FACTORS CONTRIBUTING TO MATERNAL MORTALITY AT PUBLIC HEALTH INSTITUTIONS AT THE SEKHUKHUNE DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA.

BY

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DEDICATIONS

I dedicate this work to my wife Nare Success Sioga, my three beautiful children Phathutshedzo, Vhutali and Rofhiwa, my parents and siblings.

DECLARATIONS

I, declare that "**Factors Contributing to Maternal Mortality at Public Health Institutions at Sekhukhune District, Limpopo Province, South Africa**" mini-dissertation hereby submitted to the University of Limpopo, for the degree of Master of public health, has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

…… ……

Sioga, T.R Date

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ABSTRACT

Background: Maternal mortality is a significant public health problem worldwide, and is a vital indicator of the functioning of a health system. The South African maternal mortality ratio is higher than other countries with same economic growth, despite people having free access to maternal health. How to develop relevant policies and programmes to reduce maternal mortality factors contributing to maternal mortality was investigated.

Aims of the Study: To investigate the factors contributing to maternal mortality in public health institutions in the Sekhukhune District, Limpopo Province, South Africa.

Methods: A quantitative, retrospective study was undertaken where 138 medical records of maternal mortality cases reported between 2013 to 2017 were reviewed. A simple random sampling method was used to select files that met the selection criteria from seven hospitals in the Sekhukhune District, Information was collected on maternal demographics and health service-related characteristics, including age, marital status, parity, antenatal care utilisation of services and delivery type. Inferential data were analysed using the student t-test and SPSS version 25.

Results: The mean age of the women involved in this study was 30 years, with a standard deviation of 5.7. All the women who participated in the study were black African. The majority of maternal mortality occurred in hospital. The women in the majority of maternal mortality cases were unemployed, at 93.5%, while most of the maternal mortality cases involved single women (71%).The women involved in these maternal mortality cases booked their ANC care and the major health provider was a professional nurse (58.0%), while 57.2% of the participants attended their ANC at primary healthcare facilities. Most of the maternal deaths occurred after delivery (58.7%) and, in most deliveries, the Partogram was not used (66%). HIV testing occurred in 99% of the maternal mortality cases. The causes of maternal mortality were both direct (71.0%) and indirect (23.9%) causes. The leading cause of maternal mortality was direct haemorrhage (33%), followed by eclampsia (27%) and infection (16%). The leading indirect cause was respiratory causes (22%) and retro viral disease (RVD) (9%). The personal factor that contributed most to maternal mortality was delay in seeking help (62%).

Conclusion and Recommendations: The personal factor, delay in seeking medical help by the women, contributed to maternal mortality and it was further concluded that the majority of maternal mortality cases did not occur as a result of any complications in ANC and delivery. It is recommended that the training of healthcare providers in the utilisation of the Partogram be implemented to improve skills in the management of haemorrhage and eclampsia. Furthermore, the management of complications needs to be strengthened through a multi-sectorial approach.

KEY WORDS: Contributing Factors; Maternal Mortality; Public Health Institutions

DEFINITIONS OF CONCEPTS

Maternal mortality

The death of a woman while pregnant, or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes, as reported by World Health Organization (WHO, 2015). In this study, this definition of maternal mortality will be used as is

Direct obstetric death

The death of a woman resulting from obstetric complications during pregnancy, labour or the puerperium, from interventions, omissions, incorrect treatment or from a chain of events resulting from any of these (WHO, 2015). Operationally, this definition will be used as is in this study.

Indirect obstetric death

The death of a woman resulting from previously existing disease which was aggravated by the psychological effects of pregnancy (WHO, 2015). Operationally, in the context of this study, indirect obstetric death was defined as a death resulting from previous, existing diseases which were aggravated by pregnancy.

Maternal health

Maternal health is defined by the World Health Organization as the health of a woman during pregnancy, childbirth and the postpartum period (WHO, 2015). Operationally, this definition will be used as is in this study.

Public health institutions

Healthcare institutions offering services, including reproductive healthcare and emergency medical treatment; basic nutrition and basic healthcare; and, medical treatment as contemplated in Section, 27, 28(1)c and 35 of the National Health Act of South Africa. Operationally in the study the context a public health institution is an institution which offers basic healthcare services, including reproductive healthcare (including, antenatal, labour/intrapartum and postnatal care services), emergency medical, surgical care, basic nutrition and rehabilitation care.

Contributory factor

Contributory facts are influencing and causal factors that contribute to a patient safety incident. These factors affect the chain of events They may be positive as well as negative and they may have mitigated or minimised the outcome of the incident, (Merriam-Webster.com dictionary).

In the context of this study the contributory factors are the factors that contributed to maternal mortality.

LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Therapy
BANC	Basic Antenatal Care
CHC	Community Health Centres
DHIS	District Health Information System
DNB	District Health Barometer
HIV	Human Immunodeficiency Virus
HST	Health System Trust
ICU	Intensive Care Unit
IMMR	Institutional Maternal Mortality Ratio
MDG	Millennium Development Goals
MMC	Maternal Mortality Cases
MMR	Maternal Mortality Ratio
MNM	Maternal Near Miss
NCCEMD	National Committee for Confidential Enquiry into Maternal Deaths
NDoH	National Department of Health
PMTCT	Prevention of Mother-to-Child Transmission
PPH	Post-Partum Haemorrhage
PTB	Pulmonary Tuberculosis
RVD	Retro Viral Disease
SDG	Sustainable Development Goal
SPSS	Statistical Package for Social Science

TREC	Turfloop Research Ethics Committee
UK	United Kingdom
UN	United Nations Organization
UNAIDS	United Nations Programmes on HIV/AIDS
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 INTRODUCTION TO THE STUDY

In this chapter, the researcher sets the context of the study by providing background information which includes an overview of the maternal mortality situation worldwide, in Africa, in Sub-Sahara, in South Africa and in Limpopo. The researcher also briefly describes the participants' demographic and socioeconomic data.

1.2 BACKGROUND OF THE STUDY

Globally, according to World Health Organization (WHO, 2019), over 810 women die because of pregnancy- and childbirth-related complications daily. According to the United Nations Maternal Mortality Estimation Inter-Agency Group, there were 303,000 maternal deaths globally in 2015 (Alkema, Leontine, Hogan, Zhang, Moller, et al., 2016). This number represents an overall global maternal mortality ratio (MMR) of 216 maternal deaths per 100,000 live births, representing a 44% decrease over the past 25 years. (Ozimek & Kilpatrick, 2018). A WHO report, furthermore, indicated that almost all of these deaths occurred in low-resourced countries and most could have been prevented (WHO, 2015).

The endorsement of the Millennium Declaration by all United Nations (UN) member states in the year 2000 served as a catalyst for substantial improvements in, among others areas, maternal health, defined by Millennium Development Goal 5 (MDG 5), which includes the specific target of reducing maternal mortality by 75% between 1990 and 2015 (United State Agency for International Development [USAID], 2016). From 2000 to 2017, the global maternal mortality ratio declined by 38 %, from 342 deaths to 211 deaths per 100,000 live births, (WHO, 2019). This translates into an average annual rate of reduction of 2.9 per cent.

Countries in the Sub-Saharan region of Africa are among a number of countries that have halved the level of maternal mortality between 1990 and 2015; while countries in Asia and North Africa have shown greater progress and made greater headway in the reduction of maternal deaths (WHO, 2015). Although the global maternal mortality rates have declined by between 2.3% and 5.5% per year, the Sub-Saharan

region still accounts for more than two third (196 000) of the total global maternal deaths, while a third of global maternal deaths occur in South Asia, compared to 5% in developed countries (WHO, 2019).

South Africa is estimated to have a population of 55.6 million, 28.9 million of which are women (Statistics South Africa [StatsSA], 2017). The Bill of Rights in Section 27 of the Constitution of the Republic of South Africa of 1996 states unequivocally that access to healthcare is a basic human right. Despite having access to a free healthcare system, many people still experience challenges in accessing these services and many pregnant women still deliver at home, while some give birth in-transit while trying to access a public health facility. South Africa is characterised by a disparity in the allocation of health resources between urban and rural areas. South Africa is not spared from maternal mortality (WHO, 2015). It is reported that the country had a maternal mortality ratio of 764 per 100,000 live births in 2007, of this, 102 deaths per 100,000 live births occurred in the Western Cape Province and 1 639 deaths per live births occurred in the Eastern Cape Province (Udjo, & Lalthapersad-Pillay, 2014).

South Africa has embarked on its own plan of action. By 1997, South Africa had already established the National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD). In the same year, maternal deaths became a notifiable condition. The National Department of Health (NDoH) indicates that healthcare in South Africa varies from the most basic primary healthcare offered free by the state, to highly specialised, hi-tech health services available in both the public and private sectors. Health care is an important investment for governments and other key stakeholders in communities to make, because maternal and child mortality is an indication of the success of failure of a country's healthcare systems (UNICEF, 2016)

An increase in antenatal visits, from an average of four (4) to eight (8), has contributed to a decline in the maternal mortality by identifying potential complications and initiating early management (Lawn, Bhutta, Wall, Peterson & Daviaud, 2017). In South Africa, the burden of non-pregnancy-related infections, namely, preeclampsia or eclampsia and haemorrhage, remains unchanged and are

the leading causes of maternal mortality, according to the Saving Mothers Report (2015).

There has been a continuous reduction in potentially preventable maternal deaths since 2008 in South Africa. Despite strategies to improve maternal and child health, maternal mortality remains high in South Africa and it is unlikely that the MDG to reduce maternal deaths will be achieved (Udjo & Lalthapersad-Pillay, 2014). This study took place in 2014, a year before the MDG was evaluated. However, there is still much to be done, and efforts need to concentrate on improving the health system in order to reduce the deaths as a result of haemorrhages and hypertension (Knapp, Mumm, Skaal & Wittwer-Backofen, 2018).

South Africa has failed to meet its MDG 5, meaning there are still hundreds of women dying while giving birth, which is a concern in South Africa, the country with the largest economy in Africa. Maternal mortality may be the result of systematic challenges this country faces, such as unequal distribution of the health resources, including human capital and resource-poor systems in rural areas. Currently, the Sustainable Development Goals (SDG), goal 3 (three) aim to achieve less than 70 maternal mortalities per 100,000 live births globally by 2030 (Alkema, Leontine, Hogan, Zhang, Moller et al., 2016). The main reason for this slight decline in maternal deaths has been the success of the antiretroviral treatment programme for HIV-positive women (Moodley, Fawcus & Pattinson, 2018).

The MMR in South Africa is lower than that of other developing countries in Africa but remains unacceptably high. Limpopo is a rural province with only two tertiary hospitals, namely, Pietersburg and Mankweng. Healthcare institutions in the Sekhukhune District refer maternity patients to these tertiary hospitals. The current situation in regional offices shows that there is a severe shortage of specialised personnel, such as obstetricians and midwives, hence, all complicated maternal cases are referred to the tertiary hospitals where there are an adequate number of specialists. Referral is, unfortunately, sometimes done when patients have complications and it is too late to save the mother or the child. The medical officers, sometimes community-service doctors or interns in the facilities, have to deal with the cases and refer cases to the tertiary hospitals, when necessary. The clinics must be operational for 24 hours a day, according to the Ideal Clinic Realisation ,DoH

(Department of Health) report (2017), however, most clinics do not operate for 24 hours a day. This leaves the district hospitals to perform basic, non-complicated deliveries, while the complicated cases do not receive the attention required on time, further overburdening these institutions.

There is a need to investigate the factors contributing to maternal mortality. The findings will provide detailed information on these observations and, hence, this information will inform strategies needed to curb maternal mortality and further evaluate the current practices in the Sekhukhune District of Limpopo Province, South Africa.

1.3 RESEARCH PROBLEM

Major changes in health policy and health service delivery were introduced. Specific protocols, guidelines and recommendations for the management of common causes of maternal death were developed. Despite these endeavours, the MMR remains high in South Africa, with substantial variations in provincial maternal mortality (Bomela, 2015).

In Limpopo Province, the Capricorn District was regarded the district where a pregnant woman was most likely to die while giving birth. This is no surprise since both tertiary hospitals in the province, namely, Pietersburg and Mankweng hospitals, are located in this district. All the districts in the Province, including the Sekhukhune District, refer their complicated cases to these two tertiary hospitals. According to Ntuli, Mogale, Hyera and Naidoo (2017), 43% of deaths occur within 24 hours of admission, 35% of patients died in ICU and 89% are referred to the tertiary hospitals from regional and district hospitals, as well as from community health centres. Eighty-three per cent of the referred cases were referred from district hospitals.

This situation was further aggravated by the fact that the majority of referred patients required intensive care admission to the tertiary hospitals, primarily because the district hospitals have a limited number of ICU beds for the whole district. While obstetrics patients formed a small proportion of ICU admissions, mortality among these patients was high (Ntuli, Ogunbanjo, Nesengani, Maboya & Gibango, 2015).

The question is, what are factors that contribute to maternal mortality in the Sekhukhune District?

1.4 AIM OF THE STUDY

The aim of the study was:

> To investigate the factors contributing to maternal mortality in public health institutions in the Sekhukhune District, Limpopo Province, South Africa.

1.5 OBJECTIVE OF THE STUDY

- To determine maternal factors contributing to maternal mortality.
- To determine sociodemographic factors contributing to maternal mortality.
- To determine the health service-related factors contributing to maternal mortality.

1.6 RESEARCH QUESTION

What factors contribute to maternal mortality in public health institutions in the Sekhukhune District, Limpopo Province, South Africa?

1.7 OVERVIEW OF THE RESEARCH METHOD AND DESIGN

In this study, a quantitative approach and retrospective research design were used to determine the factors that contribute to maternal mortality in public health institutions in the Sekhukhune District, Limpopo Province, South Africa.

Research design emphasises objective measurement and the statistical, mathematical or numerical analysis of data collected through polls, questionnaires and surveys, or by manipulating pre-existing statistical data using computational techniques (Babbie, 2010).

1.7.1 Study site

The study site is the Sekhukhune District in Limpopo and files from the seven hospitals in the district, namely, Dilokong, Mecklenburg, Matlala, Jane Furse, St Ritas, Groblersdal and Philadelphia, were reviewed.

1.7.2 Population

Population is the entire set of individuals or objects having some common characteristics of interest to the researcher (Polit & Beck, 2012). The study population was all files/records of women who were pregnant and who died, and their mortality was recorded with the NCCEMD between 2013 and 2017.

Population can also be defined as the portion of the target population to which the researcher has reasonable access (Burns & Grove, 2011). In this case the population was the files of clients of the healthcare system in Sekhukhune who died antepartum, intrapartum or postpartum.

1.7.3 Sampling

Sampling is the process of selecting cases to represent an entire population so that inferences about the population can be made (Burns & Grove, 2011). A total of 206 files that were kept at 7 hospitals in the Sekhukhune District were used in the study. A simple random sampling procedure was done and 138 files were selected.

1.7.4 Sample size

The sample size was all the reported cases from 2013 to 2017. In order to simplify the process of determining the sample size for a finite population, Krejcie and Morgan (1970) came up with a table using a sample size formula for a finite population and this sampling approach was adopted. There were 206 reported cases of maternal mortality between 2013 and 2017, drawn from hospital data in the District Health Information Software (DHIS) system in the Sekhukhune District, therefore, using the Krejcie and Morgan's (1970) sample size formula, the sample size for the study was 136.

1.7.5 Data collection

The data collection tool was adopted from the maternal death notification form, the Basic Antenatal Care (BANC) checklist and the antenatal care form, and was modified to meet the study objectives. The data collection tool was completed with data collected from the patient records in the admission registers in the wards of the 7 Sekhukhune District hospitals by reviewing the medical records and the NCCEMD reports. Secondary data was used to address the data collection tool's identified variables by ticking the space provided in the data collection tool.

1.7.6 Data analysis

A data analysis plan is the systemic organisation and synthesis of research data and, in quantitative studies, the testing of hypotheses using the data (Polit & Beck, 2011).

The data was entered into, and analysed, using the Statistical Package for the Social Sciences (SPSS version 25). Categorical data were presented as frequencies and percentages, while continuous data were presented as means and standard deviations. Chi-square was used for statistical comparisons between groups for categorical data, while the student t-test was used for continuous data analysis. A statistical significance of $p<0.05$ at 95% confidence interval was considered.

1.7.7 Ethical clearance

The researcher adhered to the ethical norms for conducting research on human subjects to promote knowledge and truth in order to avoid misunderstandings and any exploitation of the participants. Ethical clearance (TREC/255/2017:PG) was obtained from the University of Limpopo Turfloop Research Ethics Committee (TREC) (Appendix A), while permission to collect data from the health facilities was obtained from the Limpopo Department of Health (Annexure C). The participants gave their consent to the researcher to include them in the interview sessions and signed consent forms before the interviews were conducted. All participants were assured of their privacy, confidentiality and anonymity.

1.8 SIGNIFICANCE OF THE STUDY

The significance of the study is the fact that the outcome may assist the Department of Health and policy developers to develop policies or procedures that will support the management of maternal health and pregnant women before, during and after birth.

1.9 OVERVIEW OF CHAPTERS

The layout of the chapters in this report, in order of their chronological sequence, is as follows:

Chapter 1: Introduction of the study the overview of the global trends, Africa and sub-Sahara Africa.

Chapter 2: Literature review the global , Africa, sub-Sahara and South African literature a brief review.

Chapter 3: Research methodology the descriptive retrospective quantity research design method, with simple random sampling.

Chapter 4: Results (discussion / presentation / interpretation of findings)

Chapter 5: Conclusion, Summary, Limitations, Strategies and Recommendations of the study.

1.10 CONCLUSION

A number of factors contribute to maternal mortality in public health facilities in the Sekhukhune District, Limpopo Province and, therefore, it was necessary to investigate these factors within specific categories. In this chapter, the researcher provided an introduction and background, the research problem, the research question, data collection and the objectives of the study.

In the next chapter, the researcher will discuss the literature review.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review provides an overview of the literature, showing the main sources of knowledge by critically evaluating and interpretative research work from anthologies, conference papers, newspapers, reports, journals, lectures, textbooks, theses, newsletters and internet domains (Hart, 2018). In this chapter, the researcher critically examines and reviews selected literature that provides information about global maternal mortality prevalence, African prevalence, South African prevalence, Limpopo prevalence and Sekhukhune District prevalence, as well as the sociodemographic and health-related factors that contribute to maternal mortality. Public health interventions and various policies introduced to reduce factors contributing to maternal mortality will also be examined. This review of the literature will focus on the following subheadings: Global Maternal Mortality, the African Perspective on Maternal Mortality, the South African Perspective on Maternal Mortality, Sociodemographic Factors, Maternal Obstetric Profile and Maternal Mortality, Health Service-Related Factors Contributing to Maternal Mortality, Public Health Interventions to Reduce Factors Contributing to Maternal Mortality and Conclusion.

2.2 GLOBAL MATERNAL MORTALITY

Most countries in the world adopted the Millennium Development Goals for 2015, of which MDG 5 specifically targeted the reduction of maternal mortality by three-quarters by 2015 (United Nations, 2015). Governments worldwide began defining their own policies and goals for maternal mortality reduction accordingly (USAID, 2016). The SDGs were set, goal 3 (three) to achieve less than 70 maternal death per 100,000 live births globally by 2030 (Alkema, Leontine, Hogan, Zhang, Moller et al., 2016).

The causes of maternal mortality vary both globally and per region (Mokgatlhe, 2012). Globally, the leading cause of maternal mortality is classified as

haemorrhage, followed by hypertensive disorders, sepsis, abortion and embolism (Say, Chou, Gemmil, Tuncalp, Moller, et al., 2014). The risk of a woman dying as a result of pregnancy or during her lifetime is about one in six in the poorest or developing countries, compared to the developed or first world countries, where there is one in 30,000 chance of a woman dying in Northern Europe, for example (WHO, 2015).

In the United Kingdom (UK), a study indicated that there are six factors which are independently associated with maternal death. They are: inadequate use of antenatal care; substance misuse; medical co-morbidities; previous pregnancy problems; and, hypertensive disorders in pregnancy (Nair, Kurinczuk, Brocklehurst, Sellers, Lewis & Knight, 2015). This study found that the maternal mortality rate was 9 per 100,000 in 2014, with 99% birth assistance.

There are only 9 deaths per 100,000 live births in Canada (WHO, 2019).The leading cause of maternal death in Canada was obstetric haemorrhage, followed by severe hypertension in pregnancy and postpartum venous thromboembolism (D'Alton, Main, Menard & Levy, 2014).

By comparison, in the rural and urban areas of Pakistan, a study found out that mothers in rural areas were more likely to die (81.9%) in rural areas, compared to urban areas. Multiple parity women with five and above pregnancies, the visit to the health facility were majority got three or more visits and the majority died 24 hours after birth, the leading cause of death in Pakistan was haemorrhage, followed by hypertensive disorders/eclampsia and sepsis (Asim, Yassin, Mahmood, Tanwir & Habib, 2017). The MMR was found to be 178 deaths per 100,000 live births, with 55% skilled attendance at birth (WHO, 2019).

In India, the leading and most common cause of death was preeclampsia/eclampsia, followed by obstetric haemorrhage and puerperal sepsis, as direct causes. The leading indirect causes of death were anaemia, infective hepatitis and tuberculosis. Maternal death in India accounted for one-third of global maternal mortality, at 19%, or 560,000 deaths (Singla, Rajaram, Mehta & Radhakrishnan, 2017). The reported MMR between 2015 and 2017 was 145 deaths per 100,000 live births, with 60% of skilled attendance at birth (WHO, 2019).

In United State of America, the maternal mortality rate for 2018 was 17.4 deaths per 100,000 live births (Hoyert & Miniño, 2020).

Other factors identified as contributing to maternal mortality are the systemic review, which presented comprehensive, evidence-based typology of the mistreatment of women during childbirth in the health facility. The systemic review is the result of system failure at the facility level and at the health system levels (Bohren, Vogel, Hunter, Lutsiv, Makh et al., 2015). These challenges must be taken under review, through research, to understand the extent of the challenge, which can prevent women from attending the clinic or the health institution for delivery or other maternal health issues (Bohren et al., 2015).

In Japan, maternal age was a major factor in maternal mortality, where very advanced maternal age (≥ 45 years) was related to a greater risk of adverse birth outcomes compared to younger women, especially for maternal complications, including caesarean section (c-section), preeclampsia, severe preeclampsia and placenta previa, leading to maternal mortality. The magnitude of the influence of age also differed by conception method and by parity. (Ogawa, Urayama, Tanigaki, Sago, Sato, et al., 2017).

In China, the leading cause of maternal mortality is obstetrical haemorrhage associated with the distance travelled to the hospital (Wang Song, Qiu, Jing, Wang, et al., 2019). In Iran the leading cause of maternal mortality is obstetric haemorrhage, at 30%, followed by hypertensive-related infections (Zalvand, Tajvar, Pourreza & Asheghi, 2019). In Russia, the leading cause of maternal mortality is cardiovascular diseases, at 51%, and respiratory diseases at 29% (Milovnanov & Dobryakov, 2018).

2.3 AFRICAN PERSPECTIVE ON MATERNAL MORTALITY

Africa has the largest burden of maternal mortality, globally. In Tanzania, there have been no strides made to meet the MDG, despite the fact that the population of the country has doubled in size, with the double healthcare services and triple the funding for HIV and AIDS care. In Nigeria, maternal mortality is reported to be 917

deaths per 100,000 live births between 2015 and 2017, according to the Maternal Report (WHO, 2019).

Sociocultural, economic and logistical factors, combined with overwhelming poor health services delivery, are found in Zambia. World Bank investment is positive, lending on maternal mortality within Sub-Sahara African nations, which are highly hit by the maternal mortality is high which might improve maternal mortality (Coburn, Reed, Restivo & Shandra, 2017). The belief system of people has an influence on maternal mortality. Superstitions are pervasive and evidence has been uncovered that belief systems prevent learning about maternal health risk levels and correlates. A comparison between the modern belief and traditional belief systems concluded that people with old beliefs are likely to ignore birth complications and risks versus people who hold modern beliefs (Ashraf, Field, Rusconi, Voena & Ziparo, 2017).

Factors contributing to maternal mortality identified in Kenya were the age, marital status, educational level, poor health seeking behaviour and delays at household level in referring pregnant woman to a healthcare facility or to seek healthcare. In addition, a poor referral mechanism between facilities, poor provider attitude and a lack of skilled human resources were found to influence maternal mortality (Yego, D'Este, Byles, Williams & Nyongesa, 2014).

Maternal age plays a major role in the outcome of pregnancy, hence, mothers who were between ages 15 and 24 years were nine times more likely to die during pregnancy compared to mothers in the 35 to 45 years age group (Yego et al., 2014). Furthermore, Yego et al. (2014) found that mothers who smoke or drink alcohol while pregnant have a greater chance of maternal mortality compared to non-smokers. There are countries that are doing better in this regard and have tried to reduce maternal mortality. Ghana, for example, reduced maternal mortality from 325 deaths per 100,000 live births in 2010 to 308 deaths per 100,000 live births in 2017 (WHO, 2019).

In Uganda, severe preeclampsia was the most common cause of morbidity, followed by postpartum haemorrhage, followed by eclampsia (Nakimuli, Nakubulwa, Kakaire, Osinde, et al., 2016). The three groups (maternal deaths, near misses and non-life-threatening obstetric complications) differed significantly with respect to gravidity and

education level. The most common diagnostic criteria, being an emergency referral and the need for cardiopulmonary resuscitation, were prognostic factors (Nakimuli et al., 2016).

In Nigeria, the rate of antenatal attendance by pregnant women has remained at 64%, while a skilled birth attendance of 33% is one of the lowest in Sub-Saharan Africa. This is an indicator of maternal and reproductive healthcare and it is not surprising that no significant achievements have been made over the past decade (Ntoimo, Okonofua, Ogu, Galadanci, Gana, Okike, Agholor, Abdus-Salam, Durodola, Abe & Randawa, 2018). Nigeria has one of the highest ratios of maternal mortality in the world, at 817 deaths per 100,000 live births (WHO, 2019).

In Chad, only 7% of pregnant women use the maternal health services and the factors associated with the maternal mortality in the country are education, occupation, household wealth and place of residence (Kim & Kim, 2019). The maternal death rate of 1140 per 100,000 live births in this country was aggravated by low antenatal care coverage and preventing factors, such as distance to the facility, insufficient equipment, poor infrastructure and a lack of quality nursing and medical staff (Lechthaler, Abakar, Schelling, Hattendorf, Ouedraogo et al., 2018)

Zambian maternal mortality is 452 deaths per 100,000 live births, with the leading causes of death being obstetric haemorrhage, preeclampsia/eclampsia obstructed labour and, lastly, the abortion-related deaths (Serbanescu, Goldberg, Danel, Wuhib, Marum et al., 2017). In Zimbabwe, the leading cause of maternal mortality are hypertensive disorders and abortion-related infections, followed by obstetric haemorrhage (Chikadaya, Madziyire & Munjanja, 2018).

2.4 SOUTH AFRICAN PERSPECTIVE ON MATERNAL MORTALITY.

The South African maternal mortality report from WHO (2015) indicated that South Africa did not meet its MDG 5 target. In 2011 the MMR was 202 deaths per 100,000 live births, with 94% skilled attendance at birth. This improved significantly to 165 deaths per 100,000 live births in 2013, with 96% skilled attendance at birth (WHO, 2015) in 2017 MMR was 119 per 100 000 live birth (WHO, 2019). The South African government views maternal health as a vital aspect and priority of healthcare in the

country, although, as indicated earlier, maternal mortality in South Africa increased significantly between 1990 and 2015, from 108 to 138 deaths per 100,000 live births (WHO, 2015) and in 2017 was 119 per 100 000 live birth(WHO, 2019). This has prevented the country from reaching the targeted MDG 5. Hence, looking at the space and time patterns, and at the risk factors associated with maternal mortality in a rural area of South Africa, could help to target the limited resources and policy guidelines to deal with high-risk areas for greater impact (Tlou, Sautorius & Tanser, 2017). According to Soma-Pillay, Pattinson, Langa-Mlambo, Nkosi and MacDonald (2015), in order to reduce maternal mortality in South Africa, it is important to understand the process of obstetric care, in order to identify weaknesses within the system and to implement interventions for improving care.

Family or community factors affecting maternal mortality include, delay in seeking care, problems with the transport to the healthcare facility and access to the unsafe termination of pregnancy by the unregistered providers (Bateman, 2016). A confidential enquiry report into maternal death in South Africa identified delay in seeking care and transport factors as avoidable factors and, if identified, they can easily be remedied, thus, the death of a woman can be prevented or avoided.

Administrative problems, which involve the omission with the management offered by the healthcare providers; and problems with transport between facilities, from clinic to hospital or inter-hospital transfer (Moodley, Pattinson, Fawcus, Schoon, Moran et al., 2014). Furthermore, accesses to the ICU, these speciality units are very few and far between, and the demand exceeds the availability. Bloods products (whole bloods, platelets and other products) are also scares could result in maternal mortality.

2.4 LIMPOPO PROVINCE PREVALENCE

Maternal deaths occurred more frequently in tertiary hospitals compared to district and regional hospitals because of delayed referrals. This was the evidence provided in a study by Ntuli, Mogale, Hyera and Naidoo (2017). Eighty-nine per cent of woman died within 24 hours of admission and the following challenges were identified: failure to recognise the problems; inadequate staff numbers and the competence of staff; health provider problems; assessing the patient poorly; not following standard protocols and poor monitoring of the patient; and, a lack of specialised staff,

including advanced midwifes and gynaecologists. Mothiba, Maputle and Tladi (2013) indicated that the epidemiological feature of ever increasing maternal mortality in the Limpopo Province have not been described in detail.

According to the Saving Mothers Report (2013), the Province reported 750 deaths and an iMMR (Institutional Maternal Mortality Ratio) of 196 deaths per 100,000 live births between 2011 and 2013. The Health Systems Trust's (HST) District Health Barometer (HST,2013) reported the Capricorn District as one of the top ten districts where a pregnant woman is most likely to die while giving birth, with 292 deaths per 100 000 live births.

This was further evidenced by a study undertaken at a Limpopo tertiary hospital (Pietersburg hospital), which showed that postpartum haemorrhage was a major concern in Limpopo and was the major or main cause of maternal death in the hospital (Ntuli, Mogale, Hyera & Naidoo, 2017). It was further alluded to in this study that the senior doctors or the advanced personnel (gynaecologists) were not available in rural parts of South Africa. Interventions in this regard were done in the struggling Sekhukhune District in Limpopo Province by the NDoH, headed by the Minister of Health (Bateman, 2016).

Ntuli, Mogale, Hyera and Naidoo (2017) reported that a lack of senior or experienced doctors available to help junior doctors; inexperienced doctors; a lack of antenatal care; and, an ineffective referral system within the health services, including a lack of dedicated ICU staff, as factors contributing to maternal mortality.

2.6 SEKHUKHUNE DISTRICT PREVALENCE

The Sekhukhune District has not been spared maternal deaths, the District reported 129 deaths between 2011 and 2013, according to the Saving Mothers Report (2014), an iMMR of 164 deaths per 100,000 live births was evidenced. Eighty-nine per cent of woman who were transferred, died within 24 hours of being referred, which may be due to a delay in referral arrangements (Ntuli et al., 2017).

However, few studies have been done on maternal mortality in this District.

2.7 SOCIODEMOGRAPHIC FACTORS.

Sociodemographic factors are important factors related to maternal and child health uptake that inform relevant stakeholders about possible areas of improvement. Programmes to educate families about the importance of maternal and child healthcare services should be implemented. In addition, interventions should focus on age differentials in the use of maternal and child health services; on women with higher parities; on women in rural areas; and, on women from the poor quintile, as well as on issues associated with the low use of postnatal services (Tsawe, Moto, Netshivhera, Ralesego, Nyathi et al., 2015).

The availability of primary healthcare (PHC) facilities with 24 hours a day, 7 days a week services and access to health facilities via all-weather roads failed to significantly predict adequate ANC in Gujarat or Tamil Nadu (Vora, Koblinsky & Koblinsky, 2015). Inadequate use of antenatal care, substance misuse, medical comorbidities, previous pregnancy problems and hypertensive disorders during pregnancy could be attributed to these factors (Nair, Kurinczuk, Brocklehurst, Sellers, Lewis et al., 2015). One-third of women in South Africa had access to a specialist as an antenatal care provider. The most important avoidable factors contributing to death was a delay in patients seeking help (> 50% of patients) (Soma-Pillay, Seabe & Sliwa, 2016).

Sociodemographic variables were significant predictors of ANC maternal education in Gujarat. The odds of a Gujarati woman receiving adequate ANC were 2.8 times higher among women who had 10 or more years of education compared to uneducated women (Vora et al., 2015). The majority of patients attended antenatal care but booked late (Soma-Pillay, Seabe & Sliwa, 2016). Of the woman who attended antenatal care classes, 40% were poor, had not completed secondary school education, were likely to consume alcohol and were multipara (Smith, Burger & Black, 2019).

Jordanian pregnant women had the risk of preeclampsia was 2.3 times higher in first pregnancies than in second or more pregnancies (Khader, Batieha, Al-Njadat & Hijazi, 2018). The major complications that result in maternal deaths are well described and include haemorrhage, infection, hypertensive disorders and obstructed labour (Merali, Lipsitz, Hevelone, Gawande, Lashoher, Agrawal & Spector, 2014).

Maternal mortality due to the HIV epidemic in Eastern and Southern Africa means that disentangling the fraction of HIV deaths during pregnancy reduced maternal mortality in Southern Africa (Kassebaum, Bertozzi-Villa, Coggeshall, Shackelford, Steiner et al., 2014).

Cardiovascular diseases (CVDs) remain the leading killer of pregnant women. One sex-specific risk factor is preeclampsia, a syndrome of hypertension and proteinuria that complicates 5% of pregnancies (Pruthi, Khankin, Blanton, Aronovitz, Burke et al., 2015). Eclampsia, cerebral haemorrhage and pulmonary oedema accounted for the majority of maternal deaths as a result of a hypertensive disorder. The biggest subcategory of indirect maternal mortality was bleeding at or after c-section, ruptured uterus, placental abruption and uterine atony after vaginal delivery, while retained placenta and prolonged obstructed labour were also common causes of maternal mortality (Moodley, Pattinson, Fawcus, Schoon, Morgan & Shweni, 2014).

A delay in seeking care, a lack of ambulances and a delay in referral to the higher levels of care were identified as factors hindering accessibility to care in Nigeria (Ekpenyong, Bond & Matheson, 2019). A delay in booking for antenatal care was also an identified cause of maternal mortality (Mocumbi, Sliwa & Sona-Pilay, 2016). Thirty eight per cent of the maternal death at the Natalspruit hospital were un-booked cases. (Uzabakiriho & Maswime, 2019)

A Cameroon report found inadequate use of antenatal classes, pre-existing medical conditions, place of delivery either home or health facilities with untrained healthcare providers, the distance and time to health facilities if more than 1 hour as factors influencing maternal mortality. Postpartum haemorrhage is the leading cause, at 77.53%, followed by unsafe abortion and hypertension disorder in pregnancy (Valere, Felix, Henri, Danielle & Robinson, 2019). While in Egypt, maternal death in rural areas was higher than urban areas, with the primary causes of death being substandard care due to inadequate supplies and drugs, a lack of staff and poor communications between wards or departments. including the blood bank. Secondary causes of deaths included a delay in transfer from primary or secondary healthcare clinics (Abass, Amin, Ali & Salem, 2016).

2.8 MATERNAL OBSTETRIC PROFILE AND MATERNAL MORTALITY

2.8.1 Maternal mortality and parity

In New Zealand and Australian multiparous women, the effects of medical and obstetric history were additive maternal mortality adverse outcome was high (Morris, Totterdell, Bin, Ford & Roberts, 2018), The results of a study in Nigeria showed that parity and gravidity have a great effect on maternal mortality and are significantly correlate to maternal death in the Ekiti State of Nigeria (Moses, Iluku-Ayoola & Adeola, 2020). The study in India noted that, maternal mortality was shown to rise with a higher degree of parity,(multigravida),(Tripathy, 2019). In Mozambique, maternal mortality was strongly associated with parity (adjusted odds ratios [AORs] of 3+ versus nulliparity, at 95% confidence interval [CI], 2.46-21.10) (Lancaster, Barnes, Correia, Luis, Boaventura, Silva, & von Drygalski, 2020).

2.8.2 Maternal mortality and ANC attendance

In Egypt, utilisation of facility health services increased with regard to antenatal, natal and postnatal visits, reducing the chances of maternal mortality significantly (Metwally , Abdel-Latif, Mohsen et al., 2020). It is widely recommended that women make at least four ANC visits during pregnancy. It is thought that ANC visits prevent high-risk complications in pregnancy Frequency of visits is, however, unlikely to impact on some major causes of maternal mortality, such as haemorrhage and obstructed labour (Das, 2017). Accessible antenatal care can help prevent maternal deaths (Singla, Rajaram, Mehta & Radhakrishnan, 2017). A study in Uganda found that mothers who made one or no ANC visits had a higher likelihood of death, both of themselves and of their babies, than those who made more visits (Atuhaire & Kaberuka, 2016).

2.8.3 Maternal mortality and previous c-section

In Iran, although the c-section is known as a lifesaving procedure, it can also increase the risk of maternal mortality and morbidity. Nearly 58% of all MNM (Maternal Near Miss) cases were related to women with a history of c-section

(Moudi, Arabnezhad, Ansari & Tabatabaei, 2019). In Turkey, maternal mortality as a result of PPH (Post-partum haemorrhage) is 2.27 times higher among those who had a c-section (Gulumser, Engin-Ustun, Keskin et al., 2019). While in the UK, most of the maternal mortality cases had a history of previous C-sections, single or multiple times (Sultan, Fateh & Seher, 2018). In Netherlands, compared to vaginal birth, maternal mortality after a c-section was three times higher, following the exclusion of deaths that had no association with surgery (Kallianidis, Schutte, Van Roosmalen & Van Den Akker, 2018).

In Sub-Saharan Africa, most maternal deaths were caused by bleeding associated with caesarean delivery (Yaya, Uthman, Amouzou & Bishwajit, 2018). In Uganda, delivery by c-section is essential to reducing unnecessary maternal mortality, however, intraoperative complications, such as excessive bleeding and placenta previa in subsequent pregnancy, are a challenge. (Mazimpaka, Uwitonze, Cherian, Hedt-Gauthier, Kateera, Riviello, El-Khatib et al., 2020). In Tanzania, numerous forms of management were provided to women who experienced maternal death, including c-section (35.5%) (Mapunda, Msuya, Kapologwe, John et al., 2017).

2.8.4 Maternal mortality HIV and pre-existing maternal condition

In the UK, maternal deaths were largely due to indirect causes, and cardiac disease was the single largest indirect cause (Nair, Nelson-Piercy & Knight, 2017), while in the USA, cardiovascular conditions ranked first (15.5%), followed by other medical conditions, such as, often reflecting pre-existing illnesses (14.5%), infection (12.7%), haemorrhage (11.4%), and cardiomyopathy (11.0%) (Creanga, Syverson, Seed & Callaghan, 2017). In India, the leading pre-existing medical condition resulting in death was hypertensive disorders in pregnancy (37%), followed by haemorrhages (14.8%) and sepsis (11.1%). The leading cause of death in India was hypertensive disorders in pregnancy (Kumari, Revathi & Reddy, 2018). In the USA, Washington state Hypertension was associated with severe maternal morbidity (Hitti, Sienas, Walker, Benedetti & Easterling, 2018).

There was a significant (70%) increase in the risk of mortality between the group ‘before the implementation of PMTCT’ and the group ‘when the availability of PMTCT services was widespread’, suggesting that prenatal antiretroviral therapy and healthier mothers do not fully eliminate this increased risk of mortality (Brennan,

Bonawitz, Gill, Thea et al., 2016). HIV-infected women face higher rates of mortality from direct maternal causes, which suggests that we need to improve access to quality maternity care for these women (Calvert, Marston, Slaymaker, Crampin, Price et al., 2020).

Women living in Sub-Saharan Africa cope with both high rates of HIV infection and high rates of pregnancy-related maternal death, relative to the rest of the world (Rodriguez, Gaffield, Han & Caughey, 2017.) South African study findings revealed that there was an underlying factor contributing to the vulnerability to death of the mothers, which was found to be HIV or AIDS (Mmusi-Phetoe, 2016). Maternal mortality as a result of hypertension complications remains stubbornly high in South Africa (Moodley, Fawcus & Pattinson, 2018). In Johannesburg, South Africa, the MMR among HIV-infected women was 3-fold higher than in women who were HIV negative (Black, Black, Rees, Guidozzi et al., 2016). In rural South Africa, the main causes of death were communicable diseases (38.2%), and HIV and AIDS (Tlou, 2018).

2.9 HEALTH SERVICE RELATED FACTORS CONTRIBUTING TO MATERNAL MORTALITY

Transport is a critical factor in healthcare access, serving as a link between home and health facilities. In developing countries, poor road networks and the absence of regular means of suitable transport leaves rural areas inaccessible, making physical access to specialised healthcare difficult, specialized care is not provided in local health facilities. (Atuoye, Dixon, Rishworth, Galaa, Boamah & Luginaah, 2015).

Referral requests by a health professional for patients to seek health services at a higher level has been recognised as a critical component in an emergency health service delivery system (Atuoye et al., 2015). Referrals connect different tiers of health service provision, starting from the lowest level, mostly primary healthcare units (Ntuli, Mogale, Hyera & Naidoo, 2017).

With respect to referral, distance to facilities has been identified as a critical factor and, apart from its association with a delay in reaching the next point, the distance has the tendency to influence rejection of referral, which has dire implications for maternal and child health (Atuoye et al., 2015). A lack of expertise of medical staff

managing the case (30%), delay in referral to the appropriate level of care and inappropriate action (Soma-Pillay, Seabe & Sliwa, 2016).

Mocumbi, Sliwa and Sona-Pilay (2016) indicated that low capacity for diagnosis at the peripheral levels of the health system results in few women being identified for referral to next level of care earlier. Furthermore, contributing factors to maternal mortality includes factors, like social pressure to conceive, insufficient access to contraceptives and the ostracism of women who are known to be using contraception (Mocumbi et al., 2016). Hence poor spacing or multiple birth within short space which may contribute to maternal mortality cases.

Maternal deaths in Natalspruit hospital in Gauteng indicated that many women died after hours during the week, which may be the result of staff shortages and a lack of supervision (Uzabakiriho & Maswime, 2019). This situation is similar to the situation in Nigeria, where inadequate human resources contribute to maternal mortality (Sageer, Kongnyuy, Adebimpe, Ogunsola & Sanni, 2019).

Maternal death from haemorrhage can result from the absence of prophylactic oxytocin, undetected bleeding and/or inaccessible blood transfusion capability, representing three different types of system failures that necessitate different intervention approaches to prevent failure recurrence. (Merali et al., 2014).

2.10 PUBLIC HEALTH INTERVENTION TO REDUCE FACTORS CONTRIBUTING TO MATERNAL MORTALITY

The public health interventions strategy that has been implemented by the NDoH called Basic Antenatal Care (BANC) is a unique preventative public health intervention offered routinely to healthy pregnant women, with the main objective of improving the pregnancy outcome for mothers and babies (Hofmeyr & Mentrop, 2015). A woman attends the clinic on the specified dates, which assists in the early detection of complications or conditions, like preeclampsia (Hofmeyr & Mentrop, 2015).

The second South African intervention was the introduction of the MomConnect application, which is a mobile phone application introduced in August 2014 with the aim of helping to improve the life of pregnant women and their babies (Seebregts, Barron, Tanna, Benjamin & Fogwill, 2016).

The third intervention introduced in South Africa is the reporting of access to medicines using the National Department of Health's Stock Visibility System (SVS), which is an electronic mechanism of measuring stock levels at a clinic by scanning the barcode or manually capturing barcode, the package or bottle using a specially provided cell phone loaded with special applications. When personnel scans or manually captures the barcode at the clinic, the stock level is automatically reported to an electronic map of all clinics in Pretoria, in real time.

2.11 CONCLUSION

In this chapter, the researcher discussed a review of the literature on the topic of maternal mortality from a global, African and South African perspective. The public health interventions in managing stock availability, MomConnect and assistance for pregnant mothers were also discussed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this chapter, the researcher details the research methodology used in the study of factors contributing to maternal mortality at public institutions in the Sekhukhune District, Limpopo Province. Secondary data was collected from patients records from seven hospitals in the Sekhukhune District. In this chapter, the researcher further explains the procedure followed in execute of the study, the research methods employed, the research design, the target population, sampling methods, data collection and analysis, as well as measures to ensure validity and reliability.

3.2 RESEARCH DESIGN

In this study, a quantitative approach and a retrospective research design was used to determine factors contributing to maternal mortality at public health institutions in the Sekhukhune District, Limpopo Province, South Africa.

Quantitative research design emphasises the objective measurement and the statistical, mathematical or numerical analysis of data collected through polls, questionnaires and surveys, or by manipulating pre-existing statistical data using computational techniques (Babbie, 2010).

Retrospective research design typically starts with the dependent variables of an observed result or outcome and then moves backwards in time, locating information on these variables that helps explain individuals and on actual data collected in the past (Johnson & Christensen, 2019).

In this study, the files, representing medical records from 2013 to 2017, were reviewed and the data were collected using a checklist against which the researcher ticked the identified variables.

3.3 STUDY SITES

The study was conducted at public health facilities in the Sekhukhune District, Limpopo Province, South Africa, which is a rural area situated 88 km south-east of the Polokwane Provincial Department of Health, Head Office. The district comprises four municipalities, namely, the Greater Tubatse-Fetakgomo Local Municipality to the east, which boarders the Mopani District and Mpumalanga Province, to the North bordering Capricorn district, to the West is Ephraim Mogale local municipality bordering Waterberg district and the South is Elias Motswaledi local municipality bordering Gauteng province and Mpumalanga province.

Figure 3.1: Sekhukhune District Municipality

The District has 7 hospitals (2 regional hospitals and 5 district hospitals), 84 fixed clinics and 3 community health centres (CHC). The District offices are situated in the Capricorn District, housed in the Lebowakgomo government building complex.

This is a rural district with an economy that relies on farming, tourism and recent mining development. Mining is largely undertaken in the Greater Tubatse-Fetakgomo Local Municipality. The main referral hospitals are Pietersburg and Mankweng. The distances to the Pietersburg hospital from the hospitals in the Sekhukhune district are as follows: Matlala hospital – 121 km; Dilokong hospital – 135 km; Philadelphia hospital – 189k;. Groblersdal hospital – 163 km; St Ritas hospital – 124 km; Jane Furse hospital – 120 km; and Mecklenburg hospital – 147 km.

3.4 STUDY POPULATION

Population is the entire set of individuals or objects having some common characteristics (Polit & Beck, 2012). The study population was all files/records of women who were pregnant and died, and their mortality were recorded with the NCCEMD between 2013 and 2017. A total of 206 files/records of women from Sekhukhune District hospitals were used in the study.

Study population is also defined as the portion of the target population to which the researcher has reasonable access (Burns & Grove, 2011). In this case the study population was the files of clients who had died antepartum, intrapartum or postpartum in the 7 hospitals in the Sekhukhune District. The study population was 206 patients files.

3.5 SAMPLING

Sampling is the process of selecting cases to represent an entire population so that inferences about the population can be made (Burns & Grove, 2011). Each case from the list provided by the DHIS of all maternal deaths was assigned a number from 01 to 206. The numbers were then placed in a bowl and shuffled. A number was picked until the sample size number of 138 was reached. All records were found at the health institutions and the sampled files were included in the study.

3.5.1 Sample size

The sample size was all reported cases between 2013 to 2017. To simplify the process of determining the sample size for a finite population, Krejcie and Morgan (1970) came up with a table using a sample size formula for finite population and this approach was adopted. There were 206 reported cases of maternal mortality in the hospital database from the DHIS between 2013 and 2017 in the Sekhukhune District, therefore, using the Krejcie and Morgan's (1970) formula, the sample size of the study was 138, at a 95% confidence interval.

Formula used to calculate sample size from a given population size is as follows:

$$S=\frac{x^2 NP\ (1-p)}{d^2(N-1)+x^2 P(1-P)}$$

S= required sample size.

X" = the table value of chi-square for 1 degree of freedom at the desired confidence level 3.841 CI = 95%

N = the population size=206.

P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size).

d = the degree of accuracy/sampling error expressed as a proportion (0.05).

Calculations

$3.841x206x0.5x0.5 / (0.05)^2x205+3.841x0.5x.05$

197.81/1.47

135

At a given conditions the sample size was approximately 138.

(See attached table in Appendix 2.)

3.5.2 Sampling method

Simple random sampling is defined as a sampling method with the basic requirement that all the elements in the sampling frame have an equal chance of being included in the sample (Brink, Van der Walt & Van Rensburg, 2012). In this study, all patient records had an equal chance of being selected. All the patient files were assigned a number from 01 to 206 and then the simple random sampling method was used to select 138 files for the study.

Simple random sampling is defined as a sampling method where each individual case in the population theoretically has an equal chance of being selected for participation in the research. Each participant within the population was assigned a unique number (De Vos, Strydom, Fouche & Delport, 2010).

The researcher determined the most typical characteristics of the participants that should be included in the sample; inclusion criteria are based on the judgement of the researcher and used to deliberately include specific participants in the study (Botma et al., 2010). A complete list of the records of all maternal deaths that occurred between 2013 and 2017, which were up to date, was used as the sampling frame, which is defined as the list from which the study sample was selected to be part of the research (O'Dwyer & Bemauer, 2013)

The population of 206 cases of maternal mortality between 2013 and 2017, recorded in DHIS, formed the sample frame. The files were given a number from 01 to 206 and those numbers were placed in a bowl, mixed together and shaken, and then numbers were randomly picked from the bowl until the sample size of 138 was reached.

3.5.3 Data collection procedure

A data collection procedure is the precise and systemic gathering of information relevant to the research purpose or specific objectives, questions or hypothesis of study (Burns & Grove, 2011). A data collection sheet was used, which the researcher completed by filling in the data acquired from the patient records. In this study, the researcher executed a data collection schedule. Dates were allocated to each hospital and data collection was done by the researcher. Data were collected by reviewing medical records from hospitals and the abstraction of data was done by ticking the checklist and entering the numerical data, such as age, until all the variables were captured. No missing data were found as the files contained maternal mortality notification forms. The files were kept in chief executive officer's office.

3.5.3.1 Data collection tool

The collection data tool was adopted from the maternal death notification form, from the Basic Antenatal Care (BANC) checklist and from the antenatal care form. This tool was modified to meet the objectives of the study. The data collection tool was completed with data which were collected from the admission registers in the wards of the Sekhukhune District hospitals and from the patients records by reviewing the medical records and the NCCEMD reports. Secondary data was collected from patient files to answer the variables identified by ticking the space provided on the data collection tool, (Appendix 1: The data collection tool). The data collection tool served as a checklist that was completed by the researcher.

3.5.3.2 Inclusion criteria

All records of death cases of women while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management were included in this study.

3.5.3.3 Exclusion criteria

All records of patients who were transferred out of the Sekhukhune District and who died at Pietersburg and Mankweng hospitals or other institutions outside of the district borders were excluded. All files with missing data or variables, such as time and cause of death, as entries or data records will stop at point of transfer, were excluded. Suicides, assault, poisoning and/or murder of pregnant women were excluded.

3.6. DATA ANALYSIS PLAN

A data analysis plan is the systemic organisation and synthesis of research data and, in quantitative studies, the testing of hypotheses using the data (Polit & Beck, 2011).

All records were checked for accuracy and completeness, which assisted in early identification of missing data, and corrections were made early before data collection was completed.

The coding of the categorical data and entering of data, the numerical data, such as age, was entered as numerical values. This helps to determine the central tendency of the sample. Thereafter, quality control was done by selecting 10% of the checklist using simple random sampling and the data was re-entered when errors were found. All variables were checked individually and, when incorrect codes were found, they were corrected by going to the checklist.

The data were entered and analysed using SPSS (version 25), categorical data were presented in frequencies and percentages and continuous data were presented in means and standard deviations. Inferential statistics were calculated: Chi-square

was used for statistical comparisons between groups of categorical data, while a student t-test was used for continuous data analysis. A statistical significance of $p<0.05$ at 95% confidence interval was considered.

3.7 VALIDITY AND RELIABILITY

3.7.1 Validity

According to Babbie (2007), validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. Genuineness and soundness are the synonyms for validity. Simply put, the term validity is all about testing that the tool the researcher uses actually measures what the researcher needs to have measured. Heale and Twycross (2015) refer to validity as the extent to which a concept is accurately measured in a quantitative study (Heale & Twycross, 2015).

Validity is concerned with the representativeness or sampling adequacy of the content or topic of an instrument, thus, validity focuses on whether the full content of a conceptual definition is represented in the measure. A valid measure will provide an adequate or representative sample of all content of the phenomenon under study (De Vos et al., 2012).

3.7.1.1 Face validity

Face validity refers to whether a scale appears to measure what it intends to measure (Heale & Twycross, 2015), In the case of this study, whether the checklist collected what is was designed to collect (Charalambous, Koulori, Vasilopoulos, & Roupa, 2018). In this study the instrument appeared to measure what it was meant to measure, since all maternal mortality variables identified were captured and answered well.

3.7.1.2 Content Validity

Content validity is related to the degree that the items included in a scale are suitable to measure the outcome under investigation on the target population (Charalambous, Koulori, Vasilopoulos & Roupa, 2018). The instrument was adapted from NCCEMD (National Committee for Confidential Enquiry into Maternal Deaths).

In this study, the instrument was able to capture all the components of the variables which were measured. The instrument was given to the group of experts, i.e. doctors and midwives, to evaluate it for content validity, which was done before data were collected.

3.7.2. Reliability

Reliability represents the consistency of measurements achieved. This means that, if the instrument is applied to different grounds under various circumstances, it should produce the same results (Botma et al., 2010). Reliability or the accuracy of an instrument, in other words, is the extent to which a research instrument consistently produces the same results if it is used in the same situation on repeated occasions (Heale & Twycross, 2015). The sampling method used was to ensure representativeness of the sample The data collection tool was adapted from the NCCEMD, hence, it was a reliable tool. Furthermore piloting of the instrument was done. The instrument was piloted using the records of 10 patients which did not form part of the study in order to check reliability of this tool.

3.7.3 Piloting

Piloting was done using 10 patient records in order to test whether the tool was able to capture the required variables or obtain the data required to meet the research objectives. This piloting process assisted in checking whether the tool was reliable. The patient records that were used did not form part of the study sample. The researcher did the piloting, there was no problem noted the check list captured the data as required and all variables were filed. Therefore the was no adjustment to the check list.

3.8 BIAS

Bias is any tendency which prevents unprejudiced considerations of a question. Bias occurs when systemic errors are introduced into sampling or testing by selecting or encouraging one outcome or answer over others (Christopher, Pannuci & Wilkins, 2010). Bias was reduced since the researcher was the one administering the checklist to the patient records to ensure accuracy and quality control of the data collected.

Selection bias was minimised in that the sample was randomly selected using simple random sampling in a manner such that all the records had an equal chance of being selected. Furthermore, bias was minimised by developing clearly defined criteria for the selection of records to be incorporated into the study.

3.9 ETHICAL CONSIDERATIONS

3.9.1 Obtaining permission

The research proposal passed through University of Limpopo Turfloop Research Ethics Committee (TREC) for approval. Ethical approval was granted, project number TREC/200/2019:PG (see Appendix 4). Permission was obtained from the provincial Department of Health in Limpopo Province, Ref LP_201908_015 (see Appendix 5) and, subsequently, from the Sekhukhune District (see appendices 6 and 7). These permissions were cascaded to the chief executive officers (CEO) of Sekhukhune District hospitals, namely, Dilokong, Mecklenburg, St Ritas, Jane Furse, Matlala, Philadelphia and Groblersdal.

3.9.2 The principle of beneficence

Beneficence is defined as the principle where a researcher will ensure the well-being of the participants and participants are protected from harm and discomfort, be it emotional, psychological, spiritual, economic, social or legal harm or discomfort (Brink et al., 2012). The benefit of the study to the community is the fact that that factors contributing to maternal mortality were identified, intervention strategies will be drawn from results and the maternal mortality may be reduced or prevented. These are the indirect benefits for currently pregnant women.

3.9.3 The principle of justice

The principle of justice means that participants should be treated fairly, the research proposal information should be adhered to and no new procedure, intervention or technique, which has not been mentioned in the proposal, will be introduced (Botma et al., 2010). The secondary data was collected from patient files/records and only the variables on the data collection tool were recorded. Only the individuals who were directly involved with data collection were allowed access to the files. Care was

taken with the information obtained to avoid leaking of, or unauthorised access to, the data.

3.10 CONFIDENTIALITY/PRIVACY/ANONYMITY

The confidentiality is in under the following premise – the person who receives information in confidence has a duty to maintain confidentiality and, it is not compulsory to disclose everything (Botma et al., 2010).

With respect to data storage and access of the data, the researcher and the supervisor had access to the master copies. The data were stored under lock all the time. A copy disc was made in case the master disc was lost and access to the information was strictly controlled. Private information was not be shared with people who were not directly involved in the study. Names of patients from records were not disclosed, not even in the data collection tool.

Invasion of privacy was kept to the absolute minimum and no individual reporting was made. Aggregate rather than individual information, which the researcher and other individual might relate to individuals, was collected (De Vos et al., 2012).

No names from the records were used and codes were assigned to the records. The master copy of the data was kept by the researcher and the supervisor under lock and key in order to prevent unauthorised individuals from accessing either the data collected or the master copy.

3.11 CONCLUSION

This study used the quantitative, retrospective research design, with the aim of investigating the factors contributing to maternal mortality. Simple random sampling was used to sample 136 files. Data was collected using a data collection tool and, later, data analysis was done using the SPSS version 25, chi-square and the student t test. In the next chapter, the researcher will discuss data analysis.

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF RESULTS

4.1 INTRODUCTION

In this chapter, the researcher present the results of the data collected from the 138 patient records, a description of the sociodemographic data, obstetric data (antenatal, intrapartum and postpartum care) and health facility characteristics, which include ANC provider, referral from other facility, family and personal characteristics, and causes of maternal mortality, both direct and indirect causes.

4.2 SOCIODEMOGRAPHIC RESULTS

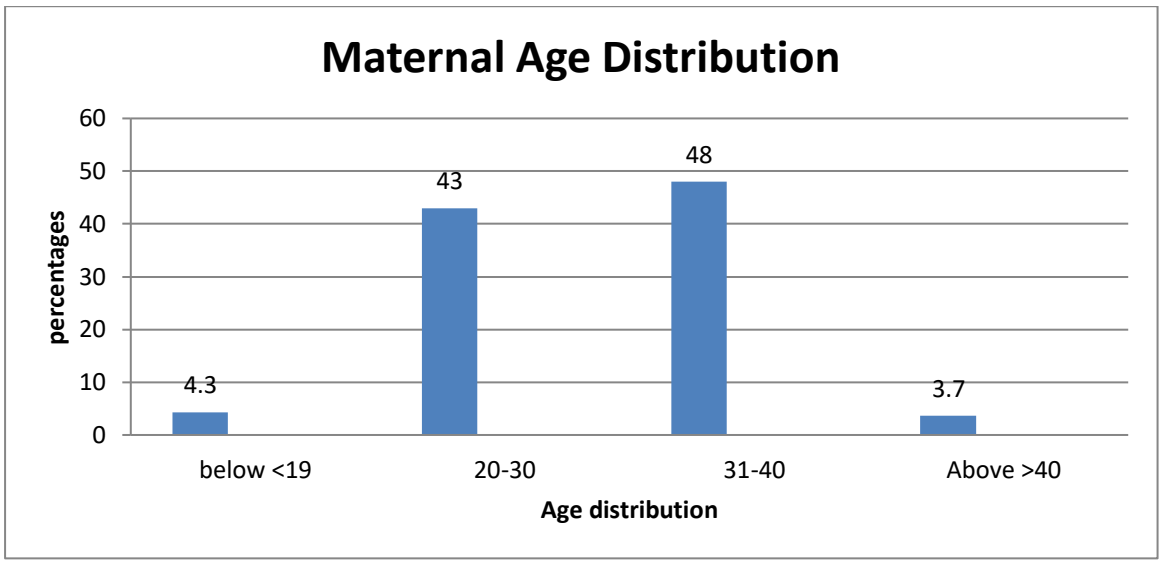

Figure 4.1 Maternal Mortality Age Distribution

The figure above reveals that the maternal mortality age group 31-40 had the highest number of maternal deaths (48%), followed by the 20-30 age group, with 43% of the maternal deaths. The study revealed that all pregnant women who died were black African woman. The study results revealed that the minimum age at death was 18 and the maximum age at death was 43, with a mean age of 30 and the standard deviation of 5,74815.

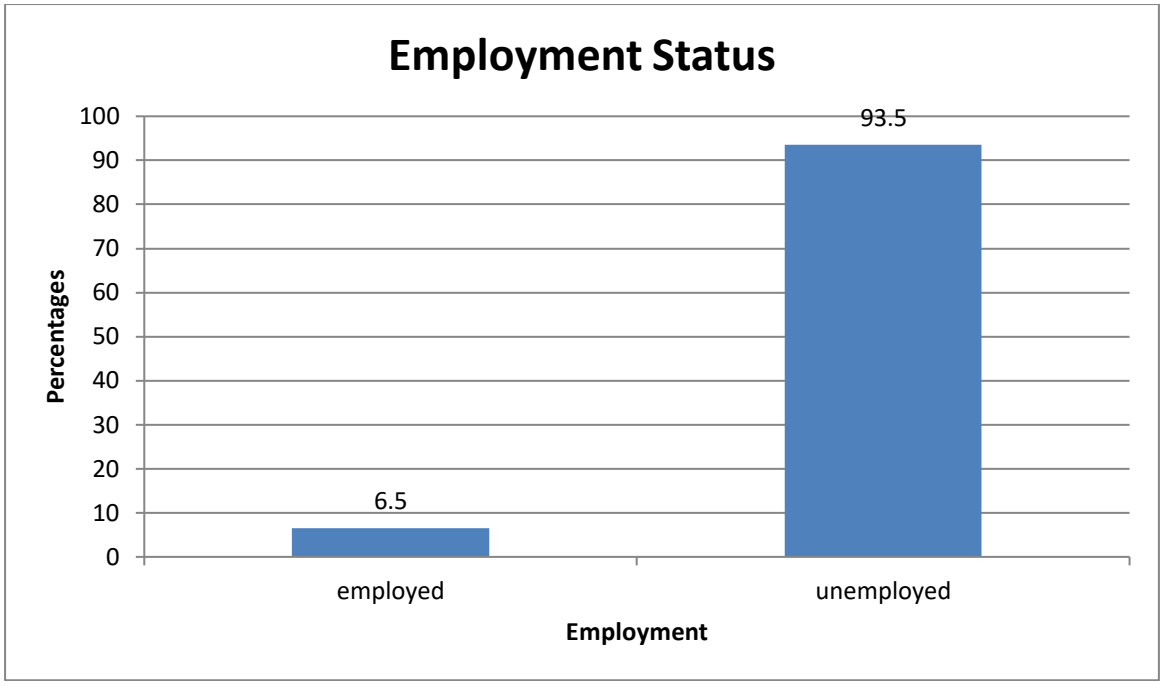

Figure 4.2. Employment Status

Figure 4.2 above shows that the majority of women who died were unemployed, at 93.5%, while only 6.5% of the women were employed.

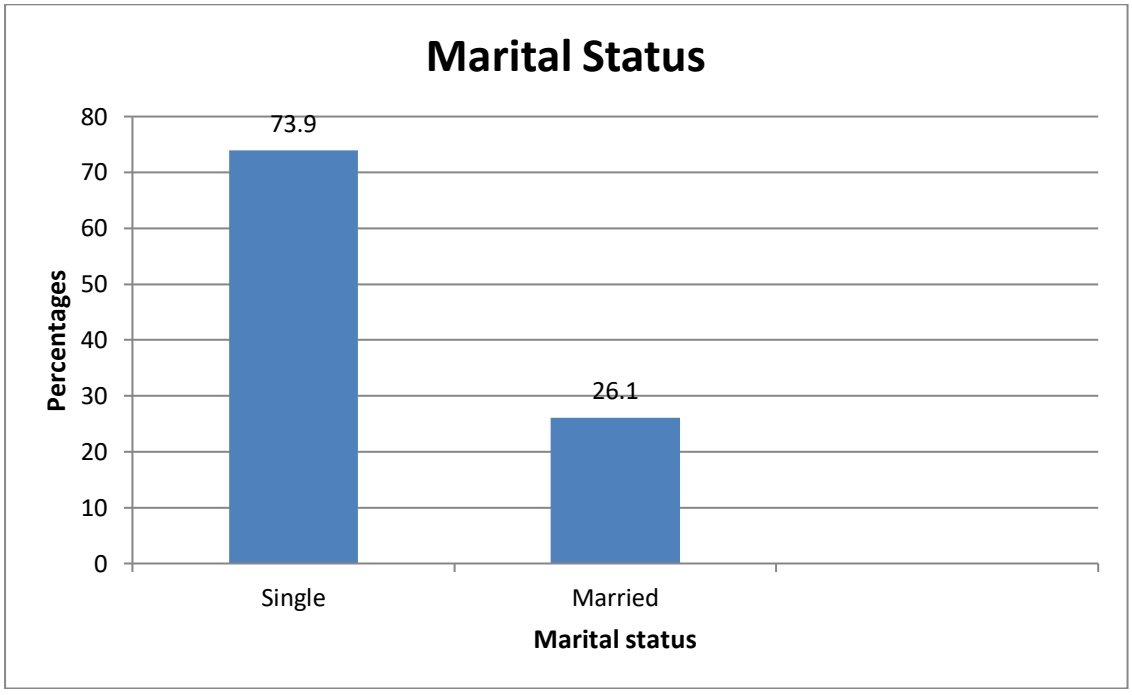

Figure 4. 3. Marital Status

Figure 4.3 above reveals that the majority of women who died were single, at 71%, while only 26.1% of the women who died were married.

4.3 MATERNAL OBSTETRICS

The following data was collected: ANC attended, total number of ANC visits before 20 weeks, the number of ANC visits, place of ANC visit, ANC provider, ANC risk, risk distribution, HIV testing and haemoglobin testing.

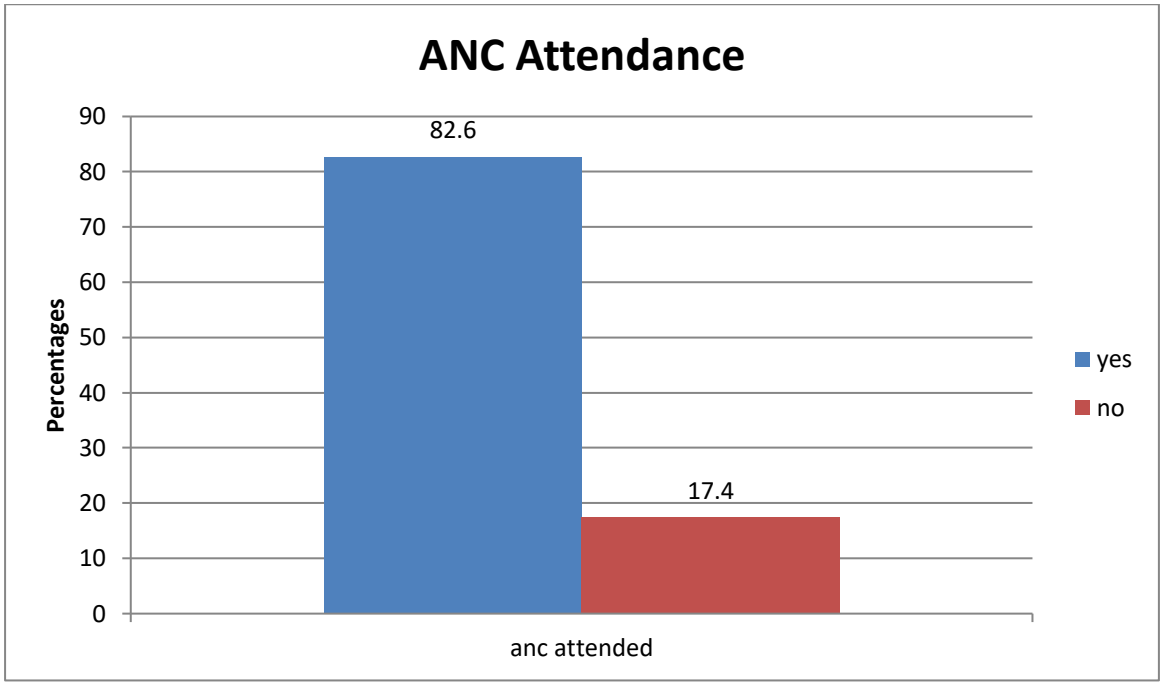

Figure 4.4. Antenatal care attendance

Figure 4.4 above shows that 82.6% of women who died attended their ANC, while 17.4% did not.

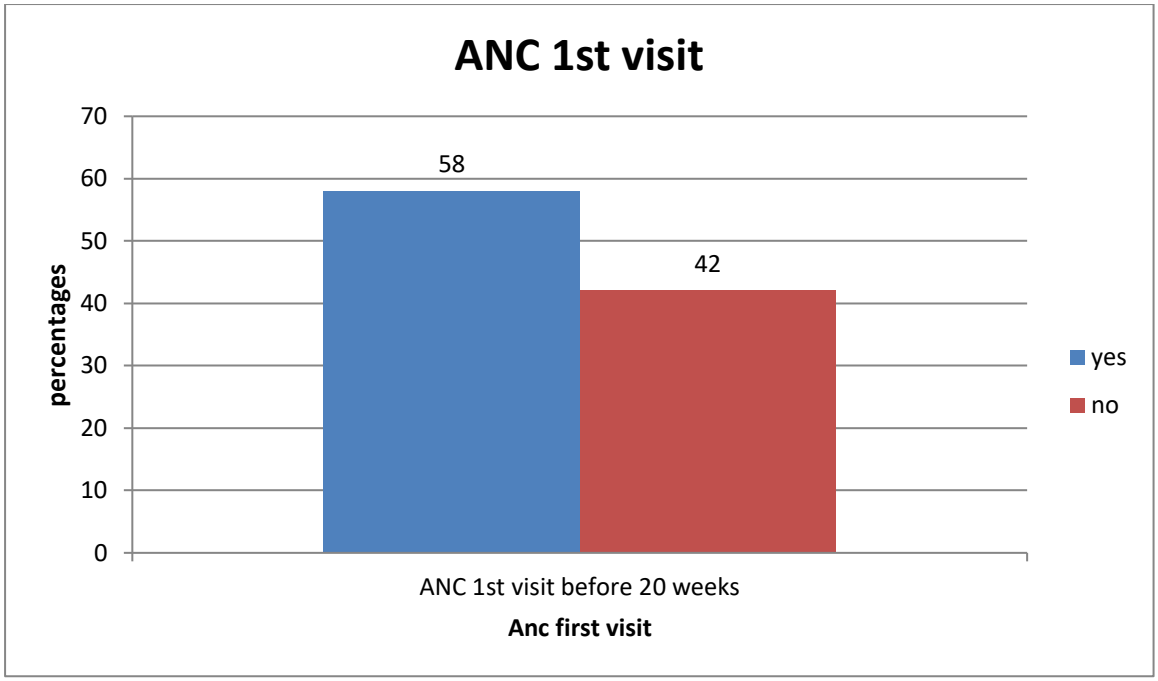

Figure 4.5. ANC 1st visit before 20 weeks

Figure 4.5 above shows that 58% of the women who died started their ANC first visit before 20 weeks, while 42% did not.

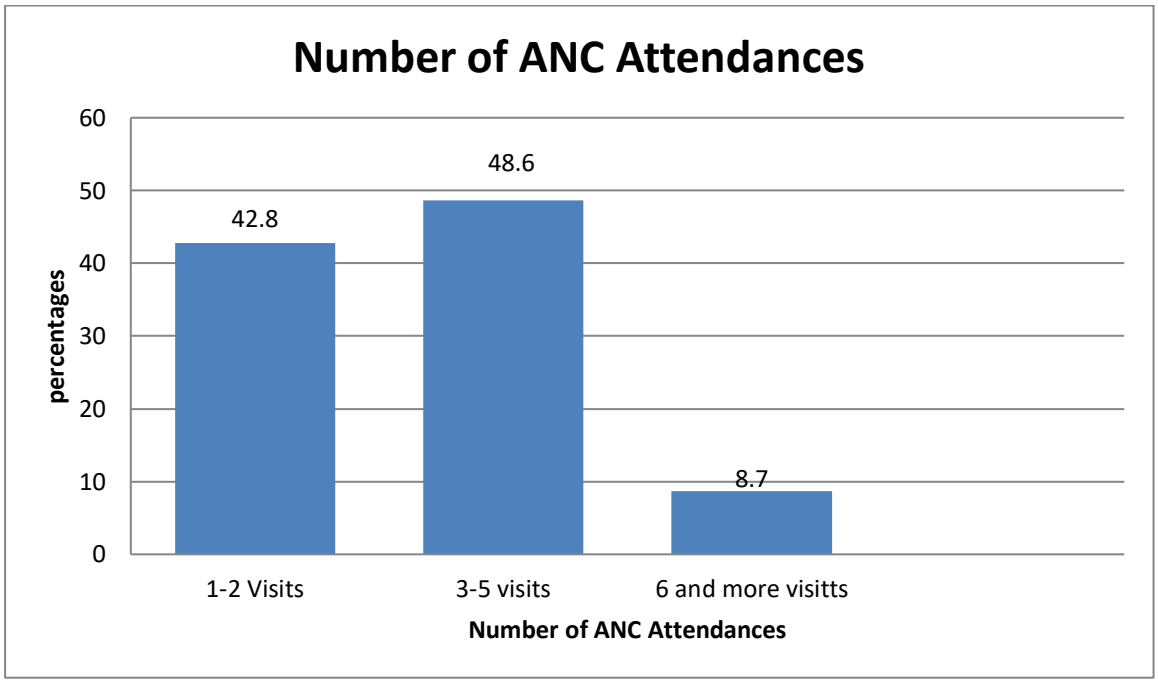

Figure 4.6. Number of ANC Attendances

Figure 4.6 above shows that 48.6% of the women who died had attended their ANC between 3 and 5 times.

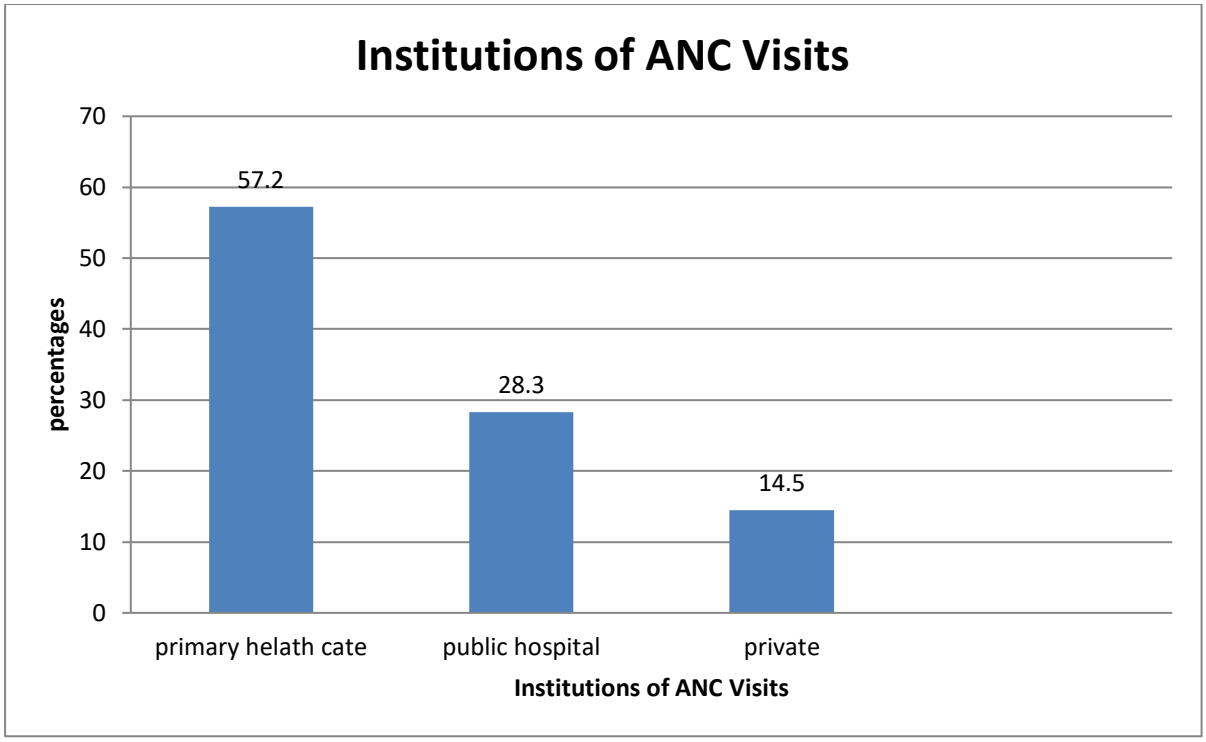

Figure 4.7. Institutions of ANC visits

Figure 4.7 above shows that, in the most of maternal mortality cases (57.2%), the women attended their ANC at primary healthcare facilities, 28.3% at public hospitals and only 0.7% at private hospitals.

Table 4.1. Maternal Mortality Parity Distribution and Attendance, Care of ANC

Parity	Frequency	Percent
0	26	18.8
1-2	64	46.4
3-4	32	23.2
5 and above	16	11.6
Total	138	100.0
Attendance personnel	frequency	Percentage
Medical officer/General practitioner(GP) public hospital	40	29.0
professional Nurse	80	58.0
Advanced midwife	1	0.7
Other (Gynae or private doctor) private	17	12.3
Total	138	100

Table 4.1 above shows that, in the most of maternal mortality cases, the women were attended to by the professional nurses, at 58%. Furthermore, this table shows that women with a parity of 1-2, at 46.4%, were more likely to die when pregnant compared to the other groups.

Table 4.2. Maternal Risk and Maternal Mortality Risk Distribution

Maternal risk responses	Frequency	Percent
Yes	65	47.1
No	73	52.9
Total	138	100.0
Maternal risk distribution	Frequency	Percent
Hypertension	14	10.1
Proteinuria	5	3.6
Glycosuria	1	0.7
Anaemia	6	4.3
Previous c-section	18	13.0
Grand multipara	10	7.2
Advanced maternal age (AMA)	11	8.0
None	73	52.9
Total	138	100.0

Table 4.2 above shows that, in most of the maternal mortality cases, women had no maternal risk (52.9.5%), while 47.5% of the women had maternal risk. Furthermore, this table shows that most of the women had no maternal risk (52.9%), however, previous c-section was the leading maternal risk, at 13%, followed by hypertension, at 10.1%.

Table 4.3. Maternal Mortality and Gestational Age Distribution

Categories	Frequency	Percent
0-12 weeks	17	12.3
13-24 weeks	16	11.6
25-36 weeks	50	36.2
37 and above weeks	55	39.9
Total	138	100.0

Table 4.3 above shows that the greatest maternal mortality occurred where mothers were at their pregnancy gestational age of 37 weeks or more (39.9%).

4.4 INTRAPARTUM CARE

The maternal mortality admission status, referral from other health institutions, mode of delivery, HIV test, distribution of maternal mortality, haemoglobin tests, will discussed below.

Table 4.4. Maternal Mortality Referrals from Local Primary Health Care Institutions and Maternal Mortality Admission Status

Categories ()		Frequency	Percent (%)
Referral	Yes	39	28.3
	No	99	71.7
Total		138	100.0
Stable		95	68.8
Antenatal (complication)		9	6.5
Dead on arrival		2	1.4
Unstable		32	23.2
Total		138	100.0

Table 4.4 above shows that 71.7% of maternal deaths occurred at home, with no referral from other institutions when admitted to the hospital. Furthermore, this table shows that the majority of the maternal mortality were stable on admission to the hospital (68.8%) and only 1.4% were pronounced dead on arrival.

Table 4.5. Mode of Delivery

Categories	Frequency	Percent
Normal(Vaginal delivery)	50	36.2
C-section	31	22.5
Undelivered	57	41.3
Total	138	100.0

Table 4.5 above shows that, in most of the maternal mortality cases, the women had delivered (58.7%) while 41.3% of cases were undelivered. Of those women who delivered, 36.2% had a vaginal delivery and 22.5% had a c-section.

Table 4.6. Maternal Mortality Distribution Pattern

Categories	Frequency	Percent
Abortion (CTOP)	12	8.7
Ectopic pregnancy	2	1.4
Not in labour	46	33.3
In labour	23	16.7
Postpartum	55	39.9
Total	138	100.0

Table 4.6 above shows that 39.9 % of woman died postpartum, 33.3% were not in labour and 8.7% died post abortion.

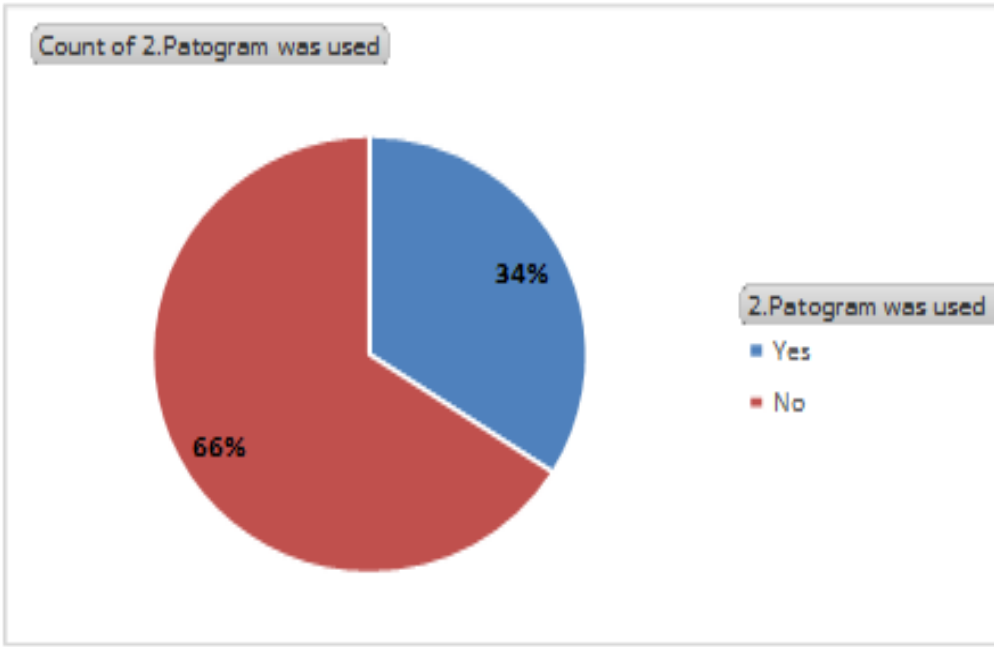

Figure 4.8. Partogram Utilisation.

Figure 4.8 the above shows that a Partogram was not used in 66% of the maternal mortality cases.

Table 4.7. Intrapartum Care

Categories	Frequency	Percent
C-section	33	23.9
Hysterectomy	1	0.72
Transfusion	6	4.34
None	98	71.01
Total	138	100.0

Table 4.7 above shows that, in 23.9% of the maternal mortality cases, the women had C-sections as an intervention. Table 4.7 above shows that 4.3% of the mothers had blood transfusions and that the majority, 95.7%, did not have a blood transfusion.

Table 4.8. Postpartum Care

Categories	Frequency	Percent
Anaesthesia	17	12.3
Epidural	1	0.7
Spinal	6	4.3
Invasive monitoring	1	0.7
ICU care	4	2.9
Normal care	109	79.0
Total	138	100.0

Table 4.8 above shows that, in the majority of maternal mortality cases, the women did not need emergency postpartum interventions (79%), 12.3% had received anaesthesia, and 2.9% were admitted in ICU.

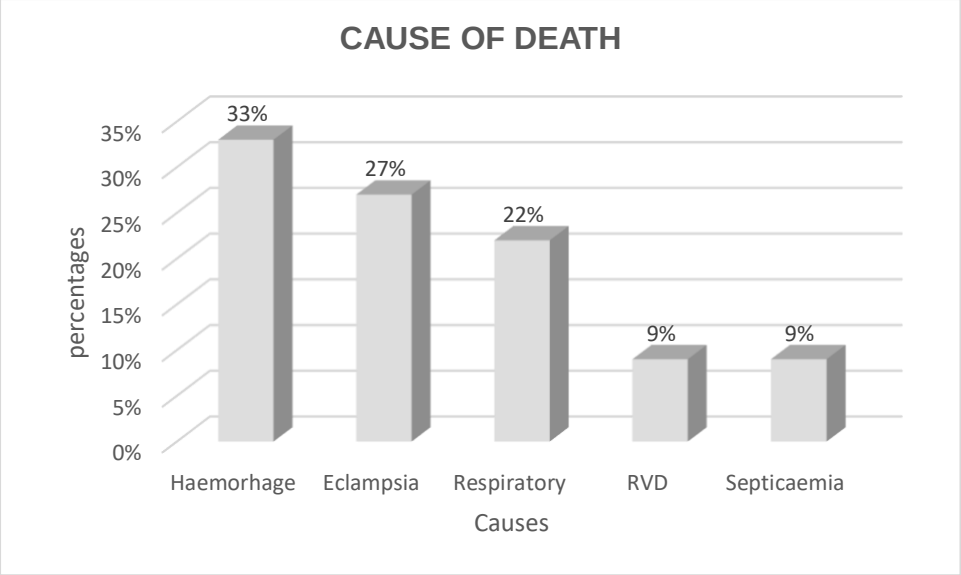

Figure 4.9: Causes of Death Among MMC.

Figure 4.9 above shows that, in a third (33%) of the cases, women died because of haemorrhage; followed by 27% of women who had eclampsia; and 22% of women who died from respiratory complications. Only 9% of the women died from RVD and septicaemia.

Table 4.9 Risk factor; HIV Status and Cause of Death vs. Age Group of MMC (% in Rows).

Variables		<20yrs n(%)	20-30yrs n(%)	31-40yrs n(%)	>40yrs n(%)	Chi Square p value
ANC Risk factors	Hypertension	0	6(43)	6(43)	2(14)	X^2 = 32.150 p = 0.006*
	Proteinuria et al.	1(8)	4(34)	7(58)	0	
	Previous c-section	0	11(61)	6(33)	1(6)	
	Grand Multi	0	0	8(80)	2(20)	
	Med Conditions	0	3(27)	8(73)	0	
	None	6(8)	36(49)	31(42)	0	
HIV Status	Negative	4(5)	38(49)	32(42)	3(4)	X2 = 4.164 p =0 .384
	Positive	3(5)	22(36)	34(56)	2(3)	
Cause of death	Septicaemia	0	9 (75)	3(25)	0	X2 = 18.052 p = 0.114
	Eclampsia	3(8,)	14(38)	18(49)	2(5,)	
	Respiratory	0	8(27)	22(73)	0	
	Haemorrhage	3(6,5)	24(52)	17(37)	2(4,5)	

	RVD	1(7,6)	5(38)	6(46)	1(7,6)	

**statistical significance at 95% confidence interval*

Table 4.9 above shows that there was a significant association between ANC risk factors and age, p = 0.006, at 95% CI. In addition, there was no significant association between HIV status and cause of death by age (p = 0.384 and 0.114, respectively).

Table 4.10 Risk Factor; HIV Status and Cause of Death vs, Year of death (% in Rows).

Variables		Year of Death					
		2013 n(%)	2014 n(%)	2015 n(%)	2016 n(%)	2017 n(%)	Chi Square p value
ANC risk factors	Hypertension	0	2(14)	2(14)	6(43)	4(29)	X2 = 29.253 p = 0.083
	Proteinuria/ Glycosuria/Anaemia	0	1(8)	3(25)	3(25)	5(42)	
	Previous c-section	1(5.6)	6(33,3)	4(22,3)	1(5,6)	6(33,3)	
	Grand Multi parity	1(10)	1(10)	5(50)	2(20)	1(10)	
	Med Conditions	0	1(9,1)	5(45)	2(18,9)	3(27)	
	None	12(16)	19(26)	13(18)	18(25)	11(15)	
HIV test	Negative	10(13)	14(18)	16(21)	21(27)	16(21)	X2 = 4.164 p = 0.384
	Positive	4(7)	16(26)	16(26)	11(18)	14(23)	
cause of death	Septicaemia	2(17)	3(25)	1(8)	2(17)	4(33)	X2 = 10.975 p = 0.811
	Eclampsia	2(5)	9(24)	8(22)	10(27)	8(22)	
	Respiratory	3(10)	7(23)	7(23)	8(27)	5(17)	
	Haemorrhage	6(13)	8(17)	15(32)	7(15)	10(22)	
	Rvd	1(8)	3(23)	1(8)	5(38)	3(23)	

Table 4.10 above shows that there was no significant association between ANC risk factor and year of death, p = 0.083, at 95% CI. In addition, there was no significant association between HIV status and cause of death by year of death (p = 0.384; 0.811, respectively).

Table 4.11. Direct and Indirect Causes of Maternal Death

Categories	Frequency	Percent
home death	7	5.1
Direct	98	71.0
Indirect (pre-existing medical conditions)	33	23.9
Total	138	100.0

Table 4.11 above shows that a direct cause of maternal mortality was identified in 71% of the cases compared to 23.9% of the cases which identified an indirect cause of death, while only 5.1% of deaths were recorded as home deaths.

4.5 PERSONAL AND FAMILY CONTRIBUTING FACTORS

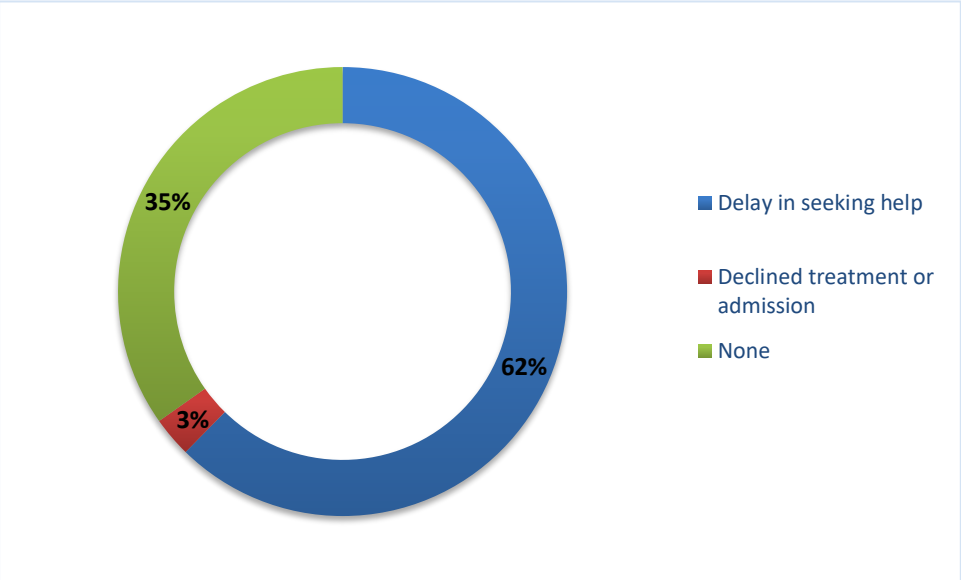

Figure 4.10. Personal and Family Contributing Factors

Figure 4.10 above shows that, in 62% of the maternal mortality cases, there was a delay in seeking help from public health facilities, while 35% of the cases had no known factors personal or family contributing factors.

4.6 LOGISTICAL AND FACILITY FACTORS

Table 4.12. Logistical System Factors

Categories	Frequency	Percent
Lack of transport between facilities	3	2.2
Health service communication breakdown	1	0.7
None	134	97.1
Total	138	100.0

Table 4.12 above shows that the logistical factor ‘lack of transport between facilities’ was apparent in only 2.2% of the cases.

Table 4.13. Facility Factors

Categories	Frequency	Percent
Lack of facility equipment	4	1.4
None	135	97.8
Total	138	100.0

Table 4.13 above shows that, in 2.2% of the facilities, a lack of expertise, training or education were indicated as factors and only 1.4% of the facilities had a lack of facility equipment.

4.7 CONCLUSION

In summary, in this chapter, the researcher outlined the variables in different formats, namely, figures tables and charts, which presented the study findings. An explanation was given for each variable, namely, sociodemographic, antenatal, intrapartum and postpartum, personal or family factors, logistical factors and causes of death, both direct and indirect. In the following chapter, the researcher will deal with a discussion of the results, recommendations and limitations.

CHAPTER FIVE

DISCUSSION OF RESULTS, RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

5.1 INTRODUCTION

In this chapter, the researcher will discuss of results, detailed findings and limitations of the study. The researcher further provides conclusions drawn from the discussion of the findings; providing recommendations for policy and interventions with respect to factors contributing to maternal mortality in the Sekhukhune District of Limpopo, South Africa, which are discussed per each variable and supported by the literature.

5.2 THE OBJECTIVES OF THE STUDY:

5.2.1 To determine sociodemographic factors contributing to maternal mortality.

This was achieved by collecting and analysing data for sociodemographic variables, namely age, marital status, and employment status. Majority of the MMC were single and most were unemployed.

5.2.2 To determine maternal factors contributing to maternal mortality.

This study objective was achieved through collection of data by a checklist for maternal related variables. Obstetric variables were parity, attendance of antenatal care at health institution. Previous c/section and other risk factors, hypertension, anaemia, Hiv and other pre-existing medical condition.

5.2.3 To determine the health service-related factors contributing to maternal mortality.

The intrapartum care indicated that majority of the MMC partogram was not used. Majority were self-referral from home as the local health institutions were closed at night. Majority of MMC were assisted by professional nurses. Majority of MMC occurred at health facility while most were admitted in a stable condition. The personal factor was identified as the delay of seeking help from health institution**.**

5.3 DISCUSSION OF RESULTS

5.3.1 SOCIODEMOGRAPHIC FACTORS

5.3.1.1 Age

The results of this study revealed that the women in close to half of the maternal mortality cases were less than 30 years of age, with a mean age of 30 years, while the youngest MMC was 18 years of age. The maternal mortality cases were all black African women, the majority of whom were unemployed and single. These results are similar to global trends, as highlighted in a study conducted by Alkema et al. (2016), who found that most MMC were young adults, single and unemployed. Similarly, a study conducted by Ntuli, et al. (2017) in Limpopo Province, found that the mean age of the MMC was 29 years and a study done in Gauteng Province found the mean age was 29 years in a range from 14 to 40 years (Uzabakiriho & Maswime, 2019; Tlou et al., 2017). Similarly, studies conducted in Nigeria, Ghana, Ethiopia and Zambia showed that, in the maternal mortality cases, women were between the ages of 18 and 41 (Sageer, Kongnyuy, Adebimpe, Omosehin, Ogunsola & Sanni, 2019; Gulumbe, Alabi, Omisakin, & Omoleke, 2018; Getachew, Liabsuetrakul, Virani, & Gebrehiwot, 2020; Tembo, Chongwe, Vwalika, & Sitali, 2017). Other studies found that maternal mortality occurred in the age group 20 and 39 years, peaked in the 25–29 year age group (Kim et al., 2020; Yaya, Uthman, Amouzou & Bishwajit, 2018). Similar studies in Mozambique and Ghana reported that the median maternal mortality age was 29 years (Lancaster et al., 2020; Sumankuuro, Wulifan, Angko, Crockett et al., 2020).

Furthermore, studies show that countries with low socioeconomic status, such as India and Pakistan, demonstrated a mean age of maternal mortality of 30 years, which is similar to the findings of the current study (Mittal, Kapoor & Bajaj, 2019 ; Humayun, 2017; Sheikh, Qureshi, Raza, Memon, Ahmed et al., 2019 and Ballu & Asha, 2019). All the above countries are classified as underdeveloped countries and have been struggling to reduce maternal mortality, just like South Africa. Younger mothers (aged <20) and older mothers (aged >40) were found to be at a greater risk of maternal mortality (Lancaster, Barnes, Correia, Luis et al., 2020). McCall, Nair, and Knight (2017) and Bwana, Rumisha, Mremi, Lyimo & Mboera, (2019) found that age was associated with maternal mortality.

5.3.1.2 Marital status

Most of maternal mortality cases in this study and other studies occurred among women who were unmarried. The study results revealed that, in the majority of maternal mortality cases, the women were unmarried, which is similar to findings in Kwazulu Natal, South Africa, where it was reported that women in the majority of maternal mortality cases were never married (Bomela, 2020). Similarly, studies conducted in other parts of Africa, such as Ghana and Botswana, found that the majority of women in maternal mortality cases were unmarried (Addai, 2019; Nkhwalume & Mashalla, 2019). Interestingly, studies conducted in other underdeveloped countries, like India, reported similar findings, reporting that married women were less likely to die because of support from their partners (Hamal, Dieleman, De Brouwere & De Cock, 2020). A study conducted in Tanzania by Manyeh, Nathan and Nelson (2018) found that there was a significant association between single women and the divorced women. Therefore, the above evidence suggest that marital status is significantly associated to maternal mortality, as illustrated in this current study, where only a quarter of married women died. It was, however, not possible to find out whether partner support was a significant factor in the current study.

5.4 CAUSES OF MATERNAL MORTALITY

5.4.1 Direct cause vs indirect cause

The death of a mother that results from direct causes, such as obstetric complications, labour or the puerperium complications resulting from poor/lack of intervention, omissions, incorrect treatment, or a chain of events resulting from any of these factors, can be devastating to families (Ballu & Asha, 2019). A maternal death that is not directly due to an obstetrical cause, death that results from previously existing disease or a disease developing during pregnancy, labour, puerperium, or condition aggravated by maternal physiological adaptation of pregnancy is classified as indirect cause (Ballu & Asha, 2019). This results of this study revealed a higher proportion of direct obstetric causes of maternal mortality cases (two-thirds) than the indirect causes (one-third). Similar findings globally show

that maternal mortality cases as a result of direct causes, compared to indirect causes, were higher in India, Pakistan, Latin America, the Caribbean and Sub-Saharan Africa, (Filippi, Chou, Ronsmans, Graham & Say, 2016; Nisar, Abbasi, Chana, Rizwan, & Badar, 2017; Ballu & Asha, 2019; Nkhwalume & Mashalla, 2019 Tembo, Chongwe, Vwalika & Sitali, 2017; Sageer et al., 2019). Furthermore, even developed countries, such as Japan and the US, reported similar findings, where direct obstetric causes contributed to more than two-thirds of the causes of maternal mortality in 2018 (Hasegawa et al., 2019; Hoyert & Miniño, 2020).

5.5 OBSTETRIC PROFILE

Studies show that obstetric factors, such as parity, previous c-section and antenatal attendance, contribute significantly to maternal mortality. This is discussed in detail below.

5.5.1 Parity

The results of this study revealed that women in the majority of maternal mortality cases had parity of one to four. Similarly, Ntuli, Mogale, Hyera and Naidoo (2017) reported that the women in most maternal mortality cases had a parity of 2 or more in Polokwane, Limpopo Province. In addition, a study in Gauteng indicated that most of the women involved in maternal mortality cases had a parity of two (Uzabakiriho & Maswime, 2019). Tlou et al. (2017) reported that higher parity was a significant predictor of increased risk of maternal death. These studies further re-emphasised the fact that parity is linked to increased risk of maternal deaths in South Africa. Studies show that socialisation significantly influences how many children a family should have and that societal expectations also influence the age by which a female should have at least one child. These expectations place enormous pressure on women to continue to produce children, even if they experience high risk pregnancies which put them at risk of dying (Leaper & Bigler, 2011; Hodgkinson, Smith & Wittkowski, 2014).

Poor maternal outcomes were also found to be related to parity in underdeveloped countries, like India, Nigeria and Tanzania (Mittal, Kapoor & Bajaj, 2019; Moses, Iluku-Ayoola & Adeola, 2020; Manyeh, Nathan & Nelson, 2018). For example, in India, studies found that women in the majority of maternal mortality cases were

multigravida (Soni, Soni, Gupta & Gupta, 2016; Ballu & Asha, 2019). The findings of a study conducted in Pakistan indicated that a higher than three parity is associated with increased maternal mortality (Humayun, 2017). Similarly, in Nigeria, grand multiparty (>Para 5) increased the odds of maternal mortality by nearly sevenfold (Ntoim, Okonofua, Ogu, Galadanci, Gana et al., 2018). In Ghana, the findings of a study were that women with a parity of two or higher were more likely to have a negative maternal outcome (Addai, 2019), while in Tanzania, a strong association between grand multiparity and the risk of maternal death was found (Bwana et al., 2019). These studies imply that women with multiple pregnancies stand a high risk of mortality, especially in rural areas in South Africa. Therefore, there is a greater need for the healthcare system to upscale the use of contraception by women in order to prevent unnecessary complications during pregnancy.

5.5.2 Antenatal attendance

The South African Department of Health Guidelines on Basic Antenatal Care Plus (BANC Plus) recommend that women should attend their first ANC as early as 12 to 20 weeks. This is because most of the ANC complications start very early in pregnancy and, at times if detected early, intervention is likely to save both the mother and child (Pattinson, Hlongwane & Vannevel, 2019). It is, therefore, a concern that 42% of the women in the maternal mortality cases in this study attended their first ANC visit after 20 weeks, which clearly can result in complications being detected too late. Mogawane et al. (2015) found that the majority of women in Limpopo attended their first ANC after 20 because, initially, they hide their pregnancy as a result of their indigenous beliefs. Similarly, it was found that the odds of maternal mortality was higher for those women who made inadequate use of antenatal care than for those who made adequate use of antenatal care (McCall, Nair & Knight, 2017). In Nigeria, non-booking for antenatal and delivery care and late presentation in labour have been reported as causes maternal mortality (Ntoim et al., 2018). Similarly, findings by Manyeh, Nathan and Nelson (2018) showed that less than 5 ANC visits increases the chances of maternal mortality in Tanzania significantly.

According to National Department of Health's BANC Plus BANC Plus report, (2018), the recommended frequency of ANC visits is more than 6 times in order to detect any signs of maternal complications and manage them timeously. The results of this study further revealed that the highest frequency of ANC attendance ranged from 3 to 5 visits, and a significantly lower frequently of ≥6 attendance among the women involved in the maternal mortality cases being studies. A study conducted by Atuhaire and Kaberuka (2016) concluded that mothers who make few or no ANC visits had a higher likelihood of both themselves and their babies dying, than those women who undertook more visits. This is, therefore, indicative of the fact that the frequency of ANC visits in the countries with low socioeconomic status can be influenced by a number of socioeconomic factors, such as distance, transport and availability of specialised care. According to Singla, Rajaram, Mehta and Radhakrishnan (2017), an increase in the frequency of ANC visits is necessary for early detection of pregnancy-related complications. It is, therefore, a concern that more women did not comply with this BANC Plus recommendation, which could have detected complications early in their pregnancies and subsequent interventions could have been saved their lives.

The results of this study further revealed that the majority of women involved in maternal mortality attended ANC at a public sector healthcare facility, mostly primary healthcare facilities, while a few of these women attended ANC in a private facility. Because the study was conducted in a rural area with low socioeconomic status, the ANC visits to public health facilities is eminent. It is, however, not clear why some obstetric problems were not picked up early and why interventions were not timeously undertaken in order to prevent death.

It is further a concern that this study revealed that just over half of the women involved in maternal mortality cases had no apparent maternal risk factors. It is also not clear why the institution could not save the mother and child, if they presented to hospital with no maternal risk factors. Therefore, there is a need to empower these facilities with skills to properly monitor these women during ANC visits, to prevent unnecessary deaths of women during pregnancy. For those women with maternal risk factors, it was found that previous c-section and hypertension were more prevalent than other risk factors. Other studies have shown that haemorrhage and hypertension are more prevalent maternal risks in South Africa, and in Sub-Saharan

Africa (Heitkamp, Aronson, Van Den Akker, Vollmer et al., 2020; Ntuli, Maboya, Hyera et al., 2019; Tura, Scherjon, Stekelenburg, Van Roosmalen, Van Den Akker & Zwart, 2020).

5.5.3 MMC and previous c-section

WHO (2015) recommends that c-section prevalence as a mode of delivery should not surpass 15%. According to the DHIS (2019) the target for c-section should be less than 15% with numerous evidence signifying that c-section prevalence beyond 15% is not linked to a further reduction in maternal mortality (Yaya, Uthman, Amouzou & Bishwajit, 2018). The current study results revealed that close to a quarter (22.4%) of women involved in the maternal mortality cases had a c-section during the intrapartum care and a further 13% had history of previous C-sections. A study in Turkey found that maternal mortality due to postpartum haemorrhage was 2.27 times higher among women who had had a c-section (Gulumser, Engin-Ustun, Keskin, Celen, Sanisoglu et al., 2019), while in Iran, sepsis or severe systemic infection was associated with C-sections (Moudi, Arabnezhad, Ansari & Tabatabaei, 2019). The current study also found that c-section was a significantly associated with age ($p = 0.006$). Similarly, a study in Uganda found that the most common indication for c-section was previous history of c-section (Yaya, Uthman, Amouzou & Bishwajit, 2018).

The results of this study revealed that direct obstetric complications were the leading causes of maternal deaths, the most common of which was maternal obstetric haemorrhage.

5.5.4 HIV and pre-existing medical conditions

HIV and other pre-existing medical condition, are also important and account for approximately 29% of maternal deaths in Sub-Saharan Africa (Merdad & Ali, 2018). The results of this study revealed that women in close to half (44%) of the cases were HIV positive. Similarly, studies in rural South Africa have shown that HIV status and parity were linked with increased risk of maternal death. According to Manyeh, Nathan and Nelson (2018), HIV-positive status remains a high contributory risk factor of maternal mortality cases in Tanzania. In South Africa HIV infection has been attributed to the large increase in maternal mortality (Tlou, Sartorius & Tanser,

2017). In Kwazulu-Natal, the researchers in a study observed that HIV-positive postpartum women had a more than two times greater maternal mortality rate and the causes of death were recorded as attributable to AIDS or TB. (Kim, Dobra & Tanser, 2020;). In contrast, a study conducted in Ethiopia found that maternal mortality as a result of HIV-related causes was relatively stable (Tessema, Laurence, Melaku et al., 2017). It has been reported that the rate of ART initiation following diagnosis or entry into antenatal care ranged from 54% to 100% in some provinces in South Africa (Bac, Pattinson & Bergh, 2019). However, it is of concern that a quarter of women in the maternal mortality cases in the current study died of HIV related causes.

The hypertensive disorders of pregnancy, including preeclampsia/eclampsia, account for significant maternal and foetal mortality globally and is especially true in South Africa (Moodley, Soma-Pillay, Buchmann & Pattinson, 2019). The results of this study revealed that 10% of cases had hypertension and 27% of the women died from eclampsia. Studies further show that severe preeclampsia/eclampsia was the most common cause of mortality (Kodan, Verschueren, Van Roos, Malen, Kanhai & Bloemenkamp, 2017). An increase in the number of antenatal care contacts in the third trimester can increase the number of women diagnosed with hypertension in pregnancy by 46% (Bac, Pattinson & Bergh, 2019), hence, there is a need for campaigns to raise awareness of this among women.

Globally, more than half of the maternal deaths between 2003 and 2009 were to the result of haemorrhage and hypertensive disorders, especially in underdeveloped countries (Geller, Koch, Garland, MacDonald, Storey & Lawton, 2018). Studies reported haemorrhage as the leading direct cause of maternal deaths worldwide, followed by hypertensive disorders (Soni, et al., 2016; Ballu & Asha, 2019; Rahman, Austin, Begum & Anwar, 2020).

In the current study, a third of the women died of haemorrhage. Severe haemorrhage results in decreased haemoglobin levels, which can result in mortality. In Iran, the most common cause of severe haemorrhage was reported to be a low haemoglobin level of <11 g/dl (Moudi, Arabnezhad, Ansari & Tabatabaei, 2019). Studies further report that anaemia (Hb ≤ 6.0 mmol/L) was the cause of maternal mortality. Obstetric haemorrhage, often caused by uterine atony, retained placenta,

ruptured uterus, vaginal/cervical tears and unspecified causes, lead to anaemia and result in maternal mortality (Kodan et al., 2017). Countries in Africa, such as Ethiopia, reported similar findings, where maternal haemorrhage, hypertensive disorders and maternal sepsis resulted in maternal mortality (Tessema, Laurence, Melaku et al., 2017). The causes of death above clearly indicate that postpartum haemorrhage and eclampsia still persist to be leading causes of maternal mortality, however, there was no significant association between these causes of death and age in the current study ($p > 0.005$). The explanation could be that the sample size was too small and only one district in Limpopo was studied.

5.5.5 Intrapartum care

A lack of adequate training and supervision and the inappropriate treatment of women in emergencies by health professionals was sometimes the result of understaffing or staff being under too much pressure to pay enough attention to a woman; or the result of their engagement in administrative tasks or lack of priority for maternal healthcare over other programs and lack of proper monitoring and supervision (Hamal et al., 2020). The use of a Partogram during labour processes serves as a crucial tool to monitor both maternal and foetal vital signs. The results of this study revealed that the majority of maternal mortality cases occurred after delivery and that the Partogram was not used during labour or the delivery process. Similarly, findings in India show that majority of maternal mortality occurs in the postpartum period; that one-third of deaths occur in the first 24 hours after delivery; and, that more than two-thirds of deaths occur during the first week after birth (Ballu & Asha, 2019). Furthermore, a lack of knowledge in, and the ignorance of, midwives in using the Partogram has been reported by Mothiba, Skaal & Berggren (2019). Similarly, in Gauteng, South Africa, the results of a study found that a variety of reasons were cited for not using the Partogram. Reasons included being too busy and the Partogram taking too long to plot (Maphasha, Govender, Motloba & Barua, 2017).

Similarly Jain and Sharma (2016) reported that the Partogram is still underutilised, especially where it is most needed, since it can assist in the early detection of abnormal labour; its use can, therefore, prevent prolonged labour and thus, significantly reduce the risk of postpartum haemorrhage and sepsis; obstructed

labour; and, uterine rupture, and, thereby, reduce maternal mortality. Studies in countries like Sri Lanka, India, Rwanda and Cameroon reported that there was minimal use of a Partogram and many technical errors in most of the maternal mortality cases were found (Jayaweera, 2017; Hamal, Dieleman, De Brouwere & De Cock, 2020; Bazirete, Mbombo & Adejumo, 2017; Egbe, Ncham, Takang, Egbe & Halle-Ekane, 2016; Lancaster et al., 2020). This is a common trend in underdeveloped countries and tantamount to poor recordkeeping and utilisation of life saving tools to monitor women in labour.

5.5.6 Place of death

The study results revealed that most of maternal mortality cases occurred in the hospital, with very few cases occurring at home. These findings are similar to studies conducted elsewhere in South Africa (Bomela, 2020; Tlou et al., 2017). Similarly, the findings in Tanzania from a study dealing with hospital-based maternal mortality ratios, maternal mortality death was observed to increase substantially over a 10-year period (Bwana et al., 2019).

5.6 PERSONAL FACTORS

Personal factors range from a lack of skilled health personnel, poor transport system, delay in seeking help, a lack of services near residence and late booking for antenatal care, have been reported to contribute to maternal mortality, especially in South Africa and other developing countries. The results of this study revealed that the most documented personal factor contributing to maternal mortality was a delay in seeking help in more than two-thirds of the cases.

Other studies reported that delays in seeking medical care remains the most common community-related problem (Sageer et al., 2019), whereas there are studies that found that a lack of transport facilities, a lack of services near place of residence and delay in seeking healthcare were among the major contributing factors to maternal mortality (Khan, Haider & Bakhsh, 2020; Hamal et al., 2020).

In this current study, it was not clearly documented whether a lack of skilled personnel or late antenatal booking contributed to maternal mortality, however,

studies in other countries found that a lack of skilled health personnel and poor transport systems have contributed to a high maternal mortality rate in that country (Apanga, & Awoonor-Williams, 2018; Moodley, 2018). Studies report that poor personal attitude to health care, self-risk perception, transportation logistics and a delay in making referrals from other health facilities often make it difficult to access healthcare facilities, which can cause complications, such as maternal deaths and inappropriate treatment (Sageer et al., 2019; Khan et al., 2020; Hamal, Dieleman, De Brouwere & De Cock, 2020).

5.7 HEALTH FACILITY FACTORS

The results of this study found that there were no significant health-related factors recorded in the patient records. However, other studies report that both poor health service delivery and availability contribute to higher maternal mortality, particularly with respect to distance to hospitals (Cameron, Suarez & Cornwell, 2019). Because the health facilities in rural areas are sparsely distributed, other studies conducted in the Limpopo Province reported that health service access strongly reduced the risk of maternal death, with every extra 10 kilometres a woman is from the nearest hospital being associated with a 3.9% increase in the likelihood of maternal death (Netshikweta, 2018).

5.8 LIMITATIONS

The limitations associated with retrospective studies included any missing data from patient files which affects the reliability of the data. This was minimised by reviewing admission and death registers, as well as all files from the records department. Additionally, the recorded causes of death were based on a clinical assessment of the attending medical doctors. In the absence of post-mortem autopsy records, the correctness of the causes of death could not be verified.

Medical records are associated with being cumbersome as data is usually incomplete, since it was not collected for research purposes. Furthermore, since the data on medical records were collected by different people at different times, the variables may be inconsistently defined. It is important to note that, even with these

limitations, the study still provides useful insights that will assist in developing strategies to reduce maternal mortality.

5.9 RECOMMENDATION

- There is a need for more in-service education and on-the-job training, as outlined by Mothiba, Skaal & Berggren (2019). Workshops or training and different courses need to be offered in order to broaden the knowledge of healthcare professionals related to pregnancy, childbirth and management of pre- and postpartum women.
- The majority of the pregnant women had attended antenatal care consistently, therefore, the researcher recommends that interventions for screening and management of preventable causes of maternal deaths (direct and indirect) at these facilities should be strengthened. In addition, investing in educating women on the importance of ANC; and, educating healthcare providers on early detection of risks related to pregnancy and instituting corrective measures in a timely manner, are necessary for reducing maternal mortality.
- Awareness campaigns/intensified health education for women about danger signs during antenatal, puerperium and post-natal care should be developed and launched.
- The consistent use of Partogram should be encouraged and in-service or on job training on the use of Partogram should be implemented.
- Similar research on factors contributing to maternal mortality should be conducted in all districts in the Limpopo Province so that these results can be generalised.
- A study should be conducted on the challenges faced by mothers in accessing primary healthcare services at night.
- The study indicates that MMR is still high in the Sekhukhune District, in particular, and in South Africa, in general, as developing country. This calls for more comprehensive studies to be undertaken in order to explore options to reduce MMR in the country and rural area, in particular.

5.10 CONCLUSION

This study found that maternal mortality risks were as follows: age, marital status, parity, antenatal attendance, previous caesarean section, HIV and other medical conditions, intrapartum care and place of death were significant factors contributing to maternal mortality. Furthermore, personal factors and logistical factors were found not to contribute to maternal mortality in this district. From the study results, it can be concluded that there is a need to strengthen multidisciplinary interventions to reduce and prevent maternal mortality in the Sekhukhune District.

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Appendix 1: DATA COLLECTION TOOL

University of Limpopo
finding solutions for Africa

ID code

U	L			

Instructions

a) Please complete all the questions

b) Mark the appropriate block with an X or write the answer in the space provided

c) Do not omit any item of information

d) Do not fill the space marked for office use-

1. Date data collected d d / m m / y y

A. MATERNAL DETAILS

Dd mm yy

2. Date of birth or age (years) ……./……/……..

……..

Years

3. Race

1	African
2	Coloured
3	Indian
4	White
5	Other

4. Employment status

1	Employed
2	Unemployed

5. Marital status

1	Single
2	Married
3	Widower
4	Divorced

6. Parity

1	0
2	1-2
3	3-4
4	5 or more

7. ANC ATTENDED

1	Yes
2	No

8. ANC 1st visit before 20 weeks

1	Yes
2	No

9. ANC number of attendance

1	1-2

2	3-5
3	6 and above

10. Place of ANC visits

1	Primary health care
2	Hospital high risk
3	Private

11. ANC provider

1	Specialist
2	Medical officer/GP
3	Professional nurse(midwifery)
4	Advanced midwife
5	0ther

12. Risk

1	Yes
2	No

12. Antenatal risk factors

1	Hypertension
2	Proteinuria/glycosuria
3	Anaemia
4	Abnormal lie
5	Previous c/section
6	Grand multi parity
7	Other(AMA,RH-, medical

	conditions)
8	None

B. ADMISSION AT INSTITUTION WHERE DEATH OCCURRED OR FROM WHERE IT WAS REPORTED

1. Date of admission d d / m m / y y

2. Time of admission 24h min

3. Date of death d d /m m / y y

4. Time of death 24h min

5. Complication at admission

1	None
2	Pre-eclampsia
3	Anaemia
4	Haemorrhage
5	Obstructed labour
6	Ruptured uterus
7	Other

6. Gestational Age

1	0-12 weeks

2	13-24 weeks
3	25-36 Weeks
4	37 and above

7. Condition on admission

1	Stable
2	Antenatal
3	Dead on arrival
4	Other

8. Referral from other centre

1	Yes
2	No

9. Diagnosis at the moment of death

1	Abortion
2	Ectopic pregnancy
3	Not in labour
4	In labour
5	Post-partum

10. Mode of delivery

1	Normal (vaginal delivery)
2	Caesarean section
3	Assisted vaginal Forceps/vacuum
4	Undelivered

C. HIV STATUS and other tests

1. HIV Test

1	Unknown
2	HIV negative
3	HIV Positive

(AIDS =CD4<200 or AIDS defining illness)

CD4 count =……

2. Haemoglobin done

1	Yes
2	No

D. DELIVERY and PEUPERIUM

1. Labour occur

1	Yes
2	No

2. Partogram was used

1	Yes
2	No

E. Interventions

1. Early pregnancy

1	Evacuation

2	Hysterectomy
3	Transfusion
4	None

2. Antenatal

1	Transfusion
2	Version
3	None

3. Intra-partum

1	Instrumental delivery
2	Symphysiotomy
3	Caesarean section
4	Hysterectomy
5	Transfusion
6	None

4. Postpartum

1	Anaesthesia
2	Epidural
3	Spinal
4	Invasive monitoring
5	ICU ventilation
6	None

F. CAUSE OF DEATH

1. Primary cause of death …….....

2. Final cause of death ……

3. Contributory cause ……

G. FACTORS CONTRIBUTED TO DEATH

1. Personal/Family

1	Delay in seeking help
2	Declined treatment or admission
3	None

2. Logistical Systems

1	Lack of transport from home to health facility
2	Lack of transport between health facilities
3	Health service communication break dawn
4	None

3. Facilities

1	Lack of facility equipment's
2	No consumables drugs, infusion sets, bloods fluids etc.
3	None

4. Human Resource

1	Lack of human resources
2	Lack of expertise, training or education
3	None

APPENDIX 2: DETERMINING SAMPLE SIZE FROM GIVEN POPULATION

N	s	N	s	N	s
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Key N-population size, *s*-the sample size

Appendix 3: APPLICATION LETTER FOR RESEACH

Sioga T.R

P.O Box 180

Thornhill Plaza

0882

The Head of Department

Department of Health

Private Bag x 9307

Polokwane

0700

Dear sir/madam

REQUEST PERMISSION TO CONDUCT RESEARCH AT SEKHUKHUNE DISTRICT

I Sioga Tshimangadzo Ronald request permission to conduct a research study at Sekhukhune District public hospitals, Matlala, Groblersdal, Philadelphia, St Ritas, Jane furse, Dilokong and Mecklenburg. The study is “Factors contributing to maternal mortality at public health institutions at Sekhukhune district, Limpopo Province”.

This study is conducted in partial fulfilment of the requirements for masters of Public health degree in the school of Health Sciences at the University of Limpopo Turfloop campus. The aim of the study is to investigate the factors contributing to maternal mortality at public health institutions of Sekhukhune district, Limpopo province, South Africa.

I am looking forward to positive response from your office.

Yours faithfully

Sioga T.R

072 341 3383/ 083 395 2021

Email: siogapv@gmail.com

APPENDIX 4: UNIVERSITY TREC ETHICAL CLEARANCE

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 6 August 2019

PROJECT NUMBER: TREC/200/2019: PG

PROJECT:

Title: Factors contributing to maternal mortality at public health institutions at Sekhukhune district, Limpopo province, south Africa.

Researcher: TR Sioga
Supervisor: Prof L Skaal
Co-Supervisor/s: Prof T Mothiba
School: Health Care Sciences
Degree: Master of Public Health

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

APPENDIX 5 : DEPARTMENT OF HEALTH LIMPOPO ETHICAL CLEARANCE

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Ref	:	LP_ 201908 _015
Enquires	:	Mrs PN Motimele
Tel	:	015-293 6028
Email	:	Phoebe.Mahlokwane@dhsd.limpopo.gov.za

Tshimangazo R. Sioga

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

Factors contributing to maternal mortality at public health institutions at Sekhukhune District, Limpopo Province, South Africa.

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
   a. Present this letter of permission to the institution supervisor/s a week before the study is conducted.
   b. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
   c. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   d. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   e. The approval is only valid for a 1-year period.
   f. If the proposal has been amended, a new approval should be sought from the Department of Health
   g. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

Head of Department 27.09.19 **Date**

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street. Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

The heartland of Southern Africa – Development is about people!

APPENDIX 6: SEKHUKHUNE DISTRICT ETHICAL CLEARANCE FOR ALL SEVEN HOSPITALS.

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 015 633 2401 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 08 October 2019

To: Sioga TR
University of Limpopo: School of Health Care Sciences
Turf loop, Limpopo

From: Human Resource Utilization and Capacity Development.

Subject: Approval of permission for the collection of data: Yourself

1. The above matter bears reference.
2. Based on the approval granted by the Head of Department of Health, Limpopo Province regarding your request to conduct research in our institution, the Acting District Executive Manager for Sekhukhune is permitting you to visit the institution as indicated in your application letter.
3. Also take note that as per your individual request, you are only granted permission to visit the institutions specified and should you find a need to visit other facilities within our district, you are advised to make a new request for those facilities.
4. **During assumption of data collection, you will present yourself, your scope of work and schedule to the Chief Executive Officer of the Hospital you will be visiting.**
5. Hope the matter is found to be clear and understandable.

per procurationem
Acting District Executive Manager:
Mrs Ralefe M

17/10/2019
Date

Private Bag X04, Chuenespoort 0745 Tel: (015) 633 2300,
Fax: (015)6336487,Website:www.limpopo.gov.za

The heartland of southern Africa – development is about people!

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: Jane Furse Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter requesting to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

per Procurationem

Acting District Executive Manager:
Mrs. Ralefe MS

17/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: Matlala Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

pp Prof Research

Acting District Executive Manager:
Mrs. Ralefe MS

17/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: Dilokong Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter requesting to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

per Provincial Executive

Acting District Executive Manager:
Mrs. Ralefe MS

17/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: Groblersdal Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter requesting to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

Acting District Executive Manager:
Mrs. Ralefe MS

17/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: Mecklenburg Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter requesting to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

Acting District Executive Manager:
Mrs. Ralefe MS

12/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

Ref: 5/3/1
Enq: Mashiane PN
Tel: 0156332352 / 078 126 5414
E-mail: Philistus.Mashiane@dhsd.limpopo.gov.za

Date: 11 October 2019

To: Director: Hospital Services
Chief Executive Officer: ST Ritas Hospital

From: Human Resource Utilization and Capacity Development.

Subject: Approval for permission to conduct research: Mr. Sioga TR

1. The above matter bears reference.

2. The Head of Department of Health, Limpopo Province has approved a request to conduct research in our institution in respect of **Mr. Sioga TR**; therefore the Acting District Executive Manager for Sekhukhune grant permission to the applicant to visit your institution as he has specified in his individual application letter requesting to collect data.

3. Please take note that the approval for the research is valid for a period of 1 year. Also be informed that the collected findings from your facilities will be kept confidential and will not be made available for public use in any way by the applicant.

4. During assumption of data collection, Mr. Sioga will present himself to your offices, his scope of work and schedule on how he will be visiting your institution. The researcher's visit should not in any way disrupt the rendering of services during collection of data.

5. Hope the matter is found to be clear and understandable.

p/p Discretionary

Acting District Executive Manager:
Mrs. Ralefe MS

17/10/2019
Date

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

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Acting District Executive Manager:
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