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A RETROSPECTIVE ANALYSIS OF MATERNAL DEATH IN THE NELSON MANDELA ACADEMIC HOSPITAL IN EASTERN CAPE PROVINCE, SOUTH AFRICA FROM 2013 TO 2017

BY

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DECLARATION

I, ***Nosipho Sharon Majiki Student number 201816925***, hereby declare that "A retrospective analysis of maternal death in the Nelson Mandela Academic Hospital In Eastern Cape Province, South Africa from 2013 to 2017" submitted to the University of Fort Hare, Eastern Cape, is my own independent work and has not been submitted before to any institution by myself or any other person in fulfilment of any requirement for the attainment of any qualification.

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Date: 30 April 2023

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I, ***Nosipho Sharon Majiki,*** *student number* ***201816925,*** declare that I am fully aware of the University of Fort Hare's policy on research ethics and I have taken every precaution to comply with the regulations. I have obtained an ethical clearance certificate (REC-100118-054) from the University of Fort Hare's Research Ethics Committee: reference number: Ref #2021=05=09=MajikiN

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I, **Nosipho Sharon Majiki**, student number **201816925,** hereby declare that I am fully aware of the University of Fort Hare's policy on plagiarism and I have taken every precaution to comply with the regulations. All ideas and words that I have borrowed from other sources have been correctly and completely referenced.

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DEDICATION

I dedicate this mini-dissertation to the people who have contributed significantly to my life:

My parents: my late father Mr E. M. Majiki and his wife my late mother Mrs N. L. Majiki (mother), who have played a part in my upbringing. I will be forever grateful for unconditional love and support you give me throughout my journey, both personally and academically.

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LIST OF ABBREVIATIONS AND ACRONYMS

MDG	Millennium development goal
AIDS	Acquired immune deficiency syndrome
HAART	Highly active antiretroviral therapy
PMTCT	Prevention of Mother to Child transmission
HIV	Human immunodeficiency virus
MMR	Maternal mortality ratio
NCCEMD	National Committee for Confidential Enquiries into Maternal Deaths
NPRI	Non-pregnancy-related infection
WHO	World Health Organization
ICA	Incomplete abortion
PPH	Post-partum hemorrhage
PE	Pulmonary embolism
PO	Pulmonary Eodema
MMEIG	Maternal mortality estimation interagency
ESMOE	Essential Management of Obstetric Emergency

ABSTRACT

Background: Globally thousands of women die each year from preventable causes during pregnancy and childbirth. It is considered the key indicator of a country's progress in improving the health status of their communities these deaths of women could be prevented through the provision of the skilled birth attendance, emergency obstetric and neonatal care services and increase use of contraceptives. However, many poor countries cannot manage to provide these to pregnant women. It is unfortunate that the deaths of women in a family and community bring along many psychological and emotional factors in families and health services, because it leads to a long-term social and economic breakdown, both for the immediate family and the wider community. Furthermore, the cost of the maternal death to families, living children, and other dependents are widespread, affecting future generations and economic progress of the country. The study was conducted using patients' records women classified as maternal deaths at Nelson Mandela Academic Hospital in the 2013 to 2017.The aim of the study was to conduct a descriptive retrospective review maternal death causes, trends and contributory factors of maternal death in Nelson Mandela Academic Hospital in the year 2013 to 2017.

Methodology: It was a retrospective analysis, quantitative and descriptive study where 202 maternal death patients whose age was between 18 and 45 years old and were admitted in NMAH. Two hundred patient's files were reviewed and analysed over. Only record files of patient's that were admitted and died in Nelson Mandela Academic Hospital in Umtata due to pregnancy related conditions. Data were collected over a period of twelve weeks and analysed using descriptive statistics.

Results: The main primary causes of maternal deaths at NMAH were non-pregnancy-related, infections and avoidable factors that included lack of appropriately trained specialist and health personnel; delay in initiating care or delay of referrals; lack of blood products; managing patients at an inappropriate level of care; problem recognition; and sub-standard care in the referral hospitals. The patient related contributory factors were

unbooked patients, delay in seeking help and patients' refusal of medication or surgery or advice for religious reasons.

Keywords: Maternal deaths, maternal mortality; non-pregnancy-related infections, unbooked maternal patients, antenatal care, perinatal care and postnatal care.

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1. Introduction

Globally thousands of women die every year during pregnancy and childbirth due to preventable causes. An estimate of 830 women die from of pregnancy or childbirth complications every day. Maternal death or maternal mortality is widely regarded as a crucial indicator of a nation's success in enhancing the health status of its population (Sofer, 2018). The term "maternal death" refers to the demise of a woman during pregnancy or within 42 days of termination of pregnancy, regardless of the length and location of gestation, due to causes related to or aggravated by pregnancy or its management, excluding accidental causes (Apanga & Awoonor-Williams, 2018).

Maternal deaths are considered to be human tragedy with catastrophic effects on the family and community. These catastrophes could be averted through widespread provision of the skilled birth attendance, emergency obstetric, quality maternity services, safe abortion services and increase use of contraceptives globally and low and middle income (LIMIC) countries in particular (Miller & Belizán, 2015). The deaths of women bring psychological and emotional factors in family and health services, because it leads to a long-term social and economic breakdown, both for the immediate family and the wider community (GBD, 2016). The cost of maternal deaths to families, children, and other dependents are widespread. They affect future generations and economic progress of a country. There is therefore a need globally particularly developing countries to investment in maternal health and prevent high maternal deaths (Pattinson, et al., 2021)

Since maternal mortality is destructive and has serious consequences to the families and the communities, there is a need to understand the causes and factors that contribute to maternal deaths within the health services to prevent institution based maternal mortality rates. It is therefore, important that the health services should work hard to prevent and

diagnose early the risk factors and provide safe maternity care services to all women (GBD, 2016).

According to World Health Organization (2010) about 99% of maternal deaths occur in developing countries than in the developed countries. In 2013, 50% of Sub-Saharan Africa countries had maternal mortality ratio (MMR) above 300 per 100 000 live births (World Health Organization, 2014). The Sub-Saharan Africa institutional maternal mortality rates (iMMR) recorded during the same period of time show a slightly in regional hospitals. These maternal deaths were caused by pregnancy related and non-pregnancy related conditions. The non-pregnancy related infection such as immunodeficiency virus (HIV) infected pregnant women, tuberculosis (TB) and pneumonia that accounted for 34.7% of maternal deaths in countries like South Africa (South African Department of Health, 2015). The slow pace at which maternal deaths are reduced in under developed countries raise concerns about the world's ability to reach the set Sustainable Development Goals (SDG) of reducing maternal mortality to less than 70 per 100 000 births, with no country having a maternal mortality rate of more than twice the global average (World Health Organization, 2023).

Globally, many strategies for the reduction of maternal mortality health have been developed and implemented for example, the Millennium Development Goal (MDG) 5 was put in place to reduce maternal mortality by three quarter between 1990 and 2015. This MDG goal focused on the reduction of maternal deaths through the provision of universal access to reproductive health by 2015 (United Nations, 2010). However, by 2015 many countries including South Africa were far from achieve their goals. South Africa did not achieve its goal of reducing the maternal mortality ratio by three quarters between (Statistics of South Africa, 2015). This means that South Africa needs to work harder to address the shortfall in the achievements of the SDG 3 target by 2030.

1.2. Background of study

The new global 2030 Agenda for Sustainable Development, Goal 3 seeks to reduce global maternal mortality ratio to less than 70 per 100 000 live births (World Health Organization, 2016). Since 1994 several policies, laws and procedures which were intended to improve the health status of women and reduce maternal deaths in South Africa were developed and implemented. These are as follows:

- In 1994 free services for pregnant women and children, six years of age were introduced to improve access to maternal and child health services.
- In 1997, the choice of termination of pregnancy Act (1994) was introduced to reduce maternal deaths due to unsafe abortion.
- In 1998 the national committee for confidential enquiry into Maternal Deaths (NCCEMD) initiated maternal deaths notifiable by law in order to monitor institutional maternal deaths through confidential inquiries, whereby causes and contributory factors, challenges in health care delivery are identified.
- Recommendations that should be used to improve maternal care and prevent deaths of mothers in the affected institution and all other institutions through the Saving Mothers reports are made (South African Department of Health, 2012).
- The introduction of the National Strategic Plan for Maternal, New-born, Child and Women's Health and Nutrition (MNCWH&N) in South Africa (2012-2016) was meant to reduce the maternal mortality ratio by at least 10% by 2016 by improving coverage, quality and access to maternal health services and interventions (Statistics of South Africa, 2015).
- In 2012, the Campaign for Accelerated Reduction in Maternal and Child Mortality in Africa (CARMMA) was adopted to influence action towards improving maternal and newborn health and survival in South Africa (Statistics of South Africa, 2015).

Although the implementation of these policies, laws and procedures have reduced institutional maternal death ratio, these institutional maternal deaths are still unacceptably high. There was a noticeable reduction in institutional maternal mortality ratio from 160

per 100 000 live births in 2012 to 134 per 1000 000 live births in 2017. The major causes of maternal death in South Africa including the Eastern Cape Province are the following: non-pregnancy related infections such as human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), hypertensive disorders, obstetric haemorrhage, sepsis, and lack of skilled doctors and midwives (South African Department of Health, 2018).

Since 2011 a major reduction in deaths owing to non-pregnancy-related infections (NPRI) due to the introduction of antiretroviral treatment to all pregnant women living with HIV have been realised in South Africa. There has also been small drop in the number of deaths owing to obstetric haemorrhage. Deaths due to the complications of hypertension in pregnancy have shown a slight increase. These three biggest contributors are preventable and account for 64% of the avoidable causes of maternal deaths (South African Department of Health, 2018).

However, institutional maternal death due to obstetric haemorrhage increased from institutional maternal mortality ratio (iMMR) of 20.52 per 100 000 live births in 2002-2004 to 23.32 per 100 000 live births in 2011-2013. The iMMR figures due to hypertension reported from various provinces were estimated at 73.26 per100 000 live births. Cerebral complications related to hypertensive disorder in pregnancy and failure to lower very high blood pressure timeously was estimated at 58.2%. Pulmonary eodema was responsible for 34.3% maternal deaths in South Africa (Statistics South Africa, 2020).

According to Moodley et al., (2018) lack of skilled doctors contributed 51% of maternal deaths due to ectopic pregnancies, and 33% due to miscarriages, 46% due to pregnancy related sepsis, 48% due to obstetric hemorrhage and 71% due to anesthetics related cases.

Furthermore, obesity in pregnancy was associated with many adverse clinical outcomes among pregnant women in South African (Tisane, Van der Merwe & Hall, 2017). Other contributory factors indicated were the following:

- The poor attendance of antenatal clinics, poor clinical assessment as well as delays on referrals, not responding or unable to detect abnormalities in monitoring the patients and not following the proper standard protocols or guidelines were indicated as the most common health care provider avoidable factors.
- The lack of trained health care personnel was a significant contributory factor was recorded in 51% of women died due to ectopic pregnancies, 33% due to miscarriages, 46% due to pregnancy related sepsis, 48% due to obstetric
- Haemorrhage, 34%due to hypertension and 71% due to anaesthetic related case (South African Department of Health, 2016).

The triennial data and interim Saving Mothers Reports (SMRs) indicates an increase in the numbers of the case fatality rates from excessive bleeding, associated with caesarian deliveries (BLDACD), which increased from 78 cases in 2002-2004 to 221 during 2011-2013. The number was reduced slightly to 217 in 2014-2016. The case fatality rate from BLDACD dropped from 33.1 deaths per 100 000 caesarian deliveries in 2011-2013 and to 31 deaths per 100 000 caesarian deliveries in 2014-2016. Annual reviews indicate that BDLADC caesarian average rate (CAR) was the highest in 2012 estimated at 40 cases and a decline to 30 cases was observed in 2016 (Moodley et al., 2018).

According to the World Health Organization (WHO) (2019a) maternal mortality is an important measure of human and social development. Its analysis is conducted worldwide in order to identify the risks associated with pregnancy and childbearing, and economic and social factors that lead to negative pregnancy outcomes. Determining the level maternal mortality and associated risk factors is necessary for both diagnosing issues and assessing the progress and effectiveness of existing programmes meant to reduce maternal mortality.

According to Moodley et al., (2018) to reduce the maternal deaths challenges in South Africa, there is a need for intervention that target safer pregnancy and childbirth. Pregnant women should have access to fully equipped hospitals and a great need to improve

awareness among women concerning the importance of facility delivery. It is for this reason that the researcher wanted to conduct an analysis of maternal mortality at Nelson Mandela Academy Hospital to determine the trends and causes maternal mortality and contribute towards finding ways of reducing maternal mortality in this hospital. By analysing maternal death in Nelson Mandela Academy Hospital (NMAH) a from 2013 to 2017 could shed some light on the causes of institutional maternal mortality and assist the hospital to develop interventions that will contribute towards the reduction of maternal deaths in the health care services.

Maternal death has become an issue concern and measure of human rights and social development in the Eastern Cape Province. It gives an indication of women's overall value and social status in the province through the ability of the province to provide women with access to health care and timeous responsiveness of the health care system to women's health needs. Therefore, knowledge of the trends, causes and contributing factors of maternal mortality is important not only for identifying the risks associated with pregnancy and childbearing, but also for what it says about women's health, and their economic and social status. Determining the level maternal mortality and associated risk factors is necessary for diagnosing and assessing issues, progress and effectiveness of existing maternal health, and sexual and reproductive health programmes in South Africa and Eastern Cape Province in particular.

1.3. Research problem

South Africa like many countries worldwide, has been involved in a long struggle towards reducing maternal mortality in the last decades especially in deep rural areas. The Limpopo, Eastern Cape, North West, and Mpumalanga Provinces are composed of deep rural areas where people are staying far from the clinics and health care centers or hospitals. These provinces have the characteristics of low-income countries and continue to struggle with maternal deaths. The most leading and preventable cause of maternal deaths such as hemorrhage, and hypertension complications due to pregnancy and non-

pregnancy related infections including HIV/AIDS exist in these provinces (Statistics of South Africa, 2020).

The Eastern Cape Province is among the provinces that have high institutional maternal mortality ratio. Statistical estimations indicate that in 2016/2017 the Eastern Cape Province was the third highest in iMMR estimated at 135 per 100 000 live births. The maternal deaths statistics are based on District Health Information System (DHIS) and the maternal morbidity and mortality audit system (MAMMAS) programmes that are conducted in the health services to collect information from all provinces. The MAMMAS data and information collected for the Saving Mothers reports are published yearly and made available to all hospitals. Similarly the Triennial Saving Mothers reports are also made available to all health facilities. These programmes were meant to reduce institutional maternal death in the hospital, health centers and clinics. However, the number of maternal deaths, continue to increase in some health facilities of the Eastern Cape Province (South African Department of Health, 2019).

These increased maternal deaths particularly in hospitals raise concerns regarding the quality of prenatal, perinatal, postnatal care and management of women, recording events and referral processes through their care (Maluleke et al, 2018; Moodley, et al, 2018)
Although the records on maternal deaths and confidential enquiries reports are available in the hospitals, it is not clear whether these records are analysed regularly within the facilities to identify gaps in their maternal health services. It is also not clear whether the recommendations from maternal deaths hospital review committees are used to identify to develop interventions.

Therefore, there is a need to analyse these available data from records to identify trends, e causes of maternal death and challenges in maternity care services at NMAH to inform the health care services and those responsible for making policies to improve maternal health. It is also critical to determine the challenges of healthcare workers and problems in the management of pregnant women to improve maternal care services and reduce the maternal death in the (NMAH).

This study could contribute towards identify these causes of maternal death and challenges in maternity care services.

1.4. Aim of the study

The aim of the study was to determine trends, causes and contributing factors of maternal death that occurred in Nelson Mandela Academic Hospital between the years 2013 to 2017 using patients' records and maternal deaths review reports.

1.5. Research questions

The research questions of the study are:

- What are the trends of maternal death that occurred at Nelson Mandela Academic Hospital during the period 2013 to 2017?
- What were the causes of maternal death in Nelson Mandela Academic hospital during the period of 2013 to 2017 period?

1.6. Objectives of the study

The objectives of the study are to:

- Describe trends of maternal death that occurred at Nelson Mandela Academic Hospital during the period 2013 to 2017.
- Examine the causes of maternal deaths at the Nelson Mandela Hospital during the period 2013 to 2017.

1.7. Significance of the study

The significance of a study refers to a written statement that explains the importance, contribution/s and impact of the study in the area of the study. Its purpose is to make clear why your study was needed and the specific contribution your research made to furthering

academic knowledge in your field. It also indicates who will benefit from the research findings and how they will benefit (Hiebert, et al., 2023).

The findings and recommendations from this study was to assist maternity services in the NMAH to strengthen of the knowledge and skills of the health care professionals in assisting women during prenatal, delivery and post-natal period. They might identify challenges was to assist in improving pregnant women's knowledge, behaviour and attitudes towards prenatal care. The results could also assist the policy formulators to develop and strengthen policies and procedures concerning prevention of maternal deaths.

1.8. Limitations of the study

Limitations of a study are about the potential weaknesses that are usually out of the researcher's control, and closely related to the research design, statistical constraints and other factors (Theofanidis & Fountouki, 2019).

This study was limited to the NMAH maternal deaths and covered the period of 2013 to 2017. Some patients' records did not have all information needed for the study. When sampling, the researcher had limitations on equal distribution of the sample, age, marital status, educational status, marital status, socio-economic status and geographical area and whether the patients were coming from rural or urban areas.

The study was restricted to maternal deaths review record information and patient's file of maternal death pregnant mothers in Nelson Mandela Academic Hospital in the year 2013 to 2017. For that reason, the study's findings were limited, not being broad to the wider population. Furthermore, the study was retrospective, which means the results were based only on analytic contents of patient records and files not from certain individual patient.

Also, some of the information extracted from the patients' records and file might not have been completely accurate and could have affected the findings of the study. Another limitation of the study might be the fact that some of the information from the patients' records could not be validated with regard to the trends and causes of maternal death. When sampling, the researcher had limitations on equal distribution based on age, marital status, the geographical area that is rural or urban and socio-economic status.

1.9. Delimitations of the study

Delimitations are the parameters or boundaries or limits that the researcher consciously set for the study. They are concerned with the definitions that the researcher has set as the boundaries or limits of the study. Delimitations are mainly about the reasons for rejecting a certain course of action during the research process and giving reasons for not using certain available options. These limitations may make it difficult to draw conclusions and may influence the results (Coker, 2022; Theofanidis & Fountouki, 2019).

Some of the patients' record did not have the all information needed for the study. When sampling, the researcher did not have equal distribution based on age, marital status, the geographical area that is rural or urban and socio-economic status.

1.10. The layout of the study

Chapter 1 provides the study process from the introduction, study background, research problem, research aim, research objectives research questions and significance of the study, which guided the study to reach its findings and recommendation.

Chapter 2 contains the scientific discussion of the literature review that was done, which includes reviews of scientific journal article and the published reports.

Chapter 3 provides the research methodology which has been used for the study. It discusses the study setting, research design, sampling, data collection tool reliability, validity, data analysis and data collection process in detail.

Chapter 4 Presents and discusses the results of the study using bar charts and tables for categorizing data, standard deviation including ranges.

Chapter 5 Provides a summary of the study and discusses the conclusions and recommendations of the study based on the aim and objectives of the study.

1.11. Summary

The main purpose of this chapter was to provide the introduction and background the reader to the research problems that caused and trends of maternal death in NMAH. In chapter two the researcher there will be reviewing of literature and the findings of the view concerning the research questions.

In this study the researcher develops a clear understanding into the causes and the trends of maternal deaths. The results of the study provide the most important knowledge that may be important to the Department of Health in the Eastern Cape South Africa. The most important aim of the research study was no to determine the MMR of the different health in globally but to identify the trends, and the causes of MMR in NMAH in the Eastern Cape South Africa.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

In chapter two discusses the literature foundation of this study. It discussed literature related to maternal death that address the aim, research question and research objectives. The literature review conducted on the topic of the study is systematically arranged around topics that address different aspects of the maternal death concept. The review is divided according to topics related to the global understanding of maternal deaths and gives a global picture of maternal deaths, describes maternal death as a phenomenon, maternal deaths in developed and developing countries, and maternal deaths in the Sub-Saharan Africa and South Africa. These are further divided into subheadings related maternal deaths that assisted the researcher in understanding the different aspects of maternal deaths.

2.2. Presenting literature review on maternal death globally

Literature review was carried out to relate to previous studies on the maternal death or maternal mortality topic before planning the study. The purpose of the literature review was to familiarise the researcher with the latest knowledge and development in the area of the study as well as related areas to avoid the data redundancy. It also assisted the researcher to learn and understand the latest scientific evidence related to maternal deaths globally including the Sub-Saharan Africa and South Africa. Additionally, the literature review aimed at identifying the gaps in the knowledge, weaknesses and strengths of previous studies and how this study will add value to the available body of knowledge. It also served the purpose for the avoidance for the duplication of previous studies (Burns & Grove, 2016).

2.3. Maternal Death

Maternal death or maternal mortality has been defined by WHO as the death of a pregnant woman due to complications related to pregnancy and underlying conditions worsened by the pregnancy or management of these conditions. This can occur either while they are pregnant or within six weeks of resolution of the pregnancy (Patwardhan et al., 2016). Maternal mortality is an indicator about the quality of medical services of a country. It is a tragic event that is preventable if the mother is given proper medical care and access to health facilities. Maternal death is crucial issue in public health in developing countries due to its shocking size and decrease pattern. Due to strategy, intensive planning and implementation programmes in some countries remarkable progress has been made in reducing maternal deaths. However in developing countries where more than 90% of maternal deaths are occurring with small or no progress has been made (Mehboob et al., 2021).

The World health Organization's International Classification of Disease-Maternal Mortality (WHO ICD-MM) classified the type of maternal death into direct and indirect cause of maternal death. The direct causes are those resulting from obstetric complications of pregnancy state (pregnancy, labour, and puerperium) from interventions, omissions, incorrect treatment, or any of above (Say et al., 2014). In 2015, direct causes of maternal mortality accounted for about 86% of all maternal deaths globally The Indirect causes are non–obstetric deaths resulting from previous existing conditions or diseases, which develop during pregnancy not due to the direct cause, but aggravated by physiological effects of pregnancy by International Classification of disease (Desta, et al., 2022).

Methods to reduce maternal deaths should address both direct and indirect causes of maternal deaths. These methods must empower the healthcare providers with the necessary skills and health education to the family and mothers including females of childbearing age. The fact that hypertension has been one of the most conspicuous cause of maternal death indicates deficiencies in antenatal care, health education, intra-partum and postpartum care and management of women. The use of magnesium sulphate as

the essential treatment of eclampsia has been emphasised by WHO to prevent unnecessary deaths. However, eclampsia remains the most predominant condition associated with the maternal death in many of the member states of WHO (World Health Organization, 2019a).

2.4. Causes of Maternal Death

An estimated 287 000 maternal deaths occurred worldwide in 2010, most of which were in low-income and middle-income countries and were avoidable (Say et al., 2014). Some authors group the maternal causes of death as follows: Obstetric hemorrhage, pregnancy-related sepsis, embolism, hypertension disorders abortions, and other causes (Say et al., 2014**).** Other authors argue that many of these causes of maternal death in many countries were avoidable. There is therefore a need for the healthcare providers to have knowledge of all the causes of maternal death before the implementation of the prevention and treatment measures for all the causes of maternal death (World Health Organization, 2010).

2.5. Avoidable Causes of Maternal Death

Early booking is viewed by many authors as very important in monitoring the well-being of pregnant women and the foetus. The World Health Organization stressed the early antenatal care (ANC) coverage as a safe method to reduce the problem of maternal death as avoidable health challenges can be identified and treated early. Additionally, the recommendations are important for a pregnant woman to book early and have more than four antenatal visits during the pregnancy (Alemu & Aragaw, 2018).

Pregnant women younger than 18 years of age are at higher risk of pregnancy related deaths or complications than those aged 20 years and 35 years. WHO also states that the leading cause of 12% of female adolescent deaths were maternal complications and conditions. It is therefore recommended that health education to the families and mothers

must include females of mature groups as another method of reducing maternal deaths particularly in low income communities (Maswime & Buchmann, 2016).

Another challenge is the unavailability of magnesium sulphate and the absence comprehensive policies or protocols for the management of patients with severe hypertension and the prevention of eclampsia (Say et al., 2014). Therefore, ensuring the availability of the necessary treatments for maternal complication, and recruitment and training of skilled health care personnel that can provide quality maternal care from antenatal through intrapartum and postpartum is essential in order to curb maternal deaths in many countries. The healthcare systems in many countries must ensure that rural populations, lower socio-economic groups and emigrants have access to skilled health care workers during pregnancy, delivery and post-partum (Damian et al., 2019).

2.6 Maternal death globally

Globally, maternal mortality decline has been observed in different countries since 2000. However, the number of women that die every day is still unacceptable high. It is estimated that more than 800 women globally die every day due to preventable maternal complications (Girum & Wasie, 2017). Although according to the World Health Organization estimates a decrease in maternal mortality ratio maternal deaths remains unacceptably high particularly in low income countries. In 2020 maternal mortality rate in developing countries was estimated at 430 per 100 000 live births versus 12 per 100 000 live births in developed countries. Developing countries continue to account for an average of about 97% of the maternal deaths worldwide with South Asia and Sub-Saharan Africa contributing an average of 87% of global maternal deaths (World Health Organization, 2023; Bomela, 2020).

Another challenge is that countries with high numbers of maternal death ratios have minimum reliable vital statistics registry system making it difficult to get reliable data on maternal mortality. In these countries the level of maternal mortality is usually

underestimated and scanty information is available regarding locally specific contributory factors for maternal death (Maluleke et al., 2018).

2.7 Causes of maternal death globally

Globally, about 75% of all maternal deaths are due to obstetric hemorrhage, unsafe abortion, infections, hypertensive disorders of pregnancy and obstructed or prolonged labour. The underlying causes for maternal deaths are socio-economic status, inequity, not accessible, or unaffordable health care, poor access to resources, status of women and uneducated (Pattinson, et al., 2022).

The systematic review of causes of maternal death in developed and developing countries show inequity in accessibility of quality in health services which shows the inter space between rich and poor. The global MMR in low socio-income countries in 2016 was 362 per 100 000 live births versus 10 per 100 000 live births in high income countries. While that of the Sub-Saharan Africa maternal mortality rate for 2016 was 545 per 100 000 which was way more than the global average. In 2020 the MMR in low-income countries was 430 per 100 000 live births versus 12 per 100 000 live births in high income countries. This raises questions on whether low income countries will be able to reach the 70 per 100 000 target of SDG (World Health Organization, 2023).

Most of the causes of maternal deaths are preventable. To ensure that maternal deaths are prevented healthcare providers must have knowledge of the causes, skills to prevent and manage complications efficiently. Healthcare services must ensure that all women have access to high quality care in pregnancy, and during and after childbirth. It is also vital to prevent unintended pregnancies to prevent unsafe abortions. All women and adolescents must have access to contraception, safe abortion services and quality post-abortion care (Tang, 2022).

Among the global causes of maternal deaths, 23% and 7% categorized as indirect causes and direct causes respectively. About 14.2% as obstetric hemorrhage of which include

ante-partum and postpartum hemorrhage are the most prominent cause of the maternal death. The direct maternal deaths are those related to obstetric complications during pregnancy, labour or puerperium (six weeks) or resulting from any treatment received. Indirect deaths are those associated with a disorder, the effect of which is exacerbated by pregnancy (Jahvan, 2018; Neal et al., 2016). One-third of maternal deaths in developing countries are caused by maternal infection while maternal death caused by sepsis amount to 4.6% (Say et al., 2014). Similar findings were observed in Nigeria where wound infection was found to be the most common maternal complication estimated at 48.2% (Ubom, et al., 2021).

2.8 Maternal death in developed countries

Maternal deaths in developed country are way below the global average due to the fact that in most of the developed countries, they have high number of midwives and Obstetricians that provide quality care in the maternity sections. They also provide quality care at primary care through antenatal care which play a central role in the provision of care to pregnant women. Many of the maternal deaths in developed countries occur post postpartum. To curb this challenge, many of these countries provide home visits to all pregnant and postpartum women and paid parental leave in the postpartum period. However, the United States of America (US) is the only country that does not guarantee pregnant and postpartum women access to home visits or paid parental leave in the postpartum period. This could be responsible for the high number maternal death in the US when compared with other developed countries. According to Hoyert (2023) maternal mortality in the US has increased between 2019 and 2021. In 2021, 1,205 women died of maternal causes in the US compared with 861 in 2020 and 754 in 2019. The maternal mortality rate for 2021 was 32.9 deaths per 100,000 live births, compared with a rate of 23.8 in 2020 and 20.1 in 2019. The increase could be related to shortages of maternity personnel and challenges of accessing needed health care during the COVID 19 Pandemic.

2.9 Causes of maternal deaths in developed countries

The common causes of maternal deaths in developed countries are infection, hemorrhage and hypertensive disorders of pregnancy, which accounted for 60-70% of maternal deaths between 2006 and 2010 in these countries (Creanga, 2017). Among the developed countries maternal deaths in the US has the highest maternal deaths reported and has been increasing since 2000. The increase has been alluded to the undersupply of maternity care providers, especially midwives and lack of comprehensive postpartum supports. In 2018 the US was estimated to be having 17 maternal deaths for every 100,000 live births with New Zealand and Norway were having the lowest maternal death estimated at 1.7 and 1.8 per 100 000 livebirths (Tikkanen, et al, 2020). According to Ghazal-Aswad (2013) an acute increase in maternal mortality was observed in a high income country in the Middle with hypertensive disorders (59.5%) and hemorrhage (39.6%) being the leading causes.

2.10 Maternal deaths in developing countries

Maternal mortality is much higher in developing countries as compared to developed nations due to the lack of sufficient medical care, high statistics of infectious diseases and health care differences. India and Nigeria account for one third of the global maternal deaths. Beside the effect of health issues pregnancy, disabilities among mothers and children can also occur slowing down socio-economic development efforts in developing countries. There is a need that studies and intervention strategies should consider the effects of the broader health and social indicators like contraception to deal with maternal deaths in developing countries. Also as these countries lack of sufficient medical care, and have high statistics of infectious diseases and health care differences interventions to curb maternal deaths should address these challenges (World Bank, 2016.)

2.11 Factors causing maternal deaths in developing countries

Rodriguez (2021) describes the following as factor causing maternal deaths in developing countries: Lack of access to available technology and medical knowledge, poverty and inadequate care in time to address complications, high rates of child marriage and

unintended pregnancies. These factors need to be addressed to ensure that developing countries reach the SDG target of reducing maternal death to 70 per 100 000 live births by 2030. It is also important that health care personnel manage maternal deaths in accordance with the standard guidelines of clinical services. Insufficiencies in skills, number of personnel and facilities need to be determined and addressed to ensure that women receive quality care that will lead to positive pregnancy outcomes. This requires ongoing training of health care personnel and continuous assessment of their understanding in order to improve their capacity to contribute to the strategy of decreasing maternal deaths (Tikkanen, et al, 2020). According to Agrawal et al. (2014), better management of pregnancy, delivery and postnatal care by healthcare personnel could have prevented a certain number of maternal deaths.

An analysis of avoidable factors conducted by Merali, et al., (2014) in low and lower-middle income countries showed that 64.2% of the avoidable factors associated maternal death were linked to health care workers. Another avoidable factor recognised in the study was related to the pressure of the community on the family actions such as the influence on the mother by the community and the control of agreement by the community members. Due to the influences from the community and control of decision-taking by the community, many women are unable to understand danger signs related to pregnancy. It also creates mistrust between individual patients and their families, and healthcare provider and healthcare facilities (Merali, et al., 2014).

According to Rai et al. (2012) avoidable factors include the women's consciousness of signs and symptoms of the dangers of pregnancy, accessibility of the healthcare services, transport to healthcare services, affordability and the quality of care at the healthcare services. Rai et al. (2012) emphasised the importance of contraception, safe abortions, early booking antenatal care, well trained birth attendants, and basic emergency obstetric management as interventions in order to avoid maternal deaths.

Furthermore, unavailability of blood transfusion is described as a factor causing maternal deaths, because of its role in dealing with emergencies in obstetrics particularly obstetric

haemorrhage. The unavailability of blood when women need blood transfusion can be due to lack of material to collect the blood, shortage of blood contributors and inaccessibility blood bank (Rai et al., 2012).

The findings of a retrospective study by Combs Thorsen et al., (2012) in order to determine the community and facility challenges causing maternal death in Malawi indicate that delay in seeking help by the pregnant women was controlled by the presence of traditional midwives. Also, the inability to recognise the signs and symptoms and severity of the maternal problem was due to lack of knowledge on maternal emergencies and complications (Combs Thorsen et al., 2012). Internationally as a whole, shortage of skilled healthcare workers and use of unskilled birth attendants at births has been recognised as an avoidable factor in developing countries and specifically in Africa. There is a need to develop more skilled maternity personnel and birth attendants. However, the increase in their numbers alone is not sufficient. Hence, the quality of care by the skilled birth attendant should be the focus as well (Rai et al 2012).

The high rate of maternal mortality is also linked to maternal delay proposed which include delay in making decision to seek maternal health care, delay in locating and arriving at a medical facility and delay in receiving skilled pregnancy care when the woman gets to the health facility. It is therefore important that developing countries should work hard towards improving the accessibility, availability, affordability and care quality antenatal care in order to reduce the high rate of maternal mortality. Another factor contributing to maternal death in developing countries was unsafe abortions contributing about 13% of maternal deaths worldwide. In Africa, 99% of abortions are unsafe resulting in one maternal death per 150 cases. The prevalence of unsafe abortions in developing countries are associated with restricted abortion laws, poor quality of health service, and low community awareness (Gebremedhin. et al., 2018).

2.12 Maternal death in Sub-Saharan Africa (SSA)

The knowledge of the leading cause of maternal death in sub-regions and countries is crucial because it helps governments, local partners and global health organization to intervene in the management of maternal mortality. In 2017 the Maternal Mortal Estimation Interagency Group (MMEIG) estimated that 295 000 maternal death occurred in the SSA (Musarandega et al., 2021). In 2017 the Sub-Saharan Africa accounted for approximately two-thirds (196 000) of maternal deaths. Nigeria had the highest maternal deaths at 67 000 followed by the Democratic Republic of Congo at 16 000, Ethiopia at 14 000 and Tanzania at1 1,000 per 100 000 live births. The following Sub-Saharan countries maternal deaths of less than 150: Seychelles had the lowest estimated at 53, followed by Cabo Verde at 58, Mauritius at 61, South Africa at 119, Sao Tome and Principle at 130 and Botswana 144 per 100 000 live births (Tongun et al, 2019; World Health Organization, 2019b).

Obstetric hemorrhage, hypertensive disorders in pregnancy, non-obstetric complications, and pregnancy-related infections are the leading causes of maternal deaths in SSA. In sub-Saharan Africa, it is estimated that 390 women will die in childbirth for every 100 000 live births by 2030. The 2020 SSA maternal mortality ratio was 390 deaths per 100 000 live births when compare to the global ratio of 223 maternal deaths per 100,000 live births. Although a decline of 34% maternal deaths was experienced globally in 2020, maternal deaths are still way above the targeted 2030 SDG particularly in SSA. There is therefore a need for SSA countries to prioritise maternal care and take actions to implement available intervention strategies that will reduce MMR (World Health Organization, 2023).

Since many women who experience maternal death in SSA live in poverty and do not receive adequate care on time to address complications, maternal health interventions programmes must address women's socio-economic issues to reduce maternal deaths. Other contributing factors include high rates of child marriage and unintended pregnancies. There is therefore a need in the SSA to ensure the protection of female children from harmful influences, abuses and exploitation in families, cultural and social life. Countries

in the SSA must also ensure that contraceptives are made available and accessible to all women of reproductive age at all times (Rodriguez, 2021).

According to the Fragile States Index in the year 2016 the 13 countries were observed as to be a high vigilance being a fragile state (South Sudan, Somalia, Central African Republic, Yemen, Syria, Sudan, the Democratic Republic of the Congo, Chad, Afghanistan, Iraq, Haiti, Guinea, Zimbabwe, Nigeria and Ethiopia), and these 15 countries had MMRs in 2016 ranging from 32 (Syria) to 1140 (South Sudan). Many pregnant women in these countries had more deliveries than those women in developed countries, and the risk of maternal death are due to the high numbers of pregnancies (Messner & Haken, 2016).

Furthermore, the women on maternal death risk are aged 15- to 20-year-old woman will eventually die from a maternal cause, though in high income countries, this is 1 in 4300, versus 1 in 55 in low-income countries (World Health Organization, 2015).

2.12.1 Causes of maternal death in SSA regions

Obstetric hemorrhage was commonly leading cause of maternal death in each of the three SSA regions with the proportion of maternal deaths (28.8%), followed by hypertensive disorders in pregnancy as the second leading cause of maternal death (22.1%). However in Central Africa, East and West Africa regions including the third in Southern Africa, where non-obstetric complications (18.8%) were the second leading cause. Pregnancy-related infections were the fourth leading cause in SAA estimated at 11.5% (Musarandega, et al., 2021).

In Obstetric hemorrhage the post-partum hemorrhage was the leading cause of death in the obstetric hemorrhage group. In hypertension disorders complication conditions pre-eclampsia/eclampsia and imminent eclampsia was the leading cause in pregnancy group, and puerperal sepsis the leading cause in the pregnancy-related infections group (Alkema et al., 2015).

2.12.2 Uganda

The institutional maternal mortality ratio has decreased by 44% since June 2012. The proportion of major obstetric complications that died before in facilities has decreased over the course of the initiative (USAID, 2012). Half of the deliveries in Uganda almost 53% occur in health care facilities and 56% of other deliveries assisted by a traditional birth attendance with the 57% at least over the period of 10years (Ngonzi et al, 2016).

2.12.3 Nigeria

Nigeria had the highest number of maternal deaths in the world in 2014 and contributed in 15% of all maternal death globally (Sageer et al, 2019). A total of 44 000 of women died in Nigeria from complications of pregnancy and childbirth in 2013, making Nigeria the second highest contributor of maternal deaths globally. The 2013 statistics in Nigeria shows the maternal mortality ratio in Nigeria of 560 maternal deaths per 100 000 live births making it to be the highest in the world. The low levels of health facility delivery, lack of well-trained birth attendance at birth and the inadequate use of modem contraceptive methods, all contribute to poor maternal outcomes (Allagoa & Kotingo, 2019).

2.12.4 Zambia

The causes of maternal death in Zambia were direct maternal deaths obstructed labour and sepsis of 71%. The challenge of primary inappropriate choice of abortion services, shortage of antibiotics, poor blood supply by Blood Banks and poor monitoring of vital signs contributed to the 71% of maternal deaths. The delay of seeking care had important role in all maternal death of 28% and poor accessibly to health care services implicated in 24% of maternal death cases (Kabuya et al, 2020). Similar findings were observed in Mozambique where the three delays also contributed enormously to maternal deaths. There is therefore a need to strengthen referral systems, early diagnoses and manage pregnancy related complications. Both health professionals and communities must understand the impact of the delays on maternal health outcomes in the different settings, home, clinics and hospitals (Chavane et al., 2018).

Since the beginning of saving mothers giving life initiative in Zambia, maternal mortality ratio has decreased by 50% in health facilities. The learning districts hospitals in Zambia have a goal to improve maternity services with a goal of reducing maternal mortality by up to 50% in 5 years (Gaffey et al., 2015).

2.13 Maternal death in Republic South Africa (RSA)

The national system for maternal death enquiries into maternal death was implemented in the South African National Department of Health in October 1997 in South Africa. Seven triennial reports since 1999 have been submitted for the Confidential Enquiries into Maternal Deaths (NCCEMD) by the South African National Committee to the minister of health with recommendation on guidelines to reduce maternal mortality (South African Department of Health, 2012).

The NCCEMD was responsible to submit the report to the Minister of health in every three years for the approval and publication. This reports provide valuable statistics related to maternal death and recommendation for the reduction and prevention of maternal death. The causes of maternal death, maternal age, institution death, parity, contributory causes and avoidable factors were the indicators that were used by NCCEMD committee (MacDorman et al., 2021).

2.13.1 Causes of Maternal Death in Republic South Africa

The most common leading causes of maternal death in South Africa during the period of 2008 to 2010 were the non-pregnancy related infections which were mainly HIV infection and other pre-existing conditions such as TB (South African Department of Health, 2014). Similarly, non-pregnancy related infections and hypertension were the most common cause of maternal death including pre-existing medical conditions in the subsequent years.). In 2011-2013 Saving the Mothers report non-pregnancy related infections constituted 34.7% of maternal deaths in South Africa due to HIV infection and complicated by TB, pneumocystis pneumonia and pneumonia, obstetric haemorrhage contributed 15.8%, complications of hypertension in pregnancy at 14.8%) and medical and surgical

disorders were at 11.4% (South African Department of Health, 2015). Before 2008 the common direct cause was hypertension disorder in pregnancy. The change was brought about by the implementation of national guidelines for the management of hypertension disorder in pregnancy (Damian et al, 2019; Visintin, et al, 2010).

The most common causes of maternal death in RSA are due the patient related factors such as acceptable and affordability of health care services, lack of health care resources to provide a good quality maternal health care service (South African Department of Health, 2012).

The first full scale of the report into maternal deaths in South Africa was announced in October 1999, and acted towards the details with maternal deaths that occurred in the year1998. The data information used for this report contain the maternal deaths that occurred in 1999 and were announced to the National Committee for Confidential Enquiries into Maternal Deaths (NCCEMD) secretary Data used for this report consist of the maternal deaths that occurred in 1999 and were reported to the National Committee for Confidential Enquiries into Maternal Deaths (NCCEMD) secretariat (South African Department of Health, 2012).

2.13.2 Primary cause of maternal death in RSA

The maximum regular cause of maternal deaths in all levels of care setting in RSA was non-pregnancy- related sepsis, (level 1, 32.9%, level 2, 31.6% and level 3, 27.0%) 2011 and 2013. The difference between the year 2011 and 2013 of the rate of the disease at the various levels of care was difference. The complications of hypertensive diseases in pregnancy and as a cause of maternal death, has declined in between 2011 and 2013. However, this is not due to the proper management of hypertensive diseases in pregnant mothers but there were increase in deaths due to non-pregnancy related sepsis. Complications of hypertension remain the cause of direct maternal deaths in level 2 and three hospitals (32.1% and 32.0% respectively) with obstetric hemorrhage being the commonest direct cause in level 1 institutions (33.2%). The relative importance of

puerperal sepsis has increased at each level, most dramatically in level 1 institutions South African Department of Health, 2012).

2.13.3 Maternal death per province in RSA

South Africa has a high maternal mortality rates for some decades of which in 1998 was estimated by Healthy Survey and demographic state that every 100 000 live birth 160 women died due to child birth. The current statistics in South Africa reported that the number of maternal death in hospital has been decreased to 88 per 100 000 live birth in 2020 from 145 per 100 000 in 2012 which report much improvement of maternal death specific in hospital except maternal death occurred outside hospitals (Statistics South Africa, 2022).

The report shows differences among the provinces with Western Cape 44 death and Mpumalanga 67 deaths showing the minimal numbers of maternal death per 100 000 live births. Provinces with high numbers of maternal death are Free State 108 deaths per 100 000 live births, Northern Cape 108 maternal death per 100 000 live birth, and Eastern Cape 108 maternal death per 100 000 live birth of which not because of the resources that is not available but due to poverty related issues. South African Medical Journal reported that the pregnant mothers died between March and December 2020 increased by 21.2% (Statistics South Africa, 2022).

2.14 Factors contributing to maternal deaths

There many contributory factors of maternal mortality which are preventable. These factors include inadequate human resource for health, delay in seeking care, inadequate equipment, lack of ambulance transportation, and delay in referrals services (Sageer et al, 2019). There are other factors that increase the risk of maternal death which include: existing health condition of the pregnant woman, age, life style, parity, multiple pregnancy, socio-economic background and gender inequality (Diana et al., 2020).

2.14.1 Age

Maternal death is influenced by age of the pregnant woman. A pregnant woman younger than 17 years of age has a high-risk complications pregnancy-related maternal death than the women with the age of 18 to 30 years of age. WHO reported that 15% of young women or adolescence death was due to maternal conditions, which were the leading cause of maternal death for this group (World Health Organization, 2010).

2.14.2 Gender inequality

In countries such as developing countries, girls and have less opportunity to get treated for the infection, because of not attending the antenatal clinic they prefer the additional midwives. They do not have a choice of choosing the mode of delivery in case of an emergency because they not well educated (Morgan et al., 2017).

2.14.3 Socio-economic status

The following factors contributed to increase rate of maternal mortality rate: lack of education, family planning, long distance to the clinics, and lack of transport, bad road, and long travelling distance to the clinics. High blood pressure, post-partum hemorrhage with high quality care rendered buy skilled health care personnel can be prevented (Department of Health, 2013).

To reduce maternal, the provision of skilled health care workers trained to provide appropriate advice during pregnancy and motherhood where necessary. The reduction of maternal death continues to fall each triennium by 12.8% from 2008-2010 and 2010 to 2013 was 12.5%. From 2008-2010 an overall reduction of 1152 (World Health Organization, 2010).

2.14.4 Parity

This is the number of women becoming pregnant. Some chances of having complications during pregnancy are low but very high in the first pregnancy. Nevertheless, after more than five or six pregnancies the risk of complications increases (Say et al., 2014).

2.15 Direct causes of maternal death

There are seven main direct causes of maternal deaths in the South Africa. These include obstetric hemorrhage, hypertensive diseases, abortion, sepsis or infections, obstructed labour, ectopic pregnancy, embolism, and anesthesia-related death (World Health Organization, 2010).

2.15.1 Post-partum hemorrhage (PPH)

Post-partum haemorrhage is defined as an excessive bleeding of more than 500mls after birth or after 24-hours follow by birth. Post-partum haemorrhage can be managed by a well-trained health care provider can manage the bleeding. However, in the absence of a well-trained, knowledgeable and experiences health care provider a woman can complicate or die from excessive bleeding. Post-partum haemorrhage is the most leading cause of maternal death estimation of 28% in the worldwide (Say et al., 2014).

2.15.2 Infection

Many women develop an infection from backstreet abortions, poor sanitary dispose prolong labour. Urinary tract infection (UTI) or respiratory tract infection pneumonia can trigger the body and cause pulmonary tuberculosis (PTB). A lack of knowledge of personal hygiene before and after delivery can also develop infection after childbirth can be eliminated if good hygiene is practice and if early signs of infection are recognized and treated in a timely manner (Say et al., 2014).

2.15.3 Termination of pregnancy (TOP)

Unsafe abortions or back street abortions is also a leading cause of death among women who unattended antenatal bookings which consist of 8 % of the maternal deaths in the world (Republic of South Africa Government Gazette, 1996).

2.15.4 Pulmonary embolism (PE)

It has a cloth that is accumulates the lungs, which can develop after delivery, and the risk is high in cesarean sections (C/Sections), which account for 4% of maternal deaths (Raul, 2015).

2.15.5 Caesarean section

The risk of death from anesthesia in women undergoing obstetric procedures was 1.2 per 1000 women go for obstetric procedures (Raul, 2015).

2.15.6 Other indirect causes

Death of a woman from the unknown cause, which estimates 27% of maternal deaths (Slone McKinney et al., 2017). The pre-existing cause cardiac, anemia HIV that can be accelerated by pregnancy (Raul, 2015).

2.15.7 Direct complications

Conditions like Antepartum hemorrhage (APH) uterine rupture and ectopic pregnancy can lead to complications of maternal death without proper management and well-trained staff personnel (Say et al., 2014).

2.15.8 Administrative avoidable factor

In adequately trained skilled Doctors was the major common administrative avoidable factor in Republic of South Africa (RSA). Other administrative avoidable factors included the lack of intensive care beds as well as lack of Transport (South African Department of Health, 2012). The knowledge of the underlying factors of maternal death is important in order to avoid maternal deaths (Rai, 2013).

The Nursing Act, 2005 (Act no .33 of 2005) indicate that on chapter two section 30 in order to practice independently. There was also a patient related factor, which based on patient behavior, community factors, socio-economic factors, and political influences. Saving Mother, recent report showed the delay in seeking the medical abortion and lack clinical attendances in Antenatal care services, which were the most important

administrative avoidable factors in South Africa (South African Department of Health, 2012). The acceptance of accountability for maternal deaths by the staff and the protection of human rights need to be the part of a strategy for maternal care (De mesquite & Kermode 2012). The knowledge of the underlying factors of maternal death is important in order to avoid maternal deaths (Rai, 2013).

2.16 Methods for the reduction of maternal death

The education of women during antenatal bookings, at the school where there are teenagers, the use of contraception more birth attended in health facilities, adequate prenatal care, skilled health care providers, availability of antibiotics with proper management, early identifying of abnormalities can help to reduce maternal mortality rates (World Health Organization, 2010).

2.16.1 Access to health care

Employment of skilled health care personnel and health management by following protocols and guidelines, management of pre-existing conditions with safe procedures can prevent death during pregnancy. School campaigns and awareness including nutrition services and reproductive health services are important for teenagers and young women (Say et al., 2014)

2.16.2 Education

Family planning education in postnatal before discharged can prevent unplanned pregnancy and unsafe abortions cause young men and young women who know about reproduction, fertility, birth control and the consequences of the unprotected sex can do better and informed choices (Moodley, et al 2018).

The statistics of 2008 -2010 Saving the Mothers report the three conditions that have been contributed on to the majority of the prevention of maternal death has been identified which are non–pregnant related infections, the complication of hypotensive effect of blood pressure (HTP) HTP and obstetric hemorrhage (South African Department of Health,

2013). These three contributors may have common preventable factors, which mostly related to the knowledge and skills of the health care providers and the challenges within the health care system. The recommendations that have been made by the Department of Health in South Africa is to reduce death from HIV, proper management of obstetric hemorrhage, reducing death on HTP, training of health care providers, strategies of proper referrals and the health system strengthening (Moodley et al., 2014).

2.16.3 HIV/AIDS

According to the South African National consolidated guidelines for the prevention of mother-to-child transmission of HIV (PMTCT) and the management of HIV in children, adolescents and adult (2015), the issuing of the treatment to HIV positive patient irrespective of CD4 count, interventions such as community educations, prevention of prolonged labour especially after ruptured membranes, prevention of anemia or proper management of anaemic pregnant women, use the safe method in the management of the third stage of labour are paramount in the reduction of maternal deaths in the country (National consolidated guidelines for the prevention of mother-to-child transmission of HIV (PMTCT) and the management of HIV in children, adolescents and adult 2015). Severe obstetric hemorrhage is an emergency, which required a team approach and immediate attention to identify the cause of hemorrhage (Department of Health, 2018).

2.16.4 Hypertension

Early detection of hypertension, early referred and timeously of women in HTP and complications must be recognized as the life-threatening condition, which required attention. All maternity facility must have protocols and guidelines to administered MgSo4 regime to prevent seizures and women monitored closely before and after birth and manage Urine Protein. The promotion of choice of termination of pregnancy (TOP) due to severe HTP, and family planning services accompanied by health education by the community at large (women, their spouse, families, and communities (Alkema et al., 2016).

2.17 Summary

From this chapter the findings of literature review show the evidence of the causes of maternal deaths in developing countries which are not similar in Sub-Saharan Africa. The Obstetric hemorrhage is the most of the three-leading cause in maternal deaths globally. The causes of maternal death in South Africa are similar to the avoidable factors for Sub Saharan Africa with one exception which is unsafe abortion. The essential of antenatal care, usage of essential drugs, training of health care personnel and level of care supported by the studies applicable to the develop as well as South Africa including developing countries.

The results of literature review presented in this chapter related to the objectives of this study. It is clearly and understood that the management of hypertension as the cause of maternal death is essentially in order to decrease maternal death. The causes of maternal death in SSA and maternal developed countries are not the same.

CHAPTER THREE

RESEARCH METHODODLOGY

3.1 Introduction

Research methodology refers to the techniques used by researchers to collect and analyze relevant data related to their research questions (Polit & Beck, 2017). For this study, a quantitative descriptive design, which involved a formal and systematic process of collecting numeric data to understand certain aspects of the research problem was employed (Grove et al., 2013). Additionally, the importance of reliability, validity, and ethical considerations during the implementation of the research process are discussed.

3.2 Research design

The study was the quantitative retrospective cross-sectional design using information extracted from files of maternal patients who died in NMAH and maternal review reports for the period 2013 to 2017. The main purpose of choosing the retrospective study design was to obtain information of the participant from a documentary source which was inexpensive, easily accessible and also allows historical comparison of causes of maternal - deaths trends for the period of 2013 to 2017.

3.3 Study setting

The study was conducted at Nelson Mandela Academy Hospital at Umtata in Eastern Cape under the OR Tambo district in the King Sabbath Dalindyebo Sub-District. The population was mixed urban, rural, and mainly rural- communities use this facility. NMAH is academic hospital and the catchment was the whole districts of OR Tambo District. It receives patients referred from all the healthcare facilities in the OR Tambo District. NMAH has 13-specialist doctors who are obstetricians and gynecologists, 20 medical internship doctors and 50 student doctors and four specialist-registry doctors allocate in

the unit per day. One specialist with two medical officers and two interns were allocated during the night. Six students allocated to this unit monthly in different cubicles labour ward, antenatal ward and gynecology ward.

The hospital has an Obstetrics and Gynaecology (O and G) unit which has a bed capacity of 72. It is divided into four sections namely, Antenatal, Labour, Post-natal and Gynae. The staff compliment for O and G is as follows: 38 Midwives, eight Enrolled nurses, six assistance nurses.

The 2018 statistics in the NMAH O and G section indicates the following: More than 1% of pregnant women referred in NMAH were married. The age range is between 15-40 and the number of previous pregnancies ranged from 0-15. Many hospitals around OR Tambo district refer their critically ill and abnormal maternity cases to NMAH. This situation leads to increase number of maternity cases admitted in labour ward resulting in increased overload and institutional maternal mortality rate estimated at an average of 55 maternal deaths per year (Nelson Mandela Academic Hospital database, 2018).

3.4 Population of the study

The population of the study is described as the entire aggregation of cases that meet specific criteria (Polit & Beck, 2017). The population of this study was all files of women who died during pregnancy, delivery and six weeks after delivery at NMAH. No human beings were used in this study. The following documents were used as sources of information: Labour registers and records, maternal death registers and records of maternal deaths reviews that occurred at NMAH between 2013 and 2017.

3.5 Sampling

Sampling is the process of selecting a portion of the population to represent the entire population under study (Polit & Beck, 2017). For this study, the record files of women who had died during pregnancy, delivery, and up to six weeks after delivery were classified as

maternal deaths at NMAH O and G department were used. The files were selected using simple random sampling technique. The sample size was calculated based on the suggestion of the statistician. Simple random sampling is a probability sampling technique that involves randomly selecting a sample of participants from a population, with each member of the population having an equal chance of being selected (Creswell & Creswell, 2018).

To compile the sample list for this study, a list of women in the maternal death registers of NMAH from January 2013 to December 2017 was created using Microsoft Excel, with the computer used to randomly select the sample. The target sample size was 70 patient files per year, but for years that had fewer than 70 files, all files were included, and for years with a high number of maternal deaths, a proportion of files were randomly selected. However, due to incomplete and missing documents, the final sample size for this study was 200 patient files.

3.5.1 Sample size

A sample of size of 381 is the required minimum sample for an infinite population at a confidence level of 96%, the precision level of +-5%, and at a maximum variation of 50%. The target sample was divided into about 70 patients' files each year, but for the years that had less than 70 maternal deaths all files were included. The following formula was used to calculate sample size for the study:

$$n = \frac{z^2.N.\partial_p^2}{(N-1)e^2 + z^2\partial_p^2}$$

The sample size was used for the following formula as indicated by Singh and Masuku (2013). However, due to low numbers of maternal deaths, incomplete and missing documents the sample size was 200 patients' files was as follows:

Table 3.1: Distribution of the sample per year

Year	Number of files	Percentage (%)
2013	35	17.5%
2014	44	22%
2015	58	29%
2016	33	16.5%
2017	30	15%
Total	**200**	**100%**

3.6 Inclusion criteria

All record files of maternal death patients that occurred at NMAH from January 2013 to December 2017 and are in the record room of the hospital was included in the study. The records must have all the required documents and complete.

3.7 Exclusion criteria

All record files of maternal death patients that occurred at NMAH from January 2013 to December 2017, but their records were not in the record room of the hospital during the time of the study were excluded. Also records with missing documents was excluded from the study.

3.8 Data collection

Data collection was conducted at NMAH from the 15 September 2021 to 16 December 2021. Data collection was done in a lockable private quiet room that the researcher had request from the facility manager for data collection. Only the researcher was having access to the room and its key during the data collection period.

The room was locked when the researcher leaves the room. This was ensured that the patient's files are kept confidential and not accessible to unauthorized people. The individual files were referred to using a code number and the codes was only be known to the researcher.

3.8.1 Research instruments

Data collection tool was a structured information collection sheet developed to collect the required information from the files and records. The information was extracted from patient files, labour registers, maternal death case review reports, and maternal mortality registers of the hospital. Data collection was done over a period of three months. The data collection sheet was consisting of the following: demographic data, antenatal care, labour and perinatal care and postnatal care information including all investigations, specialized care, and treatment received. The collected was stored in locked cupboard to maintain confidentiality. All electronic data was stored in a password-protected computer. Access to the database was restricted to the researcher and supervisor. Data was stored as per the university's protocols. Any identifiable information that was collected was remain confidential and only accessible to the researcher and supervisor.

3.8.2 Pre-testing of the instruments

The validity of instruments is a determination of the extent to which the instrument actually reflects the abstract construct being examined (Burns & Grove, 2016). The instrument was tested to check or assess if the items on the data collection sheet addresses and measure what was supposed to or intend to measure. This was tested using four patients' record of maternal deaths that occurred in 2020 and had already gone through the reviews. The collected data was analyzed and instrument updated based of the findings of the pre-testing. However, the results of the pre-test did not form part of this study results.

3.9 Data analysis

Data was analyzed by means of a Statistical Package for the Social Sciences (SPSS 24) where by the frequency distribution and cross tabulation was used. The causes of maternal mortality were analyzed and displayed in the form of mean, standard deviation, and confidence intervals for each of the cause. Age groups related to maternal death was analyzed and displayed in the form of graph. Trend analysis of the maternal mortality causes was done, by calculating annual percentage, test significance, confidence

intervals and p-values of all the causes and contributory factors cut off for p-value was set at 0.05.

3.10 Validity and reliability

According to Creswell and Creswell (2018) validity and reliability in quantitative research measure the quality and integrity of the study. They ensure that data and findings of the study are accurate and replicable.

3.10.1 Validity

Validity ensures that the research findings are realistic about what they should be, and can be applied elsewhere (Creswell & Creswell, 2018). There was consistency in terms of selection and assessment of the patients' files and this was done according to prescribed research sampling and analysis methods to improve the validity of the study. The data collection instrument was adequately prepared and tested to address content validity and all issues related to the research objectives and questions.

3.10.2 Reliability

Reliability is a measure of quality in a quantitative study, which include the accuracy of an instrument and the extent to which a research instrument consistently has the same results if it is used in the same situation on repeated occasions (Creswell & Creswell, 2018). The data collection instruments were pre-tested and corrections and adjustments were made according to the findings and experiences during pre-testing.

These assisted the researcher in rectifying the identified discrepancies and irrelevant information that did not address the aim and objectives of the study. The data collected in this quantitative research study was converted into number arrangements and analyzed statistically and mathematically. Credibility, transferability, dependability, and conformability was also taken into consideration during data collection.

3.11 Ethical considerations

The research proposal obtained ethical clearance from the Faculty of Health Sciences Research Ethics Committee of the University of Fort Hare (Appendix C). Permission to conduct the study was obtain from the Eastern Cape Provincial Department of Health, and NMA Hospital. Furthermore, permission to access to patients' files and records was obtained from the hospital superintendent and Head of the Department (HOD) of Gynecology and Obstetrics in the hospital (Appendix E).

The researcher was allocated a lockable office close to the patients' record keeping section to ensure that records are safe and closer to where the researcher was working. In this research, confidentiality was to ensure by keeping records in a safe and locked place and by not sharing information obtained from the records with hospital personnel.

Records were obtained and signed out in batches of 20 at a time according to the years. After completion the records were returned checked and signed off by the researcher and a staff member from the record keeping section. Each patient's record was allocated a unique study number so that patients' identity would not be revealed. Names of the patients were not used on the data information sheet. During data collection period, the researcher never left the office unlocked or patient records unattended. Confidentiality was maintained during data collection by using unique numbers to ensure anonymity in the data collection form. Furthermore, to avoid the risk of losing the patients' file or some of the patients file contents, the researcher only worked with one file at a time in the designated room and no patients' files or parts of its contents were taken out of the room.

3.12 Dissemination of findings

Upon completion of the study the mini-dissertation will be stored in the University of Fort Hare library and archives. At least one article will be written and published in peer reviewed journals. Research findings will be presented in the seminars, conventions, conferences and online publications. Records will be made available for access as stipulated in the university's term and conditions.

3.13 Summary

There was a quantitative approach with retrospective study of maternal death that occurred in NMAH in the year 2013 to 2017. The information was extracted from patient files, labour registers, maternal death case review reports, and maternal mortality registers of the hospital. The causes of maternal mortality were analyzed and displayed in the form of mean, standard deviation, and confidence intervals for each of the cause.

Furthermore, permission to access to patients' files and records was obtained from the hospital superintendent and Head of Department (HOD) of Gynecology and Obstetrics in the hospital. In this research, confidentiality was ensured by keeping records in a safe and locked place and by not sharing information obtained from the records with hospital personnel.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

The previous chapter presented the methodology that was used by the researcher. This chapter presents the findings from the data collected from the respondents. The aim of the study is to present the finding on hospital-based maternal death in order to determine trends, causes and contributing factors of maternal death that occurred at NMAH. The first section of this chapter presents the demographic data of the patients. The second part discusses the analysis of the research findings.

4.2 Maternal Death trend in NMAH

As indicated under sample size the researcher planned to analyse 70 patients' record of women who died due to pregnancy, delivery and postnatal complication until after 42 days after delivery in the five participating years. However, due to the reduction in maternal deaths that has been observed in many healthcare facilities and South Africa at large NMAH did not have the required seventy maternal deaths per year. Also, maternal deaths records that were missing from the record room or incomplete could not be included in the study. Figure 4.1 shows the total NMAH recorded iMMR as indicated in the NMAH maternal deaths records and annual reports. In total between 2013 and 2017, 274 maternal deaths occurred at NMAH.

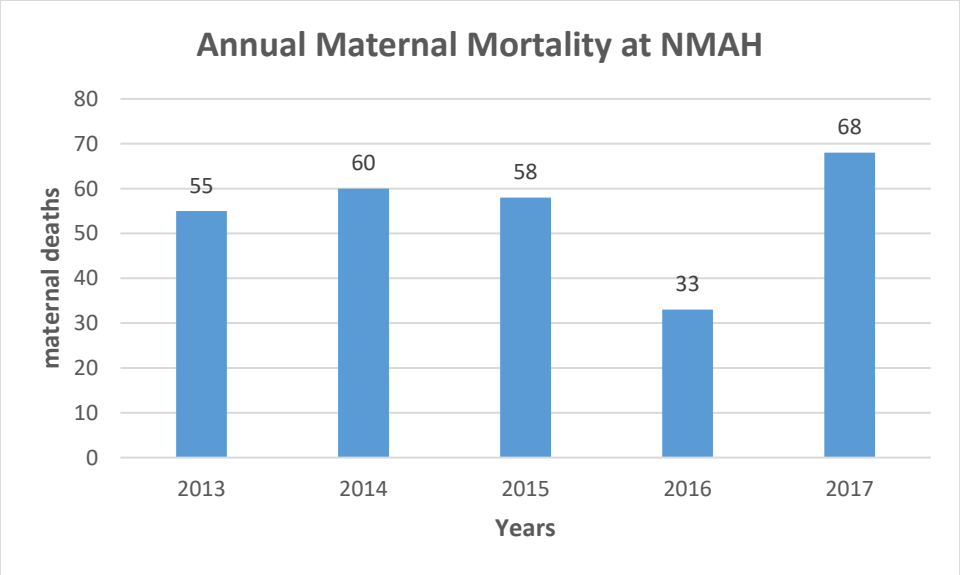

Figure 4.1: NMAH institutional maternal mortality recorded per year (n=274)

Figure 4.1 shows the number of maternal deaths records from 2013 to 2017 that were available in the patients' records section of NMAH. Based on the number of maternal deaths recorded the researcher was planning to use all the records, but unfortunately some of the records were incomplete or missing. Each year between 2013 and 2017 NMAH had more than 50 maternal deaths recorded except in 2016 where only 33 maternal deaths were recorded. The iMMR was the highest in 2017 at 68 maternal deaths, followed by 60 in 2014, 58 in 2015 and 55 in 2013. These were followed by 33 deaths in 2016 and the lowest IMMR recorded between 2013 and 2017. This is in line with the 2016 maternal death where only 14% maternal deaths that occurred in the Eastern Cape when the Eastern Cape managed to achieve its target of a 20% reduction in maternal deaths (Saving the Mothers, 2018). However, NMAH iMMR increased very significantly in 2017 to 68% which was way above the 2016 by 35%. The reasons for this hike could not be established. The decline in 2016 could also be related to the iMMR reported by Bomela (2020).

In a study by Moodley et al., (2018) shows a decline of iMMR from a peak of 189 deaths per 100 000 live births in 2009 to 135 deaths per 100 000 live births in 2016. Similarly, the Saving Mothers Report 2014-2016 also reported a decline of maternal deaths each

triennium by 24% from 2011-2013 to 2014-2016, which was 339 fewer deaths in 2016 than 2011 and 580 fewer maternal deaths than at the peak of maternal deaths in South Africa in 2009 (South African Department of Health, 2018). A slow, but steady decline has also been observed in the number of potentially preventable deaths. A similar decline was also observed worldwide between 2000 and 2017 where a 38% drop of the maternal mortality ratio per 100 000 live births was observed worldwide (World Health Organization, 2019b).

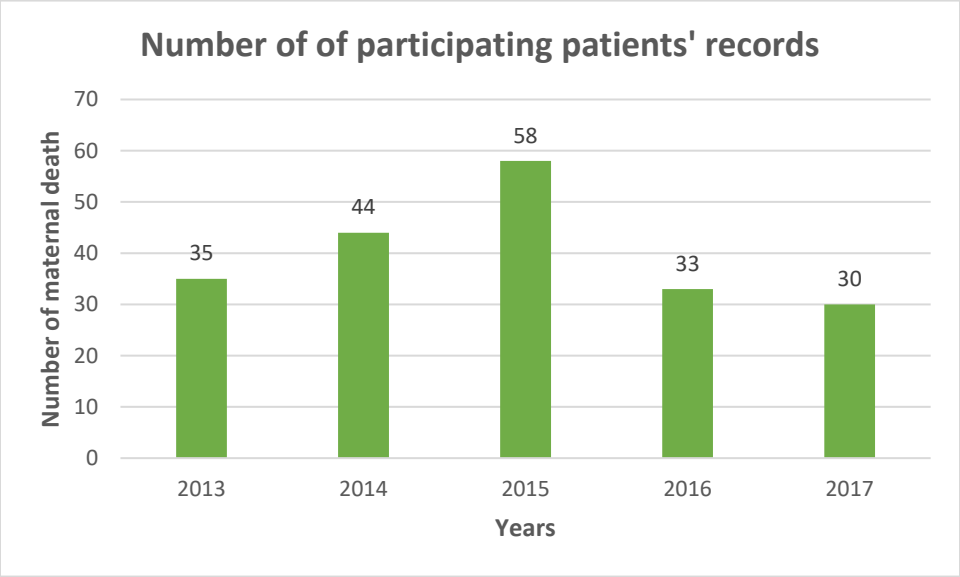

Figure 4.2: Participating patients' records (n=200)

Figure 4.22 shows the participating maternal deaths patients' records. The selected records were as follows: the years 2015 and 2014 had more than 40 maternal deaths records selected with 2015 having the highest at 58 and 2014 at 44 maternal deaths records selected. There were 35 maternal death records selected in 2013 followed by 33 in 2016 and 30 in 2017. The selection of the participating records was guided by the availability and completeness of the records. The trend based on the selected patients' records indicate that maternal deaths were the highest in 2014 followed by 33 in 2016 and 30 in 2017 that participated in the current study. This is different from the trend based on the real numbers of the maternal deaths that occurred at NMAH. It was for this reason that the researcher felt the calculation of the trend must be based on the real figures as

the sampled figures could be misleading under this section. Findings on all other sections will be based on the selected records.

The iMMR due to preventable maternal conditions also decreased from 100 per 100 000 live births in 2008-2010 to 92.6 per 100 000 live births in 2011 and decreased to 83.3 in 2016. These improvements were alluded to a slight improvement in quality of care and reduction in maternal deaths due to HIV infection and obstetric hemorrhage. However, there was no change in deaths due to hypertensive diseases in pregnancy. Despite the decline in the national iMMR, provincial tertiary hospitals had the highest iMMR that contributed 160% higher than regional and national central hospitals in 2016 except the Eastern Cape that managed to achieve its target of a 20% reduction in maternal deaths from 2014 to 2016. Referral problems, inadequate postnatal care, early discharge of mother and lack of follow-up were identified as the major contributor to maternal deaths in these hospitals (Saving the Mothers, 2018). Statistics South Africa has shown that the decrease in maternal deaths is continuing in South Africa despite the COVID 19 Pandemic (Statistics South Africa, 2022).

According to the World Health Organization (2010) maternal deaths are due to inadequate care, unskilled health care providers, non-availability of antibiotics with proper management, late identification of abnormalities, because women start antenatal clinic late. Bomela (2020) argues that the persisting provincial variations in South Africa requires government to pay more focus on improving quality of care at district, regional and provincial tertiary hospitals. Improved quality of care in health care delivery will ensure adequate and immediate attention to not only maternal health problems. There is a need for a more concerted effort to address the poverty, economic and health inequality in South Africa to assist in improving the maternal health outcomes.

The implementation of the World Health Organization Package that requires women to have eight-contact antenatal care visits and the updated antenatal care package of South Africa has contributed to the improvements in maternal care. However, commitment by all stakeholders to quality maternal care is essential for success. Training and readiness

among healthcare providers are key to identifying and managing women with complications and developing an efficient antenatal care system accessible to all women. Furthermore, the attendance of antenatal care, women's experiences, improvement in screening and detection of pregnancy-related complications and improved maternal care quality at all stages could improve pregnancy outcomes and further decrease maternal deaths in South Africa (Hlongwane et al., 2021).

4.3 Demographic characteristics of the patients in the participating maternal deaths' records

4.3.1 Age distribution of the maternal deaths patients records reviewed at NMAH

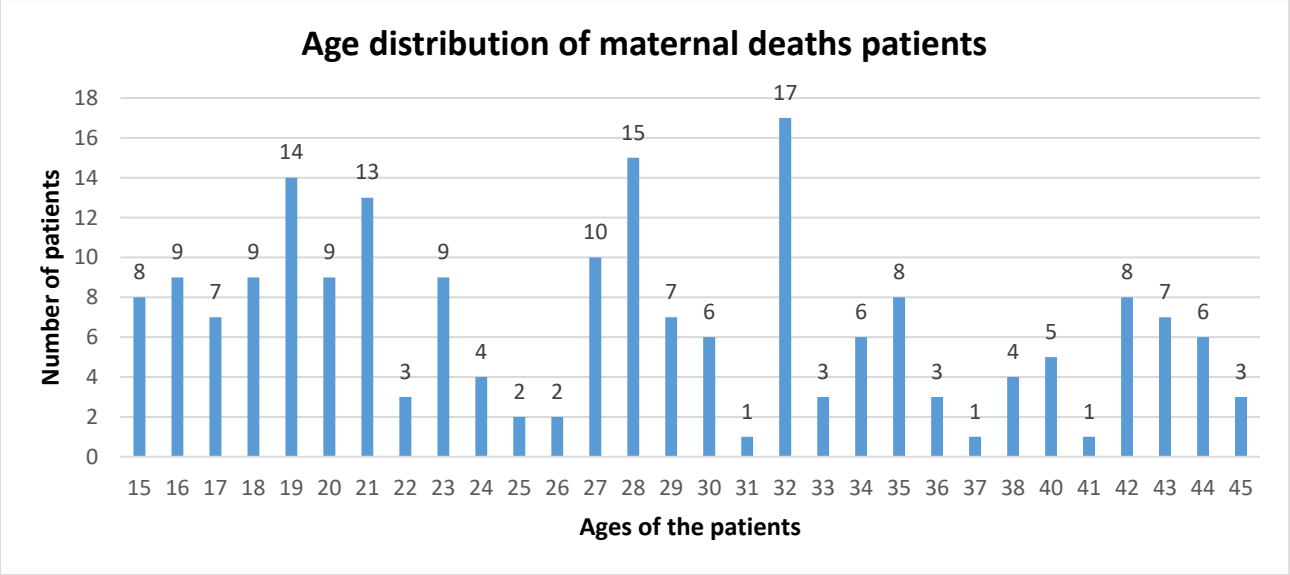

Figure 4.3: Age distribution of the maternal deaths patients (n=200)

Figure 4.33 indicate that the women were aged 15 to 45 years in 2013 to 2017 maternal deaths that occurred in NMAH. Their Mean age was estimated at 27.7 and Standard Deviation (SD) of 8.757. The ages of these patients were within the World Health Organization classification of women of reproductive age which is 15 to 49 years (World Health Organization, 2022)**.** According to the NMAH maternal deaths records analyzed, women aged 32 years were the highest at 8.5% (17) followed by those aged 28 years at 7.5% (15), 19 years at 7% (14), 21 years at 6.5% 13) and 5% (10) were aged 27 years

when they died of maternal complications. All other age groups were less than 5%. The maternal deaths were further analyzed according to the following categories, teenagers (15-19), best childbearing age (20-34) and late childbearing age (35 and over) as described (Meczekalski, et al., 2016).

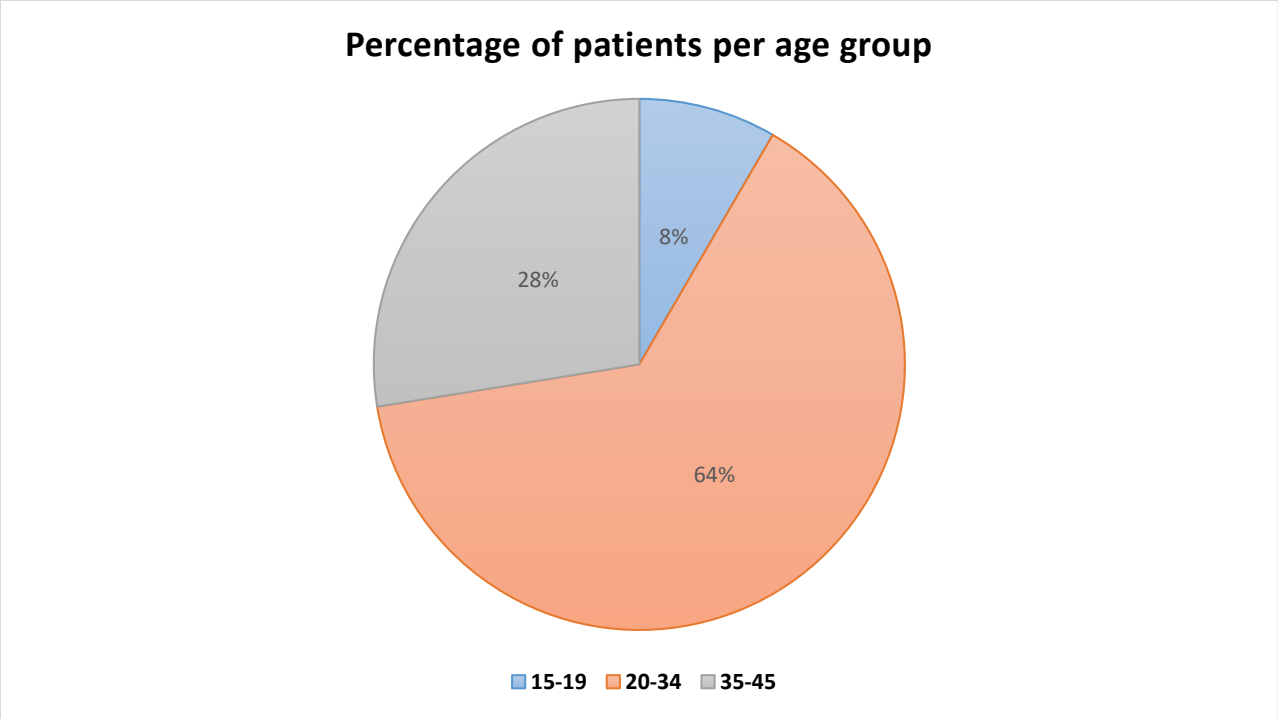

Figure 4.4: Number of maternal deaths per age group (n=200)

Figure *4*4.4 indicates that among the NMAH 2013 and 2017 maternal records reviewed, teenagers constituted 8%, women age 20-34 (64%) and those aged 35-45 were 28%. According to March of Dimes (2022) healthcare workers worldwide consider teenagers and women aged 35 years and above to be at higher risk of pregnancy-related death than those aged between 20 and 34. In the United States women aged 35 to 39 are twice likely to die from pregnancy-related causes than pregnant and parenting women aged 20 to 24. This is different from the NMAH findings, where maternal deaths among women aged 20-24 were twice higher (19%) than those aged 35 to 39 (8%). The reasons for this could be related to the HIV prevalence among this age group, maternal complications and pregnancy related conditions. In 2017 HIV prevalence was highest among sexually active

women in the age groups 25 to 29 (South Africa Statistics, 2022). According to Cichocki (2020) the 15 to 24 age group constitute almost 50% of people living with HIV in South Africa.

The WHO states that 12% female adolescent deaths are caused by maternal complications and pregnancy related conditions. It is important to use other methods to reduce the maternal deaths through education to the families and mothers that includes the importance of females of getting mature to reduce maternal deaths worldwide (World Health Organization, 2010). For many years it has been known that teenage pregnancy has some effects such as higher risk for pregnancy-related high blood pressure (preeclampsia) and its complications than average age mothers. Preeclampsia can also harm the kidneys or even be fatal for mother or baby. However, despite the availability of contraceptives and sexual health education teenage pregnancy continue to be a challenge in many healthcare facilities and contribute to high iMMR (Filippi et al., 2018). According to South African Department of Health (2021) figures from the Gauteng Department of Health show that more than 23 000 girls aged under 18 gave birth between April 2020 and March 2021 of which 934 were aged under 14 compared to 14 577 girls aged 19 and under having babies in the same period a year earlier.

4.3.2 Marital Status

As indicated by Figure 4.5 below the marital status of the maternal death patients varied. A greater proportion (66.5%) of the maternal death patients consisted of single women followed by married women 25.5%, 4% widowed and another 4% divorced. In essence almost three quarter of these women were from female headed families. This could be showing the extent at which most household in South Africa are structured. According to Galal (2021) in 2019, 41.8 percent of households in South Africa were female-headed, which amounted to a total of approximately 7.2 million with the Eastern Cape Province having the highest female-headed households estimated at 50%. This could be one of the contributory factors responsible for the high numbers of single maternal deaths recorded at NMAH.

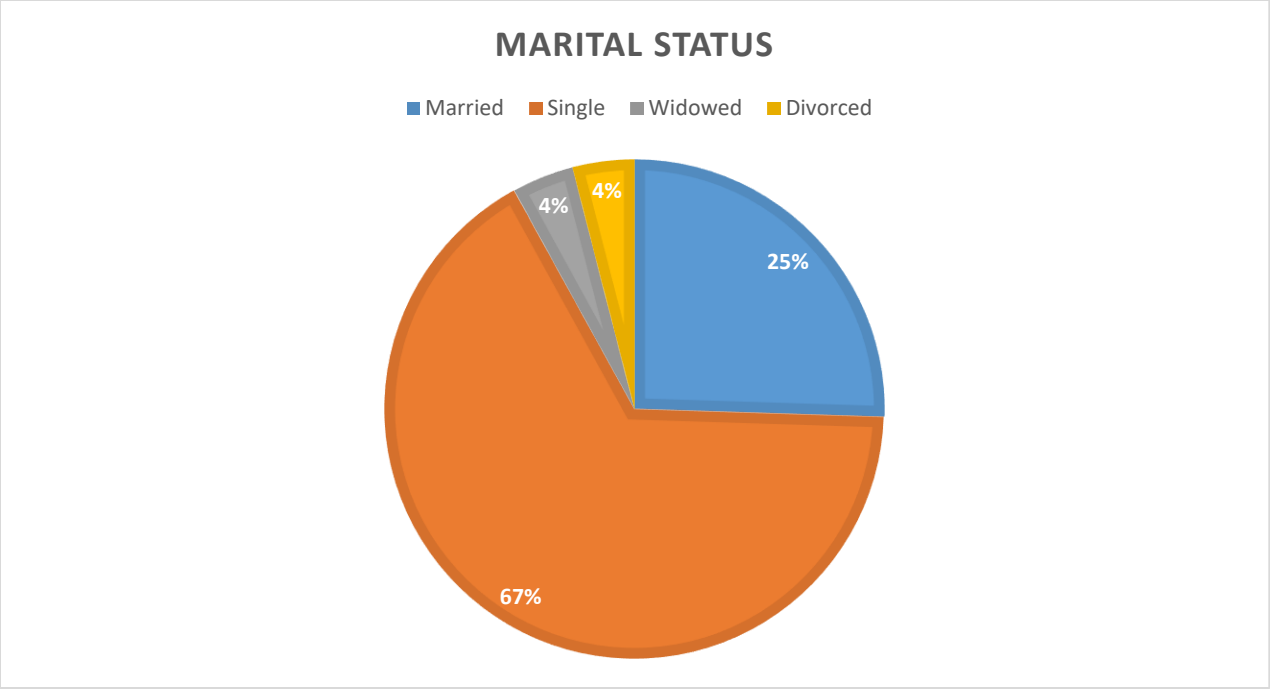

Figure 4.5: Marital status (n=200)

According to the 2020 Statistics South Africa (2022) statistics more than 60% of the births in South Africa are registered were registered without the father's information. This could mean that many pregnant women in South Africa are single. Hence the high number of maternal deaths among single women.

Balayla et al., (2011) argue that childbearing among women who are single seems to be associated with an increased risk of maternal, fetal and infant deaths. It is therefore, important for antenatal care to pay special attention to this category of patients. They must have unmarried mothers-to-be health education programmes that increase awareness among single mothers of the risks and provide resources for proper obstetrical and maternal care that could be of benefit to their pregnancies. For example, counselling services and socio-economic assessment and assistance by social workers where necessary. Another challenge related to the marital status of the mother is that in the sub-Saharan Africa, the highest levels of neonatal and child mortality is among children of unmarried women face considerable disadvantage (Clark & Hamplová, 2011).

A study in Uganda found that unmarried youth were more likely to use health facilities than the married youth in Uganda between 2006 and 2016. This could be due to the confounding factor that married youth had higher parity than the unmarried ones. As in many studies pregnant with higher parity have been associated with lower use and late access to antenatal care services and use of safe childbirth (Agaba et al., 2022).

4.3.3 Employment status of the patients

The maternal deaths files that took part in the study indicate that 47.4% of the women were unemployed followed by students (28.1%) and 24.5% that were employed. as indicated by figure 4.6 more women were unemployed whist also the issue of teenage pregnancy. About (24%) woman who were recorded during the period when the study was conducted, were teenagers and therefore could be among those that indicated that they were students.

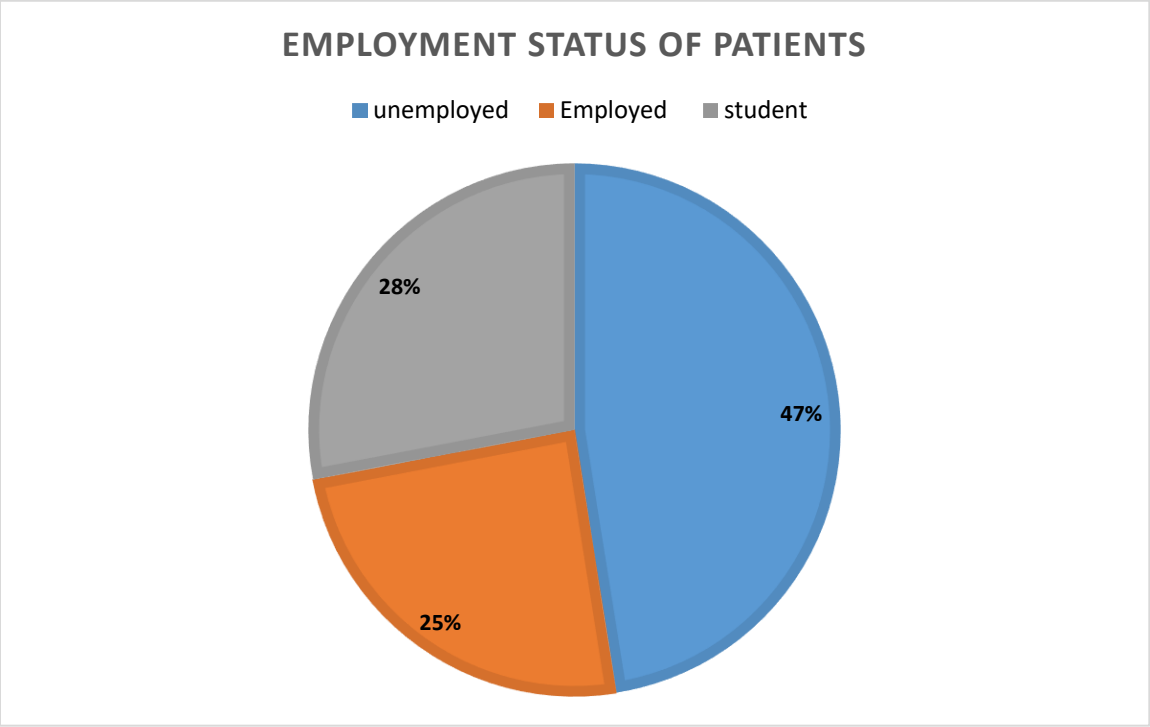

Figure 4.6: Employment status (n=200)

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Employment status is among the many factors that increase women's risks to maternal morbidity and mortality depending on the occupation of the woman, employment conditions and type of services rendered. In a study by Feitosa-Assis & Santana (2020), they found that certain occupations have greater maternal mortality and morbidity rates (MMR) than others depending on the working environment and hours of work. They found that MMR to be higher among service workers, retail sellers from stores and supermarkets, and agricultural, forestry and fishing workers. These could be related to the number of hours the women work, lifting of load, intense work rhythms, work-related stress, lack of support from colleagues and supervisors, social isolation, excessive noise, extreme temperatures and humidity, electromagnetic fields, exposure to poisonous materials, solvents, lead, pesticides, cleaning products, other chemical agents and biological agents (Feitosa-Assis & Santana, 2020).

4.3.4 Academic achievements

Table 4.2: Academic Levels achieved (n=200)

Academic achievement	Frequency	Valid Percent
Matric	144	72%
Tertiary	38	19%
None	18	9%
Total	200	100%

Education enables people to access and understand relevant information. Whilst health education in the clinics by health care workers assist individuals to make informed decisions about their health. In a way, the accuracy of an individual's response comprehension of to a social issue is likely to be a function of the individual's level of education (South African Department of Health, 2013). As indicated in Table 4.2: Academic Levels achieved (n=200)matric and tertiary level only. The maternal death records show that 144(72%) of the women had matric only as their qualification with 38(19%) who had tertiary qualifications and 18(9%) with no academic qualification (they were still at school or had no education at all). In essence, the majority (91%) of the

participating maternal death records belonged to women who had high levels of education in the South African standards and only 18(9%) were still at school or had no education at all.

In South Africa low levels of education are linked to socio-economic status, which affects access to healthcare among pregnant and postnatal women due to lack of money for transport. Lack of education is indicated as one of the contributory factors to maternal deaths among socio economic status, family planning, long distance to the clinics, and lack of transport, bad road, and long travelling distance to the clinics (South African Department of Health, 2012). In this study low levels of education was not a contributory factor to 91% of the maternal deaths. There is a possibility that long distance to the clinics, lack of transport, bad road, long travelling distance from the clinics to NMAH could have contributed to the deaths of women with higher education. Also, the three delays identified by Forbes et al., (2023) could have contributed to the maternal deaths. These delays are: delay in reaching the health facility, delay in receiving quality care in emergency of obstetric haemorrhage and late diagnosis of the problem (Forbes et al., 2023).

There were 18 women who had no academic qualification or no education at all. The challenge with lack or low education level is that it also affects other factors that contribute to maternal mortality through delays and failure to access appropriate and skilled care needed. There are many other studies worldwide that have documented an association between years of schooling attained by women and maternal, infant and child mortality. The possible underlying reasons for this strong relationship between education level and severe maternal outcomes is that less educated women might experience longer primary and secondary delays in deciding to seek and reach care (Tunçalp et al., 2014).

UNFPA (2012) argues that poor uneducated women stay are found in many instances in remote areas and informal settlements where they are least likely to receive adequate maternal health care due to lack of or few healthcare facilities, long distances to health care facilities and low numbers of skilled health workers in their areas. This prevents women from getting the required number of antenatal care visits, attended by a skilled

health worker during delivery and receive postnatal care as required. Furthermore, education allows women to make informed choices and seek proper health care when needed. While the World Health Organization (2008) add to the argument by indicating that the more literate the female population in a country, the lower the maternal mortality rate. It is therefore important that countries should encourage education among women to lower maternal mortality and meet their Sustainable Development Goals (SDG) targets World Health Organization (2016).

4.4 Conditions for and reasons for referral of patient to NMAH

Table 4.3: Condition and reason for referral and causes of the maternal deaths (n=200)

No	Condition	Frequency	Valid Percent
1	Hypertension	34	17%
2	Pulmonary eodema	2	1.0%
3	Obstetric hemorrhage	39	19.5%
4	Epilepsy	7	3.5%
5	Septic shock	2	1.0%
6	Pregnancy-related infection	2	1.0%
7	Prolonged labour	1	0.5%
8	Previous cesarean section	3	1.5%
9	Anemia in Pregnancy	36	18%
10	Non-pregnancy-related infection	8	4%
11	Acute-collapse-causes	2	1.0%
12	Unknown	1	0.5%
13	Kaposi sarcoma	1	0.5%
14	Meningitis	1	0.5%
15	Pulmonary Embolism	6	3%
16	Medical and surgical disorder	4	2%
17	Contributory causes	31	15.5%
18	Hysterectomies	20	10%
	Total	**200**	**100%**

Table 4.3 indicates the conditions that the patients had or reasons for referral to NMAH and causes of the maternal deaths. Eighteen conditions were indicated as condition that

the patient had or reason for referring the patient to the hospital for further management or as causes of the maternal deaths. The following conditions were each responsible for twenty or more of the maternal deaths in this study. The highest among them was obstetric haemorrhage that caused deaths to 39(19.5%) women, followed by anemia in pregnancy 36(18%) deaths, hypertension 34(17%) deaths, contributing causes 31(15.5%) deaths and 20(10%) women died due per partum hysterectomies. These were followed by non-pregnancy related infections that contributed 8(4%), epilepsy and pulmonary embolism contributed 7(3.5%) and 6(3%) maternal deaths respectively. All other conditions were two percent and less.

Although the Department of Health in South Africa has made a commitment to reduce maternal deaths from obstetric haemorrhage, hypertension anemia and HIV through proper management of patients from antenatal through to postnatal care, training of health care providers, strategies of proper referrals and the health system strengthening these maternal conditions continue to be a problem in many healthcare facilities (Moodley et al., 2014).

4.4.1 Obstetric hemorrhage

Obstetric hemorrhage refers to any kind of excessive bleeding, vaginally or within the abdominal cavity during pregnancy, child birth and in the postpartum period up to 12 weeks after having a baby. Obstetric hemorrhage is the most frequent cause of maternal mortality and morbidity worldwide. It responsible for a third of the maternal mortality in Africa with post-partum haemorrhage accounting for 30–50% of maternal deaths in sub-Saharan Africa. Obstetric haemorrhage is preventable with timely detection and initiation of care. The high maternal deaths due obstetric haemorrhage in SSA is due inadequate clinical care, delayed detection and management, delayed treatment and lack of resources (Forbes et al., 2023; Heitkamp et al., 2018).

The current study also found obstetric hemorrhage to be the leading cause for 39(19.5%) of maternal death in NMAH despite the implementation of the 2018 World Health Organization recommendations utero-tonics for the prevention of postpartum

haemorrhage (PPH) in South Africa and NMAH in particular. It occurred during postpartum period. The risk of PPH was lowest among women in their 20s and then increased with the age and highest among 40 years old women. The causes of the PPH were placenta abruption prior delivery which was induced by hypertension, profuse bleeding after (C/Section) and normal vaginal delivery caused by placenta accreta, uterine atony, uterine rupture and delays in reaching the health facilities. The most maternal death caused by haemorrhage were between the year 2013 and 2015 with very low numbers of maternal death due haemorrhage in 2016. Most of the PPH-related deaths are preventable with timely detection and initiation of care. However, the three delays that occur during the diagnosis and the intervention of PPH are generally associated with the greater incidence in maternal death. The three delays are delay in reaching the health facility, delay in receiving quality care in emergency of obstetric haemorrhage and late diagnosis of the problem (Forbes et al., 2023).

4.4.2 Anaemia in Pregnancy

Anaemia was found present in 23(11.5%) cases during pregnancy. In 13(6.5%) of the patients with anaemia during pregnancy was unknown especially to those un-booked cases. However, the studies conducted in Gondar, North west Ethiopia shows that the anaemia found in majority that had mild anaemia and followed by those with moderate anaemia and this difference may be the result of geographical variation of factors across different areas (Gallos et al., 2019). Anaemia in pregnancy is a decrease in the total red blood cells or hemoglobin in the blood during pregnancy. It is a condition whereby the blood of the pregnant woman has a lower-than-normal amount of red blood cells or hemoglobin due to iron, folate and vitamin B12 deficiencies (Melku, et al, 2014).

There are three types of anaemia in pregnancy, iron-deficiency anaemia, folate-deficiency anaemia and vitamin B12 deficiency anaemia. Severe iron deficiency anaemia during pregnancy increases the risk of premature birth (when delivery occurs before 37 complete weeks of pregnancy (Uscher, 2020; Abu-Ouf & Jan, 2015).

4.4.3 Hypertension in pregnancy

Hypertension in pregnancy was the most common cause of maternal death between the patients aged 15 to 35 and they were 34(17%). Of these patients, ten of them were due to proteinuria and 24 eclampia contributed to the maternal causes of death. Proteinuria in hypertension was one of the major causes of NMAH maternal deaths increase from 9% in 2014 to 12% in 2015 with no maternal deaths due to eclampsia. During 2017 increase in maternal death three of maternal death were caused by eclampsia. Furthermore, the women that died due to hypertension in NMAH had placenta abruption 5% and maternal death before hospital discharged.

The cause of hypertension in pregnancy is unknown, but certain conditions may increase the risk of developing the condition that include the following: pre-existing hypertension and kidney disease. The challenge with hypertension in pregnancy is that it decreases blood flow to the placenta causing the baby to receive less oxygen and fewer nutrients, which often cause low birth weight and premature birth. In severe cases, it can be life-threatening and might contribute to cardiovascular disease later in the woman's life (Braunthal & Brateanu, 2019). Teenagers and women less than 25 years of age and pregnant for the first time are at a higher risk of hypertension in pregnancy and death from preeclampsia (Bates *et al*., 2008).

4.4.4 Contributory causes

The contributing factors for the 31(15.5%) included delay in seeking care, lack of ambulance transportation and delay in referring the patient to NMAH. According to Sageer et al., (2019), the leading contributory factors of maternal deaths include inadequate human resource for health, delay in seeking care, inadequate equipment, lack of ambulance transportation, and delay in referrals services. These contributory causes are preventable through combined strategies that focus on improving the quality of antenatal care services, prompt referral, active management of labour and immediate post-partum period and access to family planning.

4.4.5 Peri-partum hysterectomies

Peri-partum hysterectomy is described as a lifesaving surgery performed on a mother with intractable obstetric haemorrhage. The incidence of peri-partum hysterectomy is increasing in this era not because of improperly managed third stage of labour or obstructed labour but most likely, because of increasing incidence of C/Sections. Chances of repeat C/sections thus increase. This ultimately increases the incidence of placenta preavia and accrete (Sharma et al., 2017). Peri-partum hysterectomies during the current study was responsible for 20(10%) of the maternal deaths. However, the indications of these incidences were not indicated. In a study by Wandabwa et al., (2013) at NMAH, they found that the majority (84.2%) of peri-partum hysterectomies were performed to save the lives of women who had uterine atony (30.2%), puerperal sepsis (27%) and ruptured uterus (27%).

4.4.6 Non-pregnancy related infections (NPRI) and conditions responsible for the maternal deaths

Thirty-four (17%) maternal deaths that occurred at NMAH were referred with or had conditions that were classified as non-pregnancy infections (NPRI) and conditions that claimed their lives. These conditions ranged from sweating, stiffness of the neck, history of fits at home, tight chest, constant cough, palpitations, fatigue, weakness and dehydration. Eight of these patients classified as NPRI the causes of deaths were indicated as HIV/AIDS, tuberculosis (TB) and bronchopneumonia. The other conditions indicated as causes of maternal deaths were epilepsy, pulmonary embolism, medical and surgical disorder, pulmonary oedema, acute-collapse-causes, septic shock, kaposi sarcoma, meningitis and unknown. The statistics of 2008-2010 report the three conditions that have been contributed on to the majority of the prevention of maternal death has been identified which are non–pregnant related infections, the complication of HTP and obstetric hemorrhage (South African Department of Health, 2012). Although South Africa has been implementing the live long antiretroviral treatment for HIV infection and the prevention of mother to child transmission programmes since 2011, maternal deaths due to NPRI remained the leading cause of maternal for the period 2017 to 2019 (Komane,

2020). It is therefore important to adopt a multi-sectoral approach and integrate evidence-based innovations in order to deal with the challenges of NRPIs and reduce iMMR.

4.4.7 Prolonged labour

Maternal records with prolonged labour indicated were only three (0.3%) and delay in referral was also identified. Thirty-five (17.5%) of the files indicated that prolonged labour was not applicable and ten (5%) indicated that prolonged labour was not diagnosed during labour. Five (2.5%) of the records that had indicated something about prolonged labour were un-booked. In more than three quarter (76%) of the files nothing was indicated under prolonged labour. These findings are similar to a study by conducted in Malawi where some women with prolonged labour were referred from other facilities and only 52(1.6%) of their participants had a documented prolonged second stage of labour (Bakker et al., 2021).

Prolonged labour is when a woman in labour takes more than 18 hours of active contractions. It can be due to slow cervical dilations, slow effacement, a large baby, a small pelvis, delivery of multiple babies and emotional factors. It poses serious risks for both the mother and baby. Women that experienced prolonged labour are prone to postpartum heamorrhage, obstetric trauma, infections, or both including problems, obstructed labour or death. Sometimes prolonged labour may be due obstructed labour that resulted from mismatch between foetal size and the mother's pelvis or brow presentation and shoulder presentation (Pattinson, et al., 2022; Yakubu , et al., 2020). According to Desta, et al., (2022), obstructed labour and prolonged labour in developing countries are often due to stunted growth of the maternal bones or abnormalities of the pelvic shape of the women.

4.4.8 Previous caesarean section

Only three (1.5%) of maternal death files indicated a surgical previous history of C/section and nine (4.5%) files indicated that patients had ruptured uterus which led to obstetric haemorrhage of which some files indicated the cause of death as the use of anaesthesia complications. Only 15(7.5%) women with pre-eclampsia have increase rate of C/section

due to high incidence of intra uterine growth restriction and foetal distress. Women age group 15 to 21, 20(10%) were found to be at an increased risk of dying due to complications of anaesthesia. While women over 30 to 34 years of age were at an increased risk of dying due to most condition. However, several studies shown the safety of spinal, epidural and combine spinal epidural anaesthesia for C/section women in pregnancy and the risk of death from anesthesia in women undergoing obstetric procedures was 1.2 per 1000 women go for obstetric procedures (Raul, 2015).

According to a study by Kallianidis et al., (2018) the risk of death after C/section in the Netherlands was 21.9 per 100.000 versus 3.8 deaths per 100.000 normal vaginal births. Similar findings were observed in a Brazilian study that indicated that births by C/section were three-fold higher in maternal mortality when compared to vaginal delivery. A survey conducted in nine Asian countries also showed that C/section had higher rates of maternal mortality rates (Geleto, et al., 2020). Maternal deaths among women who underwent C/sections in low- and middle-income countries are 100 times higher than those in high-income countries (Sobhy et al., 2016). Maternal deaths due to C/sections in the Sub-Saharan Africa is estimated to be 2 to 11 times higher than after a vaginal delivery. South Africa has the highest prevalence of C/sections. It is estimated that more than two in three South African pregnant women in private hospitals give birth by C/section, which way above the international average. The high prevalence of C/sections are due to the high numbers of elective C/sections based on convenience instead of medical reasons (Maswime & Buchmann, 2017).

The challenge with the high prevalence of C/sections in South Africa is the increase risk of premature delivery and bleeding during and after C/section. This has increased the number of maternal deaths due to obstetric haemorrhage in South Africa. In their study Maswime and Buchman (2016) in South Africa found that 43% of deliveries in the hospital that participated in their study were C/sections. The maternal death risks due to C/sections are infections, anaesthetic risks, pulmonary embolism, postpartum haemorrhage, haemostatic hysterectomy and obstetric fistulae (Dikete et al., 2019). Sobhy et al. (2016) argue that the skill level of the anaesthetist has an impact on the

occurrence maternal deaths due to anaesthetic complications. Their study found that the rate of any maternal death to be 9·8 per 1000 anaesthetics when managed by non-physician anaesthetists compared with 5·2 per 1000 when managed by physician anaesthetists.

4.4.9 Acute collapse causes unknown

Maternal collapse is an acute event in the woman involving the cardiorespiratory systems and/or the brain, resulting in a reduced or absent level of consciousness (and potential death) at any stage in pregnancy and up to six weeks after delivery. It is classified as the primary cause of maternal death. Between 2015 and 2017, 5% of maternal collapse were due to cardiac condition, respiratory problems and immune system failure (Say et al., 2014).

Other causes of maternal collapse are maternal epileptic seizure, vasovagal reaction, pulmonary embolism, amniotic fluid embolism, haemorrhage of obstetric, ruptured ectopic pregnancy, subarachnoid haemorrhage, cerebral haemorrhage or infarction, cerebral venous thrombosis, metabolic and anaesthetic causes (Fiolna & Paraschiv, 2021).

4.4.10 Pulmonary Embolism

Two (0.2%) of maternal deaths due to pulmonary embolism between the age 30 to 39. Embolism was the primary cause of death for six of the 15 deaths in Nelson Mandela Academic Hospital during the period of 2013 to 2017. It has a cloth that is accumulates the lungs, which can develop after delivery, and the risk is high in C/sections, which account for 4% of maternal deaths (Raul, 2015).

4.4.11 Medical and surgical disorders

The medical and surgical disorders were the other cause of maternal death in seven (8.1%) indicated puerperal sepsis as the cause of death. Most maternal deaths caused medical and surgical disorders appear in 2014. A lack of knowledge of personal hygiene before and after delivery can also develop infection after childbirth can be eliminated if

good hygiene is practice and if early signs of infection are recognized and treated in a timely manner (Say et al., 2014).

4.5 Antenatal care booking status of maternal deaths

Antenatal booking particularly early booking for antenatal care is important in the prevention of maternal and neonatal death as it provides healthcare providers with the opportunity to identify early pregnancy and foetal problems, explain the importance of proper nutrition during pregnancy and breastfeeding to expecting mothers (Berhan, & Berhan, 2014).

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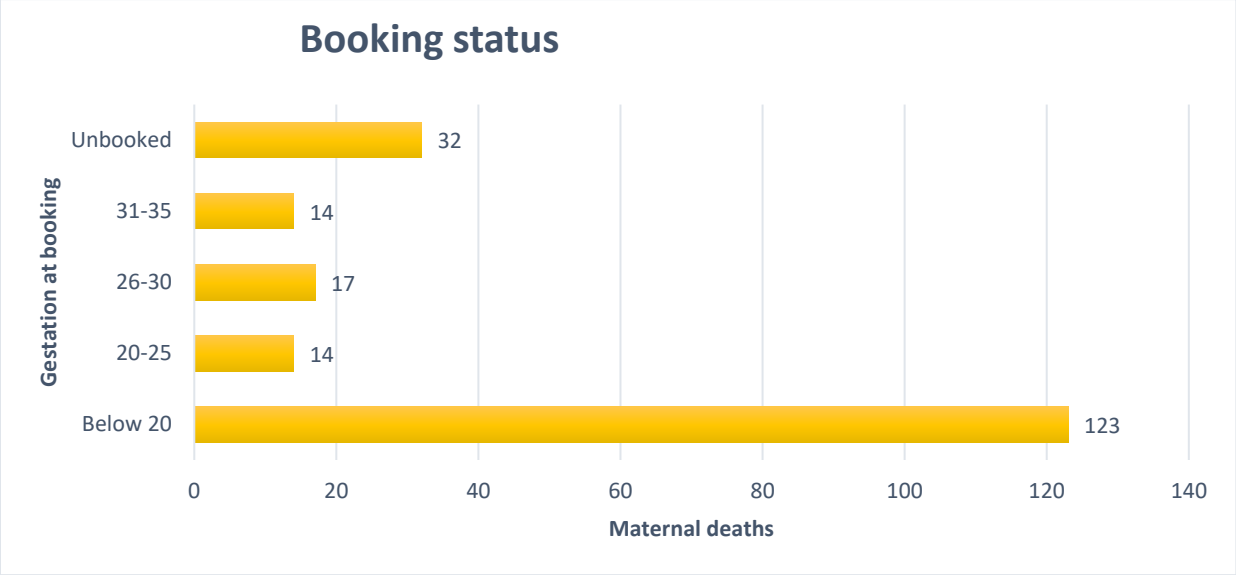

Figure 4.7: Antenatal care booking status of respondents (n=200)

Amongst the 200 maternal deaths patients 168 (84%) were booked whilst 32 (16%) were not booked. Figure 4.77 indicates the booking status according to gestational age of pregnancy. Most 123(61.5%) of these patients had their first antenatal care visit before 20 weeks of gestation. These were followed by those that had their antenatal visits at 26-30 weeks of gestation 17 (8.5%), the 20-25 weeks of gestation were 14 (7%), and lastly the 31-35 weeks of gestation were 14 (7%).

It is evident that a significant number booked late 45 (22.5%) or did not book at all 32 (16%) and this might have also contributed to some conditions not been picked up early in pregnancy. Although ANC is an important way to reduce maternal the majority of pregnant women in developing countries start attending ANC later in their pregnancies. They often attend very few ANC visits before delivery that are way less than the recommended visits. In the sub-Saharan Africa only 69% of pregnant women attend at least one ANC visit compared with four ANC visits among 80% of women in developed countries (Battu et al., 2023). The education of pregnant mothers during the period of antenatal bookings, the use of contraceptives more birth attended in the health facilities, adequate prenatal care, skilled health care providers, availability of antibiotics with proper management, early identifying of abnormalities can help to reduce maternal mortality rates (World Health Organization, 2010).

Although the services for pregnant women are free to improve maternal and perinatal outcomes in South Africa, there are still many women who deliver with only one visitor or no visit at all or start their antenatal care after 20 weeks. In this study. In South African the National Department of Health like WHO recommended that women should visit ANC clinic as soon as they realize that they are pregnant before 20 weeks of gestation. However, in the current study 38.5% booked after 20 weeks or did not book at all. The ANC services should start with women's first visit irrespective of gestational age despite the provision of free ANC services (Kaswa et al., 2018).

4.6 Medical History

The study revealed that almost all 170(84.2%) the patients that had maternal deaths at NMAH had no known medical history prior to admission, eight (4%) had asthma, seven (3.5%) had epilepsy, five (2.5%) had hypertension, and another five (2.5%) had cardiac disease and four (2%) had diabetes indicated in table 4.4. From observation it is evident that although medical history of the patients may have led to their demise, other factors may have contributed more to their subsequent death. Most women died due to the result of complication during or following pregnancy and child birth and these complications

develop during pregnancy most of which some of them are preventable or treated (World Health Organization, 2019b).

Table 4.4: Medical history of respondents (n=200)

Medical history	Frequency	Percent
Epilepsy	6	3%
Hypertension	5	2.5%
Asthmatic	8	4.0%
Cardiac disease	5	2.5%
Diabetes type	6	3%
No known medical history	170	85%
Total	**200**	**100%**

4.7 Features on admission of respondents

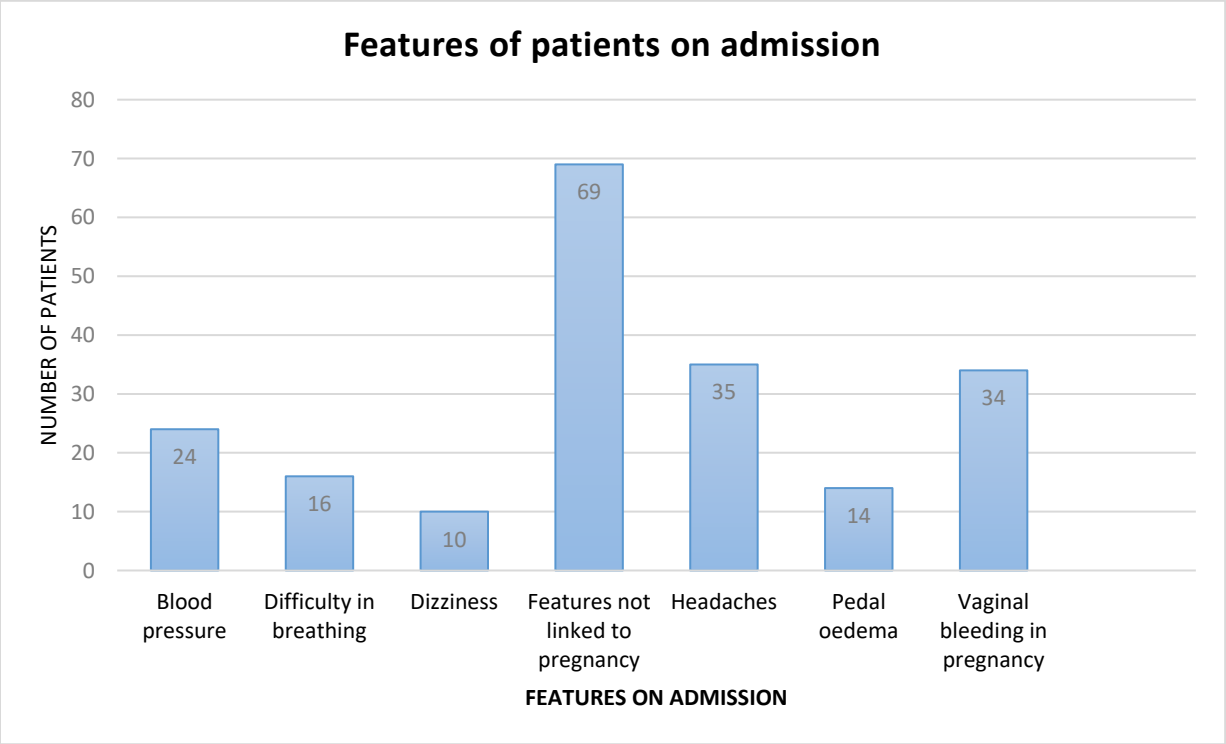

Figure 4.8: Features on admission (n=200)

As indicated by Figure 4., most 69 (34.5%) of the features that the patients displayed other features that were not directly linked to pregnancy. A significant number of the cases experienced vaginal bleeding in pregnancy 34 (17%), whilst some had elevated blood pressure, some had headache 35 (17.5%), some of the patients had Pedal oedema 14 (6.9%), other had difficulty in breathing 16 (8%) and lastly some experienced dizziness 10 (5%).

Healthcare provider are required to take the pregnant women's family health history to assist them in making important health decisions. This also helps them to learn about the health of the woman and baby even before it is born. Knowing about the patients' health conditions before or early in pregnancy can help healthcare provider and patient to decide on treatments and care for your baby (Yevoo et al., 2018). In this study maternal deaths patients had life threatening diseases ranging from epilepsy hypertension asthmatic cardiac disease diabetes type to other conditions that were not specified. Furthermore, pregnant women' act of resistance are directed towards healthcare providers' behaviours and healthcare delivery practices they perceive as unresponsive and humiliating to their personhood. Some are related to pregnant women's resistance and cultural beliefs.

4.8 Investigations done upon admission

It was indicated in most 149 (74.5%) of the cases that full blood count had been done on admission. Whilst 9 (4.5%) had platelets count done, 6 (3%) had liver function test done, 9 (4.5%) had haemoglobin done, 4 (2%) lumber puncher, 1 (0.5%) on admission. Fifteen (7.4%) had a number of different tests done on them which were not prioritised for this study and are therefore indicated as other), 1 (0.5%) had clotting factor done and 7 (3.5%) sputum culture.

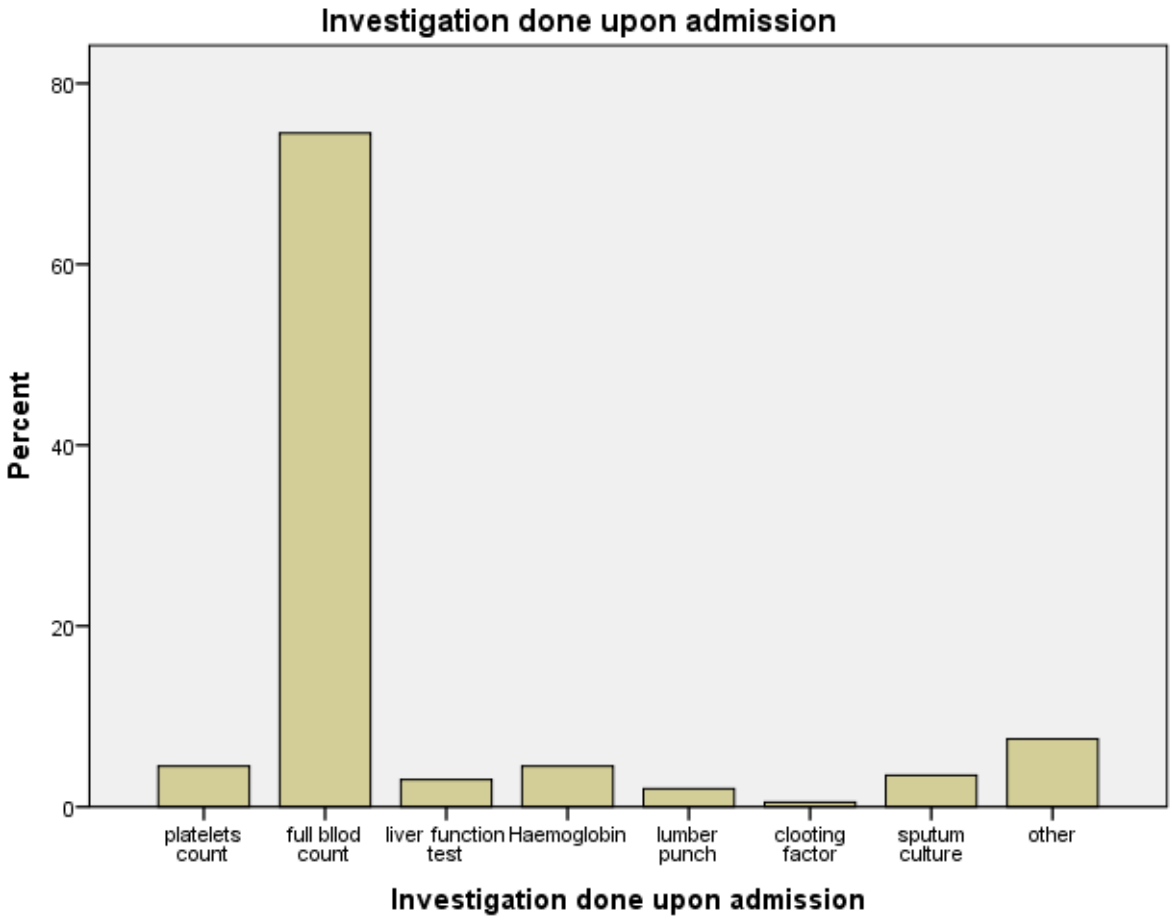

Figure 4.9: Investigations done upon admission on respondents (n=200)

Since not all pregnant women were booked or had all the required tests done during pregnancy done, maternity f]acilities require all admissions to be tested for full blood count, blood group, antibody screen, rubella antibody status, syphilis serology, hepatitis B serology and HIV. In other words, these first antenatal screen test must be requested at any stage of pregnancy if a woman presents for the first time late in pregnancy (Alkhatib, 2018). It is therefore important that healthcare facilities must find a way of ensuring that all pregnant women in their communities should attend antenatal care for early diagnosis of problems and to avoid delays in the care of a sick mother whilst waiting for laboratory tests.

4.9 Gravity and Parity of the maternal deaths patients

The table 4.9 shows that 76(38.0%) had had gravity 1, 39(19.5%) had gravity 2, 37(18.5%) had gravity 3, 21(10.5%) had gravity 4, 13(6.5%) had gravity 5, 4(2%) had gravity 6, 3(1, 5% had gravity 7 and lastly 5(2, 5%) had gravity 8. Some chances of having complications during pregnancy are low but very high in the first pregnancy. Nevertheless, after more than five or six pregnancies the risk of complications increases (Say et al., 2014).

Table 4.5: Obstetric history of maternal death (n=200)

Gravity	Frequency	Valid Percent
Gravity 1	76	38.%
Gravity 2	39	19.5%
Gravity 3	37	18.5%
Gravity 4	21	10.5%
Gravity 5	13	6.5%
Gravity 6	4	2.%
Gravity 7	3	1.5%
Gravity 8	7	3.5%
Total	**200**	**100.%**

4.10 Obstetric history –Parity Cross tabulation

Table 4.6: Parity of the maternal deaths patients (n=200)

Obstetric history	0	Parity 1	Parity 2	Parity 3	Parity 4	Parity 5		Parity 6	Parity 7	Total
Gravity 1	74	2	0	0	0	0		0	0	76
Gravity 2	6	31	2	0	0	0		0	0	39
Gravity 3	2	4	29	2	0	0		0	0	37
Gravity 4	0	0	2	18	1	0		0	0	21
Gravity 5	0	0	1	2	9	1		0	0	13
Gravity 6	0	0	0	2	0	2		0	2	6

Gravity 7	0	0	0	0	0	0		3	0	3
Gravity 8	0	0	0	0	0	0		2	3	5
Total	**82**	**37**	**34**	**24**	**10**	**3**		**5**	**5**	**200**

As noted from Table 4.6 above, gravity 1 had 0 parity and they were 74 which is the highest of the parity, followed by gravity 2 which had 34 parity 1 and gravity 3, which had parity 2 and lastly gravity 4 which had parity 3. The more the gravity the decrease in number of patients with more parity. This could have been linked to the women having more experiences with pregnancy labour and birth as the parity and gravidity increases.

4.11 Maternal Complications

Maternal complications are complications that develop during pregnancy, delivery and after delivery. There are also maternal complications that exist, because the woman had a health condition before pregnancy and the condition may become worse during pregnancy. Most of the maternal complications are preventable or treatable. The maternal complications include excessive blood loss, obstructed labour, infection, high blood pressure during pregnancy, pre-eclampsia, eclampsia, ectopic pregnancy, unsafe abortion, anaemia and heart disease. The maternal complication contribute are obstetric-hemorrhage, high blood pressure during pregnancy, non-obstetric complications, pregnancy related infections and unsafe abortion are the leading causes of maternal deaths in SSA (Musarandega et al., 2021).

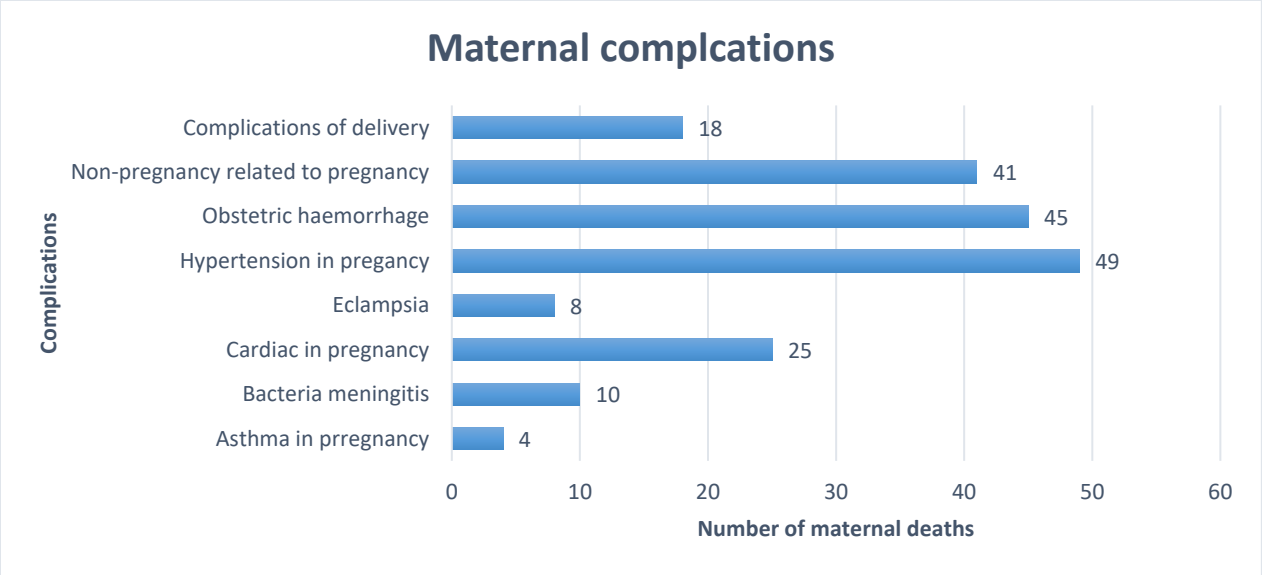

Figure 4.10: Maternal Complication (n=200)

Figure 4.10 shows the recorded maternal complications that contributed to the maternal deaths at NMAH. Some conditions had less than four patients and were then grouped together and for the purpose of this study they were classified as non-pregnancy related complications and had 41(20.5%) patients. These complications included PTB in pregnancy, tight chest, constant cough, shortness of breath (SOB), wheezing, pulmonary oedema, anaemia in pregnancy, diabetes, epilepsy, anaesthesia, convulsions, kidney diseases, infections of unknown origin and rheumatic heart disease. Each of the following conditions also had four or less patients and having 18(9%) patients in total: ectopic pregnancy, puerperal sepsis, unsafe abortion, prolonged labour and obstructed labour. For the purpose of this study these conditions were grouped together and classified as complications of delivery. Other complications that had high number were hypertension 49(24.5%) and obstetric haemorrhage 45(22.5%), cardiac in pregnancy 25(12.4%), eclampsia 8(4%), bacterial meningitis 10(5%) and asthma in pregnancy 4(2%).

According to Desta, et al., (2022), Millions of women worldwide suffer from complications related to pregnancy and childbirth like haemorrhage, hypertensive disorders and obstructed labour. Obstructed labour is responsible for 6% of labouring women in developing countries and 24% of maternal deaths in the Sub-Saharan Africa countries.

Cephalopelvic disproportion (CPD) was the commonest cause of obstructed labour. The most common maternal complication was wound infection (48, 20%). There were three maternal deaths, giving a case fatality rate of 1.25%.

A review of some indicators suggests that there is an improvement in the quality of life of women over the years. However, women are still faced with adverse health outcomes such as sexually transmitted illnesses, gender-based violence and others, leading to health complications and other un-favorable socio-demographic outcomes (Connor et al., 2020). A video that recently went viral placed a spotlight on the pressure that medical institutions have in providing appropriate levels of care for pregnant women. The video depicted the state of health care in South Africa, and in particular, the state of health care experienced by women.

The statistics in South Africa indicates states that that there is progress with regards to reducing maternal deaths to achieve the set iMMR in South Africa. The nationally ratio has decreased from 105.9 deaths per 100 000 live births in 2019 to 88.0 per 100 000 in 2020. As this is an important measure of human and social development that reveals women's overall status, access to health care and the responsiveness of the health care system to their needs it might mean that there is an improvement among pregnant women in accessing healthcare services during ANC, delivery and postnatal. It could also mean that there is improvement in the prevention of maternal complications and maternal care in many healthcare facilities of South Africa (Statistics South Africa, 2022).

4.12 Summary

This chapter presented the findings of the study, and they were presented in accordance with the research objectives and the data collection tool. The maternal death at NMAH shows that the highest maternal deaths occurred in 2017 after recording the lowest maternal in 2016. There were various complications that might have contributed to the deaths in the various years. The most contributing factors were hypertension and Obstetric haemorrhage apart from other condition such as PTB in pregnancy, tight chest,

constant cough, shortness of breath (SOB) and wheezing, ectopic pregnancy, puerperal sepsis, obstructed labour, anaemia in pregnancy, diabetes, epilepsy, and rheumatic heart disease. Amongst the contributing factors the fact that some were directly related to pregnancy whilst others were not related. Also, the findings show that in most of the cases the patients had booked late for antenatal care or were transferred from other facilities already in serious condition or were delayed due to transportation challenges. The next chapter discusses the results and limitations of the study are discussed and based on the findings of the study; recommendations are made.

CHAPTER FIVE

SUMMARY OF STUDY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the study

The study was conducted at NMAH to determine the trends, the causes and the contributory factors of maternal death in NMAH during the years 2013 to 2017. The aim of the research study was to conduct a descriptive retrospective review of hospital-based maternal deaths in order to describe trends of maternal death during the period 2013 to 2017 and examine the causes of maternal deaths at the Nelson Mandela Hospital during the period 2013 to 2017. The trends, causes and contributing factors of maternal death that occurred in NMAH between the years 2013 to 2017 were reviewed and analyzed using patients' records and maternal deaths review reports.

5.2 Summary of the findings

5.2.1 Demographics of the maternal death patients

The age, marital status employment status and education of the woman contribute to maternal deaths, because education level enables or prevent women that need maternal care from accessing the needed services and understanding of the relevant information offered to them at the healthcare facilities. It is disconcerting that the majority of maternal deaths occurred on women who ranked high on education. This raises doubts on whether their education level contributed to their demise. It is possible that these women were delayed, received substandard care the health facilities. They could have received poor quality of care which could have been responsible for their deaths. Overcrowding, lack of resources, including shortage of nursing and medical personnel could have contributed to poor quality care (Maswime & Chauke, 2023).

In their study Maswime & Chauke (2023) lack or low education level affects a number of factors that contribute to maternal mortality through delays and failure to access

appropriate and skilled care needed. For example, lack of money to access transport, challenges in understanding some of the health education given and failure to recognise danger signs in pregnancy. Educational is the therefore, the most important characteristics that improve person's knowledge and understanding importance of and issues related to pregnancy, deliver and post-partum care (Damian et al., 2019).

5.2.2 Condition for referral and condition that led to maternal deaths

A number of conditions were indicated as conditions for referral to NMAH and causes of the maternal deaths. Eighteen conditions were indicated as condition that the patient had or reason for referring the patient to the hospital for further management or indicated as causes of the maternal deaths. The highest among them was obstetric haemorrhage, followed by anaemia in pregnancy, hypertension, peri-partum hysterectomies and contributing causes. The non-pregnancy contributory factors ranged from HIV/AIDS, tuberculosis (TB), bronchopneumonia, epilepsy, pulmonary embolism, prolonged labour, medical and surgical disorders, previous C/section and antenatal care booking status of maternal deaths. These factors are similar to factors described by Moran & Moodley (2018) and Moodley et al, (2014).

There is therefore a need in NMAH to strengthen the prevention and treatment of condition that contribute to maternal deaths. There is a need to deal with the shortage of staff and patients' delays and ensure that all women a cared for by well qualified and skilled healthcare workers from antenatal care through to the 42 days postpartum care to ensure all women and their babies are safe. It is also important to have programmes in that they will prevent unplanned pregnancies among teenagers to prevent the high maternal deaths among teenagers. Teenager and older age group were the maternal age groups that were at high risk of deaths at the NMAH. Furthermore, these programmes must stress to all community the importance of early booking (in 4 weeks of gestation) (Allagoa & Kotingo, 2019).

5.2.3 Maternal mortality decreases gravidity as parity increased at NMAH

The study was conducted at NMAH to determine the trends, the causes and the contributory factors of maternal death in NMAH during the years 2013 to 2017. The aim of the research study was to conduct a descriptive retrospective review. The age marital status employment status and education of the woman contribute to maternal deaths because education level enables or prevent women] that need maternal care from accessing the needed services and understanding of the relevant information offered to them at the healthcare facilities. A number of conditions were indicated as conditions for referral to NMAH and causes of the maternal deaths. Eighteen conditions were indicated as condition that the patient had or reason for referring the patient to the hospital for further management or indicated as causes of the maternal deaths.The finding that maternal mortality decreased as gravidity and parity increased at NMAH, could be linked to women with more experience with birth. Although there was a difference regarding anesthesia given at referral hospitals and NMAH, the findings shows that other levels of hospitals are not equipped to perform a C/section or give anesthesia (Bakker et al., 2021).

5.2.4 Obstetric history of maternal death

Maternal mortality continues to be unacceptable despite the programmes that are implemented in South in order to research the SDGs it has set for itself. The majority of these death occurred in low-resource settings and remote and most could have been prevented if services could be expanded to all the corners of South Africa. Women die as a result of complications during pregnancy and childbirth. Most of these complications develop during pregnancy and most are preventable or treatable. Other complications may exist before pregnancy but are worsened during pregnancy, especially if not managed as part of the woman's care. The major complications that account and account for many of these deaths are severe bleeding (mostly bleeding after childbirth), infections (usually after childbirth and termination of pregnancy), pre-eclampsia, eclampsia, complications from delivery and unsafe abortion. The high maternal deaths in South Africa still reflect the inequities it has suffered during apartheid and it will take time for the gap between the research and the poor to close (Allagoa & Kotingo, 2019).

5.3 Conclusions of the study

The conclusions of a study are intended to assist in understanding the importance of the study. It is not just a summary or re-statement of the research problem, but a synthesis of key points related to answering of the objectives of the study or research questions (Polit & Beck, 2017). The conclusions of this study are discussed below:

- The Nelson Mandela Academic hospital maternal mortality trend is had decreased but it is still higher than the recommendation of the Eastern Cape Department of health of ensuring that maternal death is less than 20% in tertiary hospitals. Teenagers and elderly women need to be discouraged for having children or be kept under close supervision when pregnant.

- Referrals of patients must be done on time and condition for referral and reasons that led to maternal deaths must be described in details to make it easy to understand and the healthcare providers in the receiving hospital are clear. Delays related to transports must be attended to ensure no women reach the facility on time. There must also be a feedback mechanism to ensure that the referring healthcare facilities or referring team learn from the specialist. This will assist them not to repeat the same mistake in future, assist them in learning what senior person have found and done.

- Review and discussion of maternal mortality cases must be conducted regularly at both the referral and receiving health facility. There should be a combined case review in the referring facility that the patient was referred from. In other words, the case reviews should include members from the facilities that referred the patient. These must be done in a collegiality and professional. They must not be used as a witch hunting exercise that will not benefit anybody.

  There must be collegiality and respect for each other to ensure that the referring group should not be afraid if referral because of the rude reaction they might

encounter from NMAH. A number of conditions were indicated as conditions for referral to NMAH and causes of the maternal deaths. Eighteen conditions were indicated as condition that the patient had or reason for referring the patient to the hospital for further management or indicated as causes of the maternal deaths.

- Develop programmes that address patients' issues and cultural believes in the community. There is a need for programmes that address community issues and cultural believes that are not making the community feel small about their practices but make them see the challenges that might occur due to some practices during pregnancy.

5.4 Strength of the study

The findings from the study provide a well information considered the cause, the trends of maternal death in the Nelson Mandela Academic Hospital in the years 2013 to 2017.The result of the study came up with the baseline of data that might assist other researchers to investigate this ephemeron further succeeding the research that might be conducted to investigate further other remarkable maternal death problems of the mothers and how they can be managed by using research methods.

5.5 Recommendations

Recommendations of the study are arguably the most important part of the analysis phase. It is where the researcher suggests specific interventions or strategies to address the issues and constraints identified in the assessment (Creswell & Creswell, 2018). The following are the recommendations based on the findings of this study:

5.5.1 Education at antenatal (ANC) services

Despite the study reveal that the most mothers attend ANC visits before 20 weeks of gestational age, a large percentage of pregnant women visits the antenatal care after 20 weeks of gestation. Therefore, community members should be given the correct

information regarding the necessity of booking early in the clinics immediately when missed the periods. The study shown that some of the patients were un-booked due to delay in seeking medical help for this reason it is recommended the health education during visits and the outreach to community for importance of antenatal services. The affordability to be implemented to manage the barriers of accessibility to health care facilities.

5.5.2 Staff development and Equipment

The study recommends the hospital to increase staff development such as health care personnel, equipment, improve the policy referrals between the two hospitals. Collaboration to other health care multidisciplinary team, stakeholders, psychologist, leaders of the community and health ministers. The study also shown the shortage of staff Doctors and nurses in health care referral hospitals such as health district which need more attention and the following recommendation were emphasized.

5.5.3 Maternity units must have more than eighty percent of their staff trained in Essential Steps in Management of Obstetric Emergencies (ESMOE)

Eighty percent of the maternal deaths were thought to be possibly or probably manageable. ESMOE has been shown to improve knowledge and skills of health care professionals and has been associated with reduction of maternal.

5.5.4 Ensure safe caesarean section sites

Action must be made to ensure that the facilities performing C/sections can do so harmless. Efforts must be made to ensure the facilities performing C/sections can do so safely, which requires adequate numbers of doctors with relevant surgical and anesthetic skills. Which be in need of adequate numbers of doctors with relevant surgical and anesthetic skills.

5.5.5 Improve intern training

The shortage of appropriately trained doctors and nurses was considered as a significant contributory factor in NMAH and the quality of intern training must be thoroughly examined and the hospitals training interns must be properly evaluated.

5.5.6 Continue focus on HIV

One-thirds of the maternal deaths were caused by HIV positive; although the decrease noted from the year 2016, attention must be focused on screening and treatment of HIV positive women during the antenatal care.

5.5.7 Clinical audit

The specific technique used to analyze the quality service provided in NMAH against the pre-set agreement with the clinic criteria, protocols and standard. This can be described as the systematic review methods managing the care against criteria aiming to improve patient care outcomes to prevent maternal deaths in NMAH.

5.5.8 Transport system and schedule for referrals among pregnant women

Findings revealed the delay of transport various district of Metro-Ambulances for emergencies in pregnant mothers from institution to NMAH, the recommendation for special transport for pregnant mother and emergencies. The policies and guidelines for from referral hospitals to NMAH should be evaluated of the effectiveness and reviewed when necessary. High risk antenatal clinics within the hospital must be established and made accessible to all pregnant women requiring their services and it will require transformation; such as specialists outreach clinics or advanced midwife manage high risk health care settings community areas.

5.6 Summary

The maternal age, marital status, employment status and education have both negative and positive impact on the maternal outcomes. There were eighteen conditions indicated as condition that the patient had or reason for referring the patient to the hospital for

further management or indicated as causes of the maternal deaths. The highest among them was obstetric haemorrhage, followed by anaemia in pregnancy, hypertension peri-partum hysterectomies and contributing causes. There were delays in referral, accessing the health facilities and giving the necessary care and treatment due to different reasons ranging from lack of money, transportation and qualified healthcare professionals to attend to the patient. There is a need to educate communities about early access to ANC services, healthcare facilities when there is a need. There is also a need to train qualified and skilled healthcare workers to ensure that all women receive the care needed and reduce maternal deaths. There is also a need to employ more healthcare professionals to deal with the human resource shortage at NMAH.

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APPENDIX 1: DATA COLLECTION TOOL

IDENTIFICATION NUMBER……..

DEMOGRAPHIC FEATURES:

1. Home Village/Urban Area……

Age……

Marital Status:

Single……

Married……...

Separated…….

Divorced Separated……

Widow …….

2. Race

African ……. Colored……

Other (Specify)……

3. Nationality

South African Citizen…… Non - citizen (permanent resident) …….

Non-citizen (refugee)…….

Other (Specify)…….

4. Employment status

Housewife

Unemployed,

Work in Informal sector

Student / pupil/ learner

Self-employed

5. Education level:

No education…….

Primary education level…….

Secondary education level: …….

Matric education level: …….

Tertiary education level……...

6. REFERRAL:

Came directly from home…...Who accompanied the patient? Doctor…... Professional nurse……. Enrolled nurse……. Enrolled Nursing assistant…Community health worker……

Emergency services…… Family

Member……. Community leader……...

Referred from which hospital or Clinic or NGO…….

Date referred:

Time referred:

Referral letter completed:

Reason for referral:

Referred by: Doctor…... Professional nurse…… Enrolled nurse…... Enrolled Nursing assistant…… Community health worker…….

7. ADMISSION:

Date admitted: Time admitted:

Admitted by:

Reason for admission:

Admitted by: Doctor…. Professional nurse…… Enrolled nurse……. Enrolled Nursing assistant…… Community health

Received by in the ward: Doctor..… Professional nurse…... Enrolled nurse……

Auxiliary nurse ……

Nursing assistant…… Community health worker……

Arrival time in the ward:

Time treatment initiated:

8. OBSTETRIC HISTORY:

Number of previous pregnancies:

Gravidity…… Parity…….

Number of live births …….

Number of abortions/miscarriages:

Cause of the abortions:

Number of Stillbirths:

Cause of stillbirths:

History of twin pregnancy:

Number of twin pregnancies:

Other (specify)

9. PAST MEDICAL HISTORY:

1. Chronic Hypertension
2. Previous caesarian section
3. Placenta Abruption
4. Diabetes Mellitus
5. Other (Specify)

10. **BOOKING STATUS:**

1. Booked 1. Yes 2. No

1. Late Booker 1. Yes 2. No

Date of First booking

Gestational stage at first booking

Gestational stage at last visit

Blood Pressure at first booking

Weight at first booking

Tests done at first booking

Test results at first booking

11. ANTENATAL CARE HISTORY

Number of Antenatal Visits…….

Date of last antenatal visit …….

Number of routine checkups attended…….

Number of non-routine checkups……

Blood pressure at each antenatal care visit

Routine treatment prescribed at each antenatal visit

Tests done at each antenatal care visit

Gestational age at elevated BP was first recorded…….

Gestational age at sugar in urine was first recorded……

Gestational age at albumin in urine was first recorded…….

Gestational age at blood sugar in urine was first recorded…….

Gestational age at which low hemoglobin level was first recorded…….

Gestational age at HIV test recorded…….

Gestational age at HIV STI's tests recorded…….

Date of BP treatment initiated…….

Date of diabetic treatment initiated …….

Date of anemia treatment initiated …….

Date of STI treatment initiated ……..

12. Human Immune Deficiency (HIV) status…….

Date HIV first diagnosed …….

Date of STI treatment initiated …….

CD4 COUNT if reactive…….

Date of treatment initiation…….

Gestational at which tetanus injections recorded…….

13. CLINICAL FEATURES ON ADMISSION:

1. Dizziness…… ……. 1. Yes 2. No 3. Not recorded
2. Headache…… 1. Yes 2. No 3. Not recorded
3. Epigastria Pain…… 1. Yes 2. No 3. Not recorded
4. Nausea …… 1. Yes 2. No 3. Not recorded
5. Visual disturbance…… 1. Yes 2. No 3. Not recorded
6. Vomiting…… 1. Yes 2. No 3. Not recorded
7. Blood Pressure…… 1. Yes 2. No 3. Not recorded
8. Convulsions…… 1. Yes 2. No 3. Not recorded
9. CD4 COUNT if reactive…….
10. Date of treatment initiation…….
11. Gestational at which tetanus injections recorded……

14. CLINICAL FEATURES ON ADMISSION:

1. Dizziness…… 1. Yes 2. No 3. Not recorded
2. Headache…… 1. Yes 2. No 3. Not recorded
3. Epigastria Pain…… 1. Yes 2. No 3. Not recorded
4. Nausea …… 1. Yes 2. No 3. Not recorded
5. Visual disturbance…… 1. Yes 2. No 3. Not recorded
6. Vomiting…… 1. Yes 2. No 3. Not recorded
7. Blood Pressure…… 1. Yes 2. No 3. Not recorded
8. Convulsions…… 1. Yes 2. No 3. Not recorded
9. Eodema…… 1. Generalized 2. Moderate 3. Mild 4 None
10. Weight/Obese (Body Mass Index) BMI

15. INVESTIGATIONS DONE UPON ADMISSION

1. Platelet count…….
2. Hemoglobin 1. Highest level……. 2. Lowest level
3. Liver function test 1. Normal……. 2. Deranged
4. Renal function test 1. Urea ……. 2. Creatinine …….
5. Dipstick Urinalysis =1+ 2+ 3+ protein……...
6. Twenty-four-hour urine protein …….

16. MATERNAL COMPLICATIONS:

1. Eclampsia……... 1. Yes 2. No

Date diagnosed: ----------

2. Abruption placenta…… 1. Yes 2. No

Date diagnosed ……...

3. Pulmonary Edema/Embolism…… 1. Yes 2. No

Date diagnosed……

4. Cerebral pathology …… 1. Yes 2. No

Date diagnosed ……..

5. Acute renal failure…… 1. Yes 2. No

Date diagnosed……...

6. Maternal death…… 1. Yes 2. No

Date occurred …….

Date diagnosed……

7. Dis-Serminated intravascular coagulation (DIC) 1.yes 2. No

Date diagnosed…. Help Syndrome 1. Yes 2. No

18. CARE RECEIVED AT NMAH

1. Did she have an anesthetic? 1 Yes 2. No
2. Did she have Hysterectomy 1. Yes 2. No
3. Did she have Prolonged Labor 1. Yes 2. No 3. N/A 4. Unknown
4. Did the woman have previous caesarian section (C/SECTION?)
5. Treatment received in the hospital
6. Intravenous infusion

Blood

Antibiotics

Oral treatment

Injections

Other (specify)

What was done to deal with the challenges?

Was she Anemic during pregnancy? 6. 1. Yes 2. No 3. Unknown

Are there any feedback/ communication between NMAH and the referral?

1. Yes 2. No 3. Unknown

APPENDIX 2: WAIVER CONSENT FORM

No 41 Umzamane Street
North Crest
Umtata
5217

Research ethics committee
University of Fort Hare
P. Bag 5200
East London
5201

Dear Sir / Madam

RE: REQUEST A PERMISSION FOR WAIVER OF CONSENT FORM

I am requesting waiver of informed consent for a retrospective study regarding the analysis of maternal death in the Nelson Mandela Academic in the Eastern Cape Province, South Africa from 2013 to 2017.My name is Nosipho Sharon Majiki and I am a student studying for a master's degree in Public Health at University of Fort Hare Department of Public Health.The study will be a quantitative, descriptive, retrospective design based on the information extracted from patient's files and the records of maternal death consist of the following demographic data, antenatal care, labor and perinatal care and postnatal care. Information will be extracted from medical records of maternal death

Patients admitted and treated at Nelson Mandela Academic Hospital for the period of 4 years (from 01st January 2013 to 31st December 2017).

This information will be entered on a structured information collection sheet. Anonymity and confidentiality will be protected by not recording patients' names and removing all details which could lead to the identification of individuals. Only a research number will be assigned, representing each patient's record information. Furthermore, the information obtained from data collection will not be divulged to anybody. Lastly, extracted

data will be stored electronically on a password protected computer. Hard copies of structured information collection sheet

With information obtained from patients' records will be stored in a locked cupboard in my office.

Yours Sincerely

Miss: Nosipho Sharon Majiki

APPENDIX 3: ETHICAL CLEARANCE FROM THE UNIVERSITY

University of Fort Hare
Together in Excellence

HEALTH RESEARCH ETHICS COMMITTEE

P.O Box 1054
East London 5200
Tel: +27 (0) 43 704 7368
E-mail: dgoon@ufh.ac.za

ETHICAL CLEARANCE CERTIFICATE
REC-100118-054

Certificate Reference Number:	**Ref #2021=05=09=MajikiN**
Project title:	A retrospective analysis of maternal death in the Nelson Mandela Academic Hospital in Eastern Cape Province, South Africa from 2013 to 2017
Nature of Project	Masters of Public Health
Principal Researcher:	Majiki N
Student Number:	201816925
Supervisor:	Prof XT Maluleke

On behalf of the University of Fort Hare Health Research Ethics Committee (HREC), I hereby give ethical approval in respect of the undertakings contained in the above -mentioned project and research instruments(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the HREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

The Principal Researcher must report to the HREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

University of Fort Hare
Together in Excellence

HEALTH RESEARCH ETHICS COMMITTEE

P.O Box 1054
East London 5200
Tel: +27 (0) 43 704 7368
E-mail: dgoon@ufh.ac.za

The HREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principles or practices are revealed or suspected
  - relevant information has been withheld or misrepresented
  - regulatory changes of whatsoever nature so require
  - the conditions contained in the Certificate have not been adhered to

- Request access to any information or data at any time during the course or after completion of the project.
- In addition to the need to comply with the highest level of ethical conduct principal investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to HREC monitoring@ufh.ac.za.

The Ethics Committee wishes you well in your research endeavours.

Yours sincerely

Professor DT Goon
Chairperson: HREC
5th May 2021

APPENDIX 4: APPROVAL TO CONDUCT STUDY NELSON MANDELA HOSPITAL

Province of the
EASTERN CAPE
HEALTH

Clinical Governance Office• Administration Block• Nelson Mandela Academic Hospital• Private Bag X 5152•
Mthatha•5099•Tel: 047 502 4446• Fax 047 502 4968• Enq: H. Mgudlwa Ext: 4469

Ms. N. Majiki
Nelson Mandela Academic Hospital,
Sisson Street,
Fortgale
Mthatha,
5099

RE: APPROVAL FOR YOU TO CONDUCT RESEARCH AT NELSON MANDELA ACADEMIC HOSPITAL (NMAH).

This communique bears reference to your application/request to conduct clinical research at NMAH.

In reference to the Human Research Committee Clearance Certificate from Eastern Cape Department of Health, would like to inform you that your request/application has been approved. The approval is based on you meeting the conditions stipulated in the certificate issued to you by the University as attached. Kindly note that the approval is strictly restricted to the study as specified in your proposal seen by the institution. Any deviation should be accompanied by pre-approval and without such it will be prohibited and this letter could nullified. The institution and the Department reserve the right to change part or whole of the condition/s when it is deemed necessary. All relevant stakeholders that you may need for this research within the institution will be notified accordingly.

Failure to adhere to such conditions will result in unconditional withdrawal of this letter with immediate effect.

Clinical Governance Office wishes you all the best of luck and if there is any further assistance you may need, you are welcome.

Acting Director: Clinical Governance
Nelson Mandela Academic Hospital
Dr. M. Nodikida
Date: 24/08/2021

Acting Chief Executive Officer
Nelson Mandela Academic Hospital
Dr. A. Mankahla
Date: 27/08/2021

APPENDIX 5: APPROVAL TO CONDUCT STUDY FROM THE DEPARTMENT OF HEALTH

Province of the
EASTERN CAPE
HEALTH

Enquiries: Yvonne Gixela Tel no: 079 074 0859

Email: Yvonne.Gixela@echealth.gov.za / ygixela@gmail.com

Date: 14 July 2021

RE: A retrospective analysis of maternal death in the Nelson Mandela Academic Hospital in Eastern Cape Province, South Africa from 2013 to 2017 (EC_202107_011)

Dear Ms N. Majiki

The department would like to inform you that your application for the abovementioned research topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.

2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.

3. The Department of Health expects you to provide a progress update on your study every 3 months (from date you received this letter) in writing.

4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Eastern Cape Health Research Committee secretariat. You may also be invited to the department to come and present your research findings with your implementable recommendations.

5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTE

2030 NDP

TOGETHER, MOVING THE HEALTH SYSTEM FORWARD

APPENDIX 6: CERTIFICATE OF EDITING

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21 November 2022 • **015/2022**

TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING

This certificate confirms that professional language editing services were rendered on the following submission:

TITLE:	**A RETROSPECTIVE ANALYSIS OF MATERNAL DEATH IN THE NELSON MANDELA ACADEMIC HOSPITAL IN EASTERN CAPE PROVINCE, SOUTH AFRICA FROM 2013 TO 2017**
STUDENT:	**Nosipho Sharon Majiki • 201816925**
PROGRAMME:	**Master of Public Health**
INSTITUTION:	**University of Fort Hare**
PAGES:	**111 (Last page number 93)**

We hope you find our work acceptable to your expectation.

Best regards

A. BEST
*Membership No: **BES003***
Professional Editors Guild (PEG), South Africa

MSc in Public Policy and Management (London), BAdmin Hons in Public Administration (Fort Hare), Diploma in Business Computing in Information Technology (Damelin), Programme in Project Management (Stellenbosch), Programme in Total Quality Management (Unisa)

Professional registrations: CIGFARO, SAMEA, IACD, IOA, PMSA, CIPPT, SAAPAM and SABPP

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