risk of TB transmission among healthcare workers and patients in health settings. Additional personal protective equipment is needed to further aid in the reduction of TB transmission. The WHO (2019:27) guidelines recommend the use of particular respirators (N95) for healthcare workers when caring for the patient with the disease. They further recommend that for patients to reduce droplet infection to healthcare workers and people visiting healthcare facilities they should wear surgical masks.

Van Rensburg et al. (2017:4) describe that 73.9% of nurses knew the importance of wearing surgical masks by patients with suspected TB, while waiting for a diagnosis. Furthermore, many nurses (60.5%) were worried that they would contract TB from patients in their care (Van Rensburg et al., 2017:4).

However, Gizaw, Alemu and Kibret (2015:4) indicated that 38.8 % of healthcare workers knew that surgical masks do not protect the healthcare worker contracting TB, while 54.1% knew that N95 protects healthcare workers from TB.

Zinatsa, Engelbrecht, Van Rensburg and Kigozi (2018.7), their study indicated that health system factors such as lack of separate waiting rooms for TB patients, lack of surgical masks, hand soap and cleaning materials hamper good infection control.

2.8.4 TB preventive care and treatment

The WHO (2018:104) defines latent TB infection as “a state of persistent immune response to mycobacterium tuberculosis without clinically manifested evidence of active TB disease”. Pai, Behr, Dowdy, Dheda, Divangahi, Boehme et al. (2016:11) describe that the prevention and control of TB spreading, depend primarily on vaccination of children and appropriate diagnosis and treatment of active cases. In children, BCG decreases the risk of getting an infection by

20% and the risk of infection resulting in TB disease by 60% (Roy, Eisenhut, Harris, Rodriquez, Sridhar, Habermann et al., 2014: 6).

The NMHSS guideline (2019:93) in line with the WHO recommends that the eligibility criteria for the initiation of TB preventive therapy are children under the age of five who are close contacts of patients with TB disease, people living with HIV, and immunocompromised individuals that are contacts of TB patients with positive smear sputum.

A study conducted by Altynay (2019:24) aimed at assessing nurses' knowledge and attitude towards vaccination and immunization, showed that 90% of nurses knew BCG as the vaccine for TB. The findings concluded that nurses showed a rather high commitment to childhood vaccination.

Roscoe, Lockhart, De Klerk, Baughman, Agolory, Gawanab et al. (2020:9) in their study identified that 82% of people living with HIV who were eligible for TB preventive therapy, only 45% were screened and started on isoniazid treatment. It was further identified that the lack of training on providing TB preventive therapy, misunderstanding about timing TB preventive therapy initiation and unclear roles on prescribing were challenged in the implementation of IPT.

According to Fadare, Akpor, Ifechukwude, Richard and Bello (2019:7) nurses who work in the medical ward play a vital role in educating the patients on the effects of non adherence to TB medicine and teaching patients about the prevention of TB at home before they are discharged home. It was further indicated that delegating the care of a TB patient to young inexperienced nurses with inadequate training were some of the impediments faced in the TB programme.

2.8.5 IPC of TB training

The NMHSS (2019:102) on infection control guidelines recommends the availability of infection control plans at each health facility. These infection control plans guide healthcare workers on how to recognize, isolate and diagnose patients with suspected TB signs and symptoms. Ajayi and Isiyaku, (2018:45) and Shrestha et al. (2017:3) indicated that healthcare workers with previous training in IPC of TB had good TB infection control practices than healthcare workers without any TB training in IPC of TB.

A study done in Pakistan on infection control in hospitals managing TB included nurses who indicated that the reasons for not implementing triage are due to the lack of knowledge and training about infection prevention and control (Waheed et al., 2017:29). Temesgen and Demissie (2011:1) concluded that healthcare professionals trained in TB infection control had more knowledge than health professionals without training on TB infection control.

In Namibia, a quantitative descriptive study conducted by Mulokoshi (2019:59) showed that the effectiveness of IPC of TB is positively influenced by organizational processes and employee skills development. The recommendation was that managerial interventions should focus on enhancing organizational processes and employee skills development.

2.9 SUMMARY

This chapter has reviewed the literature from published articles that included quantitative, qualitative, case control and meta-analysis studies. Monitoring patients while on treatment results in successful treatment outcomes at the end of TB treatment. There is not much literature found on the nurses' knowledge about TB in Namibia and only a few Namibian published studies were found on patients' knowledge about TB. Namibia has the 11th highest TB incidence rate in the world with drug resistance, a problem. HIV prevalence rate among TB patients was also noted to be very high in Southern Africa where Namibia was not an exception. Risk factors contributing to the development of TB were grouped in two that is, socio-environmental factors and individual factors. Socio-environmental factors include overcrowding, indoor air pollution, smoking, malnutrition and alcohol consumption. Individual factors include diabetes mellitus and HIV coinfection.

The nursing process includes five stages that are: assessment as the initial stage followed by diagnosis, planning, implementation and lastly evaluation. It is noted that the researcher aimed to discuss these phases related to the study objectives of Assessment, Diagnosis, Treatment and Infection prevention and control of TB. Infection prevention and control of TB include several measures that were explained such as administrative, patient triage, separation for hospitalized patients with TB, TB IPC training, environmental, personal protective equipment and TB preventive care. Several studies have indicated the knowledge gap on the treatment, diagnosis and IPC of TB. Training is a factor associated with knowledge of TB that provides good infection control practices.

2.10 CONCLUSION

This chapter has reviewed the literature related to the assessment, diagnosis, treatment and IPC about TB. The following chapter discusses the research methodology.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

Chapter 3 provides a detailed discussion on the research methodology as applied in the study.

3.2 RESEARCH DESIGN

A quantitative approach with a descriptive research design was applied in this study to determine the nurses' level of knowledge on TB assessment, diagnosis, treatment, and IPC in Namibia's southern regions. Quantitative research is a systematic, objective, systemic method that uses numbers to describe variables, their interactions, and the relationships between them (Grove & Gray, 2019:480). In descriptive designs, the researcher identifies problems and current practice or makes a judgment about the practices (Grove & Gray, 2019: 203). The descriptive design does not entail the manipulation of variables but rather guard against bias (Grove & Gray, 2019:202). For the purpose of this study, the quantitative, descriptive cross-sectional methodology was the most appropriate method to apply. According to Grove and Gray (2019:192) cross-sectional design entails collecting data from study participants at one point in time. Protection against bias in a descriptive design is achieved through links between conceptual and operational definitions of variables, sample selection, sample size and the use of valid and reliable instruments (Grove & Gray, 2019:202).

3.3 STUDY SETTING

The southern regions of Namibia are divided into the Hardap and Karas regions. According to the Namibian Statistics Agency (2017:45), the Hardap region has a population of 87 186 living in 109.781km^2, the third vast region in Namibia. The Karas region is the largest region of 161.514km^2 and has a population of 85 759 (Namibian Statistics Agency, 2017:45).

Thirty-three public healthcare facilities are found in these two regions. The research was conducted at 29 public healthcare facilities in the southern regions of Namibia. Four clinics (Aussenkehr, Noordoewer, Roshpinah and Orangemund) were excluded from the study, due to a geographic difficulty to reach these clinics. The Hardap and Karas regions public healthcare facilities consisted of three district hospitals, six health centres and 20 clinics. Overall, the healthcare facilities in the southern region are situated in rural areas and are accessible via gravel roads. The maximum number of nurses working in each rural clinic were 2-3 nurses.

Table 3.1: Study setting

Hardap region: One hospital, three health centres and 10 clinics=14 healthcare facilities	**Karas region:** Two hospitals, three health centres and 10 clinics =15 healthcare facilities

3.4 POPULATION AND SAMPLING

3.4.1 Population

Grove and Gray (2019:229) describe the population as a specific group of people or elements to be studied. According to Grove and Gray (2019:229), the population is defined as a complete set of individuals or objects that poses common characteristics that are of interest to the researcher. All ENs and RNs working in public healthcare facilities in Namibia's two southern regions, Hardap and Karas were included in this study. Mariental, Rehoboth, and Aranos are the three districts that makeup Hardap, with a total population of 132 ENs and RNs. Karas region has also three districts, namely Keetmanshoop, Lüderitz and Karasburg with a total of 172 ENs and RNs. Thus, in total, the target population for the research was 304 ENs and RNs in the southern regions of Namibia as shown in table 3.2. The scope of practice of RNs and ENs entailed assessing, diagnosing, prescribing, and treating patients TB under their care.

Table 3.2: Study population and sampling

Name of the district	Registered nurse (RN)	Sampling (50%) RN	Enrolled nurse (EN)	Sampling (50%) EN	Total Nurses	Total sample size (50%) RN and EN
Districts						
Mariental	n=29	n=15	n=53	n=26	n=82	n=41
Rehoboth	n=12	n=6	n=12	n=6	n=24	n=12
Aranos	n=12	n=6	n=13	n=7	n=26	n=13
Hardap region	**N=53**	**n= 27**	**N=78**	**n= 39**	**N=132**	**n=66**
Districts						
Keetmanshoop	n=34	n=17	n=64	n=32	n=98	n=49
Lüderitz	n=17	n=9	n=18	n=9	n=36	n=18
Karasburg	n=18	n=9	n=21	n=10	n=38	n=19
Karas region	**N=69**	**n= 35**	**N=103**	**n= 51**	**n=172**	**n= 86**

3.4.2 Sampling

Sampling is the process of choosing participants who are representative of the population being studied (Grove & Gray, 2019:229). The researcher consulted the biostatistician of

Stellenbosch University for guidance about the research methodology and statistical analysis. The required sample size was 50% of the population. Grove and Gray (2019:469) further describe convenience sampling as a non-probability sampling technique in which participants who are included in the study happen to be available when the study is being conducted. Due to the geographical distance between healthcare facilities, convenient sampling was applied and the 152 nurses who were available on duty were asked to participate voluntarily in the study.

3.4.3 Inclusion criteria

RNs and ENs managing TB patients at clinics, health centres, and inpatient and outpatient departments in hospitals were included in the study. These included nurses who were employed in the public health sector with a permanent contract agreement.

3.4.4 Exclusion criteria

Nurse Managers and primary healthcare supervisors whose core functions were administrative were excluded from the study. In addition, nurses who were on leave, whether on holiday, sick or on any other type of leave at the time of data collection were excluded from the study.

3.5 DATA COLLECTION INSTRUMENT

A questionnaire was used in the data collection of the research based on the objectives, literature and conceptual framework. Grove and Gray (2019:480) describe a questionnaire as a self-report form that is designed to obtain information from participants. As part of the instrument, knowledge of the study subjects was scored with 1 for a correct answer and 0 for an incorrect answer to multiple choice questions (Appendix 4). The scale applied to the true and false questions measured the nurses' knowledge about the treatment of TB.

The questionnaire was divided into A-E sections. These sections were based on the objectives being investigated.

3.5.1 Section A: Demographic data

The questions that were numbered from 1-11 dealt with demographic variables of participants namely type of healthcare facility, age, sex, educational background, job category, duration of employment, current working position, screening patients for TB, treating patients for TB, workshop attendance and providing feedback. Question 11 was only applicable to participants who indicated "yes" to question 10. Participants were asked to mark in the box next to the most correct answer.

3.5.2 Section B: Assessment of TB

Objective no. 1 was to investigate the knowledge of nurses who were working in public healthcare facilities about the assessment of TB. The answer was a choice between multiple-choice questions. The questions numbered 12-16 focused on the basic information of TB regarding TB assessment, causes and transmission of TB based on the literature review and the Namibian TB guidelines.

3.5.3 Section C: Diagnosis of TB

Objective no. 2 was to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the diagnosis of TB. The questions numbered 17-21 focused on sputum examination, spreading and signs and symptoms of TB.

3.5.4 Section D: Treatment of TB

Objective no. 3 was to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about TB treatment. The answer was a choice between true or false. The responses linked to true responses to questions 24, 26, 27, 28, 29, 32 were considered as correct, while false responses to questions 22, 23, 25, 30, 31, 33, 34 were considered as correct answers.

3.5.5 Section E: Infection prevention and control of TB

Objective no. 4 was to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about IPC of TB. The answer is a choice between multiple-choice questions. These questions numbered from 35-42 focused on environmental control, personal protective equipment and administrative controls (NMHSS, 2019:15).

The approximate duration of answering the questionnaires ranged between 30-35 minutes and written in English.

3.6 PILOT STUDY

A pilot study refers to the minor version of the proposed study conducted to develop and improve the methodology that includes intervention, instruments or data collection processes to be used in the larger study (Grove & Gray, 2019:43). In this study, a pilot study was completed before the commencement of the actual research. The purpose was to pilot the methodology that included the testing of the reliability and validity of the instrument. The pilot study was conducted in the Omaheke district and the questionnaire was administered to 15 (10%) participants of the study population. Omaheke district was chosen because all nurses

met the inclusion criteria as expected in the study. Omaheke district borders with the Hardap region on the east. Six RNs and nine ENs who were randomly selected voluntarily participated in the study. The pilot study revealed errors in the instrument and allowed refinement on the questionnaires (Grove & Gray, 2019:478). The corrections were done in consultation with the biostatistician and supervisor. Refinements on numbering of sections were made to align with the study objectives.

- Section A, Question 1 was refined as “If YES to question 10, have you provided feedback to other nurses about the TB guidelines?”
- Section B was altered as “Assessment of TB”.
- Section C was corrected to “Diagnosis of TB”.
- Section D was corrected to “Treatment of TB”.
- Section E was corrected to “Infection prevention and control of TB”.

The instrument (Appendix 4), Section C, question 19, no. 1 was regarded as the correct answer. This correction was due to a new update on TB in *Circular* of 2020 “Amendment to the algorithm for the laboratory diagnosis of TB in Namibia”. This refinement was done in consultation with doctors and nurses who are experts in the field of TB.

The results of the pilot study were excluded from the main study.

3.7 VALIDITY AND RELIABILITY

3.7.1 Reliability

Grove and Gray (2019:481) define reliability as the degree to which an instrument measures variables or concepts consistently. The researcher based the self-administered questionnaire on the study's aims, literature, and the substance of Namibia's TB management guidelines. Cronbach’s alpha coefficient is the most commonly used to measure internal reliability for scales with multiple items (Grove & Gray, 2019:267). Cronbach’s alpha coefficient reliability of 1.0 indicates perfect reliability and coefficient of 0.00 indicates no reliability (Grove & Gray, 2019:267). The reliability of 0.8 is considered as strong for scales that have been used in several studies, however, for new scales, the reliability of 0.70 was considered acceptable, as scales were being refined and used with a variety of samples. The Cronbach’s alpha coefficient was identified to be low (0.634) as the researcher applied multiple questions, quizzes, true and false questions. The pilot conducted supported the reliability and validity of the study instrument.

3.7.2 Validity

The validity is the degree to which an instrument measures what is meant to measure (Grove & Gray, 2019:485).

3.7.2.1 Content validity

According to Grove and Gray (2019:469), content validity is the extent to which items on a scale include the major element relevant to the concept being measured. In this study, the validity of the questions of the questionnaire was based on the relevant literature to determine whether the questions on the scale reflect the description of the variable in the literature. These questions focused on the knowledge about assessment, diagnosis, treatment and IPC of TB. In addition, the content was reviewed by the supervisor, the biostatistician and based on the researcher's experience. Furthermore, the researcher assessed the presentation of the questionnaire to determine whether the items on the questionnaire were relevant, clear and unambiguous. This was done with guidance from the supervisor and medical doctors who are experts in the field of TB.

3.7.2.2 Construct validity

Construct validity determines the relationship between conceptual and operational definitions and that the instrument measures what it is designed to measure (Grove & Gray 2019:300). The independent variables included the demographic characteristics such as age, gender, qualification, facility type, job title, duration of employment, and years of experience. These categories were measured using a nominal scale. The dependent variables that were measured were knowledge about assessment, diagnosis, treatment and IPC of TB. The researcher conducted a pilot study to test the methodology and instrument to support the validity.

3.8 DATA COLLECTION

The researcher, as a principal investigator, started collecting data from the Karas region and ended with Hardap region. An arrangement was made with the nurse managers and primary healthcare supervisors about a suitable time to collect the data. Before obtaining consent from the participants, the researcher explained the purpose, the benefit and the risks of the study and that participation was voluntary. The researcher provided the participants with consent forms to sign. The signed consent forms (Appendix 3) were kept in a separate envelope from the questionnaires (Appendix 4). Participants were informed that their answers would remain confidential, and that completion of the questionnaire would take approximately 30-35 minutes. The interruptions of service delivery, specifically nursing care to patients were avoided as described by Van Rensburg et al. (2017:2), not to cause further disruption due to a shortage of nurses. Most hospitals had 2-3 nurses on duty in a ward during the day and 1-2

nurses on night duty. The questionnaire was completed under the supervision of the researcher as it included the measurement of knowledge. This was purposefully done to avoid looking up or to discussing questions with colleagues for answers. The researcher supervised individual participants while completing the questionnaire in the tearoom and conference room made available for the research study. However, in some clinics and health centres, participants completed the questionnaires at the nursing posts, because they were found alone on duty at the time of data collection. The nurses who were working night shift, individually completed the questionnaire under the supervision of the researcher from 20h00-23h00. At the rural clinics, an average of two nurses were found on duty, as some nurses were admitted to isolation wards as a result of the coronavirus Covid-19 infection. The researcher was available until all the nurses who volunteered to participate in the study had completed the questionnaires. Due to the vastness of the two regions, the data was collected over two months. From the expected 152 participants, 132 participants completed the questionnaire, giving a response rate of 87%.

3.9 DATA ANALYSIS

The researcher used descriptive statistics to summarize and analyse the data. The researcher used a rating score to assess the nurses' knowledge by scoring 1 for a correct response and 0 for an incorrect response. In section B, rating scores are useful in analysing the nominal or ordinal level of data (Grove & Gray, 2019:261). Categorical variables were summarized using frequency, percentages, while median and interquartile range were used for continuous variables. Bar graphs and/or pie charts were used to present key findings. The association between key independent variables (age, gender, level of education, clinical experience and training) and dependent variable (knowledge) of the nurses about assessment, diagnosis, treatment and IPC of TB were assessed using non-parametric Kruskal Wallis tests (> 2 groups) or Mann Whitney tests (2 groups). A 95% confidence level was applied with a p-value of ≤0.05 to indicate a significant difference.

The Statistical Product and Service Solutions (SPSS) for Windows software version 27 were used to analyse data in consultation with a biostatistician from the Division of Epidemiology and Biostatistics, Stellenbosch University.

3.10 SUMMARY

This chapter discussed the research methodology as applied in the study, which included the research design, population, sampling, instrumentation, data collection and data analysis. The inclusion criteria were nurses who were working in public healthcare facilities of the Hardap and Karas regions of Namibia. A pilot study was conducted which supported the study methodology, reliability and validity of the study. A self-administered questionnaire divided into

five sections based on the study objectives were used to collect the data. In consultation with the supervisor and the biostatistician of Stellenbosch University, the researcher used SPSS version 27 to analyse the data.

3.11 CONCLUSION

The data was collected as planned according to the objectives of the study. The study was directed by ethical considerations and guidelines to ensure that the participants' rights were protected. The research methodology applied was aligned to meet the conceptual framework. In chapter four, the results of the study are presented.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

In chapter 4, results of the data collected in the study were analysed and interpreted, based on the instrumentation used to collect the data. The results of the study were divided into 5 sections namely, Section A: Demographical data, Section B: Assessment of TB, Section C: Diagnosis of TB, Section D: Treatment of TB, Section E: Infection prevention and control of TB.

According to Grove and Gray (2019:45), data analysis is conducted in quantitative research to reduce, organize and give meaning to the data. The choice of analysis is based on the research objectives, questions and level of measurement achieved.

The data was captured on an Excel sheet and the SPSS, Window version 27 was applied to analyse the data. Data was verified with the questionnaire and marking scheme for accuracy and completeness, cleaned and analysed with support by the biostatistician and supervisor.

Descriptive statistical analysis was applied to present the data in the form of frequency distribution tables, graphical presentations and figures.

Mann Whitney U, Spearman correlation and Kruskal Wallis tests statistical were applied to determine whether there were statistically significant differences between the demographic variables and the knowledge scores on assessment, diagnosis, treatment and infection prevention and control of TB.

The Mann Whitney U test and Kruskal Walles are non-parametric tests used to indicate whether there were significant differences between two sets of data, which came from different sets of subjects (Harris & Taylor, 2003:102-103). The Spearman correlation test is an estimate of correlation of non-parametric variables (Harris & Taylor, 2003: 109) used to show the relationship between ages of participants and their knowledge in assessment, diagnosis, treatment and infection prevention and control of TB.

A p-value of ≤ 0.05 was applied to determine whether there is a statistically significant association between the demographical data and knowledge scores. A p-value of ≤ 0.05 was considered statistically significant. Scores of ≥80% were rated as competent (adequate knowledge) and those who obtained <80% were rated to be incompetent (inadequate knowledge) measured against the knowledge about the assessment, diagnosis, treatment and IPC of TB.

4.2 SECTION A: DEMOGRAPHICAL DATA

All participants (n=132) responded to all questions in the demographic section questionnaire.

4.2.1 Variable 1: Type of healthcare facility

Most participants who completed the self-administered questionnaire were from the hospital, n = 64 (48.5%) followed by participants from the clinic n=43 (32.6%) and the least of the participants were from the health centre n= 25 (18.9%). The Kruskal Wallis statistical test showed no statistically significant difference between the assessment (p=0.083), diagnosis (p=0.149), treatment (p=0.361) and IPC (p=0.451) of TB and the type of healthcare facility where the participants were working.

Table 4.1: Type of healthcare facility distribution of participants (frequency=132)

Variable	Frequency/n	Percentage (%)
Clinic	43	32.6
Health centre	25	18.9
Hospital	64	48.5
Total	132	100.0

4.2.2 Variable 2: Age

Table 4.2 indicates that the number of participants (41.7%) from the age group 20-29 years were the highest followed by participants n= 43 (32.6%) from the age group of 30-39 years. The mean age was 34.96 years (SD 9.625) with the youngest participant being 23 years and the oldest were 58 years of age. The majority of the nurses were younger than 40 years of age, which constituted of 74.3%. The Spearman correlation statistical test showed no statistically significant difference between the ages of participants and the knowledge scores obtained for assessment (p=0.449), diagnosis (p=0.590), treatment (p=0.443) and IPC (p=0.446) of TB.

Table 4.2: Age distribution of participants (frequency=132)

Variable	Frequency/n	Percentage (%)
20-29 years	55	41.7
30-39 years	43	32.6
40-49 years	16	12.1
50-59 years	18	13.6
Total	132	100.0

4.2.3 Variable 3: Gender

As shown in figure 4.1, there were more females n= 95 (72.0%) than males n= 37 (28.0%) who participated in the study. The Kruskal Wallis statistical test showed no statistically significant difference between gender and the knowledge scores obtained for assessment (p=0.308), diagnosis (p=0.064), treatment (p=0.443) and IPC (p=0.208) of TB.

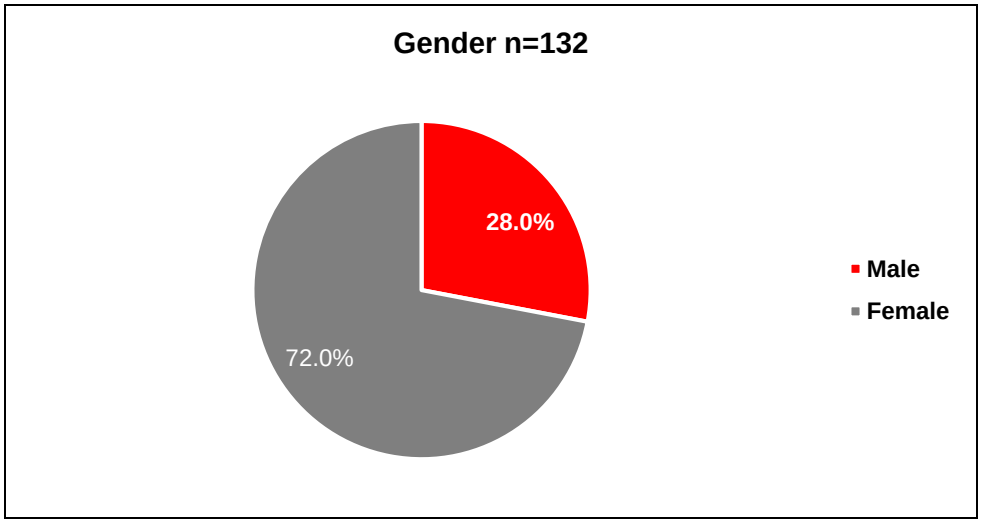

Figure 4.1: Gender distribution of participants (n=132)

4.2.4 Variable 4: Highest nursing qualification

Table 4.3 shows that the majority of participants, n=70 (53.0%) had obtained a certificate in nursing and participants with a diploma and degree qualification were n=62 (47.0%). Further analysis showed a statistically significant difference (p=0.041) between the scores obtained in the diagnosing of TB and the qualification of participants applying the Kruskal Wallis statistical test. The pairwise comparison showed that the participants with a diploma in nursing had the highest knowledge score of 76.7% than those with a certificate in nursing who obtained 63.7% and participants with a degree in nursing who obtained 53.5%.

Table 4.3: Highest qualification in nursing of participants (frequency=132)

Variable	Frequency/n	Percentage (%)
Certificate	70	53.0
Diploma	43	32.6
Degree	19	14.4
Total	132	100.0

4.2.5 Variable 5: Job title of participants

As shown in table 4.4 the majority of nurses n= 70 (53.0%) were enrolled nurses and n =62 (47.0%) were registered nurses. The Mann Whitney U test showed no statistically significant

difference between the scores obtained for assessment (p=0.535), diagnosis (p=0.237), treatment (p=0.510) and IPC (p= 0.382) of TB and the job title of participants.

Table 4.4: Job title of participants (frequency=132)

Variable	Frequency/n	Percentage (%)
Registered nurse	62	47.0
Enrolled nurse	70	53.0
Total	132	100.0

4.2.6 Variable 6: Duration of employment as a nurse

Most participants, n= 52 (39.4%) as shown in table 4.5 were employed as nurses for a duration of >1 ≤ 4 years, while n=17 (12.9%) were employed as a nurse for a period of less than a year. Thirty-seven (28.0%) of participants were working longer than 9 years as nurses in public healthcare facilities. The Kruskal Wallis statistical test showed a statistically significant difference (p=0.023) between scores obtained for the diagnosis of TB and the duration of employment of participants.

Table 4.5: Duration of employment as a nurse (frequency=132)

Variable	Frequency/n	Percentage (%)
Less than a year	17	12.9
>1 ≤ 4 years	52	39.4
>5 ≤ 9 years	26	19.7
>9 years and above	37	28.0
Total	132	100.0

4.2.7 Variable 7: Duration in current position

Table 4.6 shows that most participants n=66 (50%) were in their current position as a nurse, for the duration of 1 - 4 years. Fewer n=35 (26.5%) nurses worked either as registered or enrolled nurses for more than 5 years. No statistically significant differences were identified between the participants' duration of current position and the scores obtained for assessment (p=0.298), diagnosis (p=0.111), treatment (p=0.959) and IPC (p=0.719) of TB. However, a further analysis showed that participants who were less than a year in the current position had a median of 37.5 on the IPC scores of TB compared to participants who were at current position as a nurse for more than a year with a median of 50.0.

Table 4.6: Duration of current position as a nurse (frequency=132)

Variable	Frequency/n	Percentage (%)
Less than a year	31	23.5
>1 ≤ 4 years	66	50.0
>5 ≤ 9 years	21	15.9
>9 years and above	14	10.6
Total	132	100.0

4.2.8 Variable 8: Screening of TB

Table 4.7 shows that the majority of participants n=113 (85.6%) were screening patients for TB. A statistically significant difference (p=0.045) was identified between the knowledge score on the diagnosis of TB and screening of TB.

Table 4.7: Screening of TB by participants (n=132)

Variable	Frequency/n	Percentage (%)
Yes	113	85.6
No	19	14.4
Total	**132**	**100.0**

4.2.9 Variable 9: Treating of TB

As shown in table 4.8, the majority of participants n=102 (77.3%) are treating patients with TB and n=30 (22.7%) are not. There was no statistical difference between participants who are treating TB and the knowledge score obtained on assessment (p=0.067), diagnosis (p=0.589), treatment (p=0.580) and IPC (0.455) of TB.

Table 4.8: Treating of TB by participants (n=132)

Variable	Frequency/n	Percentage (%)
Yes	102	77.3
No	30	22.7
Total	**132**	**100.0**

4.2.10 Variable 10: Attendance workshop on TB in the past 12 months

Most participants n=112 (84.8%) as shown in table 4.9 of participants did not attend a workshop on TB guidelines in the past 12 months (table 4.9). Only n=20 (15.2%) of the participants indicated that they have attended a workshop on TB in the past 12 months. The Kruskal Wallis statistical test found no statically significant difference between the scores

obtained on assessment (p=0.838), diagnosis (p=0.227), treatment (p=0.336) and IPC (p=0.979) and participants who attended a workshop on TB in the last 12 months.

Table 4.9: Attendance workshop on TB in the past 12 months (n=132)

Variable	Frequency/n	Percentage (%)
Yes	20	15.2
No	112	84.8
Total	**132**	**100.0**

4.2.11 Variable 11: Provided feedback to other nurses on TB guidelines

Of the 20 participants who attended the workshops, n= 17 (85.0%) of the respondents gave feedback on TB guidelines to other nurses as shown in table 4.10.

Table 4.10: Provided feedback on TB guidelines (n=20)

Variable	Frequency/n	Percentage (%)
Yes	17	85.0
No	3	15.0
Total	**20**	**100.0**

4.3 SECTION B: ASSESSMENT OF TUBERCULOSIS

Section B consisted of five questions in multichoice format starting from question 12 to 16 (Appendix 4). The participants were asked to choose the correct answer. The data was analysed and scored with 1 for the correct answer and 0 for the incorrect answer. The missing data was not reported as participants chose not to answer the question. The overall description of the results for the assessment score was described.

4.3.1 Variable 12: Medical history that determines that the person had TB

Most participants n=117 (89.3%) as shown in table 4.11 knew the correct answer that the medical history that determines that a person had TB was the previous treatment.

Table 4.11: Medical history that determines that the person had TB (n=131)

Variable	Correct n (%)	Incorrect n (%)
Previous lung operation		5 (3.8%)
Previous TB treatment	117 (89.3%)	
History of Mantoux TB skin test		9 (6.9%)
Total n (%)	**117 (89.3%)**	**14 (10.7%)**

4.3.2 Variable 13 Not a socio-economic factor for TB

Table 4.12 below shows that n=100 (75.8%) of participants responded that disability was not a socio-economic factor as the correct answer.

Table 4.12: Not a socio-economic factor for TB (n=132)

Variable	Correct n (%)	Incorrect n (%)
Poverty		8 (6.1%)
Overcrowding		10 (7.5%)
Disability	100 (75.8%)	
Housing		14 (10.6%)
Total n (%)	**100 (75.8%)**	**32 (24.2%)**

4.3.3 Variable 14: Category of people qualifying for TB preventive therapy (TPT)

Table 4.13 shows that n=119 (90.8%) of participants had answered correctly to HIV positive, diabetes and children under five years as people qualifying for TB preventive therapy.

Table 4.13: Category of people qualifying for TPT (n=131)

Variable	Correct n (%)	Incorrect n (%)
Hypertension and patients with renal conditions		2 (1.5%)
Pregnant women, children and diabetes		10 (7.6%)
HIV positive, diabetes and children under five	119 (90.8%)	
Total n (%)	**119 (90.8%)**	**12 *(9.2%)**

* 9.1% was rounded off to the nearest decimal.

4.3.4 Variable 15: The vaccine given to children against TB

Nearly all n=130 (98.5%) of the participants knew that BCG is the vaccine given to children against TB as the correct answer shown in table 4.14.

Table 4.14: The vaccine given to children against TB (n=132)

Variable	Correct n (%)	Incorrect n (%)
TB skin test (TST)		1(0.75%)
Bacilli Calmette Guerin (BCG)	130 (98.5%)	
Cotrimoxazole preventive therapy (TPT)		1(0.75%)
Total n (%)	**130 (98.5%)**	**2 (1.5%)**

4.3.5 Variable 16: The site for TB disease

As shown in table 4.15 the majority n=127 (96.2%) of participants answered correctly that the lungs were the site for TB.

Table 4.15: The site for TB disease (n=132)

Variable	Correct n (%)	Incorrect n (%)
Pleura		3 (2.3%)
Lungs	127 (96.2%)	
Lymph nodes		2 (1.5%)
Total n (%)	**127 (96.2%)**	**5 (3.8%)**

4.3.6 Overall knowledge score on the assessment of TB

As shown in figure 4.2 the mean score of 89.8% was the overall score on the assessment of TB with the minimum score of 40% and maximum score of 100%. The standard deviation was 13.8. A score that is ≥ 80% indicate that participants are competent in the assessment of TB.

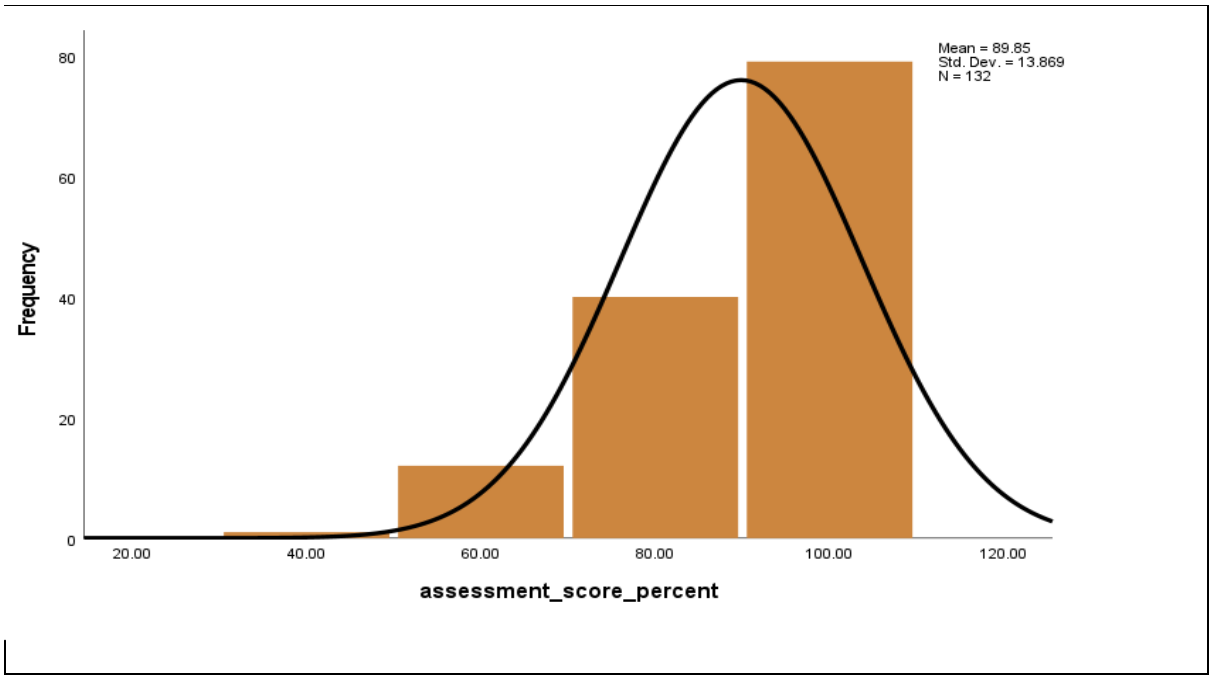

Figure 4.2: Overall knowledge score on the assessment of TB (n=132)

4.4 SECTION C: DIAGNOSIS OF TUBERCULOSIS

Section C comprised of five questions that are presented in bar graphs with data labels of frequencies and percentages as indicated in figure 4.2- 4.6. The overall description of the results for the diagnosis score is described.

4.4.1 Variable 17: Causes of tuberculosis

As shown in figure 4.3, n=126 (95.5%) of participants answered correctly that mycobacterium tuberculosis causes TB.

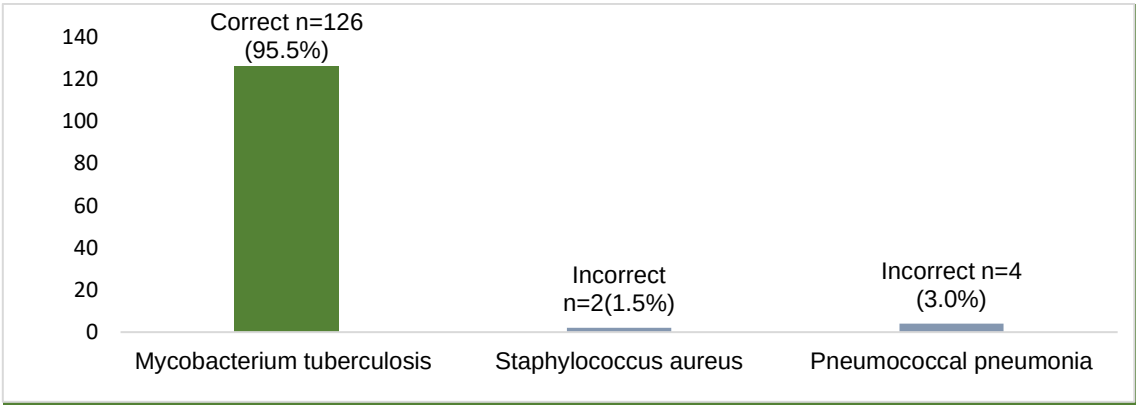

Figure 4.3: Causes of tuberculosis (n=132)

4.4.2 Variable 18: First diagnostic lab test for suspected TB cases

As shown in figure 4.4 more than half of the participants n=80 (60.6%) answered correctly that the GeneXpert MTB/RIF was the first diagnostic test for suspected TB cases.

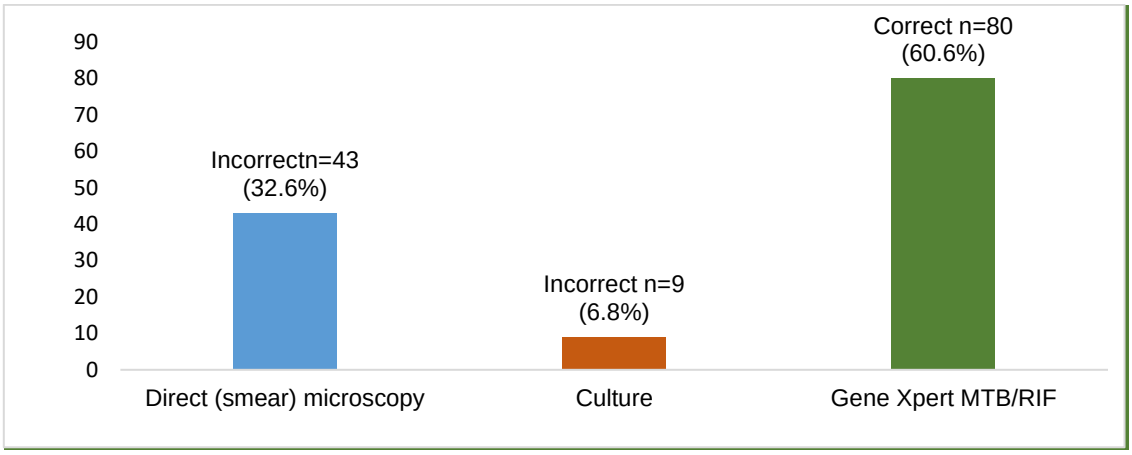

Figure 4.4: First diagnostic laboratory test for suspected TB cases (n=132)

4.4.3 Variable 19: Number of sputum specimens required for the diagnosis of TB

Figure 4.5 shows that only n=46 (35.1%) answered correctly that only one specimen was required for the diagnosis of TB.

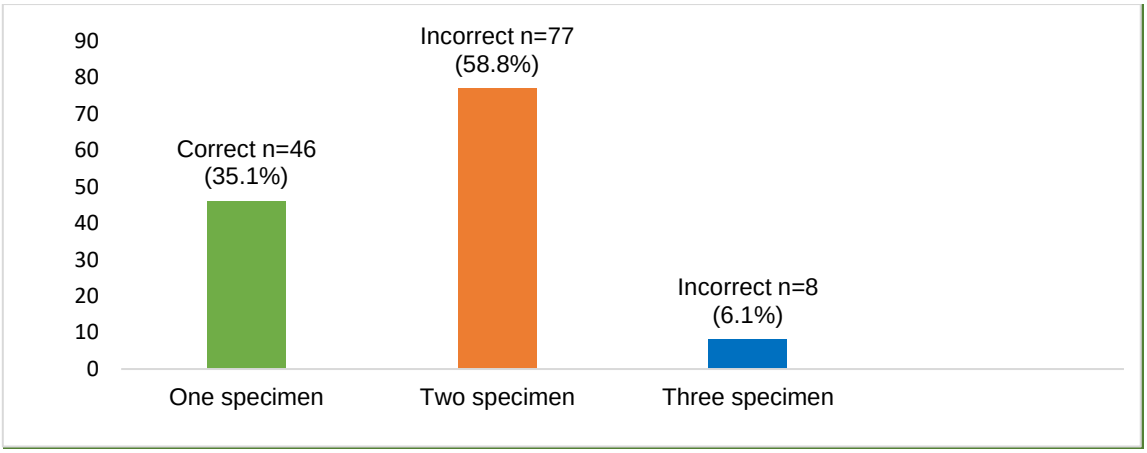

Figure 4.5: Number of sputum specimens required for the diagnosis of TB (n=131)

4.4.4 Variable 20: Method of spreading TB

All participants n=132 (100%) as shown in figure 4.6 knew that TB was spread via droplets.

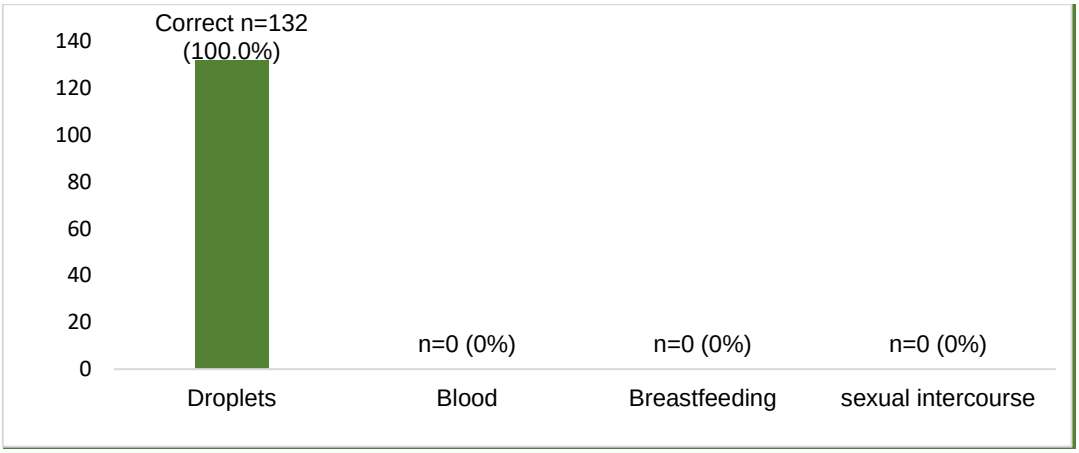

Figure 4.6: Method of spreading TB (n=132)

4.4.5 Variable 21: Signs and symptoms of pulmonary TB

Figure 4.7 illustrated that n=131 (99.2%) of participants knew that persistent cough for two weeks, weight loss and shortness of breath are the signs and symptoms of pulmonary TB.

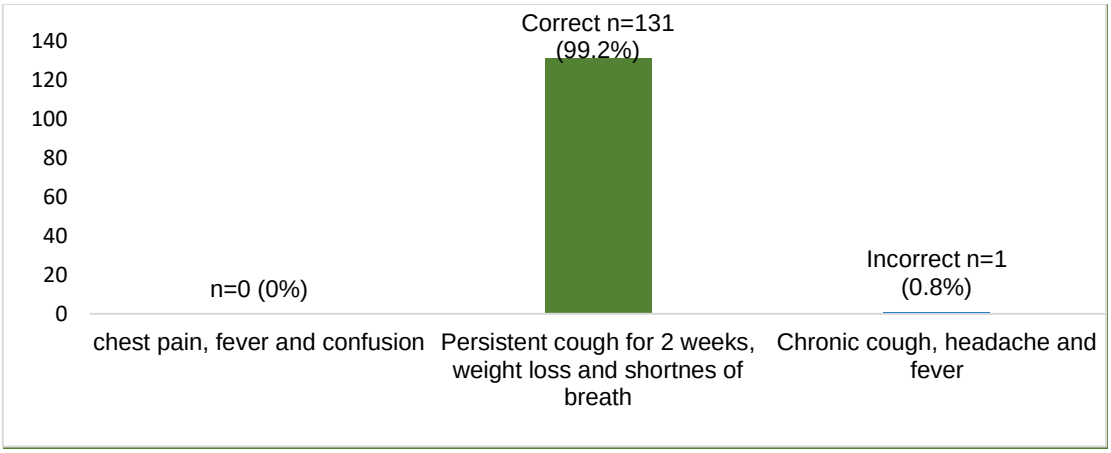

Figure 4.7: Signs and symptoms of pulmonary TB (n=132)

4.4.6 Overall percentage score obtained by participants on the diagnosis of TB

As shown in figure 4.8, the overall knowledge mean score of participants for the diagnosis of TB was 78.0%. The minimum score obtained was 60% and the maximum score of 100% with a standard deviation of 15.2. The overall score rate on the diagnosis of TB was below 80%. The results of the study show that nurses have inadequate knowledge about the diagnosis of TB.

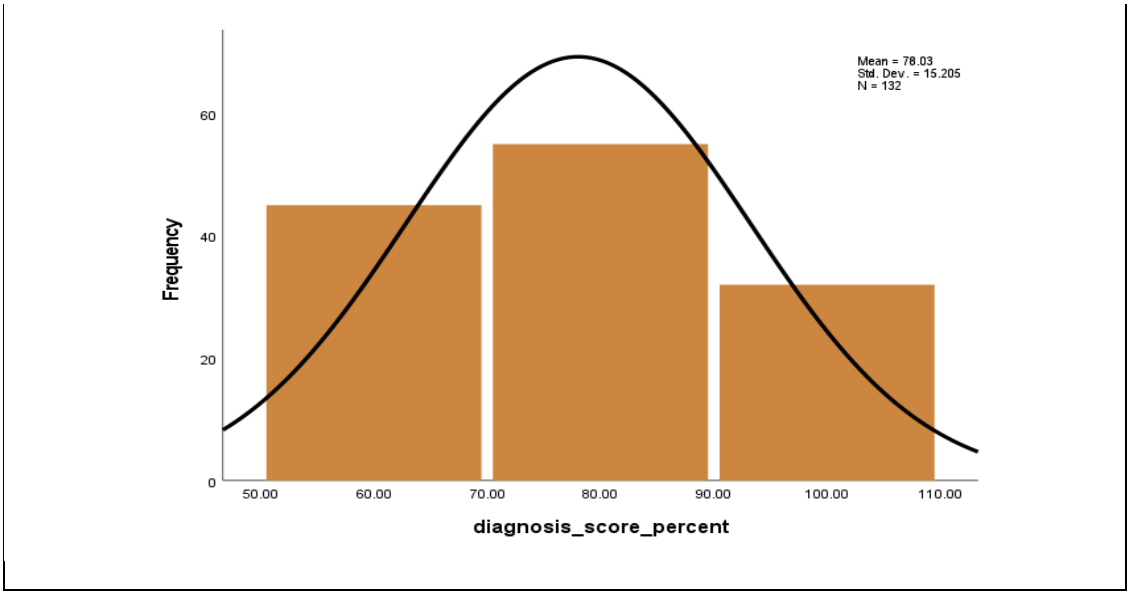

Figure 4.8: Overall percentage score on the diagnosis of TB (n=132)

4.5 SECTION D: TREATMENT OF TUBERCULOSIS

Section D comprised of 13 variables (22-34) (Appendix 4). The questions are presented in table format from table 4.17- 4.29. The descriptive results for each question are indicated. The overall description of the results for the treatment score is shown in a bar graph.

4.5.1 Variable 22: Not compulsory to register all TB patients

Most participants n=129 (97.7%) as shown in table 4.16 had correctly answered that it was compulsory to register all patients with TB.

Table 4.16: Not compulsory to register all TB patients (n=132)

Variable	Correct n (%)	Incorrect n (%)
True		3 (2.3%)
False	129 (97.7%)	
Total n (%)	**129 (97.7%)**	**3 (2.3%)**

4.5.2 Variable 23: TB cannot be cured

Table 4.17 shows that most participants n=120 (90.9%) answered correctly that it was false that TB cannot be cured.

Table 4.17: TB cannot be cured (n=132)

Variable	Correct n (%)	Incorrect n (%)
True		12 (9.1%)
False	120 (90.9%)	
Total n (%)	**120 (90.9%)**	**12 (9.1%)**

4.5.3 Variable 24: The TB treatment success rate for new and relapse cases is 90% or more

Table 4.18 shows that n=120 (90.9%) of participants answered correctly that the TB treatment success rate for new and relapse cases was 90%.

Table 4.18: The TB treatment success rate for new and relapse cases is 90% or more (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	120 (90.9%)	
False		12 (9.1%)
Total n (%)	**120 (90.9%)**	**12 (9.1 %)**

4.5.4 Variable 25: Patients with drug susceptibility to TB take TB medicine for nine months

As shown in table 4.19, n=66 (50.0%) of the participants were incorrect to say that it was true that the duration of treatment for drug susceptibility to TB was nine months, equally so n=66 (50.0%) of participants were correct.

Table 4.19: Patients with drug susceptible TB take the TB medicine for nine months (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	66 (50.0%)	
False		66 (50.0%)
Total n (%)	**66 (50.0%)**	**66 (50.0%)**

4.5.5 Variable 26: Skin rash is a common side effect of isoniazid preventive therapy (INH)

Table 4.20 shows that n=105 (79.5%) of participants who answered true, that skin rash was a common side effect of INH medication were correct.

Table 4.20: Skin rash is a common side effect of isoniazid preventive therapy (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	105 (79.5%)	
False		27 (20.5%)
Total n (%)	**105 (79.5%)**	**27 (20.5%)**

4.5.6 Variable 27: Deafness in TB treatment is caused by streptomycin injection

As indicated in table 4.21, n= 117 (88.6%) of participants who answered were correct that it was true that deafness in TB is caused by streptomycin injection.

Table 4.21: Deafness in TB treatment is caused by streptomycin injection (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	117 (88.6%)	
False		15 (11.4%)
Total n (%)	**117 (88.6%)**	**15 (11.4%)**

4.5.7 Variable 28: Pyridoxine is used to treat damage to the nerves

The majority, n=118 (89.4%) of participants who answered that it was true that pyridoxine is used to treat damage to the nerves were correct as shown in table 4.22.

Table 4.22: Pyridoxine is used to treat damage to the nerves (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	118 (89.4%)	
False		14 (10.6%)
Total n (%)	**118 (89.4%)**	**14 (10.6%)**

4.5.8 Variable 29: Patients with TB usually become non-infectious after two weeks of TB treatment

Table 4.23 shows that n=12 (84.8%) of participants who answered that it was true that patients with TB are non- infectious after two weeks of treatment were correct.

Table 4.23: Patients with TB usually become non-infectious after two weeks of TB treatment (n=132)

Variable	Correct n (%)	Incorrect n (%)
True	112 (84.8%)	
False		20 (15.2%)
Total n (%)	**112 (84.8%)**	**20 (15.2%)**

4.5.9 Variable 30: Fixed dose combination of rifampicin, isoniazid and ethambutol (RHE) is given during the initial phase of two months

As indicated in table 4.24, n= 53 (40.2%) of participants answered correctly that it was false that the RHE is given during the initial phase of two months of TB treatment.

Table 4.24: RHE is given during the initial phase of two months (n=132)

Variable	Correct n (%)	Incorrect n (%)
True		79 (59.8%)
False	53 (40.2%)	
Total n (%)	**53 (40.2%)**	**79 (59.8%)**

4.5.10 Variable 31: The first sputum smear should be tested at four weeks before changing to the continuation phase

Table 4.25 shows that more than half n=73 (55.7%) of participants answered incorrectly that the first sputum smear should be tested at four weeks before changing to the continuation phase of treatment.

Table 4.25: The first sputum smear should be tested at four weeks before changing to the continuation phase (n=131)

Variable	Correct n (%)	Incorrect n (%)
True		73 (55.7%)
False	58 (44.3%)	
Total n (%)	**58 (44.3%)**	**73 (55.7%)**

4.5.11 Variable 32: The weight of the patient is important before starting TB treatment

As shown in table 4.26, n=129 (98.5%) of participants were correct to indicate that the weight of the patient is important before starting TB treatment.

Table 4.26: Weight of the patient is important before starting TB treatment (n=131)

Variable	Correct n (%)	Incorrect n (%)
True	129 (98.5%)	
False		2 (1.5%)
Total n (%)	**129 (98.5%)**	**2 (1.5%)**

4.5.12 Variable 33: Directly observed therapy-short course is NOT important in the management of TB patients

As shown in table 4.27, n=124 (93.9%) of participants had answered correctly that direct observation therapy (DOTS) is not important in the management of TB patients.

Table 4.27: DOTS is NOT important in the management of TB patients (n=132)

Variable	Correct n (%)	Incorrect n (%)
True		8 (6.1%)
False	124 (93.9%)	
Total n (%)	**124 (93.9%)**	**8 (6.1%)**

4.5.13 Variable 34: Outcome classification of “Died” should only be applied to TB patients who are thought to have been killed by the TB disease

Table 4.28 shows that n=57 (43.2%) of participants were incorrect to know that “Died” as an outcome should only be applied to patients who were killed by TB disease. More than half of the participants n=75 (56.8%) were correct to know that this was false.

Table 4.28: Application of outcome classification of “Died” (n=132)

Variable	Correct n (%)	Incorrect n (%)
True		57 (43.2%)
False	75 (56.8%)	
Total n (%)	**75 (56.8%)**	**57 (43.2%)**

4.5.14 Overall percentage score obtained by participants on the treatment of TB

Figure 4.9 shows that the overall mean score was 77.2% on the knowledge of nurses about the treatment of TB. The minimum score obtained was 46.1% and the maximum score of

100% with a standard deviation of 11.674. The overall score rate on the treatment of TB was below 80%. Hence, the participants' knowledge level on a diagnosis of TB was inadequate.

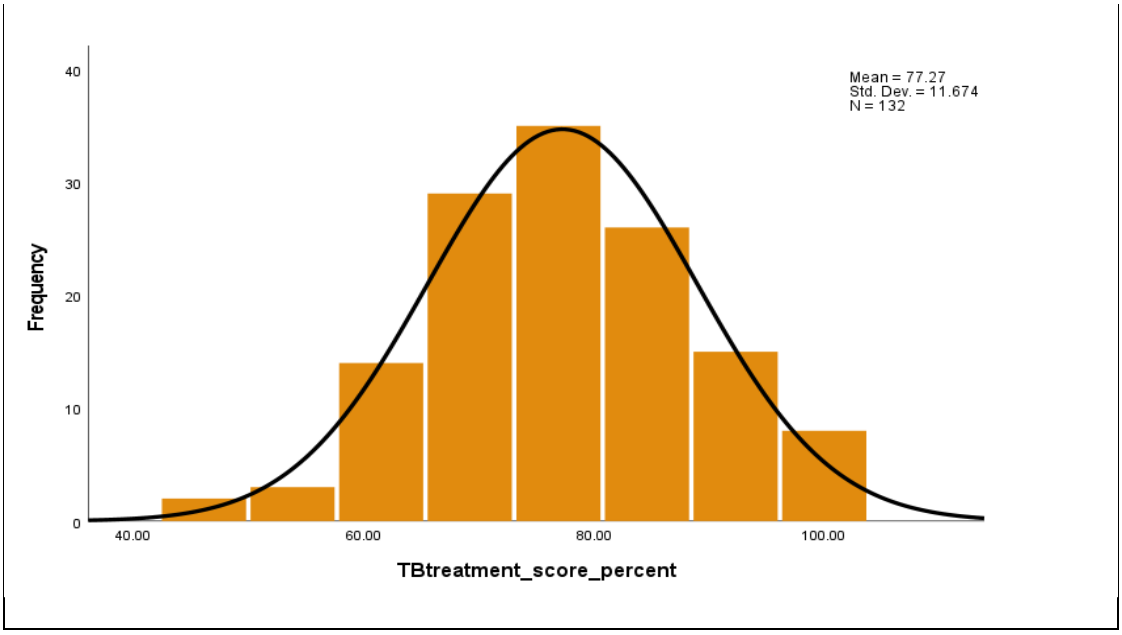

Figure 4.9: Overall percentage score on the treatment of TB (n=132)

4.6 SECTION E: INFECTION PREVENTION AND CONTROL OF TUBERCULOSIS

The eight questions in this section were presented and analyzed separately. The presentations were organized through graphs and tables. Participants were asked to choose the most appropriate answer. An overall descriptive score on the IPC of TB is presented with the mean, minimum, maximum score and standard deviation.

4.6.1 Variable 35: TB is likely to be transmitted when HCWs and patients come in contact with persons who:

Figure 4.10 illustrates that half of participants n=66 (50.0%) answered correctly that TB was likely to be transmitted when HCWs and patients come in contact with persons who have unsuspected TB disease.

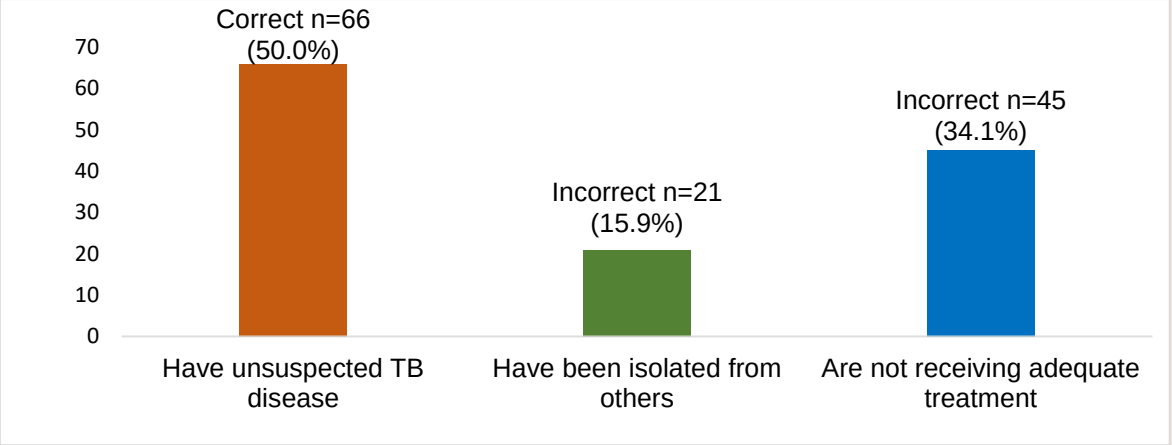

Figure 4.10: TB is likely to be transmitted when HCWs and patients come in contact with persons who: (n=132)

4.6.2 Variable 36: Types of masks that are effective in protecting nurses against TB

The majority n=131(99.2%) of participants as shown in figure 4.11, indicated correctly that N95 was the mask that was effective in protecting nurses against TB.

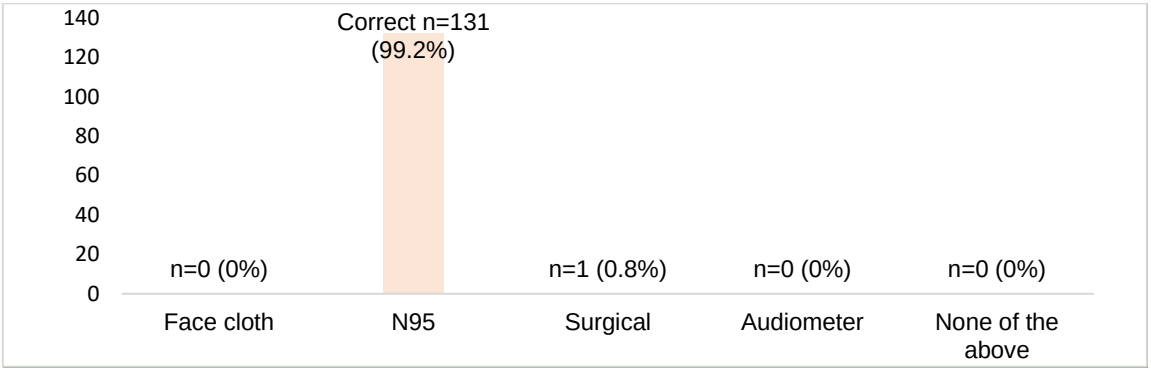

Figure 4.11: The recommended mask effective in protecting nurses against TB (n=132)

4.6.3 Variable 37: Example of administrative control

As shown in table 4.29, examples of administrative control included a and b: cough etiquette, triage, poster display, wearing of masks and isolation of patients were the most correct answers that were indicated by participants n=104 (79.4%).

Table 4.29: Examples of administrative control (n=131)

Variable	Correct n (%)	Incorrect n (%)
a) Cough etiquette, triage and poster display		18 (13.7%)
b) Wearing of masks and patient isolation		4 (3.1%)
c) a and b	104 (79.4%)	
d) Open windows		5 (3.8%)
Total n (%)	**104 (79.4%)**	**27 (20.6%)**

4.6.4 Variable 38: Example of mechanical ventilation

The pie chart, figure 4.12 shows that only n= 24 (18.2%) of participants answered correctly that an air conditioner was an example of mechanical ventilation.

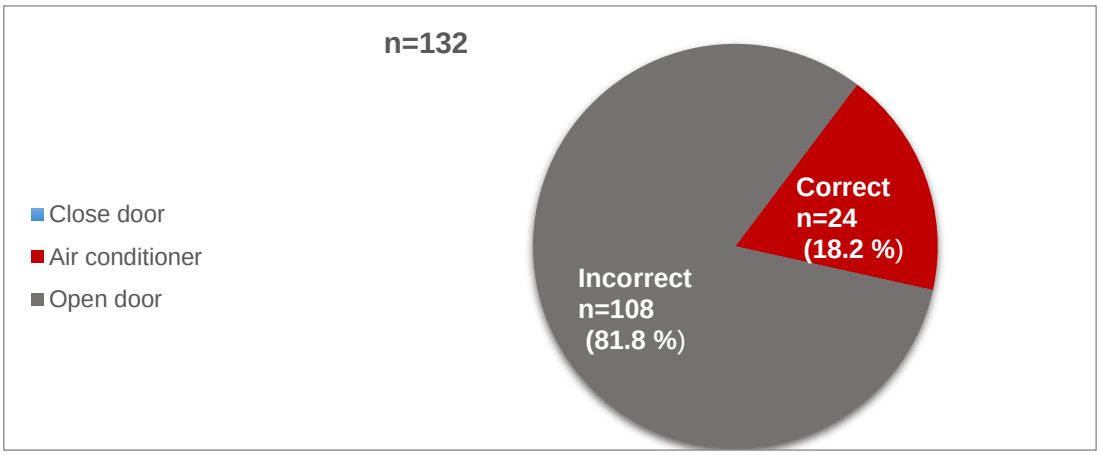

Figure 4.12: Example of mechanical ventilation (n=132)

4.6.5 Variable 39: The purpose of a TB infection control plan

Table 4.30 shows that n=105 (79.5%) of participants knew the purpose of a TB infection control plan by choosing a, b, and c as the correct answer.

Table 4.30: The purpose of a TB infection control plan (n=132)

Variable	Correct n (%)	Incorrect n (%)
a) Educate HCWs about TB		3 (2.3%)
b) Reduce the risk of TB transmission to patients & health workers		22 (16.7%)
c) Ensure early detection of patients with signs of TB		2 (1.5%)
d) a b, c	105 (79.5%)	
Total n (%)	**105 (79.5%)**	**27 (20.5%)**

4.6.6 Variable 40: HCWs included in the implementation of TB IPC measures

Table 4.31 shows that n=108 (81.8%) of participants answered correctly that the nurses, doctors, administrative personnel and laboratory personnel are HCWs that are included in the implementation of TB infection prevention.

Table 4.31: HCWs included in the implementation of TB IPC measures (n=132)

Variable	Correct n (%)	Incorrect n (%)
a) Nurses, doctors and administrative personnel		22 (16.7%)
b) Laboratory personnel		2 (1.5%)
c) a and b	108 (81.8%)	
d) None of the above		0 (0%)
Total n (%)	**108 (81.8%)**	**24 (18.2%)**

4.6.7 Variable 41: HCWs who suspect a patient waiting in a queue has TB should know that:

Table 4.32 shows that only n=11 (8.3%) of participants answered correctly, to give a patient while waiting in a queue a surgical mask and to ask the patient to cover his/her nose and mouth when coughing if TB is suspected

Table 4.32: HCWs who suspect a patient waiting in a queue has TB (n=132)

Variable	Correct n (%)	Incorrect n (%)
a) Give tissue and ask the patient to cover nose and mouth when coughing or sneezing	11 (8.3%)	
b) Give the patient a surgical mask to wear		40 (30.3%)
c) Place patient away from other patients and evaluate		81 (61.4%)
Total n (%)	**11 (8.3%)**	**121 (91.7%)**

4.6.8 Variable 42: Acronym for FAST strategy in IPC of TB

Table 4.33 shows that n=72 (55.4%) of participants indicated correctly that finding, actively, separating and treating is an abbreviation for FAST strategy in infection prevention and control of TB.

Table 4.33: Acronym for FAST strategy in IPC of TB (n=130)

Variable	Correct n (%)	Incorrect n (%)
a) Feasible, Accessible, Suitable and Timely		44 (33.8%)
b) Finding, Actively, Separating and Treating	72 (55.4%)	
c) First, Assessment, Surrounding and Timely		8 (6.2%)
d) None of the above		6 (4.6%)
Total n (%)	**72 (55.4%)**	**58 (44.6%)**

4.6.9 Overall percentage score obtained by participants on IPC of TB

Figure 4.13 shows that an overall IPC score was (58.5%) on the knowledge of nurses about IPC of TB. The maximum score was 87.7% and the minimum was 12.5% with a standard deviation of 14.6. The participants are incompetent in IPC of TB.

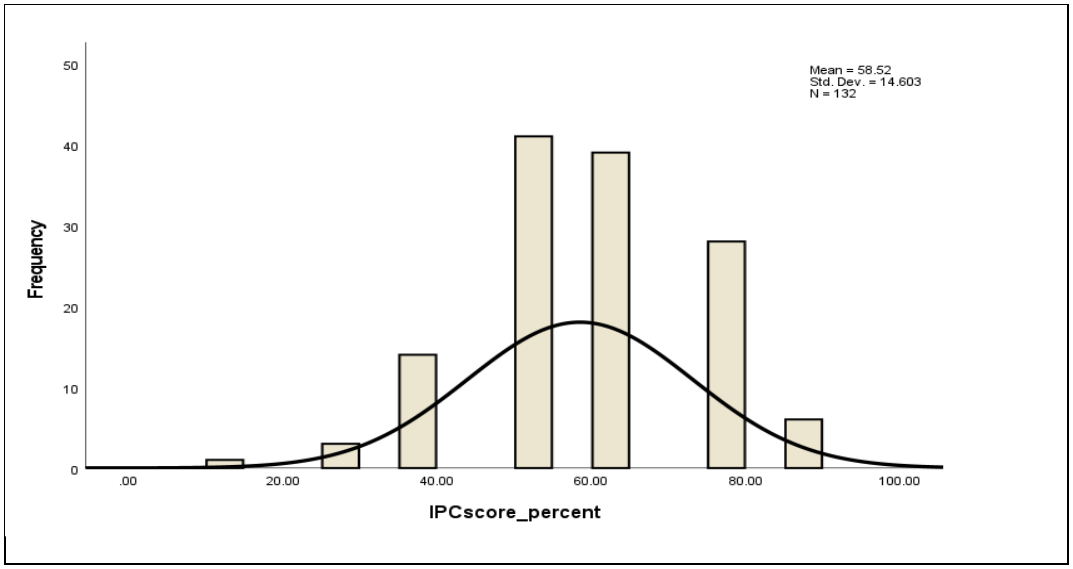

Figure 4.13: Overall percentage score obtained by participants on infection prevention and control of TB (n=132)

4.7 SUMMARY

This chapter described the findings of the study through the application of descriptive statistical analysis on the knowledge scores of nurses about the management of TB. Mann U test and Kruskal test were applied to determine the statistical significance between demographic information of participants and the knowledge scores on assessment, diagnosis, treatment and infection prevention and control of TB. There was a significant difference between the scores obtained in diagnosis of TB and the qualification (p=0.041) and duration (p=0.023) of employment of participants.

The findings have shown that there was adequate knowledge about the knowledge score on assessment of TB with the mean score of 89.8%. Conversely, the knowledge score on the diagnosis of TB revealed a mean score of 78.3%, treatment 77.2% and infection prevention, control 58.5%, and were evident as inadequate. The researcher successfully presented the answers to the research question that was about the knowledge of nurses about TB in public healthcare facilities in the southern regions of Namibia. The researcher concluded that the outcomes of the study met the study objectives.

4.8 CONCLUSION

Based on the study findings, it was evident that nurses had inadequate knowledge about the management of TB. In chapter five, an in-depth discussion on the results aligned to the study aim and objectives of the study are deliberated. The researcher equally suggests the recommendations centered on the results and confers the limitations of the research study.

CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, an in-depth deliberation of the results of the study are discussed with the support of the literature and conclusions drawn based on the results.

Recommendations are made based on the study objectives, limitations described and proposed suggestions for future research are discussed.

5.2 DISCUSSION ON THE STUDY FINDINGS

The aim of the study was to investigate the knowledge of nurses about TB in public healthcare facilities in the southern regions of Namibia. The four objectives set to meet this aim are discussed below.

5.2.1 Objective 1: To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the assessment of TB

To meet this objective, the researcher discussed five multiple questions based on the assessment of TB. The results revealed that the overall knowledge level of nurses about the assessment of TB was adequate. Based on the results as described in paragraph 4.3.6, the overall average knowledge score (89.8 %) shows that the participants were competent in assessing TB.

The patients' first contact when seeking health services is the nurse. Thus, the initial suspicion of TB frequently occurs with the nurses working at clinics, health centres and hospital outpatient departments. When a nurse has adequate knowledge and is competent in assessing patients with suspected TB symptoms, she or he takes the medical history, examines the patients, and makes a nursing diagnosis immediately to avoid the risk of TB transmission to other patients, healthcare workers and patient's family. In addition, if nurses have adequate knowledge about the risk factors e.g., diabetes, HIV, smoking and age that contribute to TB disease, it will enable the nurses to identify interventions that may mitigate these factors and eventually prevent the progression of TB (Workneh et al., 2016:9; Restrepo, 2016:3; Kanda et al.,2015:18). Competent nurses with adequate knowledge about assessing a patient regarding the history of previous TB, may be able to classify the patient correctly as a relapse when diagnosed with TB disease. Identifying patients who are lost, patients are traced and restarted on TB treatment. Furthermore, nurses that are competent in assessing

the contact history of TB of patients, effectively execute contact tracing as an intervention that determines the further transmission of TB (Mendes, Gaio, Reis & Duarte, 2013:758).

Most participants (89.3%) knew that previous TB treatment is an indication to determine the medical history that a person had TB. The knowledge score was more than 80% and thus nurses were competent. The findings were substantiated by York and Kane (2013:8), that in the situation where patients who are critically ill present with differential diagnosis at the health facilities, early identification of TB becomes possible when nurses possess adequate knowledge to assess the medical history of the patient about exposure to TB.

As shown in table 4.15 most participants (96.2%) knew that the lungs were the common site for TB disease. It is of interest that knowing the site for TB disease allows one to differentiate the type of TB the patient has and associates it with the signs and symptoms of pulmonary TB (Murphy, 2015:13) as described in paragraph 2.7.1.1.1.

The majority (90.8%) of participants knew that HIV positive patients or patients with diabetes and children under five years do qualify for TB preventive treatment. Contrary to the findings by Roscoe et al. (2020:6) showed that healthcare workers, including nurses did not screen all HIV positive clients each time they visited the healthcare services (Refer to paragraph 2.8.6).

It is worth noting that this study revealed that the majority (98.5%) of participants knew that the BCG vaccine is given to children as immunization against TB. This finding is consistent with the finding identified in Central Asia that 90% of nurses were knowledgeable about BCG as the vaccine for TB (Altynay, 2019:24). Contrary to this, it was noted that in Saudi Arabia the healthcare workers including nurses (53%), possessed inadequate knowledge (36%) about BCG vaccine for protection against TB (Alotaibi et al., 2019:5).

Objective 1: *To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the assessment of TB was investigated. It was identified* that the nurses have adequate knowledge about the assessment of TB. An overall score of 89.9% was obtained.

5.2.2 Objective 2: To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the diagnosis of TB.

The findings of this study showed that the overall knowledge of nurses about the diagnosis of TB was 78.0% as shown in figure 4.8. This is evidence that the nurses were incompetent in diagnosing TB based on the cut-off point for rating adequate knowledge of ≥80%. Inadequate knowledge of nurses about the diagnosis of TB may result in substandard care and missed or

delayed diagnosis of TB (Alotaibi et al., 2019:9). The improvement of the nurse's knowledge about the diagnosis of TB will contribute to effective TB control and will achieve the goal of End TB (WHO, 2018:40). Timely and correct diagnosing of patients with TB may increase the TB case findings in a given community and therefore improve the burden of TB.

As revealed in this study, 95.5% of participants knew that mycobacterium tuberculosis is the bacteria that cause TB. Similarly, findings from Peru in America concur with the finding of this study where 98.9% of participants had adequate knowledge about the bacteria that cause TB infection (Minnery et al., 2013:4) as described in paragraph 2.5.1.

However, the divergence from the findings of Alotaibi et al. (2019:5) in Mozambique showed that 21% of healthcare workers thought that a virus caused TB, however, these results included nurses, doctors and others and did not only indicate nurses (Alotaibi et al., 2019:4).

Nearly all participants in this study (99.2%) knew that persistent cough for two weeks; weight loss and shortness of breath are signs and symptoms of pulmonary TB. These findings were similar to a study conducted by Van Rensburg et al. (2017:4) that most primary healthcare nurses knew the signs and symptoms of TB as described in paragraph 2.7.1.1.1.

It is worth noting that all participants (100%) knew that TB is spread through the droplet nuclei. This is in line with the study conducted in South Africa by Bhebhe, Rooyen and Steinberg (2014:3) who found that 90.7% of healthcare workers recognised airborne spreading as a mode of transmission as described in paragraph 2.5.2. Furthermore, Wondimu et al. (2021:3) in Ethiopia supported the findings of this study that 96.0% of participants knew that TB is transmitted through airborne particles. The knowledge of the nurses about the methods of the spreading of TB will benefit intensive efforts of health systems to improve TB infection control in healthcare facilities.

Evidence from this study has found that 60, 6% of the participants had inadequate knowledge that the GeneXpert MTB/RIF assay is the recommended first diagnostic test used to diagnose suspected cases of TB in Namibia. According to this study, the knowledge of nurses was thus inadequate. Substantiated by Noe et al. (2019:3) found in their study that less than 30% of participants including nurses (42%) indicated that they have not heard of GeneXpert MTB/RIF assay. In South Africa, further findings revealed that healthcare workers failed to request GeneXpert/MTB RIF assay for clients who presented with cough symptoms (Chihota et al., 2015:11). However, the study conducted by McLaughlin (2018:30) contradicts the findings of this study who found that 81.0% of participants identified GeneXpert MTB/RIF assay as the preferred sputum test for diagnosing TB.

The results revealed that only 35.1% of participants knew that one sputum specimen was required for the diagnosis of TB in Namibia. It was thus evident that participants had inadequate knowledge about the number of sputum specimens required when diagnosing TB. The knowledge gap among the participants could be that they were not aware of the "amendment to the laboratory diagnosis of TB in Namibia", circular of 2020 that indicated that one specimen is needed for diagnosing TB (Office of the Executive Director circular of 2020:2).

In conclusion, objective 2: *To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the diagnosis of TB* was investigated. The results obtained show that the nurses have inadequate knowledge about diagnosing TB. The overall score of 78% was obtained.

5.2.3 Objective 3: To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the treatment of TB

As shown in figure 4.9, the participants obtained an overall percentage score of 77.2% on the knowledge about treatment of TB with a minimum score of 46.1% and the maximum score of 100%. This study concluded that nurses were incompetent in treating TB as the overall knowledge score rate on the treatment of TB was below 80%. However, the results of this study in contrast to the study conducted by Yükseltürk and Dinç (2013:50) revealed that nurses (77.0%) had good knowledge. Different rating scales used in determining the knowledge of nurses about the treatment of TB could be attributed to the inconsistency between these findings.

Nurses that are competent in treating TB particularly on the type and duration of TB treatment allow patients to complete TB treatment within a required period. It was proven that nurses who had inadequate knowledge about the treatment of TB might risk the patients in receiving inadequate treatment. This may result in poor treatment outcomes, which is an indicator of TB resistance (Ahmad, Javaid, Sulaiman, Ming, Ahmad & Khan, 2016: 46). Hence, knowledge about TB treatment should be a key factor in the fight against TB. The nurses who possess adequate knowledge about the side effects of TB medicine may be competent in educating patients about the side effects of TB medicine. For example, Rifampicin causes an orange colour of the urine. The nurses may reassure patients that orange-coloured urine is normal and harmless and is attributed to the medication being taken (NMHSS, 2019:43).

The majority (90.9%) of participants knew that TB could be cured. The findings to this question are not similar or different from other study findings, as no previous published research could

be found that investigated this variable about nurses. The findings of the study may serve as baseline evidence for future researchers.

The study identified that half (50.0%) of the participants had inadequate knowledge about the duration of TB treatment. Inadequate orientation on the revised TB guidelines published in 2020 may have contributed to the knowledge gap. It is evident in the results of this study that only 15.2% of the participants have attended a workshop on TB in the past 12 months. Noe et al. (2017:3) and Alotaibi et al. (2019:6) support the finding that over 58% of healthcare workers, including nurses could not identify the medicines or the period for the maintenance of treatment as described in paragraph 2.7.4.2.

Only 40.2% of the participants knew that a fixed-dose combination of rifampicin, isoniazid and ethambutol were not given in the initial phase of treatment. Similar findings by McLaughlin (2018:29) found that only half (50.0%) of the participants knew the standard drug sensitive TB treatment.

Nearly half (43.9%) of the participants had inadequate knowledge that the first sputum smear should be monitored at four weeks before changing to the continuation of TB treatment. The researcher did not find any study that supports or differs from these results. However, in real clinical environmental factors, such as lack of transport to collect sputum specimen from healthcare facilities and patient delayed to follow- up care affects the timely collection of specimens.

As shown in tables 4.20 and 4.21, the results revealed that 79.2% of participants knew that skin rash was the common side effect of isoniazid, and deafness (88.6%) was associated with streptomycin injection. Similar findings by Yükseltürk and Dinç (2013:50) showed that the nurses' knowledge score about the side effects of streptomycin was 81.2% as described in paragraph 2.7.4.5. Knowing the side effects of streptomycin allows the nurse to assess the hearing function before initiating TB treatment, monitor the hearing functions of the patient and refer (Raftery, Tudor, True & Navarro, 2018:33) the patient to the doctor for further evaluation.

Inadequate knowledge of nurses about the treatment of TB may result in substandard care, incorrect prescription of TB medicines, poor TB treatment outcomes and drug resistance TB among patients.

Thus, with reference to objective 3: *To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the treatment of TB* was investigated. It was found that the knowledge of the nurses about treating patients with TB was inadequate. An overall score of 77.2% was obtained.

5.2.4 Objective 4: To investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the infection prevention and control of TB

From the data presented in figure 4.13, it is evident that the participants were incompetent in managing the IPC of TB, based on the knowledge score of 58.5%. A study conducted in Ethiopia substantiates these results, which found that one third of healthcare workers, including nurses, had relatively poor knowledge on IPC of TB (Gizaw, Alemu & Kibret, 2015:8). Similarly, Shrestha et al. (2017:3) in their study in Nepal, Asia found that 46.0% of the nurses had a poor knowledge level on IPC of TB. While Ajayi and Isiyaku (2018:41) in Nigeria showed that 83.3% of healthcare professionals, including nurses had good knowledge of TB infection control. IPC of TB are determined by knowledge invested by healthcare organizations to bring the TB infection under control. Monitoring the level of knowledge about IPC will aid to address identifying and addressing the gaps to reduce the rate of transmission of TB. Nurses who do not possess adequate knowledge about the IPC of TB are more likely to spread the TB droplets among patients by not washing their hands, not separating patients with suspected TB symptoms, and not educating patients with TB to wear surgical masks (Jo, 2017:23). Furthermore, the knowledge gap of nurses about IPC of TB may hamper the implementation of interventions written in the infection control plan.

Furthermore, this study established that 79.5% of the participants had inadequate knowledge about the purpose of the TB infection prevention and control plan as shown in table 4.30. The IPC plan is a strategy aimed at ensuring early detection of patients with TB signs, educating healthcare workers about TB and reducing the risks of transmission to patients and healthcare workers as described in paragraph 2.8.7.

As supported by a study conducted in South Africa revealed that healthcare workers were not aware of the availability and the information contained about the IPC plans of TB (Tshitangano, Maputle & Netshikweta, 2013:1). Gyem, Ahmad and Mahendradhata (2020:5) in India, reported similar findings that none of the facilities had a written IPC plan of TB. The unavailability of IPC plans of TB in a healthcare facility negatively affects the implementation thereof, resulting in the transmission of TB infection. NMHSS (2014:34) highlighted that the IPC plans of TB ensure the implementation of TB infection control measures and allow healthcare workers to comply with practices and standard operating procedures indicated.

As explained in paragraph 2.8.1.1, the researcher discovered that screening all patients on entry by separating coughing patients without coughing and educating them on cough hygiene were measures taken under administrative control (Ganesh, 2011:25). Based on the data

presented in table 4.29, the participants had inadequate knowledge (79, 4%) about the wearing of masks, patient isolation, cough etiquette, triage and poster delay.

Ganesh (2011:3) revealed a similar knowledge gap in Mount Ayliff hospital in South Africa that 46.2% of nurses and doctors rarely screen patients upon entering the health facility and 50% of the participants do not educate patients on cough hygiene. According to the conceptual framework, as explained in paragraph 1.7, the nurse who enters the competent stage of expertise has adequate knowledge and thus ensures that triaging of patients entering healthcare facilities are implemented. Furthermore, suspected patients with signs and symptoms of TB are offered tissues and educated to cover their mouths when coughing as described in paragraph 2.8.1.2. This will reduce the chances of TB exposure to healthcare workers and uninfected patients (NMHSS, 2014: 12; Jo, 2017:23).

Only (18.2%) of participants knew that an open door to allow airflow in the room was an example of mechanical ventilation. However, Gizaw, Alemu and Kibret (2015:4) found that 96.4% of healthcare workers, including nurses knew that the door and windows of a room should be open whenever a TB suspected patient is in the room as described in paragraph 2.8.2.

A question asked about what participants will do when “healthcare workers who suspect a patient waiting in a queue have TB" as shown in table 4.32, only 8.3% of the participants indicated that they give tissues to the patient and ask the patient to cover his or her mouth when coughing or sneezing. The results indicated that participants had inadequate knowledge about what to do when suspecting patients waiting in a queue has TB. According to Van Rensburg et al. (2018:4), 73.9% of participants knew the importance of patients wearing surgical masks with suspected TB, while waiting on confirmation of a diagnosis. Similarly, Ngo et al. (2019:6) in their study found that 91.3% of nurses do offer surgical masks to patients who are suspected of TB.

According to table 4.33, 55.4% of the participants knew the meaning of the FAST strategy in IPC of TB. This is evidence that participants had inadequate knowledge about the meaning of the FAST acronym. Barrera, Livchits and Nardell (2015:381) describe screening as part of TB IPC measure as defined in the acronym FAST: “Find cases Actively, Separation safely and Treating effectively” based on the rapid drug susceptibility testing. As described in paragraph 2.8.1.2, knowledge about and implementation of the FAST strategy led to prompt effective treatment and reduction in the transmission of TB infection (Barrera, Livchits & Nardell, 2015:381).

Therefore, the researcher sought *to investigate the knowledge of nurses who were working in public healthcare facilities in the southern regions of Namibia about the Infection Prevention of TB.* From the data presented in figure 4.13, it is evident that the nurses were incompetent in managing the IPC of TB as evidenced by a score of 58. 5%.

5.2.5 Objective 5: To determine the association between demographical data and the knowledge scores of nurses working in the public healthcare facilities in the southern regions of Namibia

As shown in table 4.2, the majority (41.7%) of participants were between 20-29 years of age followed by 32.6% of participants from the age group of 30-39 years. In this study, young participants dominated the study population. The study found that young participants had no statistically significant differences in scores obtained for assessment (p=0.449), diagnosis (p=0.590), treatment (p=0.443) and IPC (p=0.446) of TB compared to older participants. Patricia Benner's nursing theory supports that a novice nurse relies on the rules and principles to guide the achievement of attributes (Benner, 1982:402).

More than half (53.0%) of participants held certificates in nursing; 32.6% of participants had a diploma in nursing and 14.4% of participants had a degree in nursing.

The result showed a significant difference (p=0.041) between the scores obtained in diagnosis and qualification of participants. The pairwise comparison showed that the participants with a diploma in nursing had better knowledge scores (76.7%) than participants with a degree in nursing (53.5%) about the diagnosis of TB. Furthermore, the results showed that participants with a certificate in nursing scored better (63.7%) than participants with a degree in nursing.

As shown in table 4.5, 12.9% of participants were employed as nurses less than a year, while 28.0% of participants were employed longer than nine years. Furthermore, the results showed that 39.4% of participants who were working for one to four years had adequate knowledge on the diagnosis of TB. Relative to the applied conceptual framework of Benner's theory as described in paragraph 1.7, these nurses have progressed into the competent stage of expertise; they could correctly diagnose patients with TB as opposed to novice nurses with less experience in the diagnosis of TB.

According to this study, participants who had less than a year of experience in their current position had a median score of 37.5, which revealed that they have inadequate knowledge on IPC of TB compared to participants who were more than a year in their current position with a median score of 50.0. Thus, novice nurses will require more support and guidance about the management of TB, specifically in the IPC of TB.

A statistical difference was identified between the participants screening of TB and the scores obtained for the diagnosis (p=0.045) of TB.

Furthermore, the majority (85.6%) of participants who were screening patients for TB showed that they were competent in diagnosing TB compared to participants who were not screening patients for TB as described in paragraph 4.2.8. Nurses enhance their practical knowledge through clinical experiences, and thus nurses who play an active role in screening patients for TB disease may have adequate knowledge and skills about the diagnosis of TB even though 84.8% of participants did not attend a workshop on TB guidelines in the past 12 months as shown in table 4.9.

The researcher sought *to determine the association between demographical data and the knowledge scores of nurses working in public healthcare facilities in the southern regions of Namibia*. From the above discussion, it is a concern to note that participants with a degree in nursing had inadequate knowledge about the diagnosis of TB than participants with a diploma or a certificate in nursing. Furthermore, it was evident that participants with less than a year's experience had inadequate knowledge about the diagnosis of TB and had inadequate knowledge on IPC (median 37.5) than participants who were more than a year in their current position with a median score of 50.0 as described in paragraph 4.2.7.

5.2.6 Conclusion on the study objectives

In this study, the objectives about what was the knowledge of nurses who were working in the public healthcare facilities in the southern regions of Namibia about assessment, diagnosis, treatment and infection prevention of TB, the nurses had a knowledge gap on the diagnosis, treatment and IPC of TB. When these study objectives are being compared with the literature review as described in chapter 2, to provide holistic quality healthcare to patients, nurses should be able to assess patients correctly to make a correct diagnosis, prescribe the right medicines and correctly inform and educate patients on matters related to TB management. Similar to the steps of the nursing process, nurses should have the ability to assess patients to formulate a correct diagnosis, plan clearly for an effective nursing care plan, implement the plan correctly and evaluate the care provided to determine whether patients' health conditions have improved.

The knowledge level of nurses who were working in the public healthcare facilities in the southern regions of Namibia on assessment of TB was not associated with biographic data. Related to Benner's (1982:402) theory, for nurses to have adequate knowledge in the assessment of TB, they should have progressed from Novice to an Advanced Beginner, to Competent, to Proficient and Expert of nursing expertise. However, inadequate knowledge

about diagnosis and IPC of TB was associated with a lack of experience in the nursing field. As explained by Benner's nursing theory (1982:402), these nurses were beginners without experience before the clinical environment and required induction and orientation on TB guidelines, circulars about TB and standard operating procedures on IPC of TB as explained in paragraph 1.7.

5.3 LIMITATIONS OF THE STUDY

Namibia comprises 14 regions and this study was conducted on a smaller sample from the Hardap and Karas regions. More regions should be involved in a study in future studies. IPC of TB was based on knowledge assessment using self-administered questionnaires rather than observation. This could reveal a broader picture of the level of knowledge about IPC of TB through practical observations.

5.4 RECOMMENDATIONS

The following recommendations if implemented may breach the knowledge gap of nurses about the assessment, diagnosis, treatment and IPC of TB.

5.4.1 Training

- Mandatory training on TB to newly recruited nurses within 12 months of employment.
- The National TB and Leprosy Control Program should secure and allocate funds to the Hardap and Karas regions focusing on TB related training.
- Continuous refreshment on the job training, coaching, and mentoring about TB management aimed to enhance healthcare workers' competence about TB. This should include the use of practical training using models and other adult learning approaches such as periodic knowledge quizzes on the diagnosis, treatment and IPC of TB.
- A brief report to the nursing college or university might assist in the contribution to the structure of clinical programs and the preparedness of the nurse to practice (TB care).

5.4.2 Funding

- The Hardap and Karas Regional Management Teams should allocate funds specifically for nursing education sessions focusing on the TB diagnosis, treatment and patient monitoring at all healthcare facilities. The secured funds should be allocated when conducting support supervision, giving constructive feedback and providing incentives to motivate staff that follow TB guidelines.
- At the regional level, the researcher proposes that TB programme officers develop a flowchart, outlining each step on the "process flowchart for TB education of new

patients" (United States Agency for International Development, 2013:23) and train nurses on the utilization of such charts at the facility level. The flowchart should be composed of various steps and could be adjusted to fit the clinical environment: sputum collection, interventions done when sputum results are negative or positive, education to patients by nurses, contact tracing, TB tests to contacts and TB result outcomes. The assumption is that enforcing the use of this flowchart to healthcare nurses will enhance their knowledge.

- Engaging in community projects to educate the community about the prevention of TB and adherence to treatment. The nurse interacts with the ancillary cadres, such as the community healthcare workers and TB field promoters in strengthening community education on the causes, transmission and socio-environmental factors aimed to reduce the transmission of TB.
- Since the training on TB is not always adequate to prepare nurses to manage TB, it is important to audit the environment and test nurses randomly on TB to evaluate their level of knowledge, identify good practices, gaps and work on the recommendations made. Thereafter, the committee introduces nursing education sessions focusing on TB diagnosis, treatment and patient monitoring to the identified healthcare facilities with knowledge gaps.

5.4.3 Introduce Quality Improvement Programme

- Establish a quality improvement committee (QIC), for example, the TB IPC committee aimed at addressing the common challenges about the management of TB. Team composition should include staff from regional, district and facility levels. The teams' committees should aim to promote a culture of quality improvement such as educating HCWs about quality improvement and providing nurses with skills to participate in the quality improvement process, displaying data about TB where patients and healthcare workers can evaluate the progress.
- District TB coordinators should facilitate quality improvement teams with facility nurses and community healthcare workers.

5.5 FUTURE RESEARCH

The following areas for future research are proposed:

- Further studies on a larger scale are needed focusing on the observations of the knowledge of IPC and practices.
- Future research about the management of TB should include the remaining 12 regions.

5.6 SIGNIFICANCE OF THE STUDY

The results of the study may assist the Namibian government with developing policies with specific reference to closing the gap in knowledge about diagnosis, treatment and IPC of TB.

This study signifies the awareness of TB that may expand to the Nursing colleges and Universities about the management of TB.

The significance of the study is that the findings of this study may promote the effective implementation of TB case management. This is achieved by enhancing the knowledge of nurses working in public healthcare facilities in Namibia regarding assessment, diagnosis, treatment and IPC of TB. The research may benefit the patients diagnosed with TB to adequately receive quality nursing care and improve their quality of life.

5.7 DISSEMINATION

The results of the study will be shared with the Ministry of Health under the national programme for TB and leprosy during the annual national TB and leprosy programme (NTLP) forum. The research findings will be presented to the regional and district management team of the Hardap and Karas regions to highlight the knowledge gaps and discuss the recommendations made. Feedback regarding the study results will be provided to the healthcare workers of the two southern regions of Namibia during quarterly TB/HIV data review meetings. The researcher proposes to present the study findings at conferences and publish this research.

5.8 CONCLUSION

The findings of the study showed that the nurses have inadequate knowledge of TB. The level of qualification, duration of employment, and screening of TB were factors associated with a diagnosis of TB. Patricia Benner's nursing theory discovered that nurses' knowledge was enhanced through years of experience and that nurses who had served less than a year, exhibited inadequacies in the infection prevention and control of TB. These gaps in knowledge about the diagnosis, treatment and TB IPC of TB found a late detection of TB cases, poor TB treatment outcomes and drug resistance TB among patients and healthcare workers. Thus, the nurses who participated in the current study is a representative sample of the nurses who were found incompetent in diagnosing, treating, preventing, and controlling infection of TB. Consequently, this poses a risk of missed diagnosis, poor treatment outcomes, drug resistant TB and further transmission of TB among clients and their families.

Innovative interventions such as funding, training and a quality improvement approach are needed to enhance the knowledge of nurses about the management of TB.

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APPENDICES

APPENDIX 1: ETHICAL APPROVAL FROM STELLENBOSCH UNIVERSITY

Approval Notice

New Application

02/10/2020

Project ID: 17208

HREC Reference No: S20/07/179

Project Title: AN INVESTIGATION INTO THE KNOWLEDGE OF NURSES ABOUT TUBERCULOSIS IN THE SOUTHERN REGIONS OF NAMIBIA

Dear Miss Aletha Shaanika

The **Response to Modifications** received on 18/09/2020 12:38 was reviewed by members of **Health Research Ethics Committee** via **expedited** review procedures on 02/10/2020.

Thank you for attending to the requested modifications, your research protocol is now finally approved.

Please note the following information about your approved research protocol:

Protocol Approval Date: 02 October 2020

Protocol Expiry Date: 01 October 2021

Please remember to use your Project ID 17208 and Ethics Reference Number S20/07/179 on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Translation of the informed consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Please note you can submit your progress report through the online ethics application process, available at: Links Application Form Direct Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/healthresearchethics) for guidance on how to submit a progress report.

The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Departement of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website https://applyethics.sun.ac.za/ProjectView/Index/17208

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Mrs. Brightness Nxumalo
HREC 2 Coordinator

National Health Research Ethics Council (NHREC) Registration Number:

REC-130408-012 (HREC1)•REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372

Page 1 of 2

Office of Human Research Protections (OHRP) Institutional Review Board (IRB) Number:
IRB0005240 (HREC1)•IRB0005239 (HREC2)

The Health Research Ethics Committee (HREC) complies with the SA National Health Act No. 61 of 2003 as it pertains to health research. The HREC abides by the ethical norms and principles for research, established by theWorld Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects;the South African Department of Health (2006). Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa (2nd edition); as well as the Department of Health (2015). Ethics in Health Research: Principles, Processes andStructures (2nd edition).

The Health Research Ethics Committee reviews research involving human subjects conducted or supported by the Department of Health and Human Services, or other federal departments or agencies that apply the Federal Policy for the Protection of Human Subjects to such research (United States Code of Federal Regulations Title 45 Part 46); and/or clinical investigations regulated by the Food and Drug Administration (FDA) of the Department of Health and Human Services.

APPENDIX 2: PERMISSION OBTAINED FROM DEPARTMENT OF HEALTH

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 – 203 2537
Fax: 061 – 222558
E-mail: itashipu87@gmail.com

OFFICE OF THE EXECUTIVE DIRECTOR

Ref: 17/3/3/ANS
Enquiries: Mr. A. Shipanga

Date: 11 November 2020

Ms. Aletha Nangula Shaanika
PO Box 707
Mariental

Dear Ms. Shaanika

***Re:* An investigation into the Nurses's knowledge about TB in the Southern Region of Namibia.**

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**

3.1 The data to be collected must only be used for academic purpose;
3.2 No other data should be collected other than the data stated in the proposal;
3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
3.4 A quarterly report to be submitted to the Ministry's Research Unit;
3.5 Preliminary findings to be submitted upon completion of the study;
3.6 Final report to be submitted upon completion of the study;
3.7 Separate permission should be sought from the Ministry for the publication of the findings.

4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

EXECUTIVE DIRECTOR
MINISTRY OF HEALTH AND SOCIAL SERVICES

BEN NANGOMBE
EXECUTIVE DIRECTOR

16/14688

"Your Health Our Concern"

APPENDIX 3. PARTICIPANT INFORMATION LEAFLET AND DECLARATION OF CONSENT BY PARTICIPANT AND INVESTIGATOR

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvennoot • your knowledge partner

STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

1. TITTLE OF RESEARCH PROJECT	
AN INVESTIGATION INTO THE KNOWLEDGE OF NURSES ABOUT TUBERCULOSIS IN THE SOUTHERN REGIONS OF NAMIBIA	
2. DETAILS OF PRINCIPAL INVESTIGATOR (PI)	
Ms. Aletha Nangula Shaanika	Ethics reference number: S20/07/179
Full Postal Address: P.O. BOX 707, Mariental Namibia, 9000	PI Contact number: +2642826380

You are invited to take part in a study conducted by Aletha Nangula Shaanika, from the Department of Nursing and Midwifery at Stellenbosch University. You were approached as a possible participant as a nurse who is dealing with TB patients. Please ask the researcher any questions about any part of this study that you do not fully understand. It is important that you clearly understand what the research entails and how you could be involved. You can choose whether to be in this study or not. If you agree to take part in this study, you may withdraw at any time without any consequence. You may also refuse to answer any question you do not want to answer and remain in the study. The Health Research Ethics Committee (HREC) at Stellenbosch University has approved this study. The Ethics approval number is S20/07/179.

1. PURPOSE OF THE STUDY

The purpose of the study is to assess your knowledge about TB in the public health facility where you are working.

2. WHERE WILLTHE STUDY BE CONDUCTED?

The study will be conducted at public hospitals, health centres and clinics at Karas and Hardap regions. Karas region consists of Keetmanshoop, Karasburg and Lüderitz district. Hardap region consists of Mariental, Rehoboth and Aranos district. The number of participants from Karas region will be 86 and Hardap region will be 66. The total number of the participants is 152.

3. WHAT WILL BE ASKED OF ME?

If you agree to take *part* in this study, you will be asked to respond to the questionnaire given to you by the researcher. You will be requested to complete the questionnaires in a quiet place during working hours. The researcher has obtained permission from your supervisor for this purpose. You will be requested to complete the questionnaire only once. The questionnaire is written in English. The time needed for you to fill in the questionnaire may take 30-35 minutes of your time.

4. POSSIBLE RISKS AND DISCOMFORTS

While filling in the questionnaire you may be anxious about whether your answers are correct or not. The researcher reassures you that you should not be anxious about whether your answers are correct or not.

5. BENEFITS OF PARTICIPANTS FOR TAKING PART IN THIS STUDY

The study may not have direct benefits to you as the participant. However, the study will benefit the nurses and the management of clients as there will be recommendations made about TB management.

6. PAYMENT FOR PARTICIPATION

It will not cost you anything to participate in this study. You will not be paid for participation in the study, however you will be provided with refreshments for the time you spent filling in the questionnaire.

7. PROTECTION OF YOUR INFORMATION, CONFIDENTIALITY AND IDENTITY

Any information you share with me during this study regarding your personal information will be protected. This will be done by not mentioning your name and name of the facility where you are working. To ensure confidentiality, all the data collected by the researcher will be kept inside a lockable cabinet and will only be accessed by the researcher. The electronic data will be protected with a password that is accessed controlled by the researcher and the supervisor. The final research report will not identify your name and if the information is to be shared, it will be shared with the Universality of Stellenbosch and the Namibian Ministry of Health.

RESEARCHERS' CONTACT INFORMATION

If you have any questions or concerns about this study, please feel free to contact Ms. Aletha Nangula Shaanika at +264 812826380, and/or the supervisor Prof. Ethelwynn Stellenberg at elstel@sun.ac.za and HREC2 coordinator. Mrs. Brightness Nxumalo at 0219389207;brightness@sun.ac.za.

8. RIGHTS OF RESEARCH PARTICIPANTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this

research study. If you have questions regarding your rights as a research participant, contact Ms. Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

If you are willing to participant in this study, please sign the attached Declaration of consent and hand it to the researcher.

DECLARATION OF CONSENT BY THE PARTICIPANT

By signing below, I ……. agree to take part in this research study and title: An *Investigation into the Knowledge of Nurses about Tuberculosis in the Southern Regions of Namibia.*

As the participant, I confirm that:

- I have read the above information and it is written in a language that I am comfortable.
- I have had a chance to ask questions and all my questions have been answered.
- I understand that participating in this study is **voluntary** and I was not pressurised to participate.
- All issues related to privacy, and the confidentiality and use of the information I provide, have been explained.

..... ……..

Signature of Participant **Date**

DECLARATION BY THE PRINCIPAL INVESTIGATOR

As the **principal investigator,** I, Aletha Nangula Shaanika hereby declare that the information contained in this document has been thoroughly explained to the participant. I also declare that the participant has been encouraged (and has been given ample time) to ask any questions. In addition, I would like to select the following option:

X	The conversation with the participant was conducted in a language in which the participant is fluent.
	The conversation with the participant was conducted with the assistance of a translator (who has signed a non-disclosure agreement), and this "Consent Form" is available to the participant in a language in which the participant is fluent.

…….. ……

Signature of Principal Investigator **Date**

APPENDIX 4: INSTRUMENTATION

Data collection instrument

You have been invited to participate as a nurse who is dealing with patients with TB. Remember that you may choose to take part or not. The purpose of the study is to investigate the knowledge about TB of nurses involved in the management of patients with TB in the public health facility where you are working. The information you provide will assist in completing a research study that will add value to the management and prevention of TB.

Please complete all the questions honestly. Choose only one response to each question. All information will be treated as anonymous (your name will not be used) and confidential (private).

SECTION A: Demographical data

Please mark (X) in the box next to the most appropriate answer.

1. Please indicate the type of healthcare facility you are working.	1. ☐ Clinic 2. ☐ Health Centre 3. ☐ Hospital
2. What is your age in years?	_____ (years)
3. Please indicate your gender.	1. ☐ Male 2. ☐ Female
4. What is your highest formal education qualification that you obtained?	1. ☐ Certificate 2. ☐ Diploma 3. ☐ Degree
5. What is your job title?	1. ☐ Registered nurse 2. ☐ Enrolled nurse
6.What is your duration of employment as a nurse? *Please indicate in years!*	1. ☐ Less than a year 2. ☐ >1 ≤4 years 3. ☐ >4 ≤9 years 4. ☐ >9 years and above
8. Do you as a nurse, screen patients for TB?	1. ☐ Yes 2. ☐ No
9. Do you as a nurse, treat patients for TB?	1. ☐ Yes 2. ☐ No

10. During the past 12 months, have you attended a workshop on the TB guidelines?	1. ☐ Yes 2. ☐ No
11. If YES to question 10, have you provided feedback to other nurses about the TB guidelines?	1. ☐ Yes 2. ☐ No 3. ☐ Not applicable

SECTION B: Assessment of TB

*Please mark (X) in the box next to the **most appropriate** answer*

12.What medical history determines the possible exposure to TB among patients	1. ☐ Previous lung operation 2. ☐ Previous TB treatment 3. ☐ History of Mantoux TB skin test
13. Which is NOT a socio-economic factor that determines the possible exposure to TB among patients?	1. ☐ Poverty 2. ☐ Overcrowding 3. ☐ Disability 4. ☐ Housing
14. Which category of people are qualifying for TB preventive therapy (TPT) when they are contacts of TB patient?	1. ☐ Hypertension patients and patients with renal conditions 2. ☐ Pregnant women, children and diabetes patients 3. ☐ HIV positive patients, diabetes and children under 5 years
15. Indicate the vaccine given to children to prevent TB.	1. ☐ Tuberculosis Skin Test (TST) 2. ☐ Bacilli Calmette Guerin (BCG) 3. ☐ Cotrimoxazole preventive therapy (CPT)
16. What is the most common site for TB disease?	1. ☐ Larynx 2. ☐ Pleura 3. ☐ Lungs 4. ☐ Lymph nodes

SECTION C: Diagnosis of TB

*Please mark (X) in the box next to the **most appropriate** answer*

17. What causes TB disease?	1. ☐ Mycobacterium tuberculosis 2. ☐ Staphylococcus aureus 3. ☐ Pneumococcal pneumonia 4. ☐ Pneumocystis jirovecii pneumonia
18. What is the first diagnostic laboratory test for all suspected TB cases?	1. ☐ Direct(smear) microscopy 2. ☐ Culture 3. ☐ Gene Xpert MTB/RIF 4. ☐ Line probe assay

19. Indicate the number of sputum specimen required for the diagnosis of TB from patients suspected with symptoms of TB.	1. ☐ One specimen 2. ☐ Two specimen 3. ☐ Three specimen
20. Indicate the way in which TB can spread.	1. ☐ Droplets 2. ☐ Blood 3. ☐ Breastfeeding 4. ☐ Sexual intercourse
21. What are the common signs and symptoms of pulmonary TB?	1. ☐ Chest pain , fever and confusion 2. ☐ Persistent cough for 2 weeks , weight loss and shortness of breath 3. ☐ Chronic cough, headache and fever

SECTION D: Treatment of TB

Please mark (X) in the box next to the most appropriate answer

22. It is NOT compulsory to register all patients once diagnosed with TB even if they cannot be put on treatment.	1. ☐ True 2. ☐ False
23. TB cannot be cured.	1. ☐ True 2. ☐ False
24. The recommended TB treatment success rate for new and relapse cases is 90% or more.	1. ☐ True 2. ☐ False
25. A patient with drug susceptible TB should take the TB medicine for a period of nine (9) months to heal.	1. ☐ True 2. ☐ False
26. Skin rash is a common side effect of isoniazid (INH).	1. ☐ True 2. ☐ False
27. Deafness that occur to patients while on TB treatment can be a cause of streptomycin injection.	1. ☐ True 2. ☐ False
28. Pyridoxine is used to treat damage to the nerves caused by TB treatment.	1. ☐ True 2. ☐ False
29. Patients with TB usually become non-infectious after two weeks on TB treatment.	1. ☐ True 2. ☐ False
30. Fixed dose combination of rifampicin(R), isoniazid (H) and ethambutol (E) is the TB treatment regimen given during the initial phase of two months.	1. ☐ True 2. ☐ False
31. The first sputum smear should be tested at four weeks before changing to continuation phase of TB treatment.	1. ☐True 2. ☐ False

32. Knowing the weight of the patient is important before starting TB treatment.	1. ☐ True 2. ☐ False
33. DOTS is NOT important in the management of TB patients.	1. ☐ True 2. ☐ False
34. The outcome classification of "Died" should only be applied to TB patients who are thought to have been killed by the TB disease.	1. ☐True 2. ☐ False

SECTION E: Infection prevention and control of TB

Please mark (x) in the box next to the most appropriate answer

35. TB is most likely to be transmitted when health care workers (HCWs) and patients come in contact with persons who:	a. ☐ Have unsuspected TB disease b. ☐ Have been isolated from others c. ☐ Are not receiving adequate treatment
36. What is the recommended mask that is effective in protecting nurses against TB?	a. ☐ Face cloth b. ☐ N95 c. ☐ Surgical d. ☐ Audiometer e. ☐ None of the above
37. Which are an example(s) of administrative control hierarchy in infection prevention and control of TB?	a. ☐ Cough etiquette, triage and poster display b. ☐ Wearing of masks and patient isolation c. ☐ a and b d. ☐Open windows
38. Which is an example of mechanical ventilation in infection control prevention and control of TB?	a. ☐ Closed door b. ☐ Air conditioner c. ☐ Open door
39. What is the purpose of a TB infection control plan in the healthcare facility?	a. ☐ Educate HCWs about TB b. ☐ Reduce the risk of TB transmission to patients and health workers c. ☐ Ensure early detection of patients with signs of TB d. ☐ a, b, and c
40. Which health care worker(s) should be included in the implementation of TB infection control measures at the healthcare facility?	a. ☐ Nurses, Doctors and administration personnel. b. ☐ Laboratory personnel c. ☐ a and b d. ☐ None of the above
41. Healthcare workers who suspect a patient waiting in a queue has TB disease need to know the following:	a. ☐ Give tissues and ask the patient to cover nose and mouth when coughing or sneezing b. ☐ Give the patient a surgical mask to wear

	c. ☐ Place patient away from other patients and evaluate
42. What is the acronym for *FAST* strategy in infection prevention and control of TB?	a. ☐ Feasible, Accessible, Suitable and Timely b. ☐ Finding, Actively, Separating and Treating c. ☐ First ,Assessment , Surrounding and Timely d. ☐ None of the above

Thank you for your participation!

APPENDIX 5: DECLARATIONS BY LANGUAGE AND TECHNICAL EDITORS

Lona's Language Services

English/Afrikaans
Afrikaans/English

3 Beroma Crescent Beroma Bellville

Cell 0782648484
Email illona@toptutoring.co.za

* Translations * Editing * Proofreading
* Transcription of Historical Docs
* Transcription of Qualitative Research
* Preparation of Website Articles

TO WHOM IT MAY CONCERN

This letter serves to confirm that the undersigned

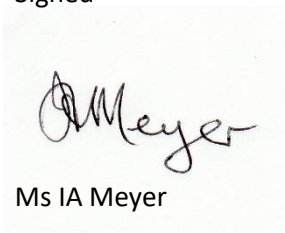
ILLONA ALTHAEA MEYER

has edited and proofread the **thesis of Aletha Nangula Shaanika**

for language correctness and has translated the Abstract into Afrikaans.

TITLE: AN INVESTIGATION INTO THE KNOWLEDGE OF NURSES ABOUT TUBERCULOSIS IN THE SOUTHERN REGIONS OF NAMIBIA

Signed



Ms IA Meyer

23 November 2021

Lize.net
COMMUNICATION (Pty) Ltd
Company registration: 2019/050723/07

To whom it may concern

This letter serves as confirmation that I, Lize Vorster, performed the technical formatting of Aletha Shaanika's thesis entitled:

An investigation into the knowledge of nurses about tuberculosis in the Southern regions of Namibia

Technical formatting entails complying with Stellenbosch University's technical requirements for theses and dissertations, as presented in the Calendar Part 1 – General or, where relevant, the department's requirements.

Yours sincerely

Lize Vorster
Language Practitioner

The Tasting Room, Uitzicht Farm, Stellenbosch, 7600 * e-mail: lizevorster@gmail.com * cell: 082 856 8221