Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State

N S Malinga

20168799

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Supervisor:	Dr A du Preez
Co-supervisor:	Dr T. Rabie
Assistant supervisor:	Ms. W. Breytenbach

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SOLEMN DECLARATION AND PERMISSION TO SUBMIT

1. Solemn declaration by student

I, **N.S. Malinga student no 20168799, ID 620912 044 0087,** declare herewith that the research proposal entitled:

Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State

Which I herewith submit to the North-West University, Potchefstroom Campus, in compliance with the requirements set for the **M.Cur Health Sciences degree**, is my own work and has not already been submitted to any other university.

I did my best to acknowledge all the references used in the dissertation. I tried by all means to paraphrase their words to the best of my ability, while still portraying the meaning of their words. Due to extensive reading on the topic, I might have internalised some of the information in my thinking but care has been taken to give recognition where due to the original authors.

Signature of student

Signed at North West University

Date: ……..

PREFACE

This dissertation will be presented in article format. Chapter 1 will provide background information about the research problem, chapter 2 comprises the article that will be submitted to the Africa Journal of Nursing and Midwifery, and chapter 3 summarises the research report by presenting the conclusions, limitations and recommendations pertaining to the current study.

The student (researcher) identified the research problem, namely the need to investigate maternal and neonatal factors associated with perinatal deaths at one district hospital in the Free State Province of South Africa. With the assistance of the study's supervisors and a statistician, the student wrote the research proposal, collected and analysed the data and wrote the dissertation. The supervisors and the statistician contributed to the article's improvements after the student had compiled the initial draft document. The co-authors' signed permission for submitting the article to the Africa Journal of Nursing and Midwifery is included in chapter 2 of this dissertation.

Three research questions were posed: (1) what were the demographic profiles of the mothers and neonates in the study's sample; were there any practically significant differences in the age, gravida, parity and health risk factor count (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta praevia, ruptured uterus and prolonged/obstructed labour) between mothers with live neonates and those whose neonates had who died within one week after birth; (2) was the baby's gender a practically significant indicator to be born alive or dead; and (3) were there practically significant differences associated with the babies' birth weights, gestational ages and Apgar scores between neonates who lived and those who had died by the age of one week?

The neonates' survival chances were influenced mostly by the neonates' Apgar scores 10 minutes after birth, gestational age, weight at birth and the parity of their mothers.

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ABSTRACT

Perinatal mortality refers to the stillbirth of baby and a baby's death up to one week after birth. The purpose of the current study was to identify maternal and neonatal factors associated with perinatal deaths in one selected district hospital in the Free State Province of South Africa. Most births and neonatal deaths occur in district hospitals, explaining the rationale for selecting a district hospital as the study site.

A quantitative retrospective descriptive design was utilised. Ex post facto data were collected from the Perinatal Problem Identification Programme's (PPIP's) data collection tool. An additional MSExcel data collection instrument was developed to transfer specific data elements from the PIPP data base to the MSExcel data instrument to facilitate the data analysis.

At the participating hospital, 2319 neonates were born during 2015 comprising the study's population. A random sample of 384 live neonates and an all-inclusive sample of 43 dead neonates were included in the current study's data collection procedures.

Descriptive statistics were calculated and Cohen's effect sizes-d (for continuous variables) as well as phi-coefficients (for categorical variables) were calculated to determine practically significant differences between the variables for neonates in the alive and dead groups respectively. A logistical regression analysis, to determine the major factors associated with neonatal deaths, was also compiled. The SAS (2016) statistical program was used to analyse the data.

These analyses indicated that the neonates' Apgar scores 10 minutes after birth, gestational age, weight at birth and the parity of the mother were the most practically significant indicators of neonates' chances to live or die.

The study's findings supported the assumption that practically significant factors are associated with maternal and neonatal factors that contribute to perinatal deaths.

Keywords: Apgar scores, neonatal deaths, neonates, new born babies survival risks, perinatal audits, perinatal deaths, stillbirths.

OPSOMMING

Perinatal mortaliteit verwys na die doodgeboorte of dood van ’n baba onmiddellik en tot ’n week na geboorte. Die doelwit van die huidige study was om moeder- en neonatale faktore te identifiseer, wat geassosieer word met perinatale sterftes, in een geselekteerde distrikshospitaal in die Vrystaat Provinsie van Suid-Afrika. Die meeste geboortes en neonatale sterftes kom in distrikshospitale voor en dit was die rationale vir die keuse van ’n distrikshospitaal as studieterrein.

‘n Kwantitatiewe, retrospektiewe beskrywende ontwerp is gebruik. Ex post facto data is deur middel van die Perinatale Probleemidentifiseringprogram (PPIP) data-insamelingsinstrument versamel. ’n Bykomende MSExcel data-insamelingsinstrument is ontwikkel om spesifieke data-elemente uit die PPIP-data-instrument na die MSExcel data-instrument oor te dra om data analise te vergemaklik.

In die deelnemende hospitaal is 2319 babas tydens 2015 gebore wat die studie se populasie behels het. ‘n Verteenwoordigende steekproef van 384 lewende neonate en ‘n alles-insluitende steekproef van 43 dooie neonate was ingelsuit in die huidige studie se data-insameling prosedures.

Beskrywende statistieke is bereken en Cohen se effekgroottes-d is bereken (vir aaneenlopende veranderlikes) en phi-koeffisiënte (vir kategoriese veranderlikes) om prakties beduidende verskille te bepaal tussen veranderlikes vir neonate in die lewende en in die gestorwe groepe respektiewelik. ’n Logistieke regressie-analise is uitgevoer om die hooffaktore te bepaal wat met neonatale sterftes verbind word. Die SAS (2016) statistiese program is gebruik om die data te analiseer.

Die analises het aangedui dat die neonate se Apgar tellings 10 minute na geboorte, duur van swangerskap, gewig by geboorte en hulle moeders se pariteit die mees praktiese beduidende aanwysers was van neonate se kanse om te lewe of te sterwe.

Die studie se bevindings ondersteun die aanname dat daar prakties beduidende faktore is wat verband hou met moeder- en neonatale faktore wat tot perinatale sterftes bydra.

Sleutelwoorde: Apgar tellings, neonatale sterftes, pasgebore babas se oorlewingsrisiko’s, perinatale oudits, perinatale sterftes, doodgeboortes.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal care
ART	Anti-retroviral treatment
BBA	Born before arrival
CARMMA	Campaign for the Accelerated Reduction of Maternal Mortality in Africa
CHERG	Child Health Epidemiology Reference Group
CPD	Cephalo pelvic disproportion
CRSV	Civil Registration and Vital Statistics (of the United Kingdom)
DCST	District clinical specialist teams
DOH	Department of Health
ENND	Early neonatal death
ESMOE	Essential steps in managing obstetric emergencies
FSB	Fresh stillbirth
HBB	Helping babies breath
HIV	Human Immuno Deficiency Virus
HREC	Health Research Ethical Committee
IUGR	Intra-uterine growth retardation
ICU	Intensive care unit
KMC	Kangaroo mother care
LBW	Low birth weight
LGA	Large for gestational age infant
LMIC	Low and Middle Income Countries
LNND	Late neonatal death
MCWH	Maternal, child and women's health
MDG's	Millennium Development Goals
MRC	Medical Research Council (of South Africa)

MSB	Macerated stillbirth
MSL	Meconium stained liquor
MTCT	Maternal to child transmission (of HIV)
NapeMMCo	National perinatal Morbidity and Mortality Committee
NMR	Neonatal mortality rate
NDoH	National Department of Health (of South Africa)
NND	Neonatal death
NNDR	Neonatal death rate
NWU	North West University
PHC	Primary Health Care
PMR	Perinatal mortality rate
PMTCT	Prevention of mother to child transmission (of HIV)
PPIP	Perinatal Problem Identification Programme
SANC	South African Nursing Council
SDG	Sustainable developmental goals
SGA	Small for gestational age infant
SSA	Sub Sahara Africa
UNICEF	United Nations Children's Fund
UK	United Kingdom
UN	United Nation
USA	United States of America
WHO	World Health Organization

CHAPTER 1
OVERVIEW OF THE STUDY

1.1 OVERVIEW OF THE STUDY

Firstly the background and rationale underlying this study will be discussed, followed by the problem statement, paradigmatic perspectives and the research methodology. This study will be presented in article format in chapter 2, prepared according to the author guidelines of the Africa Journal of Nursing and Midwifery (see Appendix F). Chapter 3 presents the conclusions of the study, recommendations for practice, research, education and policy in nursing, and the study's limitations.

1.2 INTRODUCTION

A perinatal death refers to the stillbirth or neonatal death of a newborn immediately after and up to a week after birth. Perinatal deaths are categorised as (i) antepartum stillbirths, foetal deaths before the onset of labour (ii) intrapartum stillbirths, foetal deaths before birth and (iii) neonatal deaths, deaths before reaching the age of 28 days (Smith, 2016:18). Neonatal deaths are categorised into early neonatal death, death of a baby before five days after birth or late neonatal death, death of a baby up to 28 days after birth. This study focuses on stillbirths and early neonatal deaths. Stillbirths are classified as either macerated or fresh stillbirths (World Health Organization, 2013:13). In the case of a fresh stillbirth, death occurs just before birth, while a macerated stillbirth refers to a foetus that had been retained in the uterus for some time after death (Jezova *et al.,* 2013:1). Stillbirths are the largest contributing factor to perinatal mortality and are mainly unpredictable, although many stillbirths might be preventable (Kady & Gardosi, 2004:397).

The perinatal death rate is a most sensitive index for indicating the quality of maternity care rendered to mothers during pregnancy and childbirth (or "delivery" as commonly referred to in South Africa) and also to the baby during the perinatal period (Gupta, 2011:245). Failure to comply with the standards of care for antenatal care, the delivery of neonates and the care of the newborn is a strong determinant or predictor of perinatal mortality (Gupta, 2011:245). Perinatal mortality remains unacceptably high, where there is globally an estimate of three million stillbirths and three million neonatal deaths, of which some might have been prevented by optimal care (Allanson *et al.,* 2015:37; Oza *et al.,* 2015:19). Yet, worldwide, poor progress has been made to limit the number of perinatal deaths (Allanson *et al.,* 2016:79). In some countries where perinatal death rates are high, these deaths might not be recorded. Enhancing the prevention of perinatal deaths requires that data about the factors related to perinatal deaths are captured accurately (Allanson *et al.,* 2016:79).

According to Allanson *et al.* (2016:79) perinatal deaths are prioritised on the international public health agenda. Despite this attention given to perinatal deaths, progress remains poor. As the world drew a curtain on the Millennium Development goals (MDGs), and particularly MDG 4 which expected all countries (South Africa [SA] included) to have reduced the number of childhood deaths under the age of five years by two thirds by the year 2015. Although MDG 4 was not reached, child mortality was reduced by 53% during the period 2000-2015. However the neonatal mortality rate decreased much slower (Cooper, 2016). With the unmet targets of the MDGs, the United Nations (UN) launched the Sustainable Development Goals (SDGs) of which SDG number 3 focuses specifically on ensuring healthy lives and the promotion of well-being for all ages (UN, 2015). These goals are linked to maternal and perinatal outcomes, where the quality of care impacts on the outcomes (Allanson *et al.,* 2016:79).

Perinatal death is a devastating experience for the families as well as for the midwives and the hospitals concerned (Feresu *et al*., 2005:1). Allanson *et al.* (2016:79) maintain that there should be a better understanding of the factors causing perinatal deaths in order for health care workers (midwives in this study) to develop interventions to reduce preventable deaths and improve the quality of care. In order to address the above mentioned aspects, the Perinatal Problem Identification Programme (PPIP) was developed and implemented. The PPIP is a data collection tool that was developed by Dr Johan Coetzee for the Medical Research Council (MRC) of South Africa (2012) which aimed to identify and analyse maternal and neonatal factors associated with perinatal deaths, the focus of the current study.

The PPIP was first introduced in 2000, but during the early years the PPIP was not compulsory, therefore not used in most hospitals (Pattinson, 2005). However in 2012, South Africa's National Department of Health (NDoH) committed themselves again to achieve MDG 4 which focussed on reducing under-five child mortality, including perinatal deaths. Neonatal mortality contributes 44% of all under-5 deaths, explaining why a focus on neonatal deaths is essential (Cooper, 2016). As a result, the PPIP became mandatory for all facilities (hospitals and 24-hour clinics) rendering a maternity service and taking care of newborn babies (Pattinson & Rhoda, 2014:26). The Free State Province is considered to have good quality assessments according to the PPIP (Pattinson & Rhoda, 2014:26). However, from the researcher's personal experience this was not the case in the district hospital where the current study was conducted as its PPIP revealed poor quality assessments since the implementation of PPIP.

1.3 BACKGROUND

An estimated 130 million infants are born each year worldwide of whom 4 million die during the first 28 days of life. Three quarters of neonatal deaths occur during the first 24 hours after birth (Jehan *et al.,* 2009:130). During the previous decade over 6.3 million perinatal deaths occurred worldwide; almost all of them (99%) in developing countries (Lawn *et al*., 2012:123-142). Globally perinatal deaths occur predominantly in Sub-Saharan Africa (SSA) where neonatal deaths account for 36% of the under-5 mortality rates (Patrick & Stephen, 2016:51). Perinatal mortality in South Africa remains high and neonatal deaths account for 30% of the mortality of children younger than five years (Pattinson & Rhoda, 2014:6 & 26; WHO, 2015:424-428).

Although there is a decrease in the number of perinatal deaths, the ideal would be that no perinatal deaths should occur. The *Saving Babies 9Th Report on Perinatal Deaths in South Africa* (Pattinson & Rhoda, 2014:2) added that during the period 1 January 2012 to 31 December 2013, out of 1 412 355 births 32 662 were stillbirths and 14 576 early neonatal deaths, according to the PPIP. During this period there were 588 PPIP sites within South Africa of which 17 were within the Free State Province (Pattinson & Rhoda, 2014:2). The statistics from the participating hospital indicated perinatal death rates of 16.28 per 1000 births during 2015. Most perinatal deaths occur in district hospitals (Van Heerden *et al.,* 2016) which was also the context of the current study.

1.3.1 Perinatal deaths

Perinatal deaths, including fresh stillbirths, macerated stillbirths and early neonatal deaths are closely related with the same obstetrical causes contributing to all these occurrences (Marshall *et al.*, 2016:515; Smith, 2016:18). Midwives' responsibilities for reducing perinatal deaths are crucial. Midwives can promote early antenatal care and provide education to pregnant women to try and reduce perinatal deaths, but this is not sufficient when considering the persistently high perinatal death rate. The classification and determination of perinatal deaths associated with maternal and neonatal factors are pivotal to reduce these deaths because it will link the contributory factors to these deaths across different settings (Allanson *et al.,* 2016:79).

1.3.2 Quality of care influencing maternal and neonatal outcomes

The WHO defines quality of care as "the extent to which health care services provided to individuals and the patient population improve desired health outcomes". In order to accomplish quality health care the aim should be to provide safe, effective, timely, efficient, equitable and people centred care (WHO, 2014). In the United Kingdom (UK) the Civil Registration and Vital

Statistics (CRSV) are used as a strategy to access reliable data specifying the numbers and causes of maternal and neonatal deaths. This quality improvement initiative links the local level of care to the national level through the timely notification and identification of maternal and neonatal deaths (Kerber *et al.,* 2015). During the maternal mortality audit, data and peer reviews are used to improve the quality of care, while perinatal outcome audits focus on the capturing of information about the number and causes of stillbirths and neonatal deaths (Kerber *et al.,* 2015).

Jehan *et al.* (2009:130) reported that in Pakistan, which is also a developing country such as South Africa, unacceptably many neonates died irrespective of whether or not they had been cared for in hospitals. This indicated a possible subminimal standard of care at these hospitals.

In South Africa the majority of births occur at district hospitals, which was the context of the current study (Lloyd & de Witt, 2013:519; Pattinson & Rhoda, 2014:9). The high mortality rate is associated with poor quality care, sub-optimal adherence to guidelines, delays in seeking antenatal care, inadequate inter-facility transport for emergency maternity transfers and inadequate post natal care for mothers and babies (Maredza *et al.,* 2016:2). *The Saving Babies Report* (2012-2013) indicated that the quality of care is affected by the inadequate number of health care workers, particularly midwives, in South Africa (Pattinson & Rhoda, 2014:9). Quality of care, including the number of staff members in the maternity units, level of training of the personnel as well as the availability of standardised maternity care equipment during childbirth, impact on the birth outcomes (Pattinson & Rhoda, 2014:26). The mismatch between the work load and the need for quality maternity services adversely affect the quality of care rendered to mothers and babies (Koblinsky *et al.,* 2016:2307).

1.3.3 Factors contributing to perinatal deaths

Perinatal deaths are affected by organisational and personal factors. In the following section the organisational factors and personal factors based on the mother and neonate (the focus of the current study) will be discussed.

Organisational factors

Since 2000, numerous organisational factors were identified internationally that could influence perinatal deaths. The highest neonatal mortality rates and highest stillbirth rates occur in SSA, followed by Asia and Latin America (Zupan, 2005:2047).

The three delays model is an approach that classifies the modifiable factors, identified within organisational factors, when doing death reviews to reduce perinatal deaths (WHO, 2016b:24).

The first delay relates to the family, where a delay occurs to recognise the problem. The mother, the father, or family members might be unaware of the need for skilled care for the mother during pregnancy and/or during birth (WHO, 2016b:24).In some instances the mother, the father and the family were unaware of the warning signs of problems in pregnancy or in the neonate or they relied on traditional practices and medicines that might be harmful to the mother and/or neonate or the family might be adhering to sociocultural practices such as applying cow dough to the umbilicus or discarding the colostrum (WHO, 2016b:24; Zupan, 2005:2047).

The second delay relates to the inaccessibility or non-availability of the required maternal and neonatal health services (WHO, 2016b:25). The issues to be investigated during a death review, to assess such delays, include distance from health facilities, delays in travelling to the health facility after the problem had been identified and the reasons for such delays (WHO, 2016b:25).

The third delay concerns challenges experienced when transport is being arranged to the next level of medical facility as well as delays in providing appropriate care at the referring facility as recognised in the *Saving Babies Report* (WHO, 2016b:24; Pattinson, 2000:4;). The main challenge with this delay is usually related to the timeliness of the care given as well as the quality of this care at the receiving facility, the quality of care is usually related to the provider error, lack of supplies or equipment as well as poor management (WHO, 2016:25). The last organisational challenge concerns the unavailability of neonatal ICU beds with available ventilators (WHO, 2016b:25; Lloyd & De Witt, 2013:518;). Complications of preterm births include asphyxia or trauma during birth, infections, severe malformations and low birth weight which contribute to increased neonatal deaths, unless NICU beds are easily available (WHO, 2016b:25). When doing the neonatal death and stillbirth reviews, the three delays as well as the availability of NICU beds at hospitals should be addressed.

Personal factors

Personal factors include maternal and neonatal factors that could influence neonatal mortality rates, which is the focus of this study.

Maternal factors that contribute to perinatal death include unexplained intrauterine deaths, intrapartum asphyxia, infections, hypertensive disorders, spontaneous preterm births, antepartum haemorrhage, maternal disease for example syphilis (Lloyd & De Witt, 2013:519; Fraser *et al*., 2010:1032;). Other maternal factors, listed in the PPIP, include the number of singleton pregnancies, twin pregnancies, triplets, age, gravida, parity, diabetes, syphilis,

hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruptio, ruptured uterus, prolonged and obstructed labour. Tuncalp *et al.* (2015:1045) and Oza *et al.* (2015:20) added sepsis, intrapartum complications, pneumonia and abortion.

Some maternal factors, associated with other conditions, could contribute to perinatal deaths. These include delays in seeking help and not responding to poor or absent foetal movements, as well as poor or inadequate management of hypertension at the health facilities and poor communication (without interpretation) which might affect maternal outcomes.

Neonatal factors include prematurity, asphyxia, birth trauma, infections, congenital abnormalities, hypoxia, immaturity, sepsis, pneumonia, diarrhoea and neonatal tetanus (Patrick & Stephen, 2016:51; Oza *et al.,* 2015:20; Tuncalp *et al.,* 2015:1045; Fraser *et al*., 2010:1032). According to the PPIP data collection tool the birth weight, gestational age of the baby, Apgar score and gender can also influence perinatal outcomes.

1.3.4 Internationally researched interventions to prevent perinatal deaths

Internationally research has indicated that high impact, yet cost effective interventions could save newborns' lives and prevent perinatal deaths especially in high disease burden countries, such as South Africa.

The "Every Newborn Action Plan" is an intervention implemented in the UK to prevent perinatal deaths. This plan addresses the quality of care at birth by generating data used for decision-making and developing action plans (Kerber *et al.,* 2015). Although developed countries put their trust in high-technology to improve neonatal outcomes, this is not the case in developing countries, including South Africa (Lloyd & De Witt, 2013:518). A study conducted in Latvia indicated that some medical and technological advances in maternal care could drastically reduce maternal and perinatal deaths. However, unless these interventions are implemented through interdisciplinary collaboration, they might cause harm to the mother and/or the unborn baby.

For many years, the South African government implemented various interventions (initiatives), such as Kangaroo mother care (KMC), resuscitation of newborns, breastfeeding and the prevention of hypothermia (Lloyd & De Witt, 2013:518) to reduce the number of perinatal deaths. The reduction of perinatal deaths is a major public health priority with significant disparities based on race and ethnicity (Fraser *et al*., 2010:685). Although, in South Africa, the under-5 mortality rate reduced by 40% from 2006 to 2011, mainly because of the prevention of mother to child transmission (PMTCT) of HIV, the newborn mortality rate remains stagnant at a

level of 14-20 deaths per 1000 live births (Maredza *et al.,* 2016:2). Another intervention to prevent perinatal deaths was implemented by the South African government since 1996, which was the introduction of a national policy of free maternal and child health care, ensuring that 80% of births take place in hospitals and clinics (Maredza *et al.,* 2016:2).

In South Africa, the National Department of Health (NDoH) prioritised other interventions for reducing the numbers of maternal and neonatal deaths before embarking on universal health coverage (Maredza *et al.*, 2016:2). The focus of this intervention was on economic evaluations of antenatal, intrapartum and postnatal interventions in low and middle income countries (LMICs) with low resources aiming to: (1) identify what these interventions will cost, (2) assess the relevant data in South Africa, (3) identify gaps in knowledge and prioritise areas for future research and (4) to assess the quality of the economic evaluation (Maredza *et al.,* 2016:2). In low resource countries cost-effective interventions such as resuscitation of the newborn, breastfeeding, kangaroo mother care (KMC) and the prevention of hypothermia by using polyethylene wrappings for neonates, and non-invasive ventilation at districts hospitals could reduce the number of perinatal deaths (Lloyd & De Witt, 2013:518).

A report by Baleta (2011:1303) indicated that the PPIP database had some successes in South Africa, but additional work would be required to reduce the perinatal death rate. Since PPIP had been introduction during 2000, only five out of the 29 hospitals in the Free State Province were part of the programme. The PPIP database assists in identifying factors related to perinatal and maternal mortalities. The hospital where this study was conducted did not form part of the original selected hospitals, but had been participating in PIPP since 2012.

1.4 SIGNIFICANCE OF THE STUDY

Each death of a neonate is one death too many. Numerous previous studies have been done internationally on various strategies, which focus on reducing perinatal deaths. In the South African context various strategies have been implemented to reduce neonatal deaths, including PPIP. This programme has a specific PPIP data collection tool which focuses on maternal and neonatal factors associated with perinatal deaths. The data are anonymously captured on the PPIP database and then perinatal and maternal mortality rates are calculated. The purpose of the PIPP data base is to capture data and to perform simple analyses. However, the purpose of this study was to determine the practical significance between the different maternal and neonatal factors associated with perinatal deaths. The current study is unique and significant, because it could contribute to the body of knowledge and provide scientific evidence. Such

knowledge and evidence could assist in reducing future perinatal deaths and improve the quality of maternal and neonatal care.

1.5 PROBLEM STATEMENT

Perinatal mortality is an indicator of the quality of maternity care rendered. There is widespread acknowledgment for the need to improve the quality and quantity of information regarding maternal and neonatal mortalities. However there is a slow movement towards capturing and reviewing maternal and neonatal causes that could influence perinatal deaths, in order to affect changes in practice (Kerber *et al.,* 2015). It is important that studies, focussing on perinatal deaths, should be conducted in order to understand the contributory factors in order to reduce such occurrences (Kady & Gardosi, 2004:297). Health care workers (midwives) have the power to change practice; however they need inputs from all levels of the health system. For midwives to champion the process for change in practice a data system which identifies the causes of death (such as the PPIP database in this study) is necessary to improve the quality of care rendered in order to reduce perinatal deaths (Kerber *et al.,* 2015). The particular district hospital where the current study was conducted experienced increased numbers of stillbirths (Mbisha, 2012:1). This occurrence is supported by the Saving Babies Report 2012-2013 (Pattinson & Rhoda, 2014:26) that mentioned that most births and deaths occur in district hospitals. Not only maternal and neonatal factors, but also the rendering of poor quality of care, play important roles (Lloyd & De Witt, 2013:518).

The researcher is familiar with the district hospital's statistics. Since the implementation of the PPIP in the participating district hospital in 2012, the researcher noticed fluctuations in the number of perinatal deaths. The management and staff of the hospital tried to address the issue by implementing a stillbirth and perinatal mortality reduction strategy, developed by the district office of the Department of Health of the Free State Province. As part of this strategy each maternal and neonatal death was discussed at a perinatal mortality meeting to determine whether a death was caused by organisational or personal factors. The meetings and the perinatal raw data on the PIPP database, showed no significant reduction in the number of perinatal deaths since the implementation of the perinatal mortality strategy. Therefore, the following research questions were posed:

1.6 RESEARCH QUESTIONS

The background and problem statement led to the following research questions:

- What is the demographic profile of the mothers and neonates in the study population respectively?
- Is there practical significant differences in the age, gravida, parity, and health risk factor count (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour) between mothers with live neonates and those whose neonates had died up to the age of one week?
- Is the gender of the baby a practical significant indicator to be born alive or dead and are there practically significant difference between the birth weight, gestational age and Apgar scores of neonates who were born alive and those who had died by the age of one week exist?

1.7 AIM OF THE STUDY

The aim of the study was to identify maternal and neonatal factors associated with perinatal deaths.

1.8 OBJECTIVES OF THE STUDY

The following objectives were formulated.

- To identify and describe the demographic profile of the mothers and neonates in the study's population.
- To determine whether significant differences existed in the age, gravida, parity, and health risk factor count (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour) between mothers with live neonates and those whose neonates had died up to the age of one week.
- To determine if the gender of the baby is a practical significant indicator to be born alive or dead and if practically significant difference between the birth weight, gestational age and Apgar scores of neonates who were born alive and those who had died by the age of one week exist.

1.9 RESEARCH ASSUMPTIONS

The meta-theoretical, theoretical and methodological assumptions will be discussed in the following paragraphs.

1.9.1 Meta-theoretical assumptions

My beliefs and values are grounded in the fact that God created all things and man was created in His own image and that all livings things and man is answerable to God.

1.9.1.1 Man

Man is a human being created in the image of God and functions as a whole body, mind and spirit. Man cannot live alone, but lives in constant interaction with other human beings in a community with the direct command to rule the world, together with the responsibility to be accountable for all his/her actions. A pregnant woman, as a human being, has a free will and the ability to make informed decisions about her own health and the safety of birth of her baby. She depends on the midwife and physician for guidance in this regard. However her constant interaction with the environment (the midwife, physician, family, friends and the community) influences her views, experiences and perceptions regarding childbirth and the care of her unborn baby. Her socialisation about health and pregnancy could influence the outcome of her pregnancy (Muller, 1996:11). In this study Man represents the neonate, mother and the professional nurse (midwife in the case of the current study).

The **neonate** is a newborn infant under 28 days of age (WHO, 2017; Harrison, 2008:1).

The **mother** is a female parent. With techniques of assisted fertility, three types of mother can be defined, genetic: a woman whose contribution to the child is the ovum, and hence the genes, gestational mother: a woman whose uterus was used for nurturing and developing a baby; and a social mother which means a mother who cares for the baby after birth (Free Dictionary, 2017). In this study the term mother implies the gestational mother which can be defined as a woman who gave birth to a child.

The **professional nurse** is a person who is currently registered with the South African Nursing Council (SANC), practising midwifery. A midwife is a professional in midwifery, specialising in pregnancy, childbirth, postpartum, women's sexual and reproductive health and newborn care (SANC, 2013). In this study the professional nurse refers to a midwife.

1.9.1.2 Health

Health is a state of complete physical, mental and social, well-being and not merely the absence of disease or infirmity, experienced by man (WHO, 1948). Illness can be described as ranging from minimum to severe illness implying the presence of either physical, mental, social and spiritual risks and/or problems (Muller, 1996:12).

Health can be promoted and illness can be prevented and limited by gaining knowledge through health education and by accessing quality antenatal and intrapartum care. Early neonatal deaths are experienced when some factors, for example, low gestational age, low birth weight and low Apgar scores 10 minutes after birth, are not managed effectively thus potentially contributing to neonatal deaths.

The health status of each individual depends on many issues, including the quality of care rendered at the hospital, genetic, environmental and individual lifestyle factors. Safe childbirth practices are important for reducing maternal and perinatal deaths. Health or illness has long term effects which determine the quality of life experienced by each individual.

1.9.1.3 Environment

The world was created by God and given to man to cultivate and care for. Man shares the world with other living beings and functions within an interdependent relationship between the external world, other human beings and the immediate environment as well as man's internal environment consisting of the body, mind and spirit. Man's lifestyle can, therefore, be influenced in either a positive or negative manner by the environment, posing possible threats to man's health and well-being (Muller, 1996:12). The environment includes both the social and physical structure of the health facility, which can influence the cleanliness and safety of the baby's birth environment.

In this study the environment refers to the participating district hospital's physical structure, its infrastructure, available equipment and maintenance of the buildings. The treatment of pregnant women with dignity and respect, timely referrals of potential obstetric and/or neonatal complications and adequate record keeping influence maternal and neonatal outcomes, comprising part of the environment for the purpose of the current study. The social environment requires that skilled and competent midwives should attend to the mother during the intrapartum period, providing emotional support and adequate information.

1.9.1.4 Nursing

A nurse is someone who is registered with the South African Nursing Council (SANC) and qualified through advanced training to treat certain medical conditions and assume some of the duties without the direct supervision of a physician as stipulated by R2598 of 1984 (SANC, 2013). In the current study the nurse will be referring to a midwife implying that a midwife is registered with the SANC to manage childbirths (or to 'do deliveries' as stated in South Africa) and to take care of neonates as stipulated in R254 of 1975 (SANC, 1975; SANC, 2013).

1.9.2 Theoretical Assumptions

The theoretical assumptions include the central theoretical statement and conceptual definitions of the study.

1.9.3 Central Theoretical Statement and Conceptual Definitions

Firstly the central theoretical statement will be provided and thereafter the conceptual terms will be defined.

1.9.3.1 Central Theoretical Statement

The description of the demographic profile and determination of practically significant differences between the maternal and neonatal factors assisted the researcher to identify maternal and neonatal factors associated with perinatal deaths.

1.9.3.2 Conceptual definitions

Perinatal deaths

Perinatal deaths include the death of a baby immediately after and up to a week after birth as well as stillbirths, which can be macerated or fresh stillbirths (WHO, 2016:1). In this study the operational definition of perinatal deaths refers to the data available as captured on the PPIP database, thus as the maternal and neonatal status at discharge from the participating hospital after delivery.

Newborn

A newborn baby refers to a baby less than 28 days of age, during which period the baby is at the highest risk of dying (WHO, 2014). In this study a newborn will be a baby under the age of 28 days born between 1 January and 31 December 2015 at the participating hospital.

Stillbirth

Stillbirth is defined as the death of a product of conception prior to the complete expulsion or extraction from its mother at any time irrespective of the duration of pregnancy (WHO, 2016b). Fresh stillbirth refers to a stillbirth in which death occurred shortly prior to birth whereas a macerated stillbirth refers to a foetus retained in utero for some time after death (Jezova *et al*., 2013:1). A stillbirth in the current study implies the death of a foetus after 23 weeks' gestation

(WHO, 2016a), born between the 1 January and 31 December 2015 at the participating hospital.

Neonatal death

The death of a baby after birth could be attributable to severe malformation, prematurity, obstetric-related complications (such as placenta abruptio), difficulties adapting to extra uterine life or harmful practices after birth that could cause infections (WHO, 2016a:1). In the current study a neonatal death would have taken place between 1 January and 31 December 2015 and who died before discharge from the participating hospital.

1.9.3.3 Literature review of key concepts

Perinatal deaths

A perinatal death refers to the death of a baby immediately after or up to a week after birth, including macerated stillbirths (MSB) and fresh stillbirths (FSB) and neonatal deaths (Zadkarami, 2008:53). Perinatal deaths are categorised as (i) antepartum stillbirths, foetal death before the onset of labour, (ii) intrapartum stillbirths, foetal death before birth and (iii) neonatal death, death of a newborn before the age of 28 days (Smith, 2016:18). Neonatal deaths are categorised into early neonatal deaths, death of a baby within five days after birth or late neonatal deaths occurring up to 28 days after delivery. The current study focused on stillbirths and early neonatal deaths. Fresh stillbirths, macerated stillbirths and early neonatal deaths are closely related, with the same obstetrical causes (Marshall *et al*., 2016:515; Smith, 2016:18). Midwives can promote early antenatal care and provide health education to pregnant women to try to reduce perinatal deaths but this might not be sufficient.

Different authors, as well as different countries, define perinatal deaths differently. The WHO and Statistics SA (WHO 2006:1, Statistics SA, 2015:1; WHO: 2013:13) define perinatal deaths to include both neonatal deaths during the first week of life and foetal deaths (fresh and macerated stillbirths). Stillbirths are the largest contributing factor to perinatal mortality and are mainly unpredictable (Kady & Gardosi, 2004:397).

The global strategy for Women's, Children's and Adolescents' Health (United Nations Foundation, 2016:1) indicates that from 2010 to 2015 (UNICEF, 2014) millions of neonates' lives were saved and progress accelerated towards the achievement of MDGs. However, 2.7 million of the children who died were newborns of whom 60%-80% were premature and/or small for gestational age. Globally, 2.6 million neonates die during the last three months of pregnancy

or during child birth (stillbirths). Globally 5.3 million perinatal deaths occurred during 2014 (UNICEF, 2014).

Shrestha *et al*. (2015:88) indicated that globally 6.3 million perinatal deaths occur annually. Internationally late preterm births were common and were associated with increased neonatal mortalities and morbidities compared with full term births (McIntire & Leveno, 2008:41).

In SSA, an estimated 4.7 million mothers, newborns and children (under five years of age) die annually (Mabaso *et al*., 2014:182). The MDGs concluded at the end of 2015 but MDG 4, implying that the indicator of reducing under-5 child mortality by two thirds at the end of 2015 was not realised. By the end of 2015, only 62 out of 195 countries had reached the MDG 4 target of a two-thirds reduction in under-5 mortalities (Chaibva *et al.,* 2009:16). Of the 62 countries that had achieved that target, only 21 were from SSA. The reduction of the under-5 mortality rate in SSA was the best recorded global progress.

However, South Africa, although part of SSA, had experienced an increase in under 5 mortality over the same period (UN, 2015:1-10). In 2009, South Africa's NDoH set the neonatal mortality target at 14 deaths per 1000 live births (Mabaso *et al.,* 2014:183). However, the Free State, Limpopo, Kwazulu Natal and the Eastern Cape provinces of South Africa continued to experience high neonatal death rates (Mabaso *et al*., 2014:184).

Perinatal deaths remained high in South Africa in 2013 (WHO, 2013:424), being reported as 33.4 deaths per 1000 live births. Pattinson and Rhoda (2014:162), reported that neonatal deaths accounted for 30% of the overall mortality of under-5 children. The Free State Province has four district municipalities and one metro municipality, namely: Fezile Dabi, Thabo Mofutsanyane, Lejweleputswa and Xhariep district municipalities and Mangaung Metro.

The participating hospital is situated in the Fezile Dabi District Municipality.

From 2014 (all quarters) to the second quarter of 2016, the Fezile Dabi district encountered challenges concerning neonatal deaths. The early neonatal deaths data (DHIS, 2014-2016) showed that from the first quarter of 2014, this district reported 25 neonatal deaths. However, the number fluctuated throughout all quarters of 2015. During the second quarter of 2016 it decreased to 17 neonatal deaths per 1000 live births, still exceeding South Africa's national target of 14 neonatal deaths per 1000 live births.

Causes of Perinatal Deaths

Ezechi and David (2012:5-7) indicated that there are both direct and indirect causes of perinatal deaths namely: for neonatal deaths, the causes identified include: preterm birth, asphyxia, birth trauma, infections and severe malformations. For stillbirths the researchers identified the following direct causes: pregnancy complications or maternal illnesses. However, often there is no identifiable cause, especially in cases of macerated stillbirths.

Indirect causes include several maternal, obstetric, health system and socioeconomic factors and conditions that are indirectly linked to perinatal deaths (Ezechi & David, 2012:6-7). Shrestha *et al.* (2015:87) stated that the causes of perinatal deaths included poor maternal health and nutrition, substandard care during pregnancy and child birth as well as the lack of proper new born care.

From the Saving Babies Ninth Report (Pattinson & Rhoda, 2014:4) perinatal deaths are caused by: asphyxia, prematurity and infections. Unexplained stillbirths remain one of the largest categories of macerated stillbirths across all levels of care while fresh stillbirths represent the most common category in district hospitals and community health centres. According to this report every death counts (Saigal & Doyle, 2008:1294). The causes of perinatal deaths could include modifiable factors (Saigal & Doyle, 2008:1294) related to community and family aspects (usually constituting 38% of stillbirths and neonatal deaths), those related to administrators and policy makers (usually constituting 19% of stillbirths and neonatal deaths) and those related to health care providers (usually constituting 35% of stillbirths and neonatal deaths) .

The Every Death Counts Writing Group indicated that in order to reduce perinatal deaths, facilities are to implement two main activities: “Do the right things right, right away and ensure that every mother and baby receives services when they need them thus preventing all preventable perinatal diseases” (Saigal & Doyle, 2008:1295).

Ramaiya *et al.* (2014:6) identified five major causes of perinatal deaths in SSA and worldwide among adolescent mothers, namely: low birth weight, neonatal infections, birth asphyxia, birth trauma, congenital anomalies, neonatal tetanus and diarrhoeal diseases.

Perinatal deaths associated with organisational and personal factors

The following organisational factors have been identified, namely: delays in recognising the problem, thus placing the pregnancy at risk; delays in arranging transport to the next level of care; delays in providing appropriate care at the referring facility as recognised in the Saving

Babies Report (Pattinson, 2003:4) and the non-accessibility of the NICU beds with ventilators (Lloyd & De Witt, 2013:518).

The highest neonatal mortality rates and highest stillbirth rates occur in SSA, followed by Asia and Latin America (Zupan, 2005:2047)

Another challenge, related to organisational factors, is the unavailability of neonatal intensive care units (NICU) beds with ventilators (Lloyd & De Witt, 2013:518; WHO, 2016b:25). Complications of preterm births, asphyxia or trauma during birth, infections, severe malformaions and low birth weight all contribute to increased numbers of neonatal deaths unless NICU beds are available (WHO, 2016b:25).

Personal factors include both maternal and neonatal factors comprising the focus of the current study. Maternal factors identified as contributing to high perinatal death rates (and poor maternal outcomes) include delays in seeking help, failure to respond to poor or absent foetal movements, poor or inadequate management of hypertensive disorders and poor communication without interpretation. Other maternal factors include unexplained intrauterine deaths, intrapartum asphyxia, infections, spontaneous preterm, antepartum haemorrhage, maternal diseases such as syphilis (Fraser *et al*., 2010:1032; Lloyd & De Witt, 2013:519) and the mother's age, gravida, parity, urban or rural place of birth , mode of giving birth, singleton or twin pregnancy, placenta abruptio, and prolonged labour. The study will also focus on other maternal factors (Tuncalp *et al.*, 2015:1045), according to the PPIP tool.

Neonatal factors associated with perinatal deaths include prematurity, asphyxia, birth trauma, infection, congenital abnormalities, hypoxia, immaturity, sepsis, pneumonia, diarrhoea and neonatal tetanus (Fraser *et al*., 2010:1032; Oza *et al*., 2015:20; Tuncalp *et al*., 2015:1045, Patrick & Stephen, 2016:51;). According to the PPIP data base, birth weight, gestational age of the baby, Apgar score and gender can also influence perinatal outcomes.

Hypertensive disorders of pregnancy include chronic hypertension, gestational hypertension and pre-eclampsia as well as chronic hypertension with superimposed eclampsia (Ananth & Basso, 2010:118). Pre-eclampsia is a syndrome marked by a sudden increase in the blood pressure of a pregnant woman after 20 weeks' gestation (Sikder *et al*., 2014:13) and eclampsia is a more severe form of preeclampsia characterised by seizures and coma. Manisha and Rajeev (2015:95) revealed that pre-eclampsia, eclampsia and obstructed labour are important maternal risk factors contributing to perinatal deaths.

Hypertensive disorders during pregnancy are common in primiparous women but might also be associated with extreme perinatal complications in multiparous women (Ananth & Basso, 2010:119). Women with pregnancy-induced hypertension might be more likely to experience stillbirths and neonatal deaths, especially multiparous women (Ananth & Basso, 2010:120). Pregnancy-induced hypertension is associated with a lower risk of infant mortality among preterm births but a higher risk among full term pregnancies (Luo *et al*., 2014:1373).

Gestational hypertension tends to be protective against perinatal mortality in twin pregnancies (Luo *et al.,* 2014:1374). Both low and high diastolic blood pressures in pregnant women are associated with small neonates, high perinatal mortality rates and intra uterine growth restrictions (Sibai, 2003:183).

Diabetes mellitus in pregnancy can either be gestational diabetes or pre-gestational diabetes and the impact of these situations on perinatal outcomes differ. Diabetes is a common problem during pregnancy. Both pre-existing and gestational diabetes are associated with increased adverse outcomes (Robson & Nolan, 2013:37). A woman suffering from diabetes mellitus must have her diabetes controlled before she becomes pregnant. Throughout pregnancy the insulin levels must be controlled to prevent increased levels of perinatal complications (Robson & Nolan, 2013:38).

Pre-gestational diabetes implies that the woman chronically suffers from diabetes (Vitoratos *et al.,* 2010:8). The incidence of pre-gestational diabetes is increasing and associated with increased risks of malformations, macrosomia and preterm deliveries (Vitoratos *et al*., 2010:9). Women suffering from both type 1 and type 2 diabetes mellitus might experience complications during pregnancy such as neonates being born with birth defects (Behal & Vinayak, 2015:95).

Congenital syphilis could cause perinatal morbidity and mortality, syphilis poses public health concerns (De Santis *et al*., 2012:1). The WHO declared in 2008 that an estimated 1,8 million cases of syphilis occurred globally on an annual basis among pregnant women. Few of these women were treated and the majority, of those who had been treated, were inadequately treated (Gomez *et al*., 2013:217). Untreated syphilis in pregnant women predispose their infants to stillbirths, neonatal deaths, prematurity and low birth weight (Gomez *et al.*, 2013:220; De Santis *et al*., 2012:3).

Unless testing and treatment of syphilis are universally available to all pregnant women, more than half of these pregnancies (of women suffering from syphilis) will result in adverse outcomes (Gomez *et al*., 2013:224). Teenage mothers are to be prioritised for syphilis and HIV

testing as they are at the highest risk of contracting these illnesses (Chawanpaiboon & Hengrasmee, 2013:431) which could adversely affect their neonates.

HIV positivity is related to high perinatal risks especially in low socio economic settings (Kennedy, 2011:1). Women who tested positive for HIV experienced more perinatal deaths than women who tested negative (Kennedy, 2011:1). Risks of encephalopathy were significantly more severe in HIV positive mothers. A perinatal outcome, including mother-to-child transmission (MTCT) predisposes an infant to severe complications due to HIV positivity (Mehta *et al.*, 2009:1016).

From the report "*Every Death Counts*" (Saigal & Doyle, 2008:1294), the following strategies are important to manage HIV-related issues among pregnant women: prevention of HIV infection including dual protection for all at risk; provider-initiated testing and initiation of treatment for HIV-positive pregnant women and their neonates; Antiretroviral treatment (ART) initiation for mothers where indicated; and promotion and support of exclusive breastfeeding where indicated.

Maternal age, both advanced and adolescent ages, could have different impacts on perinatal mortality rates. Ates *et al*. (2013:1) identified that advanced maternal age is related to maternal and neonatal complications. Advanced maternal age is documented to be associated with preterm deliveries, deliveries of low birth weight neonates, perinatal mortalities and high caesarean section rates (Chawanpaiboon & Hengrasmee, 2013:428). Advanced maternal ages of mothers, coupled with high parity, are more likely to deliver macrosomic neonates who are significantly larger than average. Jaccobson *et al*. (2004:727-733) also indicated that advanced maternal age is related to increased perinatal deaths, intrauterine deaths as well as neonatal deaths.

In SSA, during 2013 50% of mothers who gave birth were adolescents younger than 20 years of age (Ramaiya *et al*., 2014:6). Adolescent mothers' babies have a significantly higher risk of perinatal deaths than babies of adult mothers. The pregnant adolescents are more likely to encounter social and biological risk factors than pregnant adult women. Naqvi and Naseen (2004:278), supported the views of Ramaiya *et al*. (2014:6) and added that adolescents' pregnancies and child birth episodes pose major public health challenges in SSA countries and worldwide.

Chaibva *et al.* (2009:14) cited that adolescent mothers are more likely not to attend antenatal care clinics due to factors such as individuals' wrong perceptions concerning antenatal care,

limited knowledge about the importance of antenatal services and socioeconomic factors such as the lack of financial support to go to the clinic.

Very young mothers were identified as the being highest risk pregnant group, especially in developing countries by Chawanpaiboon and Hengrasmee (2013:431). These authors indicated that very young pregnant women would be at high risk of contracting sexually transmitted diseases including HIV, experiencing high rates of foetal birth defects and they could be reluctant to attend antenatal care clinics. Young mothers are also more likely than adult mothers to encounter the following pregnancy-related complications and perinatal complications: difficult child birth, high blood pressure, poor foetal growth and birth defects (Sikder *et al.*, 2014:13; Spriggs, 2014) Extremely young and advanced maternal age groups encountered the following risks: high incidence of preterm births, low birth weights, placenta abruptio and placenta praevia (Chawanpaiboon & Hengrasmee, 2013: 430; Manisha & Rajeev, 2015:96).

Seda *et al*. (2013:1) defined multiparous women as those who had given birth to more than five neonates and stated that multiparous women are at a high risk of experiencing perinatal deaths as well as poor obstetrical outcomes. Perinatal deaths, intrauterine deaths and neonatal deaths increase with age and parity according to Seda *et al*. (2013:1), implying high parity and maternal age pose increased risks of adverse neonatal outcomes such as Intra-uterine growth retardation (IUGR), prematurity and mortality (Lisonkova *et al*., 2010: 541). Multiparous women often give birth to abnormally large (macrosomic) infants, increasing the risk of obstetric emergencies (Agbozo *et al.,* 2016:205). Primiparous women might experience increased risks during childbirth of obstructed labour and preterm births (Kozuki *et al.*, 2013:2). Parity and maternal age have been shown to increase the risk of adverse neonatal outcomes such as IUGR, prematurity and mortality (Kozuki *et al*., 2013:2, Lisonkova *et al.,* 2010:541). Nulliparous women had significant associations with adverse outcomes but particularly when mothers were very young (Kozuki *et al*., 2013:6).

A woman who conceives for the first time is termed a primigravida (Danish *et al*., 2010:23-5). In order to have better foetal and maternal outcomes, and to manage avoidable causes of perinatal deaths, it is important that primigravida should commence attending antenatal care (ANC) clinics during the first trimester of pregnancy and adhere to the advised follow-up clinic visits (Danish *et al*., 2010:23). Primigravidae are more prone to deliver low birth weight neonates (Agbozo *et al*., 2016:206). Multigravida women, who have had five or more pregnancies, are more prone to perinatal deaths as well as to severe blood loss due to increased risks of complications associated with their age and gravida (Benjamin *et al*. 2009:14; CDC, 2015).

Worldwide 15.5% neonates are born with low birth weights, and 95% of them are born in developing countries (Onwuanaku *et al*., 2011:562). Global studies indicated that the weight of an infant at birth is an important indicator for survival of the foetus which means that birth weight is generally considered one of the best indicators of a newborn's chances of survival (Zadkarami, 2008:53). Birth weight is particularly strongly associated with foetal, neonatal and post neonatal mortality (Kramer & Victora, 2001:58). Low birth weight is defined by WHO as less than 2.5kg (Agbozo *et al*., 2016:201). Low birth weight neonates are more prone to perinatal deaths (Berhan & Berhan, 2014:55; Onwuanaku *et al*., 2011:563).

A higher incidence of preterm births and premature rupture of membranes have been observed in mothers of male infants than in female infants. More female preterm infants were identified to survive than the male infants and more male are delivered by caesarean section than females, this study was conducted in Italy in the period 1985-2006 (Di Renzo *et al*., 2007:19). Women presenting with placenta abruptio are more likely to have caesarean deliveries (Pariento *et al*. 2011:702). Berhan and Berhan (2014:56) found no relationship between the mode of delivery and perinatal mortality, especially in developing countries.

Yi *et al.* (2011:477) identified that neonatal deaths in rural China occurred more frequently than in urban China. Understanding the disparities between rural and urban settings could assist policy makers to assess the health needs and plan accordingly (Yi *et al.,* 2011:477).

Multiple gestations comprise high risk factors for adverse perinatal outcomes (Amson *et al*., 2006:556, Vergani *et al*., 2004:343), also posing a higher risk for premature deliveries than single pregnancies. Vergani *et al*. (2004:344) identified that a more premature gestation and a lower birth weight, increased the chances for perinatal deaths. Amson *et al.* (2006:557) identified that chances of the second born twin surviving during vaginal deliveries are limited irrespective of presentation or gender of the baby.

Prapas *et al.* (2006:293) reported that multiple pregnancies, in advanced maternal age compared with pregnancies of younger mothers, showed no differences with regard to perinatal risks. The perinatal risks will increase with decreased birth weight and with a shorter gestational age. However, neonates born post maturely, after 42 weeks' gestation, also experience an increased risk of neonatal complications.

The Apgar score is recorded five minutes after birth and repeated after 10 minutes. The higher the score, the better the baby's chances of doing well after birth. Scores of 7, 8 and 9 are normal indicating that the newborn is doing well (Harrison, 2008:168). Any score below 7 is a sign that the baby needs medical attention. The lower the score the more attention the baby

needs to adjust to life outside the mother's uterus. A low Apgar score does not mean a child will have serious or long term health problems. The score is not designed to predict the future health of the baby (Cassey *et al.*, 2001). Yung *et al*. (2007:232) define post term pregnancy as a pregnancy that extends beyond 42 completed gestational weeks. Post term pregnancy is associated with increased risks of perinatal mortality and morbidity due to a factors such as: uteroplacenta infections, uteroplacenta insufficiency and meconium aspiration (Yung *et al*., 2007:233).

Placenta abruptio is a term used when premature separation of the placenta from the uterine wall occurs prior to the delivery of the foetus (Atkinson *et al.,* 2015:594). Placenta abruptio is an independent risk factor for perinatal deaths (Wiznitzer *et al.,* 2011:699). Placenta abruptio is more common in early gestational periods of less than 30 weeks (Atkinson *et al.,* 2015:594; Pariento *et al.,* 2011:698). Recent abdominal trauma was identified as being an independent risk factor for placenta abruptio (Atkinson *et al.,* 2015:594).

Hasegawa *et al*. (2014:52) reported that "small for gestation babies" are more likely to be delivered when mothers are diagnosed with placenta abruptio, especially if the woman is found to be suffering from anaemia and not treated effectively. Placenta abruptio was found to occur less frequently among women being pregnant with female infants than among those with male infants (Muktar *et al*., 2012:253). These authors also found that there were no significant gender difference with regard to stillbirths and neonatal mortality.

According to Saigal and Doyle (2008:269) survival rates have improved for infants of borderline viability in recent years. They also noted that the morbidity of infants is inversely related to gestational age but no gestational age (including full term) is exempted from perinatal complications. Both preterm and full term neonates are prone to perinatal deaths but premature neonates with severe low birth weights (of less than 2,5kg) would be at greater risk of either neonatal deaths or a stillbirths (Saigal & Doyle, 2008:269).

Postpartum haemorrhage is defined as the loss of 500ml to 1000ml of blood by a woman after childbirth by Osuju *et al*. (2015:22). Maternal age, type of birth and the health care professionals who assisted the women during childbirth are associated with occurrences of postpartum haemorrhage (Osuju *et al*., 2015:30).

Women whose babies were born by caesarean sections are at a higher risk of postpartum haemorrhage than those whose babies were born normally (Osuju *et al*., 2015:22). Increased age significantly predisposes women to postpartum haemorrhage. Women, assisted by midwives during childbirth, were at greater risk of suffering from postpartum haemorrhage than

those assisted by doctors (Osuju *et al*., 2015:30). The study by Cavasos-Rehg *et al*. (2015:1203) indicated that both teenage pregnant women and pregnant women of advanced ages are predisposed to postpartum haemorrhage.

Obstructed prolonged labour is the most common preventable cause of maternal and perinatal morbidity and mortality in developing countries (Islam *et al*, 2012:43; Masakhwe, 2010:1) The most common causes of obstructed labour are cephalo pelvic disproportion (CPD), malpresentation and malposition of the foetus (Emmerson, 2012:1).Prolonged obstructed labour is experienced when the baby (passenger) is too big to pass through the passage (pelvis) and the woman has reduced energy (power) to push the baby out (Islam *et al,* 2012:43 ; Masakhwe, 2010:3). Obstructed prolonged labour occurs when spontaneous delivery cannot be achieved.

Quality of care influencing maternal and neonatal outcomes

The quality of care during antenatal care, as well as during and after birth influences the maternal and neonatal outcomes. Quality of care is defined by the WHO as "the extent to which health care services provided to individuals and the patient population improve the desired health outcomes". In order to achieve this, health care needs to be safe, effective, timely, efficient, equitable and people-centred (WHO, 2014).

In the UK, the Civil Registration and Vital Statistics (CRSV) is used as a strategy to access reliable data by detailing the numbers and causes of maternal and neonatal deaths. This quality improvement initiative link the local level of care to the national level through the timely notification and identification of maternal and neonatal deaths (Kerber *et al*., 2015:S3). During the maternal mortality audit, data and peer reviews are used to improve the quality of care, while perinatal outcome audits focus on capturing information about the number and causes of stillbirths and neonatal deaths (Kerber *et al*., 2015:S2).

1.10 RESEARCH METHODOLOGY

In the following section the research design and method will be discussed.

1.10.1 Research design

In this study a quantitative, retrospective descriptive design was used (Burns & Grove, 2009:236-240). Ex post facto data were collected using the PPIP data collection tool on a PPIP database, developed by the MRC for the NDoH to store data and cluster information. The PIPP data sheet captures perinatal mortality and identifies factors that influence perinatal deaths

(Allanson & Pattinson, 2015:424; Pattinson, 2000:2) as shown in Appendix D. The PIPP database has been in use since 2000 in South Africa, and since that time has recorded information of about 100 000 stillbirths and neonatal deaths (Pattinson, 2013:1).

Maternal and neonatal information is routinely anonymously transferred from the maternity records of women who gave birth to neonates into the PPIP database. In the current study the pre-selected maternal and neonatal factors associated with perinatal deaths were extracted from the PPIP database on a specifically designed MSExcel data sheet [see Appendix E].

The descriptive design was used to determine the demographic profile and practically significant differences of maternal and neonatal factors associated with perinatal deaths, as described by objectives in 1.8.

1.10.2 Research method

The research method includes the target population and sampling method used in the current study.

1.10.2.1 Target population

The target population in this study comprised pre-selected data captured by the PPIP database from maternity registers of woman who gave birth at the participating district hospital of the Fezile Dabi Health District in the Free State Province [See Appendix C]. The Fezile Dabi Health District is situated in the northern part of the Free State Province. The district is divided into four sub-districts namely Moqhaka, Metsimaholo, Ngwathe and Mafube. There are one regional and four district hospitals (N=4). The largest district hospital (N=1) participated in the study (see Figure 1.1). The total population of the district comprises 518 024 persons of whom 441 680 (85%) are vulnerable persons, due to their low socio economic status, facing multiple challenges arising from their personal circumstances of living in a rural community (Koblinsky *et al.,* 2016). This implies that 85% of the district's people depend solely on public health care (Fezile Dabi District Management Team, 2013). The data were collected from maternity registers of all the women who gave birth at the participating hospital during 2015, being the most recent available data. The units of analysis comprised the pre-selected factors as captured from the maternity records onto the PPIP database and transferred onto the specially designed MSExcel data sheet (see section 1.10.5 of this dissertation).

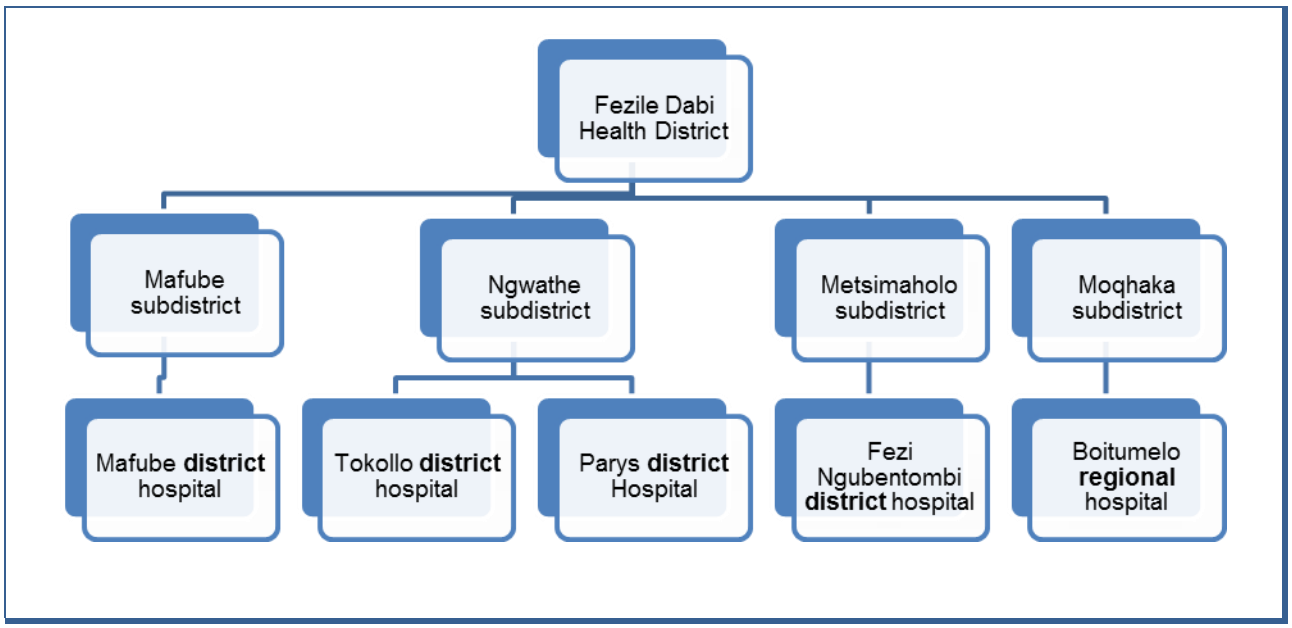

Figure 1.1: Organisational structure of the Fezile Dabi Health District

1.10.2.2 Sampling and sample size

During consultation with the statistician the decision was made to use only the most recent completed data (2015) of the largest district hospital in the Fezile Dabi District. This hospital was selected because it is the referral hospital for the smaller district hospitals and serves a large catchment area. Thus most the obstetric complications and emergencies are managed in this hospital. During sampling of the ex post facto data, the data were divided into two strata namely, those in the category of alive neonates and those in the category of dead neonates. The ex post facto data of 2015 included 2270 (N=2270) births of which 97.85% (n=2221) were live neonates and 2.15% (n=49) were dead neonates. A computerised random sample of n=350 were selected after a power analysis of the total population (N=2270) had been conducted (Field & Miles, 2010:559). As only 2.15% (n=49) of the neonates were dead neonate, all dead neonates were included in the current study.

1.10.2.3 Data collection

In the following section the data collection procedure and perinatal data sheet, including the pre-selected factors used in this study, will be discussed.

1.10.2.4 Procedure

The researcher used the PPIP database to extract the retrospective ex post facto data on a specifically designed MSExcel data sheet. The extraction was very time consuming and therefore random sampling was used rather than the entire available dataset. The PPIP database used in hospitals uses an electronic usable format for data analysis, but the data required for the current study could not be calculated directly from the PIPP data base. The researcher, in consultation with the statistician, developed a data sheet in MSExcel format with pre-selected factors for analysis [see section 1.10.5 and Appendix E]. Initially, the data were divided into two strata, namely Stratum I neonates: alive and stratum II neonates: dead. There were more alive neonates (N=2221) than dead neonates (N=49). The MSExcel computer package was used to select the data points to be used for compiling the random sample out of Stratum 1. A random sample comprising (n=350) live neonates, according to a power calculation formula of Swanepoel *et al*. (2015:17-12), was selected from stratum I. All the neonates from stratum II were included because there were only 49. The information was then captured on the specifically designed MSExcel data sheet (see Appendix E). Statistical analysis was done by the statistician of the NWU's Department of Statistics using the SAS computer package.

$$n \geq \frac{N}{1 + \frac{Nd^2}{1\,0000}}$$

Figure 1.2: Power calculation formula (Swanepoel *et al.,* 2015)

1.10.2.5 Perinatal data sheet

The PPIP data are not publicly available. By 2012 all public hospitals in South Africa participated in this initiative from the NDoH. The MRC provides extensive logistical and training support. PPIP is a health facility-based data system which assists in collecting statistics to calculate different perinatal and maternal mortality rates, to identify factors contributing to the mortalities and indicating whether the factors were avoidable or not. The complete PIPP data tool is attached as Addendum D.

Data captured on the PPIP database are anonymously transferred from the maternity records of the mothers who gave birth in the participating hospital. The PPIP database does not capture any maternal or neonatal identifiable information, only codes. For this study ex post facto data,

captured on the PPIP database, were transferred to a specifically designed MSExcel data sheet with pre-selected factors [see Appendix E].

Pre-selected factors for the current study from the PPIP data sheet

After having conducted a literature review and after consultation with the statistician and subject specialists the relevant pre-selected variables (factors) on the PPIP database were identified. The pre-selected maternal and neonatal factors were associated with perinatal deaths [see Appendix E].

Maternal factors include the following

- Number of foetuses in this pregnancy
- Age of the mother
- Gravida
- Parity
- Medical conditions of the mother including: diabetes, syphilis, hypertension and HIV, eclampsia, pre-eclampsia, haemorrhage including: placenta abruptio, placenta praevia, retained placenta, ruptured uterus, obstructed or prolonged labour
- Whether the mother lived in an urban or rural area, and
- Mode of birth (or “delivery”).

Neonatal factors include the following:

- Gender of the baby or foetus
- Apgar score of baby five minutes after birth
- Apgar score of baby 10 minutes after birth
- Birth weight of the neonate or foetus
- Dead or alive neonate and
- Stillbirth

1.10.2.6 Data analysis

The data were analysed with the assistance of a statistician at the NWU’s Department of Statistics Department.

Descriptive statistics (like means and frequencies) were reported. Cohen's effect sizes-d were calculated to identify practically significant differences between the neonates in the alive group and in the dead group (see research questions 2 and 3 in section 1.6 of this dissertation). A logistic regression analysis was done to describe the main factors associated with perinatal deaths. The SAS (2016) statistical programme was used to analyse the data.

1.10.2.7 Role of the researcher

The researcher developed the proposal and obtained scientific clearance from the scientific committee of INSINQ and ethical clearance from Health Research Ethical Committee (HREC) of the NWU, Potchefstroom campus. After ethical approval had been obtained from the HREC, permission to continue with the study was requested from the Head of the Research and Ethics Committee in the Free State Province. After that permission had been granted the researcher requested approval to continue with the study from the province and management of the district hospital where this study was undertaken. Only then could data be captured from the PPIP database onto the specifically designed MSExcel data sheet with the pre-selected maternal and neonatal factors associated with perinatal deaths.

1.10.2.8 Measures to ensure validity

Validity is the extent to which the interpretation of the results of a test and/or research project is warranted (Bannigan & Watson, 2009:3237-3243). Only content and face validity applied to the current study.

The PPIP data sheet met face and content validity criteria. During data capturing on the MSExcel sheet double checking and spot checks were done by the statistician. The researcher investigated maternal and neonatal factors associated with perinatal deaths, including avoidable and non-avoidable factors. The PPIP data collection tool used to capture data anonymously on the PPIP database and was thus a relevant tool as it incorporated the identification of causes of perinatal deaths. The PPIP database applies a computerised data validation mechanism after data capturing has been completed (Pattinson, 2013). Therefore these statistical reports are validated automatically by the PIPP database. After validation of the initial data on the PPIP database, the researcher captured ex post facto data on a specifically designed MSExcel data sheet with pre-selected factors. No identifying data were transferred to the electronic MSExcel sheet.

Since 2000, nine Saving Babies Reports have been produced using the PPIP database. In this study the researcher attempted to identify the demographic profiles and practically significant differences of maternal and neonatal factors associated with perinatal deaths.

This study design is appropriate and the detailed steps used for data capturing and analysis are provided so that other researchers could repeat similar studies. A statistician assisted with the statistical analysis of the data. The PPIP data collection tool does not have a Likert scale therefore, Chronbach Alfa coefficients could not be determined to verify the reliability of the instrument.

1.11 ETHICAL CONSIDERATIONS

This study received ethical approval from the NWU's Ethical Committee, ethical approval number NWU-00357-16-SI (see Appendix A). Permission was also obtained from the Head of Department of Health of the Free State Province (Appendix B) as well as from the Chief Executive Officer of the hospital [Appendix C] where the study was undertaken.

1.11.1 Informed consent

The information comprised retrospective, ex post facto data, extracted from the participating hospital's maternity registers of 2015. Therefore, informed consent (implying participants' informed decisions about their participation in the study) was not applicable as no participants were directly involved. However, consent was obtained from the Head of the Research and Ethics Committee in the Free State Province, Department of Health. Thereafter permission was requested from and granted by the management of the district hospital where the current study took place.

1.11.2 Principle of beneficence

The concept 'right of beneficence' means that the participant is protected from discomfort and harm (no anticipated effects, momentary uneasiness, unusual levels of temporary discomfort, risk of permanent damage, and certainty of permanent damage) (Burns & Grove, 2009:689). The current study used retrospective ex post facto data extraction therefore no participants were involved. As a result, no harm of a physical, emotional, social or financial nature was possible. There were no direct benefits of the current study, only indirect benefits. The indirect benefits included that the practically significant differences of maternal and neonatal factors associated with perinatal deaths, could be identified. This scientific evidence could help to reduce the number of future perinatal deaths and improve the quality of maternal and neonatal care.

1.11.3 Principle of justice

Veracity encompasses the practice where the truth is told (Pera & van Tonder, 2005:52). The researcher acted with truthfulness and honesty. The information is in the best interest of the selected population. The researcher did not fabricate or falsify data that might lead to the transgression of ethical principles, and affect beneficence and non-maleficence (SANC, 2013:4). There were no unforeseen risks associated with the study as the PPIP is a nationally recognised database that is reliable and no patients' names were recorded when capturing data on the PPIP database or specifically designed MSExcel data sheet with pre-selected factors.

1.11.4 Anonymity and confidentiality

In this study, no information was collected from any participant, only the PIPP data base was used during the retrospective, ex post facto data extraction. Thus the information was completely anonymous as no names of mothers or neonates were recorded.

The term confidentiality means that any information collected from participants would not be shared with other persons without the participants' consent (Burns & Grove, 2009:693). In this study, all data were confidential and anonymous as no identifying information is captured in the PPIP database, only the statistics of the mothers and neonates are captured. The PIPP information is completely anonymous as a code is linked to each maternity file. However, this code is only used to number the files from 1 to 2270, thus it is not the hospital code of the patient. This code was transferred on the PPIP database and then to the specifically designed electronic MSExcel sheet with the pre-selected maternal and neonatal factors associated with perinatal deaths. No link exists between the electronic MSExcel sheet and the original maternity records. The captured data is password protected on a computer to which only the researcher and the statistician had access.

1.11.5 Storage of data

The data were analysed at the NWU's Department of Statistics by a statistician. The researcher ensured that the information was password protected during data analysis. The hard copies, used during data analysis, were shredded and a memory stick containing the data of the study would remain locked-up in a cabinet in the INSINQ director's office for five years.

1.11.6 Dissemination and monitoring of data

After completion of the study, feedback of the findings will be presented to the Chief Executive Officer of the hospital as well as to the unit manager of the maternity ward. A report of the

findings will also be presented to the Department of Health of the Free State Province. A research article will be submitted to an academic journal for possible publication and the findings might be presented at a national conference.

1.12 RESEARCH REPORT OUTLINE

The contents of this dissertation contain the following sections:

Chapter 1: Overview of the study.

Chapter 2: Article in Africa Journal of Nursing and Midwifery: Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State.

Chapter 3: Conclusions, recommendations and limitations of the study.

1.13 SUMMARY

Chapter 1 introduced the study phenomenon of neonatal deaths, provided background information and explained the research methodology adopted during the current study. Ethical issues, relevant to the current study, were addressed and the layout of the dissertation explained.

In the next chapter, the current study's findings will be presented in the format of an article for submission to the Africa Journal of Nursing and Midwifery.

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CHAPTER 2

MANUSCRIPT FOR SUBMISSION TO THE AFRICA JOURNAL OF NURSING AND MIDWIFERY

Authors note:

The following manuscript will be submitted to "Africa Journal of Nursing and Midwifery" and will be formatted according to the authors' guidelines, with the exclusion of line numbering. Please refer to Appendix F.

Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State

N. Malinga, B Cur, North-West University

A. du Preez, PhD, North-West University

T. Rabie, PhD, North-West University

W. Breytenbach, M Sc, North-West University

Correspondending author:

Nthabiseng Malinga
North West University
School of Nursing Science
South Africa
Telephone: 056 816 2151

E-mail: nthabisengmalinga@ymail.com

Abstract

The perinatal mortality rate of a hospital is an indicator of the quality of maternity care but other factors contribute to perinatal deaths. This study addressed maternal and neonatal factors associated with perinatal deaths in one selected district hospital in the Free State Province of South Africa.

A quantitative retrospective descriptive design was used. Ex post facto data were collected from the Perinatal Problem Identification Programme (PIPP). A total of 2319 neonates were born at the participating hospital during 2015. A random sample of 384 alive neonates and an all-inclusive sample of 43 dead neonates were included in the current study.

Descriptive statistics were reported and Cohen's effect sizes-d was calculated to identify practically significant differences between the neonates in the alive group and in the dead group respectively. Cohen's effect sizes and logistical regression analyses indicated that the Apgar score recorded 10 minutes after birth; gestational age, birth weight of neonate and the parity of the mother were the most practically significant factors influencing a neonate's chances of survival.

Keywords: Apgar scores, neonates, neonatal deaths, perinatal audits, perinatal deaths, stillbirths.

Introduction and background information

Perinatal mortality refers to the stillbirth or neonatal death of a baby immediately and up to one week after birth. Perinatal deaths are categorised as antepartum stillbirths, foetal deaths before the onset of labour, intrapartum stillbirths, foetal deaths before birth and neonatal deaths implying death during the first 28 days (Smith, 2016:18). Neonatal deaths are categorised into early neonatal deaths, occurring within five days or late neonatal deaths occurring up to 28 days after birth. This study focussed on stillbirths and early neonatal deaths. Stillbirths are classified as either macerated or fresh stillbirths (WHO, 2013:13). A fresh stillbirth implies that death occurred immediately prior to birth, while a macerated stillbirth implies that the foetus had been retained for some time in the uterus after death (Jezova *et al*., 2013).

Perinatal mortality is the most sensitive index for determining the quality of maternity and neonatal care (Gupta, 2011:245). Failure to comply with the standards of care for antenatal care (ANC), during birth and for neonates could contribute to neonatal mortality rates (Gupta, 2011:2). The global perinatal mortality estimates are three million stillbirths and three million neonatal deaths, many of which might have been prevented by optimal care (Allanson *et al*., 2015:37; Oza *et al*., 2015:19). Yet, worldwide, progress to reduce neonatal deaths remains limited (Allanson *et al*., 2015:79). The prevention of perinatal deaths requires accurate data about these deaths (Allanson *et al*., 2015:79).

According to Allanson *et al*. (2015:79) perinatal deaths are prioritised on the international and the South African, public health agendas. Although Millennium Development Goal 4 (MDG 4) had not been reached, child mortality was reduced by 53% from 2000 to 2015, but the neonatal mortality rate decreased more slowly (Cooper, 2016). The United Nations (2015) launched the Sustainable Development Goals (SDGs) of which SDG 3 focuses on ensuring healthy lives and promoting the well-being for people of all ages. These goals are linked to maternal and perinatal outcomes (Allanson *et al*., 2015:37).

In Sub-Saharan Africa (SSA), an estimated 4.7 million mothers, newborns and children younger than five years of age die annually (Mabaso *et al.,* 2014:182). By the end of 2015, only 62 out of 195 countries had reached the MDG 4 target of a two-third reduction in under five mortalities (Chaibva *et al*., 2009:16). Of the 62 countries that had achieved the target, only 21 countries were from SSA. However, South Africa, had experienced an increased under-five mortality rate over the same period (UNICEF, 2014:1-10). In 2009, South Africa's National Department of Health (NDoH) set the target of a neonatal mortality rate of 14 deaths per 1000 live births (Mabaso *et al*., 2014:183). During 2013, the perinatal mortality rate in South Africa was 33.4 deaths per 1000 live births (WHO 2015:424-428). Neonatal deaths accounted for 30% of the overall under-five mortality rate (Rhoda, 2014:162). The Saving Babies 9th Report on Perinatal Deaths in South Africa (Pattinson & Rhoda, 2014:2) revealed that from 1 January 2012 to 31 December 2013, out of 1 412 355 births 32 662 were stillbirths and 14 576 early neonatal deaths. During this period there were 588 Perinatal Problem Identification Program (PPIP) sites within South Africa (Pattinson & Rhoda, 2014:2). The statistics from the participating hospital indicated perinatal death rates of 16.28 per 1000 live births, for 2015. Most perinatal deaths occur in district hospitals - the site of the current study (Van Heerden *et al*., 2016). Different authors cited different causes of perinatal deaths but many causes are similar although their relative importance might vary in different countries, regions and according to income status (Ezechi & David, 2012:5). Causes of stillbirths and neonatal deaths are generally inseparable (Atkinson *et al*., 2015:594). Perinatal deaths are caused by both organisational and personal factors. Organisational factors include delays in recognising the problem, delayed transport to the next level of care, delays in providing appropriate care at the referring facility (Pattinson, 2005:4) and the non-accessibility of neonatal intensive care units (NICU)s with ventilators (Lloyd & De Witt, 2013:518).

Personal maternal and neonatal factors comprised the focus of the current study. Maternal factors contributing to high perinatal death rates include delays in seeking help, failure to respond to poor or absent foetal movements, inadequate management of hypertensive disorders, unexplained intrauterine deaths, intrapartum asphyxia, infections, spontaneous preterm labour, antepartum haemorrhage and maternal diseases such as syphilis (Fraser *et al*., 2010: 1032; Lloyd & De Witt, 2013: 519). The mother's age, gravida, parity, place of birth, birth mode, multiple pregnancies, placenta abruptio, placenta praevia and prolonged/obstructed labour (Atkinson *et al*., 2015:594) could

contribute to perinatal deaths. Oza *et al*. (2015:20) added sepsis, intrapartum complications and pneumonia as further potential contributors to perinatal deaths.

Neonatal factors affecting neonatal mortality rates include prematurity, asphyxia, birth trauma, infection, congenital abnormalities, hypoxia, immaturity, sepsis, pneumonia, diarrhoea and neonatal tetanus (Fraser *et al*., 2010:1032; Oza *et al*., 2015:20; Patrick & Stephen, 2016:51; Tuncalp *et al*., 2015:1045). The current study focused on birth weight, gestational age, Apgar score and gender.

Interventions to prevent perinatal deaths include Kangaroo mother care (KMC), resuscitation of newborn neonates, breastfeeding and preventing hypothermia (Lloyd & De Wit, 2013:518).

Statement of the research problem

Research focussing on perinatal deaths is pivotal for identifying and addressing factors associated with perinatal mortalities (Kady & Gardosi, 2004:397). The PPIP data base was developed to identify factors contributing to perinatal deaths and to improve the quality of care. The PPIP reports are released every third year but do not supply statistics for individual hospitals as the statistics are presented according to regions.

Purpose of the study

The study aimed to identify maternal and neonatal factors contributing to perinatal deaths.

Objectives

The following objectives were formulated.

- To identify and describe the demographic profile of the mothers and neonates in the study's population.
- To determine whether significant differences existed in the age, gravida, parity, and health risk factor count (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour) between mothers with live neonates and those whose neonates had died up to the age of one week.
- To determine if the gender of the baby is a practical significant indicator to be born alive or dead and if practically significant difference between the birth weight, gestational age and Apgar scores of neonates who were born alive and those who had died by the age of one week exist.

Research questions

- What is the demographic profile of the mothers and neonates in the study population respectively?
- Is there practical significant differences in the age, gravida, parity, and health risk factor count (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour) between mothers with live neonates and those whose neonates died up to the age of one week?
- Is the gender of the baby a practical significant indicator to be born alive or dead and are there practically significant difference between the birth weight, gestational age and Apgar scores of neonates who were born alive and those who had died by the age of one week exist?

Definitions of keywords

Perinatal deaths comprise stillbirths and neonates who die during the first week after birth (Statistics SA, 2015:1). In this study perinatal deaths included stillbirths and neonates born in the participating hospital and those who had died before discharge from the hospital.

Newborn refers to a viable live born neonate from birth to five days after delivery (Statistics SA, 2015:1)

Stillbirth is the death of a foetus prior to the complete expulsion or extraction from its mother's uterus irrespective of the duration of gestation (WHO, 2016). In the case of a fresh stillbirth, death occurred just before birth but a macerated stillbirth implies that the foetus had been retained in utero for some time after death (Jezova *et al.,* 2013).

Miscarriage refers to the premature loss of a foetus up to 23 weeks of pregnancy and weighing up to 500g (WHO, 2016).

A perinatal audit is an evaluation of data, including the death data and causes of deaths, during the perinatal period. PPIP is the tool used to collect and categorise the causes of perinatal deaths. Perinatal audits are only carried out in facilities where babies are born (Pattinson, 2013:2).

Neonatal death is the death of a baby up to the age of 28 days after delivery (WHO, 2016:1). If the death occurs within one week after birth it is an early neonatal death and after this period up to 28 days it is a late neonatal death (NaPeMMCo report, 2014:7).

Research methodology

Design

This study adopted a quantitative, cross sectional, retrospective, descriptive clinical audit design (Burns & Grove, 2009:236-240).

Research site

The research site of this study was a district hospital in the Free State Province of South Africa. This study focussed on a district hospital because many births and perinatal deaths occur in district hospitals (Lloyd & De Witt, 2013:518).

Study population

The study population only included one district hospital was included because this district hospital is the largest of the other three district hospitals and delivers more or less the same number of neonates as the regional hospital. In this district 76.3% of the total population rely on public health care (Massyn *et al*., 2016:359).

The largest district hospital's data captured on the PPIP database was used. Information in this database was obtained from maternity registers of all the women whose neonates were born at the selected hospital during 2015. The reason for using 2015 data was because it was the most complete set of data and final year of the Millennium Development Goals, with specific reference to goal four focussing on the reduction of maternal and neonatal deaths. The PPIP is an official data collecting tool and capturing of data is a compulsory task that all hospitals that render

maternal services must implement. The variables of the study population were specific selected information for both the mothers and neonates associated with perinatal deaths as captured on the PPIP database.

Sample

The sample included neonates born during 2015 in a district hospital of the Free State province.

Sampling techniques

Random sampling of the alive neonates and all-inclusive sampling of all the dead neonates during 2015.

Sample size

From 2319 neonates born during 2015 a random sample of 384 neonates born alive and all dead neonates 43 were included in the sample. Stratum 1 alive neonates (n=384) and stratum 2 dead neonates (n=43). In the population there were six sets of twins, but after consultation with the statistician one baby of each set of twins was included because statistically, every data point must be independent from any other and when there are twins the two neonates are not independent because they have the same mother with identical maternal health problems. In the case of twin neonates 3 pairs only one was selected as a result of the fact that the observations had to be independent (Tabachnick & Fidell, 2001).

Instruments

The PPIP database developed by the National Department of Health (1999) contains maternal and perinatal information which is transferred from maternity records anonymously. The data are extracted retrospectively, and recorded on a specially designed Excel data sheet with pre-selected maternal and neonatal factors associated with perinatal deaths. An Excel data sheet was developed, due to the fact that the PPIP database is not in an electronic usable format for data analysis. These selected maternal variables included age, gravida, parity, and risk factor count, which are in the sum, presence of diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged or obstructed labour. The selected neonatal variable included gender, birth weight, gestational age and Apgar score.

Reliability and validity

The PPIP database meets face and content validity. Data captured on a specifically created MSExcel sheet were double checked and spot checks were conducted by the statistician. The PPIP data collection tool was relevant because it identifies factors contributing to perinatal deaths. It also has a computerised data validation mechanism which, validates captured information (Pattinson, 2013). A statistician assisted with the statistical data analysis. There were no variables on a Likert scale and thus no statistical validity and reliability coefficients could be determined.

Pre-test

Data captured from the PPIP database on the self-developed Excel data sheet underwent a pre-test before data collection commenced. Thirty numbers were randomly selected by the statistician and the pre-selected factors were captured on the excel data sheet. This was done to determine the feasibility and appropriateness of the study and to detect any flaws in the excel data sheet prior to data collection (Botes *et al*., 2010:208-209). The thirty entries were then sent to the statistician and after analysis the statistician advised that a number should be assigned to the data captured to remove wording/identifying data. For example if the baby was a boy the number 1 was given and 2 for a girl.

Data collection procedures

Thirty numbers were randomly selected by the statistician and the pre-selected factors were captured on the MSExcel data sheet to detect any flaws in the MSExcel data sheet prior to the actual data collection (Botes *et al*., 2010:208-209) but none were encountered.

The researcher used the PPIP data base and extracted retrospective ex post facto data which were captured on a MSExcel data sheet containing the pre-selected maternal and neonatal factors. A computerised random sample was selected of the alive neonates. The researchers knew which case numbers' data to capture. The completed data sheet were sent to the statistician for data analysis.

Data analysis

Descriptive statistics which included means and frequencies were computed to compile demographic profiles of the study population as well as for the two different strata, namely alive and dead neonates. Cohen's effect sizes were computed to determine the practical effect of differences between the means of the two stratums on continuous variables concerning the mothers (e.g. parity, age, gravida) and neonates (Apgar, gestational age, weight). In the case of categorical variables (e.g. gender, mothers' HIV status etc.) phi-coefficients were computed to determine if practical relationships exist of whether the baby was born alive or dead. A logistic regression analysis was done to identify the most practically significant predictors for a neonate's chances of survival. The SAS 2016 program was used to analyse the data. As a result of the fact that the study sample was not a representative random sample inferential statistics are reported in this study for completeness's sake, but interpretations will be done on Cohen's effect sizes (Cohen, 1988).

Ethical considerations

This study received ethical approval from the North-West University's Ethical Committee [Ethical approval number: NWU-00357-16-SI]. Permission was also obtained from the Head of the Department of Health of the Free State Province as well as from the Chief Executive Officer of the participating hospital. This study used ex post facto data from the 2015 PPIP database of the participating hospital; therefore no person participated directly in the research project.

Discussion of research results

Demographic profiles of the mothers and neonates of the study population

Mothers

Out of the 384 neonates, (98.44%; n=378) were singleton pregnancies and six (1.56%) were twin pregnancies. Teenagers, in the age group 14 to 18 years of age, and the advanced maternal age group of 36-44 years, are classified as high risk pregnancies. The teenage group comprised 37 (9.63%) and the advanced maternal age group comprised of 27 (7.03%). Women aged 19-35 years, considered as the normal childbearing age comprised 310 (80.74%). Of the women in the sample 118 (30.73%) were primi-gravidas, while 226 (69.26%) had been pregnant more than once.

Out of the 384 recorded births, 144 (37.50%) women were primi-parity (giving birth to a live infant for the first time), and 231 (60.15%) women had given birth to 2-4 live neonates and nine (2.35%) women had given birth to five or more live neonates.

High risk factors regarding pregnancies included diabetes, syphilis, hypertension and HIV. Nineteen (n=19; 4.95%) of the mothers suffered from diabetes mellitus. Fourteen (3.65%) mothers had syphilis. Six mothers (1.56%) had hypertension. Out of the 384 mothers, 141 (36,72%) tested HIV-positive but the HIV status did not affect the outcome

of neonates, probably due to the Anti-retroviral treatment (ART) intake and adherence. The complications associated with delivery included, postpartum haemorrhage, ruptured uterus, placenta abruption, placenta praevia and prolonged obstructed labour. Only one (0.26%) had postpartum haemorrhage and one woman (0.26%) had a ruptured uterus while three (0.78%) women had placenta abruption. Ten women (2.60%) experienced prolonged labour which predisposed neonates to perinatal deaths. Three hundred and sixty nine 369 (96.34 %) woman came from urban areas and 15 (3.66%) came from rural areas. Lastly the majority of the mothers n=280 (72.92%) had normal vaginal deliveries and n=104 (27.08%) had caesarean sections. Please note that a health risk factor was calculated for each mother by summation of all the positive diagnosed high risk medical factors for each mother.

Neonates

The total number of neonates in the study population was 384 of whom 187 (48.70%) were males and 197 (51.30%) were females. Perinatal deaths are classified as either a stillbirth (A stillbirth in this study meant the death of a fetus after 23 weeks of gestation (WHO, 2016) or a neonatal death (death of a newborn baby after birth). From the 384 neonates in the sample, 34 (8.85%) were stillbirths and nine (2.34%) were neonatal deaths. There were 341 (88.80%) live neonates and 43 (11.20%) perinatal deaths.

Out of the 384 neonates born, 129 (33.59%) were premature born at a gestational age ranging between 23 weeks to 37 weeks. Two-hundred forty eight 248 (64.58%) neonates were born full term, gestational age ranging from 38 weeks to 40 weeks. Only 7 neonates (1.83%) were born as post mature between 41 weeks to 42 weeks.

The average weight of the neonates was 3 028.10 gram (std 607.63). Apgar scores which indicates the appearance of the skin colour; Pulse or heart rate, Grimace response or reflexes; Activity or muscle tone and lastly respiration; and Breathing rate and effort of neonates (Apgar, 1952). Ranges between 0 and 10.The mean Apgar score after 5 minutes was 7.61 (std 2.73) and the average Apgar score after 10 minutes was 8.74 (std 3.02). Apgar scoring is based on a total of one to ten and is measured by a doctor or midwife after assessing the 5 activities, namely skin colour, heart rate, grimace, activity and breathing. The higher the score, the better the baby is doing after birth. A score of 7, 8 and 9 is normal and is a sign that the new born is doing well. Any score below 7 is a sign that the baby needs medical attention. The lower the score the more attention the baby needs to adjust outside the mother. A low Apgar score does not mean a child will have serious or long term health problems. The score is not designed to predict the future of the health of the baby.

Demographic profile of the mothers with dead neonates

Table 1 indicates the demographic profile of the mother and dead neonates which was the focus of this study.

Table 1 Demographic profile of the mother's with dead neonates

MOTHERS			
Categories		**Frequency**	**Percentage**
Type of pregnancy	Singleton pregnancy	41	95.35
	Twins	2	4.65
	Triplets	0	0
Age of mother	High risk age (Teenagers: age group 14-18 years)	6	13.95
	Low risk child bearing age (age group 19 to 35 years)	32	74.44
	High risk age (Advanced maternal age: age group 36 to 44 years)	5	11.65
Gravida	Primi gravida (first pregnancy)	17	39.53
	Multi-gravida (2 and more pregnancies)	26	60.09
Parity	Primi parity (first delivery)	15	34.88
	Multi-parity (2 and more pregnancies)	28	65.12
Health risk factors	Diabetes	4	9.30
	Syphilis	1	2.33
	Hypertension	0	0
	HIV reactive	16	37.21
	Postpartum haemorrhage	0	0
	Ruptured uterus	1	2.33
	Placenta abruption	1	2.33
	Placenta praevia	0	0
	Prolonged/obstructed labour	2	4.65
Area of birth	Urban	41	95.35
	Rural	2	4.65
Type of delivery	Normal vaginal delivery	30	69.77
	Caesarean delivery	13	30.23

Mothers

The demographic profile of the mothers with dead neonates indicated that more singleton pregnancy neonates died 41 (95.35%), against the twin pregnancy neonates 2 (4.65%). There were no triplets in this sample. For the category of age group of the mother, the high, risk age groups which included teenagers (ages 14-18 years) and advanced maternal age (age group 36-44 years), accumulated to a fourth of the neonatal deaths 11 (25.6%) against the number of mothers in the low risk child bearing age 32 (74.44%), for the low risk age group. More neonates from the low risk child bearing age group died (74.44%) in the study than from the high risk group (25.60%). From the peri-natal deaths, 17 (39.53%) mothers were primi-gravidas, multi-gravida mothers were 26 (60.09%). For the category primi-parity there were 15 (34.88%) against the multi parity of 28 (65.12%). The health risk factors indicated that that the frequency for HIV reactive mother were 16 (37.21%), followed by diabetes mellitus with the frequency of 4 (9.30%) and only one syphilis (2.33%). No mothers in the sample had hypertension. Prolonged/obstructed labour had a frequency of 2 (4.65%). Whereas, for both ruptured uterus and placenta abruption there were only one (2.33%). No mothers in the sample had post-partum haemorrhage or placenta praevia. The area of birth indicated that most mothers gave birth in urban areas 41 (95.35%), there were only 2 (4.65%) neonates born in the rural area. Of the sample, 30 (69.77%) mothers had normal vaginal deliveries and 13 (30.23%) mothers had caesarean sections.

Table 2: Demographic profile of the mothers and dead neonates (continue)

DEAD NEONATES			
Categories		**Frequency**	**Percentage**
Gender	Male	21	48.84
	Female	22	51.16
Gestational age	Preterm neonate	25	58.15
	Full-term neonate	16	37.21
	Post-maturity neonates	2	4.66

Dead neonates

The demographic profile for the dead neonates indicated that there was almost the same number of dead male and female neonates. The male neonates were 21 (48.84%) and for female neonates were 22 (51.16%). The gestational age showed that there were 25 (58.15%) preterm neonates, 16 (37.21%) full-term neonates and 2 (4.66 %) for post mature neonates.

Table 3 Demographic profile relating to the weight and Apgar scores of the dead neonates

Categories		**M**	**std**
Weight in grams		2 508.91	1011.03
Apgar score	5 minutes	0.83	1.85
	10 minutes	0.69	2.25

The mean weight in grams for dead neonates was 2508.91 (std 1011.03), indicating that the lower the birth weight the higher the chances to experience perinatal deaths. The mean Apgar score for dead neonates at 5 minutes was 0.83 (std 1.85) and the mean after 10 minutes was 0.69 (std 2.25), indicating that lower Apgar scores implied higher risks for neonatal death.

In table 3 descriptive statistics and Cohen's effect sizes for continuous variables related to mothers and neonates for differences on the status of the baby are given. Guideline for Cohen's effect sizes are as follow: d=|0.2| small effect, d=|0.5| medium effect and noticeable with the naked eye, d >= |0.8| large effect (Cohen, 1988).

Table 4 Descriptive statistics and Cohen's effect sizes for continuous variables related to mothers and neonates for differences on the status of the neonates

MOTHERS						
Variables of mothers	**Group**	**N**	**M**	**std**	**p-value (when random sampling is assumed)**	**d-value**
Age	Dead neonates	43	25.40	6.31	0.30	0.17
	Alive neonates	341	26.40	6.23		
Gravida	Dead neonates	43	2.12	1.21	0.37	0.14
	Alive neonates	341	2.28	1.20		
Parity	Dead neonates	43	1.16	1.11	≤ 0.01*	0.86▲
	Alive neonates	341	2.12	1.12		
Health risk factors	Dead neonates	43	0.58	0.70	0.46	0.12
	Alive neonates	341	0.50	0.60		
NEONATES						
Variables for neonates	**Group**	**N**	**M**	**std**	**p-value (when random sampling is assumed)**	**d-value**
Birth weight	Dead neonates	43	2508.9	1011.0	≤ 0.01*	0.58Δ
	Alive neonates	341	3093	501.3		
Apgar after 5 minutes	Dead neonates	43	0.84	1.85	≤ 0.01*	4.12▲
	Alive neonates	341	9.75	0.64		
Apgar after 10 minutes	Dead neonates	43	0.70	2.25	≤ 0.01*	4.02▲
	Alive neonates	341	9.75	0.64		
Gestational Age	Dead neonates	43	35.26	4.26	≤ 0.01*	0.60Δ
	Alive neonates	341	37.82	1.93		

* Statistically significant at 0.01 level according to t-test results for independent groups.

Δ Medium effect in practice

▲ Large and also practically significant

According to Table 4 the age, gravida and health risk factors of the mothers did not have any practically significant effect on the survival status of the neonate, because the d value of less than 0.2 indicates a small effect. However parity played a practically significant role because the higher the parity the higher is the chance for a live neonate. The mothers in the group with live babies had a mean parity of 2.12 while the mothers of the dead neonates had a mean parity of 1.16. Meaning that the group of mothers with the live babies has a history of delivering more live babies than those in the group with dead babies. The mean birth weight (2 508.9g) of the dead neonates differed from the mean birth weight (3 093.0g) of the live neonates with a medium effect size meaning that dead neonates weights at birth were less than alive neonates. The mean Apgar score at 5 minutes was 0.84 for dead neonates and 9.75 for alive neonates and the d value at 4.12 indicated a practically significant meaning the chances of survival was higher for neonates with a higher Apgar. The mean indicated that the Apgar after 10 minutes for dead neonates was 0.70 and the mean value for alive neonates were 9.75 which indicated that the chances of survival for alive neonates was higher because the d value was practically significant at 4.02. The mean gestational age for dead neonates was 35.26 and for alive neonates the mean gestational age was 37.82 with a d value of 0.60 indicating that a practical significance for gestational age between dead and alive neonates. From all the above mentioned variables on the status of the baby, the Apgar has the highest indications if the baby will survive or not.

Analysis of the categorical variables indicated that all the phi-coefficients were less than 0.3 and thus no practical relationship could be found between the neonates born alive or dead. Indicating that health risk factors of the mother (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour), whether the mother live in a rural or urban area, gender of the neonates had no practical effect whether the baby was born alive or dead.

All continuous variables (age, gravida, parity, health risk factors, weight and gestational age) concerning mothers and neonates were entered in the logistic regression analysis except for the Apgar scores five minutes after birth because the correlation between Apgar at 5 minutes and Apgar at 10 minutes were too high and would cause multi-colinearity (Hosmer & Lemeshaw, 2000:65). The results of the forward logistic regression yielded that Apgar 10 score of the neonate and parity of the mother were the best predictors of the status of the neonate. Yielding the following classification table (Table 5 below) with 98.7% neonates categorised correctly when using this model. Meaning that the neonates Apgar 10 score is the best predictor of whether the baby will survive in combination with the parity of the mother.

Table 5 Classification table to illustrate predictive power of the logistic regression model

		Predicted Group		
		Dead	**Alive**	**% Correct**
Actual Group	Dead	39	4	90.7
	Alive	1	340	99.7
Overall correct				98.7

As can be seen from Table 5 the Apgar 10 score of the baby in combination with the parity of the mother will predict with a 98.7% success rate whether a baby will survive or not.

Discussion

When analysing the categorical variables, all the phi-coefficients were less than 0.3 (Cohen, 1988) and thus no practically significant relationship between the status of the baby and any of these variables could be found. Indicating that health risk factors of the mother (diabetes, syphilis, hypertension, HIV, eclampsia, postpartum haemorrhage, placenta abruption and placenta praevia, ruptured uterus and prolonged/obstructed labour), whether the mother live in a rural or urban area and gender of the neonates had no practical effect whether the baby was born alive or dead.

Maternal factors such as, age and gravida did not have any practical significant effect on the status of the neonates because they both had a d value of less than 0.2 meaning that these variables do not have practical implications on whether the neonate will be born dead or alive.

However, parity plays a practical significant role on whether the neonate will be born dead or alive. The d value between the dead and alive neonates was found to be 0.86, indicating that parity has a practical significant impact on the outcome for neonates to survive. The conclusion is that the higher the parity the lower the possibility for perinatal deaths in this study population. An interesting finding is that although there is a practical significant correlation between gravida and parity, only parity have a practical significant influence on the status of the baby. Indicating that although a mother can have the ability to become pregnant it does not assure the mother's ability to deliver a live baby.

Multiparous women have been found to deliver macrosomic infants (Agbozo *et al.,* 2016:205). Nulliparous and primiparous women experiences the same high risks during childbirth particularly when mothers are of young age e.g. obstructed labour and preterm births (Kozuki *et al*., 2013:2. Parity and maternal age have been shown to inverse the risk of adverse neonatal outcomes such as IUGR, prematurity and mortality (Kozuki *et al*., 2013:2, Lisonkova *et al.,* 2010:541). Nulliparous women had significant association with adverse outcomes but particularly when mothers were of young age (Kozuki, *et al*., 2013:6).

Neonatal factors, namely the birth weight, gestational age and the Apgar score had practical implications on whether the neonate will be born dead or alive. The d value for the weight of dead neonates and alive neonates was 0.58, meaning that the dead neonates' weight at birth was less than those of alive neonates with a medium practical effect in this study. The fact is in agreement with Agbozo *et al.,* (2016:201) that low birth weight is a significant predictor for neonatal mortality. Low birth weight is defined by WHO as a birth weight of less than 2.5 kg. Low birth weight neonates are more prone to perinatal deaths (Berhan and Berhan, 2014:55; Onwuanaku *et al*, 2011:562). In this study the mean of the weight of the dead neonate are 2.51 (2 508.9g) while the mean of the alive babies are 3 093 g.

The d value for gestational age between dead and alive neonates was found to be 0.60 which indicated that the lower the gestational age the higher the risk for perinatal deaths This findings was confirmed by the findings of Amson *et al*. (2006:589) who reported that premature gestation and low birth weight increase the changes of neonatal deaths.

The Apgar scores at both five minutes and 10 minutes after birth indicated the survival chances of the neonate. The d value at five minutes was 4.12 and at 10 minutes it was 4.02 meaning that the higher the Apgar score the higher the survival chances for the neonate.

Of all these variables pertaining to the status of the neonate, the Apgar score 10 minutes after birth was the best indicator as to whether the neonate would survive or not. This fact was confirmed by Cohen's' effect size d (see Table 4 d=4.02) as well as by the results of the logistic regression analysis.

Conclusion

Maternal factors which had no practically significant effect on the status of the baby because they had d values of less than 0.2 included age, gravida and health risks factors. However, parity played a practically significant role

affecting the baby's survival chances. The d value between the dead and alive neonates was 0,86, indicating that the higher the parity of the mother the higher is the chance for the baby to live.

Neonatal factors, that had practical implications for the neonate's chances to survive included birth weight, gestational age and the Apgar score. The d value for the weight of dead neonates and alive neonates was 0.56, meaning that the dead neonates' weight at birth was less than those of alive neonates. The d value for gestational age between dead and alive neonates was 0.60 indicating that the lower the gestational age the higher the risk for neonatal deaths. Apgar scores at both five and 10 minutes after birth provided the most significant indicators of the neonates' survival chances. The d value of the Apgar score at five minutes was 4.12 and at 10 minutes it was 4.02 meaning that the higher the Apgar score, the higher the survival chances for the neonates.

Recommendations for practice

Quality of care in maternity and neonatal units could be improved if each hospital would be informed about the outcomes of the applicable PIPP records; and if trends over time could indicate increased or decreased neonatal mortality rates and possible factors contributing to such changes. Such reports should be generated by the PIPP database and used in every maternity unit to evaluate its progress consistently over time.

If the parity of the pregnant women is low, or if it is her first baby, she should be monitored closely during the antenatal and post-natal stages as well as during birth because she does not have a history of delivering live babies.

As the Apgar scores 10 minutes after birth gave the strongest indication of the neonate's survival chances, midwives should be trained to rate and record Apgar scores accurately and to implement appropriate interventions to enhance the neonate's chances of survival.

Limitations of the study

The current study was conducted at one district hospital, therefore the findings might not be generalisable to other hospitals without repeating similar studies at other hospitals.

The study did not measure the financial resources, organisational or personnel factors of the hospital related to neonatal deaths but only the maternal and neonatal factors.

Only data recorded on the PIPP system were utilised. No interviews were conducted with mothers, midwives or NICU staff members. The PIPP data did not reflect the neonates' survival status at seven days of age but merely at the time of discharge from the hospital which could be 6-8 hours after the neonate's birth.

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CHAPTER 3

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

3.1 INTRODUCTION

In this chapter, the researcher will summarise and present the conclusions, recommendations and limitations of the study.

The previous sections described the study and discussed the literature review, data collection and analysis. The research process and findings have been prepared in an article format to be submitted to the Africa Journal of Nursing and Midwifery in chapter 2 of this dissertation.

The current study focussed on determining the practical significance between the different maternal and neonatal factors associated with perinatal deaths.

The researcher used the PPIP data base and a specifically designed MSExcel tool to collect vital data, which were processed, analysed and interpreted with the assistance of a statistician.

3.2 CONCLUSIONS

The overall aim and purpose of this study was to determine the practical significance between the different maternal and neonatal factors associated with perinatal deaths. The assumption underlying the current study was that maternal and neonatal factors contribute to and/or are associated with perinatal deaths.

Maternal factors which had no practically significant effects on the baby's survival status included age, gravida and health risks factors because they all had a d value of less than 0.2.

Parity played a practically significant role in the baby's survival chances. The d value between the dead and alive neonates was 0.86, indicating that it had an impact on the survival outcomes of neonates. The conclusion is that the higher the parity the higher the possibility for perinatal deaths.

Neonatal factors that influenced the neonates' chances of survival included the birth weight, gestational age and the Apgar scores. The d value for the weight of dead neonates and alive neonates was 0.56, implying that the dead neonates weighed less at birth than alive neonates. The d value for gestational age between dead and alive neonates was 0.60, indicating that the lower the gestational age the higher the risk for perinatal deaths. Apgar scores at both five and 10 minutes after birth were best indicators for neonates' chances of survival, meaning that higher Apgar scores were associated with better survival chances of the neonates.

As the HIV-positive status of the mothers had no significant influence on the neonatal outcomes in the current study, it could be assumed that these women's used ART effectively. The midwives and the health care professionals working in ART and ANC clinics in the study area, should be congratulated on this major accomplishment.

3.3 RECOMMENDATIONS

The researcher formulated recommendations to improve nursing practice and for future research, based on the conclusions of the current study.

3.3.1 Recommendations to improve nursing practice

Quality of care in maternity and neonatal units could be improved if each hospital would be informed about the outcomes of the PIPP records applicable to it. Trends over time could indicate increased or decreased neonatal mortality rates and identify possible factors contributing to such changes in specific hospitals. This information could assist midwives to address specific factors contributing to neonatal deaths in a specific hospital.

If the parity of the mother is high the mother must be monitored closely during the ANC period as well as during birth and after birth because the higher the parity, the higher the neonatal risks. Women who have four or more children should be educated about increased obstetric and neonatal risks associated with high parity so that they can make informed decisions about future pregnancies and about seeking help timeously.

As low birth weight was associated with a high risk for neonatal death, midwives should be alert to identify small-for-dates babies and to implement appropriate interventions.

The neonates' Apgar scores 10 minutes after birth provided the strongest indicator as to the neonate's chances to live or die. Consequently all midwives should be experts in assigning Apgar scores, keeping accurate records of these scores and of interventions implemented to improve the Apgar scores and the outcomes of such interventions.

The number of NICU beds (with available ventilators) should be monitored in every area and increased where necessary. Nurses should be encouraged to become skilled NICU caregivers.

3.3.2 Recommendations for research

Similar site-specific studies, using information from the PIPP data base, should be conducted so that the findings could be generalised and serve as baseline information with which to compare future PIPP statistics.

Service-related aspects, such as staffing, finance, infrastructure, and the quality of ANC, intrapartum and postpartum care should be studied to identify strengths and weaknesses in the health care system which could impact on neonatal deaths.

Future studies should endeavour to conduct interviews with the mothers of neonates to identify challenges which the pregnant women might encounter that might influence the neonatal death rate in a specific area. Such challenges might include cultural, social, financial and/or personal aspects.

Conducting interviews with midwives could help to identify service-related challenges that might contribute to neonatal deaths.

Additional research can be undertaken regarding the neonatal and maternal factors at District hospitals for the entire Free State Province at doctoral level so as to improve maternal and neonatal outcomes.

Research on the impact of distances between referring hospitals and neonatal and maternal health outcomes could provide useful information for implementing adequate referral times to higher level health care institutions. A future study should investigate the impact of the advanced antenatal care programme on neonatal outcomes.

3.3.3 Recommendations for nursing education

The curriculum for student nurses and midwives should emphasise the need to identify maternal and neonatal factors associated with neonatal deaths, and to implement effective interventions.

The curriculum and scope of practice for the newly qualified nurses should emphasise maternity and neonatal care.

Preventive care should be emphasised rather than hospital centred care so as to improve primary health care, including ANC services at PHC level.

More Advanced ANC is practitioners must be trained within districts so as to improve ANC care.

3.3.4 Recommendations for policy

High neonatal mortality is a global public health challenge thus policy makers need to fund mother and child programmes fully so as to avail equipment for quality care in both maternity and neonatal units so as to reduce this burden.

Transfers agreements across provincial borders could save mothers' and babies' lives. In this case the Free State Province and Gauteng must have an agreement to transfer neonates (and emergency obstetric cases) to a regional hospital in Gauteng which is 24km away rather than the regional hospital in the Free State which is 145 km away.

The implementation of NICU beds with ventilators and trained staff must be prioritised if the province intends to save neonates.

3.4 LIMITATIONS OF THE STUDY

The study was conducted in one district hospital; therefore the findings might not be generalisable to other hospitals without repeating similar studies in other sites.

The study did not measure the financial resources, organisational or personnel factors of the hospital related to neonatal deaths but only the maternal and neonatal factors.

Only data recorded on the PIPP system were utilised. No interviews were conducted with mothers, midwives or NICU staff members. The PIPP data did not reflect the neonates' survival status at seven days of age but merely at the time of discharge from the hospital which could be 24 hours after a baby's birth. It is possible that information about babies who died during the neonatal period after discharge from hospital might have differed from the information available on the PIPP data base.

The study was based on record reviews therefore the data was dependent on the data already collected from maternity registers.

The researcher could not look at causality but looked at associations because the study was cross sectional.

The study did not measure the financial resources, organisational or personnel factors of the hospital but measured only the maternal and neonatal factors associated with perinatal deaths though these are not the only factors related to perinatal deaths.

3.5 SUMMARY

Different direct and indirect factors contribute to and are associated with perinatal deaths. The researcher investigated perinatal deaths at a district hospital and this was the first official research undertaken at the participating district hospital in the Free State Province of South Africa. The researcher assumed that both organisational and personal (maternal and neonatal)

factors could influence perinatal mortality rates, but only personal factors were investigated during the current study.

Parity was the most important maternal factor that contributed to neonatal deaths. The higher the mothers' parity, the higher were the chances for neonatal deaths. Nulliparous women, especially at very young ages, also had higher rates of perinatal death outcomes.

Neonatal factors that were related to neonatal deaths included the birth weight of neonate, the lower the birth weight the greater the chances for neonatal deaths. The gestational age of the neonate was also an important factor because the lower the gestational age the greater were the chances of a neonatal death. The Apgar scores were the most important indicators of neonates' chances of survival. The higher the Apgar score, the greater the chances of survival.

By identifying and addressing risks associated with a pregnant woman's parity and the neonate's birth weight, gestational age and especially the Apgar score (five and 10 minutes after birth), some neonates might have improved chances of living rather than of dying.

3.6 LIST OF REFERENCES

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3.7 INFORMATIVE SOURCES

This section lists sources which were used for further clarity and further information in the development of this document. These are listed below.

Agbonzo, F., Abubakar, A. & Der, J. & Jahn, A, 2016. Prevalence of low birth weight, macrosomia and stillbirth and their relationship to associated maternal risk factors in Hohoe Municipality,Ghana. *Midwifery*, 40:200-206. Doi: 10.1016/j.midw.2016.06.016

Cavazos-Rehg, P.A., Kraus, M.J., Spitznagel, E.L., Bommarito, K., Madden, O., Olsen, M.A., Subramaniam, H. Peipet, J.F. & Biercut, L.J. 2015. Maternal age and risk of labour and delivery complications. *Maternal child Health Journal,* 19(6):1202-1211.

Democratic Nursing Organisation of South Africa. 1986. Position statement on nursing research. Pretoria: Denosa. http://www.denosa.org.za/upload/news/DENOSA_Position_statement_on_nursing_research_(revized).pdf Date of access: 12 April 2016.

DENOSA ***see*** Democratic Nursing Organisation of South Africa.

Jansen, L., Gibson, M., Bowles, B.C. & Leach, J. 2013. First do no harm: interventions during childbirth. *Journal of perinatal education*, 22(2):83-92.

Jansone, M., Lindmark, G. & Langroff-Roos, J. 2001. Perinatal deaths and insufficient antenatal care in Latvia. *Acta obstetricia et gynecologica Scandinavica*, 80(12):1091-1095. DOI: 10.1034/j.1600-0412.2001.801203.x

APPENDIXES

A, B, C, D, E, F, G AND H

APPENDIX A: ETHICAL APPROVAL – HEALTH RESEARCH ETHICS COMMITTEE

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222 Web: http://www.nwu.ac.za

Faculty of Health Sciences
Health Sciences Ethics Office for Research, Training and Support
Health Research Ethics Committee (HREC)

Tel: 018-285 2291
Wayne.Towers@nwu.ac.za

29 March 2017

Dr A du Preez
Nursing-INSINQ

Dear Dr Du Preez

APPROVAL OF YOUR APPLICATION BY THE HEALTH RESEARCH ETHICS COMMITTEE (HREC) OF THE FACULTY OF HEALTH SCIENCES

Ethics number: NWU-00357-16-S1

Kindly use the ethics reference number provided above in all correspondence or documents submitted to the Health Research Ethics Committee (HREC) secretariat.

Study title: Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State

Study leader/supervisor: Dr A du Preez

Student: NS Malinga

Application type: Single study

Risk level: Minimal

You are kindly informed that your application was reviewed at the meeting held on 16/11/2016 of the HREC, Faculty of Health Sciences, and was approved on 29/03/2017.

The commencement date for this study is 29/03/2017 dependent on fulfilling the conditions indicated below. Continuation of the study is dependent on receipt of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation up to a maximum period of three years when extension will be facilitated during the monitoring process. **After ethical review:**

Translation of the informed consent document to the languages applicable to the study participants should be submitted to the HREC, Faculty of Health Sciences (if applicable).

The HREC, Faculty of Health Sciences requires immediate reporting of any aspects that warrants a change of ethical approval. Any amendments, extensions or other modifications to the proposal or other associated documentation must be submitted to the HREC, Faculty of Health Sciences prior to implementing these changes. Any adverse/unexpected/unforeseen events or incidents must be reported on either an adverse event report form or incident report form at Ethics-HRECIncident-SAE@nwu.ac.za.

A monitoring report should be submitted within one year of approval of this study (or as otherwise stipulated) and before the year has expired, to ensure timely renewal of the study. A final report must be provided at completion of the study or the HREC, Faculty of Health Sciences must be notified if the study is temporarily suspended or terminated. The monitoring report template is obtainable from the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-Monitoring@nwu.ac.za. Annually a number of studies may be randomly selected for an external audit.

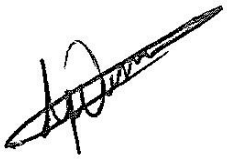
Please note that the HREC, Faculty of Health Sciences has the prerogative and authority to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process.

Please note that for any research at governmental or private institutions, permission must still be obtained from relevant authorities and provided to the HREC, Faculty of Health Sciences. Ethics approval is required BEFORE approval can be obtained from these authorities.

The HREC, Faculty of Health Sciences complies with the South African National Health Act 61 (2003), the Regulations on Research with Human Participants (2014), the Ethics in Health Research: Principles, Structures and Processes (2015), the Belmont Report and the Declaration of Helsinki (2013).

We wish you the best as you conduct your research. If you have any questions or need further assistance, please contact the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-HRECApply@nwu.ac.za.

Yours sincerely



Prof Wayne Towers

HREC Chairperson

Prof Minrie Greeff

Ethics Office Head

Current details: (13210572) C:\Users\13210572\Documents\HREC\HREC - Applications\2016 Applications\Applications 10-16 November 2016\NWU-00357-16-S1(A du Preez-NS Malinga)\NWU-00357-16-S1(A du Prees-NS Malinga)-AL\NWU-00357-16-S1(A du Preez-NS Malinga)-AL.docm 11 April 2017

File reference: 9.1.5.3

APPENDIX B: HEAD OF DEPARTMENT, DEPARTMENT OF HEALTH, FREE STATE PROVINCE

health
Department of
Health
FREE STATE PROVINCE

08 March 2017

Mrs. N Malinga
8 Hospital Road
Parys
9585

Dear Mrs. N Malinga

Subject: Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State.

- Permission is hereby granted for the above – mentioned research on the following conditions:
- Serious adverse events to be reported and/or termination of the study.
- Ascertain that your data collection exercise neither interferes with the day to day running of Metsimaholo Hospital nor the performance of duties by the respondents or health care workers.
- Confidentiality of information will be ensured and please do not obtain information regarding the identity of the participants.
- Research results and a complete report should be made available to the Free State Department of Health on completion of the study (a hard copy plus a soft copy).
- Progress report must be presented not later than one year after approval of the project to the Ethics Committee of the University of the North-West and to Free State Department of Health.
- Any amendments, extension or other modifications to the protocol or investigators must be submitted to the Ethics Committee of the University of the North-West and to Free State Department of Health.
- **Conditions stated in your Ethical Approval letter should be adhered to and a final copy of the Ethics Clearance Certificate should be submitted to** or sebeelats@fshealth.gov.za **before you commence with the study**
- No financial liability will be placed on the Free State Department of Health
- Please discuss your study with the institution managers/CEOs on commencement for logistical arrangements
- Department of Health to be fully indemnified from any harm that participants and staff experiences in the study
- Researchers will be required to enter in to a formal agreement with the Free State department of health regulating and formalizing the research relationship (document will follow)
- You are encouraged to present your study findings/results at the Free State Provincial health research day
- Future research will only be granted permission if correct procedures are followed see http://nhrd.hst.org.za

Trust you find the above in order.

Kind Regards

Dr D Motau
HEAD: HEALTH
Date: 8/3/17

Head : Health
PO Box 227, Bloemfotein, 9300
4th Floor, Executive Suite, Bophelo House, cnr Maitland and, Harvey Road, Bloemfotein
Tel: (051) 408 1527 Fax: (051) 408 1556 e-mail:sebeelats@fshealth.gov.za@fshealth.gov.za/chikobvup@fshealth.gov.za

APPENDIX C: CHIEF EXECUTIVE OFFICER – FEZI NGUBENTOMBI HOSPITAL, DEPARTMENT OF HEALTH FREE STATE

health
Department of Health
FREE STATE PROVI

9TH December 2016

North-West University

Potchefstroom Campus

Dear Dr A du Preez

Re: Permission for Student Malinga N S to perform non clinical research at Fezi Ngubentombi District Hospital

Your letter dated 1st December 2016 has reference.

I herein give permission for your student, N S Malinga to conduct non clinical research at Fezi Ngubentombi District Hospital

I pledge commitment to avail all the necessary documentation she will require for her research

Regards

M D Makgisa

CEO

Mr. MD MAKGISA
CHIEF EXECUTIVE OFFICER
Date.....
FEZI NGUBENTOMBI DISTRICT HOSPITAL
Tel: 016 970 9400

APPENDIX D: PPIP DATA SHEET

PERINATAL DATA SHEET PPIP

TOTAL BIRTHS DATA SHEET

DATA COLLECTED AT: _____

DELIVERY DATA FOR MONTH: _____

DISTRICT: _____

BIRTHS	TOTAL BIRTHS	ALIVE	STILLBORN	NND EARLY	NND LATE
500-999					
1000-1499					
1500-1999					
2000-2499					
2500>					
TOTAL					

MULTIPLE PREGNANSIES		NEONATES FROM		PREGNAN-CIES	
ANTENATAL CARE		Local Clinic		Elsewhere	
		None			
DELIVERY METHODS	NORMAL VAG			VENTOUSE	
	FORCEPS			VAG BREECH	
	C/S				
NR OF MOTHERS:					
SYPHILLIS SEROLOGY	POSITIVE		NEGATIVE		
	UNKNOWN				
HIV SEROLOGY	POSITIVE		NEGATIVE		
	UNKNOWN		DECLINED		
RECEIVED ART	YES		NO		
MATERNAL AGE	<18		18-19		
	>34				

PERINATAL DEATH DATA SHEET- PPIP V2.1

CODED PATIENT NAME:			
PATIENT FILE NUMBER:			
DATE OF DELIVERY:			
DATE OF DEATH:			
BIRTH DATE:			
BIRTH MASS:			
DELIVERY:	At this unit:	At another unit	
(Please circle**)**	At home:	Unknown	
MATERNAL AGE:			
ANTENATAL CARE:	YES	NO	UNKNOWN
CONDITION AT BIRTH:	Born alive	Stillborn, Alive on admission	Macerated stillborn
(Please circle)	Fresh stillborn Dead on admission	Stillborn, Admission status unknown	
SYPHILLIS SEROLOGY:	Positive	Negative	
	Not done	Results not available	
SINGLE / MULTIPLE	Single pregnancy	Multiple Pregnancy	
MATERNAL HIV SEROLOGY:	Positive	Negative	
	Not done	Results not available	
RECEIVE ART	Yes	No	Unknown
PRIMARY OBSTETRIC CAUSE OF DEATH:			
(Enter codes if 'other', please describe below)			
FINAL CAUSE OF DEATH			
(Enter codes if 'other', please describe below)			
AVOIDABLE FACTORS: (Enter codes and circle grade, please describe to the right)		Possible Probable	
		Possible Probable	
		Possible Probable	
		Possible Probable	

Table1: Facility Data (use data from delivery registers, admission books, theatre

registers)

	Function		Number	NA
1.	Number of newborn neonates resuscitated with bag and mask (**BR Col 45)**			
2.	Number of Manual Removed Placenta (**BR Col 45)**			
3	Number of assisted deliveries	Vacumn (**BRCol 26)**		
		Forceps **(BRCol 26)**		
4	Total number of all Caesarean Sections (**theatre records / BR Col 26**)			
	Number of emergency Caesarean Sections (**theatre records / BR Col 26**)			
	Number of elective Caesarean Sections (**theatre records / BR Col 26**)			
5.	Number of evacuation of retained products (MVA, D/C)**(theatre records)**			
6.	Number of women received Blood Transfusion (**Blood transfusion record)***			
7.	Number of women with pregnancy related problems **referred in** from another facility*(**Admissions book)**			
8.	Number of women with pregnancy related problems **referred out** to another facility *(**Discharge book)**			

NA =Not applicable. Some facilities do not provide some of these services.

BR Col= This information will most likely be found in the birth register in the specified column – check manual for column number

***** These registers may differ from facility to facility

Table 2: Information on obstetric complications

	Complication			**Number Cases**	**Number Deaths**	**Number Near misses**
1.	Eclampsia / severe pre-eclampsia (**BR Col 35)**					
020.	Haemorrhage (peri-partum)	APH	Abruptio(**BR Col 35)**			
			Placenta praevia (**BR Col 35)**			
		PPH (**BR Col 35)**				
		Retained placenta (**BR C35**)				
3.100	Ruptured uterus (**BR Col 35)**					
4.	Obstructed or prolonged labour (**Labour >12 hours**) (**BR Col 25)**					
5.	Postpartum sepsis (**Discharge book)**					
6.	Complicated abortion or miscarriage (**Theatre book)**	Abortion /miscarriage				
		Abortion/miscarriage& Sepsis (if data available)				
7.	Ectopic pregnancy (**Theatre book)**					
8.	Other (**Specify**)					
	Total for obstetric emergencies					

1. In the case of any of the <u>above complications</u> the patient <u>must be screened</u> using the checklist found on <u>Page 7</u> (Screening questions Maternal Near Miss / Maternal Death).

2. If any of the items are ticked off in Point 3 (<u>Organ Dysfunction</u>) then the patient must be considered a "<u>Near Miss</u>" and the TABLE 3: NEAR MISS must be filled in

3. The data <u>must also be filled</u> in in the MATERNAL NEAR MISS & MORTALITY DATA CONTROL SHEET (Page 8).

4. When these data sheets are sent to <u>Monitoring and Evaluation team</u> please send a copy of the screening done (<u>Page 7</u>) and a copy of the MATERNAL NEAR MISS & MORTALITY DATA CONTROL SHEET (<u>Page 8</u>)as well.

Table 3: Maternal Near miss

Date	Name	Hospital Number	Cause

Please refer to Page 7 for a guide to what is considered a "Near Miss" If the case qualifies please fill in this table

Table 4: Maternal Death

Date	Name	Hospital Number	Cause

If a patient dies this table must be completed as must the form on Page8.This form must be sent along with the other monthly data monitoring forms to the Data monitoring and evaluation team

SCREENING QUESTIONS MATERNAL NEAR MISS / MATERNAL DEATH

Hospital _____(Tick if any of items is present. Any tick in question 3 indicates the woman has a life threatening condition and a Maternal Near Miss& Mortality Data control sheet must be completed)

1. **Severe complications / potentially life threatening conditions**

- ☐ Postpartum Haemorrhage
- ☐ Eclampsia / severe pre-eclampsia
- ☐ Abruptio placenta
- ☐ Ruptured uterus
- ☐ Ectopic pregnancy
- ☐ Sepsis or severe systemic infection (post-partum/post abortal)
- ☐ Prolonged or obstructed labour

2. **Critical interventions or ICU admission**

- ☐ Use of blood products
- ☐ Laparotomy (includes hysterectomy; excludes caesarean section)
- ☐ Admission to ICU

3. **Organ dysfunction / Life threatening condition**

Cardiovascular dysfunction

- ☐ Shock
- ☐ Cardiac arrest
- ☐ Use continuous vasoactive drugs
- ☐ Cardio-pulmonary resuscitation
- ☐ Severe hypoperfusion (Lactate >5mmol/L)
- ☐ Severe acidosis (pH<7.1)

Respiratory dysfunction

- ☐ Acute cyanosis
- ☐ Gasping
- ☐ Severe tachypnoea (RR>40breathspm)
- ☐ Severe bradypnoea (RR<6 breathspm)
- ☐ Intubation and ventilation not related to anaesthesia
- ☐ Severe hypoxaemia (O2saturation <90% for >60 min.)

Renal dysfunction

- ☐ Oliguria non responsive to fluids or diuretics
- ☐ Dialysis for acute renal failure
- ☐ Severe acute azotemia (creatinine>300umol/ml)

Coagulation/haematologic dysfunction

- ☐ Failure to form clots
- ☐ Massive transfusion of blood or red cells (>4 units)
- ☐ Severe acute thrombocytopenia (<50,000 platelets/ml)

Hepatic dysfunction

- ☐ Jaundice in the presence of pre-eclampsia
- ☐ Severe acute hyperbilirubinaemia (bilirubin >100umol/L)

Neurologic dysfunction

- ☐ Prolonged unconsciousness / coma (lasting >12 hours)
- ☐ Stroke
- ☐ Uncontrollable fits / status epilepticus
- ☐ Global paralysis

Uterine dysfunction

- ☐ Uterine haemorrhage of infection leading to hysterectomy

4. **Maternal status**

- ☐ Alive
- ☐ Dead

Hospital Number _____

Date _____

MATERNAL NEAR MISS & MORTALITY DATA CONTROL SHEET (PATIENT WITH LIFE THREATENING CONDITION)

Hospital:			DR (Name):				
DEMOGRAPHICS (please draw circle around correct option)							
Admission date:		Near Miss date:					
Province:		District:		Level of care:	Home / HCC / L1 / L2 / L3 / Private Hosp		
Age:		Parity before delivery:			Gravidity		
Did she receive antenatal care:	Yes / No / Unknown	Did she book before 20 weeks:	Yes / No / Unknown				
HIV Status:	Negative / Positive / Declined testing / AIDS not on HAART/ AIDS on HAART / Unknown						
Present Pregnancy outcome:	Liveborn / Stillborn / Neonatal death / Miscarriage / Ectopic Pregnancy / Undelivered						
Route of delivery:	Vaginal / Assisted / Caesarean section / Undelivered / Not Applicable						
This patient was transferred?	Yes / No	If yes from where?					
This patient had an anaesthetic?	Yes / No	If yes, at level?	L1 / L2 / L3 / Private Hosp				
A Hysterectomy was performed?	Yes / No	Did she had prolonged labour:	Yes / No / Unknown / NA				
Mid upper arm circumference:	cm	Did she have a previous C/S:	Yes / No / Unknown				
Was she anaemic?	Yes / No / Unknown						

Medical Assessment of Case: Near Miss or a Maternal Death: In case of Maternal death, give date:

Primary Obstetric Problem (Tick box and draw circle around correct option)		**NEAR MISS MARKER (Tick box and draw circle around correct option)**	
Coincidental Cause: MVA/Other accidents/ Assault/Rape/ Herbal medicine/Other:		**Circulation system:** Hypovolaemic shock /Septic Shock	
Medical and surgical disorders: Cardiac disease/Endocrine/GIT/CNS/Respiratory/ Haemotological/Genito urinary/Auto-immune/Skeletal/ Psychiatric/ Neoplasm/ Other:		**Respiratory failure**: Respiratory failure	
Non-pregnancy-related infections: PCP pneumonia/Other pneumonia/TB/Endocarditis/UTI/ Appendicitis/Malaria/Cryptococcal meningitis/ Other meningitis/ Kaposi's sarcoma/Toxoplasmosis/Cholera/ Hepatitis/ Gastroenteritis/Wasting syndrome/ Complications of antiretroviral therapy/Other:		**Cardiac Failure:** Pulmonary oedema / Cardiac Arrest	
		Embolism: Acute cardiopulmonary collapse due to embolism	
		Renal Failure: Renal failure	
		Liver Failure: Liver failure	
Ectopic pregnancy: Less than 20 weeks/More than 20 weeks			
		Cerebral complications: Intracranial haemorrhage/ Cerebral oedema resulting in coning/ Meningitis/ Cerebral emboli/ Hypoxic event / Unspecified	
Miscarriage: Septic miscarriage/Haemorrhage(non traumatic)/Uterine trauma/ GTD/Following legal TOP			
		Metabolic: Maternal ketoacidosis/ Electrolyte imbalance/ Thyroid crisis / Lactic acidosis / Other:	
Hyperemesis gravidarum:			
Pregnancy related sepsis: Chorioamnionitis with ruptured membranes/ Chorioamnionitis without ruptured membranes/ Puerperal sepsis after NVD/Puerperal sepsis after C/S Bowel trauma after C/S		**Haemotological:** Disseminated intravascular coagulation / Severe anaemia	
		Uterine dysfunction:	
		ORGAN SYSTEMS AFFECTED (Please tick one box)	
Obstetric haemorrhage: Abruption with hypertension/Abruption without hypertension/ Placenta praevia/Other APH not specified Ruptured uterus with previous c/s / without previous c/s / Retained placenta / Morbidly adherent placenta / Uterine atony / Vaginal trauma / Inverted uterus Bleeding during c/s / after c/s / Other PPH not specified		Circulatory system	
		Renal system	
		Metabolic system	
		Respiratory system	
Hypertension: Chronic hypertension / Proteinuric hypertension / Eclampsia / HELLP/ Liver rupture / Acute fatty liver		Hepatic system	
		Haematologic system	
		Cardiac system	
Anaesthetic complications: General anaesthetic/ Epidural anaesthetic / Spinal anaesthetic		Central nervous system	
		Uterine system	
Embolism: Pulmonary embolism /Amniotic fluid embolism			
Acute collapse – cause unknown:			
Unknown: Incident at home or outside health services / No primary cause found / Lack of information			

Emergency Obstetric Simulation Training (EOST)/firedrills exercises

Date	Scenario	EOST Score

Please fill this in and send back to the Monitoring and Evaluation team with all the other monthly forms

APPENDIX E: MS EXCELL DATA SHEET

MATERNAL FACTORS													PERINATAL FACTORS						
Numbers	Single	Twins	Triplets	Age	Gravida	Parity	Diabetes	Syphilis	Hypertension	HIV	Rural and Urban	Type of delivery	Gender	5 min	10 min	Gestational age	Weight	Alive or Dead	Stillbirth Or Neonatal

APPENDIX F: AUTHOR GUIDELINES OF the AFRICA JOURNAL OF NURSING AND MIDWIFERY

INSTRUCTIONS TO AUTHORS (AFRICA JOURNAL OF NURSING AND MIDWIFERY)

Please adhere strictly to these instructions to facilitate the publication process of articles. Each article submitted must contain:

- The exact appropriate title – use as few words as possible
- The surname and initials of the author/s in the correct sequence.
- Highest academic qualification of every author
- The department and institution/university to which the work should be attributed
- Telephone, fax numbers and email address of the corresponding author (to whom galley proofs should be sent)
- Declaration signed by the corresponding author

GENERAL REQUIREMENTS

An abstract not exceeding 250 words should be on a separate page, covering the purpose of the research article, research methodology, major findings and recommendations. This should be followed by 4-6 keywords in alphabetical order. The total length of the article should not exceed **5000 words** from the first word in the title to the last word in the list of references. Avoid/limit the use of abbreviations. The abbreviated Harvard system of referencing should be used in the text. Cite the author's surname, followed by a comma, then the year of publication and page number (Jones, 2007:231). More than one reference per year per author must be distinguished by using alphabetic letters (Jones, 2007a, and 2007b). Preferably no more than 25 references should be included in the list of references; in alphabetic order (according to the surname of the first author). Only System International (SI) units should be used. English spelling should conform to that of the Concise Oxford Dictionary.

Complete and correct titles of books and journals must be supplied and written in italics. For books the **city** (not the country nor the state) of publication and the name of the publisher must be supplied (Evian, L. 2003. *Primary Aids care*.2nd Edition. Johannesburg: Jalana). Journals' titles may **not** be abbreviated.

Tables (maximum of 3) should be **single spaced in the correct position in the text** (table 1; table 2), with the heading on top of the table. All abbreviations used should be defined in a note immediately below the table.

Figures (maximum of 2) should be **presented in the correct places in the text and must be in black and white only,** and the title of the figure must be below the figure.

Acknowledgements should be brief and recognise sources of financial and logistical support and permission to reproduce materials from other sources. Enclose a copy of documentation granting such permission. Adherence to copyright rules remains each author's sole responsibility.

All manuscripts must be submitted in MSWORD format to ajnm@unisa.ac.za or mavuntr@unisa.ac.za. No hard copies should be posted. **Referees** will only review articles adhering to the author guidelines; their recommendations will be communicated to the corresponding author. **Galley proofs** must be returned to the editor within 3 days otherwise the article may be printed in a later edition. Only typographical errors and other essential changes may be made at this stage.

Authorship credit implies that listed authors should meet the criteria contributing to the conception, design, analysis, interpretation of data, drafting and revising the manuscript, and approving the final version. Participation in the acquisition of funding and/or data collection does not merit authorship credit. The corresponding author will normally be the first author.

Publication Fees will be charged at R200.00 (two hundred Rand) per published page during 2015. An account will be rendered to the corresponding author who will be held responsible for payment.

Please adhere to the following outline when writing your manuscript:
Title: BOLD CAPITALS TYPED IN VERDANA SIZE 14

Authors' initials, surname, highest qualifications and affiliations typed in Aerial Narrow 11: for example: T.P. Meyers, PhD
University of South Africa
Department of Health Studies

Abstract typed in Verdana 10 not exceeding 250 words – single spacing. Refer to background, significance of study, research methods used, most important findings and recommendations.

Keywords: 4-6 in alphabetical order typed in Verdana 10

The actual article must be typed in Aerial Narrow 11 using single line spacing, and must include the following sections:

INTRODUCTION AND BACKGROUND INFORMATION: Discuss the importance of the study and include a brief literature review, using only sources published since preferably since 2007.

STATEMENT OF THE RESEARCH PROBLEM should be done clearly and concisely. The significance of the problem/issue should also be specified.

PURPOSE OF THESTUDY, OBJECTIVES, ASSUMPTIONS, RESEARCH QUESTIONS depending on the nature of the study

Definitions of keywords/concepts

These must be supplied in alphabetical order and must include every term mentioned under 'keywords'. Please use full sentences with the key term in bold, for example: **An adolescent mother** is any woman aged 19 or younger who has given birth to an infant, irrespective of the pregnancy outcome and irrespective of her marital status.

RESEARCH METHODOLOGY should address the design, research site, study population and sample and sampling techniques, size of sample.

Under the research instrument the development, structure, reliability, validity (or trustworthiness) and the pre-test need to be addressed.

The data collection procedure needs to be discussed in sufficient detail **and the exact dates of data collection must be specified.** Data analysis procedures must be explained.

Ethical considerations must specify how permission was obtained to conduct the study and how participants/respondents were protected from exploitation. Confidentiality and anonymity should be addressed and adhered to. No identification tags should indicate potential respondents' verbatim quotations. Names of hospitals and healthcare institutions should preferably not be used.

ANALYSIS commences with the demographic information of the participants/respondents. Thereafter the results should be presented according to the research questions. In this section ONLY present the current study's findings.

DISCUSSION OF RESEARCH RESULTS Discuss the results in the same sequence as the analysis, compare and contrast the study's findings with those of other studies.

CONCLUSIONS must be based on the research results.

RECOMMENDATIONS follow from the conclusions. Recommendations that are irrelevant to the current study should be avoided.

LIMITATIONS OF THE STUDY must be specified so that the readers can interpret the significance of the findings and recommendations within the context of the limitations.

Acknowledgements: must be brief and to the point.

REFERENCES: these must be typed in single spacing and Verdana 10. Leave one space open between successive references. This list must be in alphabetical order according to the surname of the first author. Abbreviations such as WHO should be used in the text but in the list of references the full name World Health Organization must be written out. In case of Internet references, the date on which the information was accessed should be indicated in brackets. Check every Internet reference, if it is correct and shown in blue, and if one double-clicks on this reference, one should automatically be linked to the document/article/site concerned.

STYLE: no numbers should be used in headings or in lists; avoid using bullets – they take up too much space to print – try to use semi-colons instead. **Please use the past tense and plural nouns wherever possible –** most authors commit fewer errors this way. Editing of the article is the responsibility of the authors. Articles that require editing will be returned to authors for editing before being sent to reviewers.

TYPES OF ARTICLES PUBLISHED: The AJNM strives to provide worthwhile information to the nurses and midwives of Africa, not necessarily nurse academics. Consequently articles should address healthcare issues faced by nurses and midwives throughout Africa. Empirical

research articles are preferred. Articles based on theory only might be inappropriate, as well as articles based on textbooks' information. As the AJNM is an accredited academic journal, it needs to adhere to the minimum requirements of the Department of Higher Education and Training of South Africa. This means that mostly empirical peer reviewed research articles should be published, but a limited number of pages can contain book reviews or reports of conferences. In exceptional cases one article per issue might address research issues per se. The decisions of the reviewers and the editors are final.

No more than two articles will be published about any specific research project in the AJNM. No articles will be published as part 1 and part 2. In every AJNM issue, no person may author more than one sole authored or more than two co-authored articles.

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AJNM welcomes conference reports from participants who have attended conferences. The aim of conference reports is to allow readers to get a feel for which conferences they might want to try to attend in the future, reviews might have to address issues such as whether the conference is recurrent, whether it is aimed at practitioners or researchers, and where (on the web) information about future conferences can be found. Another aspect might be new trends identified during the conference. A format for such reviews might be useful. These reports include websites where further information could be obtained about the conference concerned, and about the organisation sponsoring the conferences, if relevant. Specific formats for conference reports will be adhered to as from 2014.

APPENDIX G: LETTER FROM THE LANGUAGE EDITOR

Valerie Janet Ehlers

Nurse Consultant and Researcher

Emeritus Professor and Research Fellow: University of South Africa

Associate Editor: International Nursing Review (2014-2017)

(B Soc Sc (University of Natal), Honours B Soc Sc, BA Cur, Honours BA Cur, MA Cur, D Lit et Phil, Diploma in Development Administration, TAALKU-F for Diploma in Translation- Unisa))

CONFIRMATION LETTER: EDITING OF A DOCUMENT

266 Pat Dyer Avenue
ERASMUSRAND
0181

PO Box 65075
ERASMUSRAND
0165

4 November 2017

Tel: 012 347 8287
Cell: 084 587 3303
e-mail: ehlersjh@mweb.co.za

4 November 2017	I HEREBY CERTIFY THAT I HAVE EDITED THE FOLLOWING MASTER'S DISSERTATION: **Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State** For student N Malinga (st no 21619824)

Thank you

Prof VJ Ehlers

APPENDIX H: LETTER FROM THE REFERENCE EDITOR

PostGradSupport

Elsa Esterhuizen

elsa.esterhuizen@gmail.com

084 582 6811

QUALITY CONTROL: REFERENCING TECHNIQUE

To whom it may concern

I, Elsa Maria Esterhuizen, hereby declare that the quality control of the referencing style according to the NWU Harvard guidelines, as used in the dissertation submitted in partial fulfilment of the requirements for the degree Magister Scientiae in Health Sciences at the Potchefstroom Campus of the North-West University by N.S. Malinga (20168799)

Maternal and neonatal factors associated with perinatal deaths in a district hospital in the Free State

was conducted and completed on 27 October 2017.

E.M. Esterhuizen
(B.A., UED., HLD., M.Ed. (Educational Technology)