INVESTIGATING FACTORS CONTRIBUTING TO NEONATAL DEATHS IN 2013 AT A NATIONAL HOSPITAL IN NAMIBIA

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ABBREVIATIONS

ANC	Antenatal care
APH	Antepartum haemorrhage
CTG	Cardiotocograph
EMOC	Emergency obstetrical and neonatal care
HCP	Healthcare provider
ICU	Intensive care unit
IFA	Iron and folic acid
MDGs	Millennium Development Goals
MoHSS	Ministry of Health and Social Services
NMR	Neonatal mortality rate
NRP	Neonatal Resuscitation Programme
NVD	Normal vertex delivery
RDS	Respiratory distress syndrome
UNICEF	United Nations International Children's Fund
WHO	World Health Organization

ABSTRACT

Background: The neonatal period starts at birth and ends 28 days after birth, and is the most defence less period in the newborn's life. Improving newborn health is a priority for the Ministry of Health and Social Services (MoHSS) in Namibia. The national neonatal mortality rate stood at 21.80 per 1000 live births in the country, and Namibia was unable to attain Millennium Development Goal 4 which focused on reduction of the child mortality rate by two-thirds between 1990 and 2015.

Aim: This study investigated the factors contributing to neonatal deaths at a national hospital in the Khomas region of Namibia, with the following objectives: (i) to identify causes of early neonatal deaths; (ii) to identify the causes of late neonatal deaths; and (iii) to identify avoidable and unavoidable factors contributing to neonatal deaths.

Methodology: The study used a quantitative research approach with a retrospective descriptive design to investigate factors contributing to neonatal deaths. The primary data were collected from a population of 231 record files of all neonates who died during the period 1 January to 31 December 2013 while admitted to the national hospital before 28 completed days of life.

Results: The study identified that of the neonates who died, 67.1% (n=155) were early neonatal deaths (during the first 0–7 days of life), while 32.9% (n=76) died during the late neonatal period (from 8–28 days of life). Of the neonates who died, 50.6% (n=117) were male and 48.48% (n=112) were female. The causes of early and late neonatal deaths were similar, although they happened at different stages. The causes of early neonatal deaths have been identified as respiratory distress syndrome (RDS) – 24.2% (n=56); neonatal sepsis – 12.1% (n=28); birth asphyxia – 11.7 % (n=27); congenital abnormalities – 14.7 % (n=34); hemorrhagic diseases of newborns – 3.9% (n=9); and unknown – 0.6% (n=1). Neonatal sepsis caused the highest number of late neonatal deaths 17.7 %,(n=41); followed by RDS – 7.4% (n=17); congenital abnormalities – 3.9% (n=9); birth asphyxia – 3.1% (n=7); birth trauma –

0.4% (n=1); and unknown factors – 0.4 % (n=1). The study revealed that avoidable factors related to healthcare providers had a severe impact on neonatal deaths, while congenital abnormalities were unavoidable factors.

Conclusion: The study concluded that most neonatal deaths are related to actions or inactions of the healthcare providers and could be avoided.

Recommendations: Based on the results of the study, further research is required to assess the knowledge, skills, and behaviors of the healthcare providers. Training and education about neonatal resuscitation needs to be carried out on a regular basis.

KEY WORDS: Neonatal deaths, Avoidable factors, Early neonatal deaths, Late neonatal death

DECLARATION

I declare that *An Investigation into the Factors Contributing to Neonatal Deaths in 2013 at a National Hospital in Namibia* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Saara K. Hatupopi

Signed: . . . . . .

DEDICATION

I would like to dedicate this Thesis to:

My two beautiful mothers who left us early; my biological mother Rakkel Shipo and my second mother whom I am named after, Saara Ndapandula Puleinge. I am sure if both were here today; they would be the most excited of all.

To all unborn neonates.

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 Introduction

This chapter provides an overview of neonatal deaths and discusses the problem of neonatal deaths in Namibia. The significance of the study is discussed, and an operational definition of terms is presented. Finally, an outline of the entire thesis is provided.

1.2 Background

Neonatal death can be defined as death of a neonate during the first 28 completed days of life (Kidanto, 2009). Neonatal deaths include early neonatal deaths (occurring during the first 7 days of life) and late neonatal deaths (occurring after the 7th day but before 28 concluded days of life) (Kidanto, 2009).

Living beyond the first 28 days of life is still a major challenge, specifically in most of Southern Asia and sub-Saharan Africa (Liu *et al*., 2014). A study by Wardlaw, You, Hug, Amouzou & Newby (2014) indicated that 2.8 million neonatal deaths occur globally during this short time period, accounting for 40% of deaths in those under 5 years of age. If the present situation continues in all countries, it will still be impossible for the world to accomplish the target of cutting neonatal deaths by two-thirds by 2026, which is 11 years behind the United Nations goal of reaching this by 2015 (Lloyd & De Witt, 2013).

The neonatal mortality rate (NMR) varies from region to region: Africa is ranked highest at 40/1000, Eastern Mediterranean 38/1000, South-East Asia 35/1000, America 11/1000 and Europe 10/1000 (Saugstad, 2011). Neonatal deaths continue to be a concern in less

developed countries, especially in sub-Saharan Africa. The Millennium Development Goal (MDG) for enhanced child survival is not likely to be attained in 2015 in many sub-Saharan African countries, including Namibia (Oyefara, 2013).

There are countries in the world that have been recorded with the highest numbers of neonatal deaths, and 75% of these are in Africa (Kinney *et al*., 2015). Countries with high neonatal deaths are Lesotho – 44/1000, Zimbabwe – 39/1000, Mali – 40/1000, Sierra Leone – 44/1000, Angola – 47/1000, Somalia – 46/1000, Guinea Bissau – 44/1000, Central Africa Republic – 43/1000, Nigeria – 37/1000, and Democratic Republic of Congo – 38/1000 (Kinney et al., 2015). Countries with highest neonatal death rates are faced with a lack of resources which has numerous impacts on poor neonatal survival rates. Redefining survival rates could result in increased attention on providing basic perinatal care (Opiyo & English, 2015).

Moreover, most of the 10 African countries that have the highest risk of neonatal deaths are countries that have been disturbed by war or other disasters, and there is a notable lack of information to implement existing neonatal programmers in such settings (Lawn et al., 2009).

Intrapartum asphyxia and birth trauma is one of the key roots of neonatal mortality in less developed countries. Buchmann (2014) stated that major causes of neonatal death included feotal distress that went unnoticed during the intrapartum period – this being one of the most avoidable factors contributing to neonatal deaths in sub-Saharan Africa. Liu *et al.* (2014) indicated that most neonatal deaths are caused by health worker-related factors.

There are some low-income countries, for instance Thailand and Sri Lanka, which have succeeded in lessening their NMR to fewer than 10/1000 live births. Most of these low-income countries that have attained a major decrease in neonatal deaths documented that deliveries are done by skilled birth attendants (Rohde et al., 2008). According to Kim & Saada (2013) 23% of neonatal deaths could be prevented if all pregnant women could have access to skilled birth attendants, which includes doctors, nurses, and other health providers that are expert and educated in dealing with normal and abnormal pregnancies and childbirth.

Skilled birth attendants should be able to recognise and manage complications in women and newborn babies, make required referrals, and be competent enough to resuscitate newborn neonates in all settings (Kim & Saada, 2013). There is strong evidence that in births attended by well-trained health providers, the neonates have a high chance of survival (Tura, Fantahun, & Worku, 2013). Training and equipping all skilled birth attendants with mandatory knowledge and skills on neonatal death prevention is a key indicator for achievement of MDGs 4 and 5 (Tura, Fantahun & Worku, 2013).

However, Rahman, Hairi and Salleh (2008), see a decrease in neonatal deaths not as a separate phenomenon, but emphasize that deepened neonatal survival should be seen as part of a broader package not only including care before, during and after pregnancy. They feel that it should also include wider issues of socioeconomic development, including reduction in poverty and increased maternal education. They also support overall structural and financial changes to improve the availability, distribution and motivation of adequate resources, including competent human resources for reduction of neonatal deaths (Khan *et al*., 2013).

Although it is noticeable that Namibia is not listed as one of the ten countries with highest risk for newborn deaths, neonatal death remains a challenge in the country and hindered the achievement of MDG 4.

1.3 Neonatal deaths in the Namibian context

Improving newborn health is a priority for the Ministry of Health and Social Services (MoHSS) in Namibia. However, Namibia being part of the Sub-Saharan region, it has recorded an ascending trend in NMR. The neonatal death rate has increased from 27/1000 live births in 2000 to 29/1000 live births in 2007 (MoHSS, 2014). In an effort to search for solutions to reduce neonatal deaths, the MoHSS has introduced various strategies to promote the wellbeing of pregnant women and newborn babies. In 2000 the MoHSS recognized MDGs 4 and 5, which focus on reduction of the child mortality rate by two-thirds and the maternal mortality rate by three-quarters between 1990 and 2015.

Towards attaining this goal, the MoHSS joined other African countries in developing national roadmaps to guide the process. The MoHSS has developed various strategies and conducted workshops to train healthcare providers (HCPs) in managing complications of newborn babies, such as giving emphasis to neonatal resuscitation and helping babies to breathe. In 2008 the MoHSS started the Commission of Inquiry into Maternal and Neonatal Mortality (MoHSS, 2014). Namibia's roadmap targeted to achieve MDG 4 was to reduce NMRs from 29/1000 live births in 1990 to 9/1000 live births by 2015 (MoHSS, 2010a). However, the country is still faced with the phenomenon of neonatal deaths and thus could not achieve MDG 4 by 2015. Namibia's NMR in 2013 stood at 21.8/1000 live births (World Health Organization (WHO) & UNICEF, 2013). A survey conducted by MoHSS from 2010 to 2012 indicated that a total of 498 neonatal deaths were recorded in the five regions during the study

period of January 2010 to June 2012 (MoHSS, 2014). In this study the highest number of neonatal deaths occurred in Khomas region (60.4%, n=301), compared to the other four regions (MoHSS, 2014).

In Khomas region most of the neonatal deaths occurred at Windhoek Central Hospital (42.6%, n=21) (MoHSS, 2014). According to the MoHSS, according to hospital records for 2013, the national hospital in Namibia recorded n=333 neonatal deaths from 1 January to 31 December 2013. Although the country was unable to attain MDG 4 for child survival, there is still a need for all neonatal deaths to be examined by concentrating on causes of deaths. Namibia needs to pay more attention to HCPs' knowledge and skills. Moreover, it is crucial to implement interventions that are proven to be effective in preventing neonatal deaths.

1.4 Problem statement

Despite various efforts to curb the NMR in the country, neonatal deaths remain a concern in Namibia. The report of the WHO and UNICEF (2013) estimated that Namibia's neonatal death rate stands at 21.80/1000 live births in the country. Although the causes of neonatal deaths are multifactorial, most of these are avoidable, such as errors and negligence of the HCPs (MoHSS, 2014).

In 2013 in the national hospital under study a total of n=333 neonatal deaths were recorded, but to date no study has been conducted to investigate the factors that contribute to neonatal deaths in this hospital. Therefore this study was aimed at ascertaining factors that contribute to neonatal deaths at the national hospital in Namibia, by conducting a retrospective audit of death records.

1.5 Purpose of the study

The purpose of this study was to investigate factors contributing to neonatal deaths in 2013 in a national hospital in Namibia.

1.6 Objectives

The objectives of this study were as follows:

- To identify the causes of early neonatal deaths in the first 7 days of life.
- To identify the causes of late neonatal deaths from 8 days of life up to 28 completed days of life.
- To identify avoidable and unavoidable factors contributing to neonatal deaths in a national hospital in Namibia.

1.7 Significance of the study

The results of this study are aimed at informing the management of the national hospital and other decision-making bodies about factors that contribute to neonatal deaths in this hospital. The findings of this study could also assist policy makers and authorities to develop innovative approaches that would be effective in reducing neonatal deaths. Furthermore, this study may provide some form of baseline data for further and broader research in the national hospital in Namibia.

1.8 Definitions of concepts

Avoidable factors: Acts or omissions by the patient, administration or HCPs which result in an adverse outcome for baby (Fraser &, Cooper, 2010). In this study avoidable factors refer to those relating to the HCPs, patient and administrator.

Assessment: Care given to the neonates by HCPs that follows a systematic approach based on initial assessment, problem identification, management plan and monitoring. If one of the above steps is deficient and substandard care is recorded, it will be attributed as an HCP problem.

Complications: In this study complications that are linked to high neonatal deaths are obstructed labour, foetal distress, prolonged labour, hemorrhage, pre-eclampsia, eclampsia, shoulder dystocia or malpresentation.

Drugs: Any compound used in the treatment, cure, and prevention of disease or other abnormal condition. For the purposes of this study, drugs refer to required medications that should be given to neonate during resuscitation.

Early neonatal death: The death of neonate occurring during the first 7 days of life (Kidanto, 2009).

Late neonatal death: Death of a neonate occurring after 7 days of life but before 28 completed days of life (Kidanto, 2009).

Neonatal death: Death of a neonate that was born alive, during the first 28 completed days of life (Kidanto, 2009).

Neonatal resuscitation: A set of interventions at the time of birth to maintain the initiation of breathing and circulation of the neonate (Kattwinkel, 2006).

Unavoidable factors: Those factors that could not be avoided by any means of treatment or available care at the time. In this study unavoidable factors are associated with congenital abnormalities.

1.9 Outline of the thesis

Chapter 1: This introduces the study, which includes formulation of the study objectives, rationale of the study and the definition of terms.

Chapter 2: Presents a review of the literature on neonatal deaths globally and the causes of early neonatal deaths as well as late neonatal deaths. It also discusses the avoidable and unavoidable factors in neonatal death and interventions concerning NMR reduction.

Chapter 3: This explains the methodology of the study, which includes the design, study setting, population as well as data collection procedures. Validity and reliability along with the ethical considerations are also explained.

Chapter 4: Presents the study findings.

Chapter 5: Discusses the key findings of the study in relation to the literature.

Chapter 6: This provides the conclusions, implications, recommendations, and limitations of the study.

1.10 Conclusion

This chapter presents the introduction to and background of the study and describes the problem statement, objectives, rationale and definition of terms. The following chapter emphasises the literature review as a secondary research method that supports the primary data collected.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section provides a review of literature that has been published around the world about the causes of neonatal deaths, including early and late neonatal deaths, and avoidable and unavoidable factors. It concludes with strategies or intervention measures taken for neonatal death reductions as suggested by the literature.

2.2 Global overview of neonatal mortality

According to the global survey conducted by the WHO (2013) there were 2.8 million cases of neonatal deaths around the world. The WHO estimates that each year roughly 99% of neonatal deaths happen in developing countries and only 1% in developed countries (WHO, 2013). Neonates less than 28 days old account for about 40% of deaths among children under the age of 5 globally, hindering achievement of MDG 4 – reducing the under-5 mortality rate by two-thirds by 2015 (Lloyd & De Witt, 2013). These above authors stated that if present movements continue in all developing countries, the world will not achieve its target of reducing under-five mortality by two-thirds by even 2026, as neonatal deaths now represent a larger share of total deaths in the aged under 5 years (Lloyd & De Witt, 2013).

Furthermore, Saugstad (2011) indicates that a slow decline in NMR is perceived, whereby it will require another 30 years in order to reduce the under-five mortality rate by two-thirds as outlined in MDG 4. Although most of the sub-Saharan Africa countries, including Namibia, did not manage to achieve MDG 4, there is still a need for research on issues concerning neonates' welfare and how to implement serious interventions and strategies that are proven

to be effective in order to combat neonatal deaths in Namibia. The NMR varies from region to region: in Africa it is ranked highest at 40/1000, in Eastern Mediterranean 38/1000, South East-Asia 35/1000, America 11/1000, and Europe 10/1000 (Saugstad, 2011). However, there are some low-income countries, for instance, Thailand and Sri Lanka, which have succeeded in reducing their NMR to fewer than 10/1000 per live births. Most of the low-income countries that have attained a major decrease in neonatal deaths documented that deliveries are done by skilled birth attendants (Rohde *et al*., 2008).

2.3 Causes of early and late neonatal death in general

Globally it is well documented that around 60% of early neonatal deaths (within the first 7 days of life) are associated with birth asphyxia, which is failure to initiate spontaneous respiration at birth (Ersdal *et al.*, 2012). Three documented main causes of neonatal deaths include infections; complications caused by preterm birth; and intrapartum-related neonatal deaths (such as antepartum hemorrhage, prolonged first and second stages of labour); these are responsible for almost 90% of all neonatal deaths (Ersdal et al., 2012). Birth asphyxia is among the top five causes of neonatal death in Africa. In their study Manandhar *et al*. (2010) stated that birth asphyxia caused 37%, infection 30% and prematurity 15% of early neonatal deaths. This means that deaths from asphyxia are still a major concern in less developed countries.

According to Velaphi & Rhoda (2012) birth asphyxia could be prevented if all pregnant women received appropriate care during Antenatal care (ANC), labour and birth. This means all pregnant women should get access to skilled birth attendants. Li, Zhang, Ling & Jin (2011) in their study indicated that prolonged second stage of labour could reduce the Apgar score at 1 minute and cause an upsurge in the risk of asphyxia at birth. In less developed

countries 65% of neonates died as result of birth asphyxia, while in developed countries 28% of early neonatal deaths are due to preterm births followed by 7% congenital abnormalities (Beck *et al.*, 2010).

A study conducted in Bangladesh shows that the rate of early neonatal deaths was placed at 28.6/1000 live births in government hospitals; 37.3% happened on the day of birth, 76.4% within the first 3 days, and 84.1% within the first 7 days of life (Chowdhury *et al*., 2010). The study indicated that birth asphyxia accounts for 44.9% of early neonatal deaths (Chowdhury *et al*., 2010). Another study conducted in Pakistan shows the highest NMR up to 7-28 days of 47/1000 live births and high early neonatal death rate of 70/1000 births (Jehan *et al*., 2009). Birth asphyxia and immaturity-related problems accounted for 26% of early neonatal deaths (Jehan *et al*., 2009).

In a study conducted at a Ghanaian teaching hospital by Rajab & Ghareba (2013), to identify the major causes of neonatal death, prematurity accounted for 70.69% of cases. In the same study inadequate care during delivery was also mentioned as a contributing factor. Most of the complications affecting the neonates were related to the HCPs and could be avoided if the health providers performed better (Rajab & Ghareba, 2013). Furthermore, the study mentioned a lack of skills in neonatal resuscitation, as the neonates who died were ventilated (Rajab & Ghareba, 2013). Maternal medical conditions such as per-eclampsia, eclampsia and intrapartum-related complications such as antepartum hemorrhage, prolonged first and second stages of labour, were the medical conditions and intrapartum events that led to neonates being admitted to the neonatal care unit (Mmabaga *et al*., 2011).

In their study Kinney *et al*. (2010), indicated that up to 90% of preterm newborn babies who died were low birth weight (less than 2500 g), including preterm babies who were at major risk of death. They held that most neonatal deaths could be prevented with basic care such as warmth, feeding, hygiene and early treatment of infections (Kinney *et al*., 2010).

Early neonatal death is associated with increased emergency department and hospital use and less utilization of preventive healthcare services such as vaccinating all young women against tetanus (which leads to early neonatal death from neonatal tetanus) (Udo *et al*., 2008). The same study indicated that infection was the first cause of early neonatal deaths in Calabar State in Nigeria, followed by birth asphyxia and low birth weight. Most neonates died due to neonatal tetanus (Udo *et al*., 2008). Another study conducted in Dili, East Timor, by Bucens *et al.* (2013), stated that 38% of neonate admissions to hospital were due to infection, followed by prematurity, asphyxia and respiratory disease.

Hoque, Haaq & Islam (2011) conducted a study in South Africa and demonstrated that higher than expected percentages of neonatal admission (38%) and death (33%) were associated with birth asphyxia, followed by neonatal infection as the leading cause of neonatal deaths. In another study done in South Africa by Ramaboea (2014), almost 48% of neonates were admitted to the neonatal unit due to maternal infections and maternal hypertensive disorders. Spontaneous preterm birth resulted in 13% of deaths, followed by asphyxia (4%) and neonatal infection (4%) (Ramaboea, 2014). In Namibia a national policy of free maternal and child (less than 5 years) health care at public health facilities has been implemented since 2000 in order to improve the accessibility and availability of maternal and child services around the country (MoHSS, 2010a). Higher utilisation of health services for (ANC) and delivery services has been achieved around the country. Namibia has managed to achieve

95% of ANC coverage, which is above the ratified target. More than 80% of deliveries occur in public institutions, and 81.4% of deliveries are by skilled birth attendants (MoHSS, 2010a).

According to the report of the MoHSS (2010b), neonatal deaths accounted for about 32% of deaths among children under the age of 5 years in Namibia. This means neonatal deaths now represent a larger share of total deaths in those aged less than 5 years in Namibia. Three-quarters of all neonatal deaths take place in the first 7 days after birth and most deaths occur on the first day following the delivery (MoHSS, 2010b). Like other developing countries, the causes of early neonatal deaths in Namibia are chiefly due to birth asphyxia (49.4%), followed by prematurity (12.7%), congenital abnormalities (10.8%), neonatal sepsis (10.8%), and RDS (7.2%) (MoHSS, 2014). Another study conducted by Indongo (2014) on risk factors and causes of neonatal deaths in Namibia ranked the causes in order: prematurity was the number one cause of neonatal deaths at 54.2%; RDS at 29.7%; birth asphyxia at 20%; sepsis at 19.5%; and foetal malformation at 11.3%. However these results are alarming, since they signify outcomes in descriptive studies, where a high proportion of births took place in a health facility. Deliveries assisted by skilled birth attendant and a high amount of sick neonates were cared for in the formal healthcare system.

The lack of protocols and education or training in neonatal resuscitation to decrease neonatal mortality caused by birth asphyxia is still a major concern across sub-Saharan Africa *(Hole et al.,* 2012). Early neonatal deaths are a reflection of quality of immediate perinatal and intrapartum care of the neonates. Intrapartum events are associated with greater risk of neonatal deaths than perinatal risk factors (Lawn, Cousens, Zupan & Lancet Survival Steering Team, 2005). For instance, in less developed countries antepartum hemorrhage,

obstructed labour and mal-presentation are still major contributing factors in neonatal deaths. Breech presentation and obstructed labour increase the risk of neonatal death more than six fold. Maternal fever during labour and meconium-stained amniotic fluid increases the odds of neonatal death by about 10 times (Lawn *et al*., 2005).

RDS is mostly caused by prematurity, while birth asphyxia and hypoxic ischemic encephalopathy are both linked to avoidable factors to do with HCPs (Hole *et al*., 2012). This can be attributed to lack of knowledge and skills on neonatal resuscitation and inadequate observation during intrapartum events such as prolonged and obstructed labour (Hole *et al*., 2012). Provision of quality perinatal care and, more importantly, intrapartum care could reduce neonatal mortality and morbidity meaningfully (Hole *et al*., 2012).

2.4 Causes of late neonatal deaths

Late neonatal death is a death of a neonate which is happening after the seventh day of life, but before 28 completed days of life (Kidanto, 2009). In a recent study by Oza *et al*. (2014) it was discovered that the three leading categories of causes of neonatal death, including preterm, intrapartum, and infections, are the same during the early and late neonatal periods. However, their distribution varies between the two periods, since infections generally take more time to develop and are therefore common during the late neonatal period (Oza *et al*., 2014). In other studies conducted by Bartram *et al*. (2015) and Jain *et al*. (2013), sepsis was the significant cause of death mostly in the late neonatal period. Furthermore Bartram *et al.* (2015) discovered that neonatal sepsis was responsible for nearly half of late neonatal deaths, many of which were blamed on inadequate hygiene. In a study conducted in Burkina Faso sepsis was the common cause (75%) of late neonatal deaths (Kouame *et al*., 2015).

Most studies about causes of neonatal deaths did not differentiate between causes of early and late neonatal deaths. Oza *et al.* (2014) emphasised that understanding or separating the causes of early and late neonatal deaths is imperative for identifying appropriate intervention and programme priorities. The disparities must be understood and this knowledge must inform decisions concerning the choice of suitable interventions.

2.5 Skilled birth attendants

In order to reduce neonatal deaths all pregnant women should have access to skilled birth attendants. A skilled birth attendant refers to qualified health providers – such as doctors, midwives and nurses – who have been prepared, skilled and trained, and are also regarded as experts and ready to bring about the change required in neonatal mortality reduction. These qualified health providers are also required to have skills needed in the identification, management and referral of complications in women and newborn babies (WHO, 2010). There is strong evidence that in births attended by well-trained health providers, the neonates have a high chance of survival (Tura, Fantahun, & Worku, 2013). Training and equipping all skilled birth attendants with mandatory knowledge and skills on neonatal death prevention is a key indicator for achievement of MDGs 4 and 5 (Tura, Fantahun & Worku, 2013).

According to Kim & Saada (2013) 23% of neonatal deaths could be prevented if all pregnant women could have access to skilled birth attendants who are expert and educated in dealing with normal and abnormal pregnancies and childbirth. Skilled birth attendants should be able to recognise and manage complications in women and newborn babies, make required referrals and be competent enough to resuscitate newborn neonates in all settings (Kim & Saada, 2013).

2.6 ANC

Maternal well-being is an important tool during pregnancy and has a major impact on the health outcomes of the neonates. According to the WHO (2006) guidelines for ANC, pregnant women should attend at least four antenatal visits. Pregnant women should start the first antenatal visit preferably in the first trimester. The WHO emphasised those pregnant women who are faced with complications such as diabetics and hypertension should avail themselves of ANC more than four times in the same period.

Beauclair, Petro & Myer (2014) in their study also recommended that pregnant women should start ANC at between 8 and 12 weeks, or before 16 weeks of gestation. The same study also supported the timing of the first ANC visit as influencing the risk of neonatal deaths and stillbirth in the full-term and singleton pregnancy (Beauclair *et al.*, 2014).

Hoque *et al.* (2011) highlighted that excellent ANC must be a foundation for pregnant women and should offer maximum protection for pregnant women's health and the well-being of the mother and their unborn neonates. For most countries that are wishing to achieve MDG 4, ANC should be considered as a focused strategy (Zeidan & Idris, 2011).

Gross *et al.* (2012) also supported excellent ANC which offers a great chance for all pregnant women to be examined and screened against preventive or manageable diseases. ANC also provides them with treatment and preventive measures and gives them health education, advice and counseling. Openshaw, Bomela & Pretlove (2011) stated that lack of ANC, late bookings or not booking at all and not complying with required antenatal visits is one of the factors contributing to avoidable perinatal deaths and maternal complications in South Africa.

A study by Neal & Falkingham (2014) has shown that the central origins of neonatal deaths are basically associated with the health of the pregnant woman and the care she obtains during ANC and giving birth. A neonate's health can therefore not be improved without improving the mother's health, by providing the required care during antenatal visits such as screening for infections such as sexually transmitted diseases including HIV/AIDS. Furthermore, a neonate's health can also be improved by providing supplements such as vitamins and iron before and during pregnancy. A good diet might prevent some complications such as infections which could cause preterm delivery, birth asphyxia and prematurity. Improvement of the poor household living standards that some pregnant women find themselves in due to low income (and are some of the causes of poor nutrition and infections that could contribute significantly to neonatal deaths) would have a great impact (Neal & Falkingham, 2014). In recent literature it is well documented that with improved maternal nutrition and living conditions (for instance, access to clean water, adequate housing with good ventilation), the neonates would have a better chance of survival (Neal & Falkingham, 2014). In addition, a decrease in neonatal deaths is interconnected with the improvement, accessibility and availability of maternal and primary healthcare services, which are still missing in most low-income countries including Namibia. According to the same study, neonatal mortality and specifically deaths in the first 7 days of life will not fall noticeably unless the real maternal health service is equally distributed (Neal & Falkingham, 2014).

2.7 Avoidable factors

Avoidable factors are acts or omissions by the patient, administration or HCPs which result in an adverse outcome for a baby (Fraser & Cooper, 2010). In this study avoidable factors include those involving the HCPs.

2.7.1 Health worker-related factors during intrapartum care

Intrapartum asphyxia and birth trauma is one of the key roots of neonatal mortality in less developed countries. Buchmann (2014) stated that major causes of neonatal death included feotal distress that went unnoticed during the intrapartum period – this being one of the most avoidable factors contributing to neonatal deaths in sub-Saharan Africa. Liu *et al.* (2014) indicated that most neonatal deaths are caused by health worker-related factors. In the recent literature health worker-related factors that are mentioned include fetal distress monitored but not detected; a good example that comes to mind is that HCPs might be unable to read and interpret the cardiotocograph (CTG). Sometimes health providers do not monitor the fetal heart, which leads to fetal distress.

Since health providers are responsible for applying the electronic foetal monitor, it is crucial that they are able to understand and interpret the CTG. Poor clinical skills and poor recording of clinical findings on CTG are some of the contributors to neonatal deaths and illness (Liu *et al.*, 2014). What is also notable is poor intervention or no intervention at all for a prolonged second stage of labour, which could lead to fetal distress and result in neonatal death. Health providers failing and delaying to refer patients also potentially puts the lives of pregnant women or neonates in danger. Unavailability of experts or delay in calling for expert assistance and not paying attention to early rupture of membranes is another HCP factor (Liu *et al*., 2014).

Moreover, some causes of neonatal mortality can be prevented, because the survival of newborn babies is reliant on the care they receive before, during and immediately after birth (Butt, Malik, & Kazi, 2010). Low-cost interventions including educating and training all

health workers in neonatal resuscitation and 'kangaroo' (skin-to-skin) care may effectively reduce deaths (Butt *et al*., 2010). It has been found that presenting these strategies as a package might decrease neonatal deaths by 50% or more (Carlo *et al*., 2010).

Regardless of reduction of neonatal mortality in some parts of the world, less developed countries still have the slowest improvements in NMRs, with a decline of 19% from 1990 to 2010, compared to a 43% drop witnessed in developed countries over the same period (UNICEF, 2010). According to UNICEF (2010) out of the 15.5% of neonatal deaths in the world, Africa accounts for 39% of them, with the majority of these deaths happening mainly in sub-Saharan Africa.

A study by Lloyd & De Witt (2013) showed that 44% of neonatal mortality caused by intrapartum asphyxia was associated with HCP-related avoidable factors. Another study conducted by Sepeku & Kohi (2011) in Tanzania showed that 45% of asphyxiated neonates had not received required medicines during resuscitation. This might have been due to lack of knowledge of which, when, and how to administer the drugs.

The study by Nyamtema *et al*. (2010), in Tanzania recorded that 67.7% of neonatal deaths were related to health providers' avoidable factors. Poor health workers' practices were accountable for 28.5% of neonatal deaths. Similar evidence was also documented by Merali *et al*. (2014), and they concluded that most of the avoidable factors that led to deaths were poor practice by health workers. In this same study health providers accounted for 65% of neonatal deaths, and the authors argue that most could have been avoided if optimal care was rendered to the neonates. A study by Hinderaker *et al*. (2003) identified that 12 cases required an urgent referral from the antenatal clinic to hospital due to diseases or risk factors, but these were not referred.

Merali *et al*. (2014), recommended that providing training to health workers is vital, for instance, training on interpretation of the CTG and neonatal resuscitation, as well as going on refresher courses. The training will increase the knowledge and skills of HCPs and ensures that maximum quality of care is given to mothers and their unborn neonates during the intrapartum period.

Other factors identified by Velaphi & Rhoda (2012) are related to the delays of health workers in referring patients for secondary/tertiary treatment; doctors failing or delaying in responding to calls; or the doctor not responding to calls. There is a need for prioritising the promotion of health to women and children and improving the management of labour, and the care and management of newborn infants.

In a study done in Namibia by Indongo (2014), HCPs and administrator factors were some of the avoidable issues mentioned. In the same study the author mentioned inadequacy of human resources with the expertise, knowledge and skills to care for premature and very sick neonates, and inadequate facilities including enough medication and equipment, as some of the challenges faced. Other avoidable factors such as delays in making the decision to transfer sick neonates to a higher-level hospital and deciding to do a caesarean section during prolonged first and second stage of labour were mentioned (Indongo, 2014).

Implementing neonatal resuscitation is possible with simple equipment and skills in low-resource settings (Newton & English, 2006). Techniques together with ensuring a patient's airway, suctioning, ventilation, administering oxygen, chest compressions and giving required medicine, are part of the Neonatal Resuscitation Programme (NRP) (Kattwinkel, 2006). When methodically executed by skilled personnel, this has the potential prevent 192 000 intrapartum-related neonatal deaths globally each year and 5–10% of deaths associated

with preterm complications (Hole *et al*., 2012). Curriculums with components of the NRP have meaningfully enhanced HCPs' knowledge, skills, and attitudes in less developed countries and could probably lessen neonatal deaths in these countries by up to 65.7% (Wall *et al*., 2010).

2.7.2 Administration-related factors

An administration-related preventable factor is when something that is the responsibility of the health authorities causes the death of the mother and the baby (Fraser *et al*., 2006). Administrative factors are beyond the health workers' control. They depend on the healthcare system, for instance the availability of transportation of patients from the health facility district, medicine and equipment at provincial and even national level. These play a crucial role in facilitating the smooth functioning of health facilities in the prevention of neonatal morbidity and mortality (Fraser *et al*., 2006). Velaphi & Pattinson (2007) gave some of the administrative factors that contribute to neonatal deaths in South African, including inadequate facilities, inadequate equipment, and inaccessibility and unavailability of a bed with a ventilator in neonatal intensive care unit (ICU). Others challenges include lack of transport between institutions for patients, inadequate nurses and doctors to attend to patients, or personnel too junior to manage the cases.

Delaying anaesthesia, lack of theatre facilities and inadequate neonatal transport also contribute to the problem of neonatal deaths. In addition, no devoted high-risk ANC at the referral hospital and too rapid staff rotation are some of the avoidable factors identified in South Africa (Velaphi & Pattinson, 2007). In a study conducted by Osifo & Ovueni (2009), lack of facilities contributed to 39.5% of neonatal deaths, further strengthening the point of lack of support services.

2.7.3 Patient-related factors

Patient-related avoidable factors are when the woman, by doing something or not doing something, causes her own death or the death of her baby (Fraser , Cooper, & Nolte 2006). Patient-related factors are those that could have been prevented if the patient had reported and come to the health facility earlier. Velaphi & Pattinson (2007) identified some of the avoidable factors that are related to neonatal deaths in South Africa to include pregnant women looking for medical attention very late during labour, booking late or not booking at all, and not complying with recommended antenatal visits. Absence of transport from home to institution, not paying attention to rupture of membranes, ignoring antepartum hemorrhage (APH), not complying with follow up, and bringing the sick neonate to the hospital late were also cited (Velaphi & Pattinson, 2007).

Jehan *et al*.'s (2009) findings revealed that despite the good availability of ANC and increased rates of births in health facilities done by skilled birth attendants, and also increased rates of caesarian section, women are still failing to use the services. Women staying at home and not paying attention to intrapartum problems, such as heavy vaginal bleeding and the presence of foul-smelling amniotic fluid, were noteworthy risk factors for early neonatal death. However, it might be that women lack information about danger signs in pregnancy.

In their study Hinderaker *et al*. (2003), identified that 51% of the 34 avoidable cases were related to patients, as 13 of the patients failed to look for professional assistance in time. This is similar to the findings of Kibel *et al*. (2010), who identified common patient-related avoidable factors such as failure to seek ANC, delay in seeking help and inappropriate response to danger signs as contributing to neonatal deaths.

2.8 Unavoidable factors

Non- avoidable factors are those factors that could not be avoided by means of any treatment or available care at the time. In this study unavoidable factors are associated with congenital abnormalities.

2.8.1 Congenital abnormalities

Congenital abnormality is one of the unavoidable factors causing neonatal deaths. According to the WHO (2008) congenital abnormalities could be defined as physical or functional abnormalities which include metabolic syndromes which could be present at birth. Furthermore, the WHO (2008) estimates that around 260 000 deaths globally or about 7% of all neonatal deaths are caused by congenital abnormalities.

A study by Hoque *et al.* (2011) revealed that a congenital abnormality was present in 2.9% of admissions and accounted for 9.2% of neonatal deaths. In the same study congenital abnormalities was ranked as the third factor contributing to neonatal death. A study by Indongo in Namibia (2014) revealed that congenital abnormalities caused 11.3% neonatal deaths in that study. A study by Kouame *et al*. (2015) in Abidjan, Cote de Ivoire, identified that congenital abnormalities accounted for 65% of neonatal deaths. Death was more common in the first 7 days of life, and gastroschisis, neonatal occlusions, and esophageal atresia were the causes of neonatal deaths (Kouame *et al*., 2015). A study conducted in Libya identified congenital abnormalities as causing 17% of neonatal deaths (Alburke, Ashur & Assadi, 2015). Another study, in Cameroon, reported congenital abnormalities as accounting for 10.54% of neonatal deaths, with digestive tract obstruction causing 37%, defects of the abdominal wall 37% and spinal bifida 27% (Mah-Mungyeh *et al*., 2015).

Saugstad (2011) stated that congenital abnormalities could be prevented if all pregnant women were provided with folic acid for prevention of myelomeningocele and cleft lip. Also improved surgical services should be available within a reasonable time. Early sonar done in the first trimester of pregnancy will be of advantage, as liberal abortion practices will be an option for severely malformed fetuses.

2.9 Strategies to reduce neonatal death

Lawn *et al*. (2006) puts neonatal deaths within the wide-ranging context of maternal and child health care. The authors state that the approaches to reduce neonatal deaths must cover the entire range of care, from maternal health before and during pregnancy to delivery, and early neonatal care to child health programmes.

However, Rahman, Hairi & Salleh (2008), see a decrease in neonatal deaths not as a separate phenomenon, but emphasize that deepened neonatal survival should be seen as part of a broader package not only including care before, during and after pregnancy. They feel that it should also include wider issues of socioeconomic development, including reduction in poverty and increased maternal education. They also support overall structural and financial changes to improve the availability, distribution and motivation of adequate resources, including competent human resources for reduction of neonatal deaths (Khan *et al*., 2013).

2.9.1 Antenatal period interventions to reduce neonatal mortality

Khan, Zahidie & Rabbani (2013) identified some approaches to decrease neonatal deaths in low and middle-income countries. They emphasised that all women who are childbearing age, regardless of their marital status, should be injected with tetanus toxoid vaccine. Strategies such as community-based intervention, and clean and skilled care at delivery should be encouraged. Training and education on neonatal resuscitation is of paramount

importance. Exclusive breastfeeding, care of the umbilical cord and management of different types of infections in neonates, as well as safer delivery practices are some of the strategies.

These strategies are supported by Beauclair *et al.* (2014). Tetanus toxoid vaccination is predicted to decrease the danger of neonatal death from neonatal tetanus by 94%, and extensive immunisation creativities have been very important in achieving the greatest reduction in neonatal mortality from tetanus toxoid in the last 20 years. Their proposition entails that the pregnant women take iron and folic acid (IFA) supplementation daily, and have three ANC visits or even four or more where required (Beauclair *et al*., 2014). According to Singh *et al.* (2014), tetanus toxoid injections provided the chief protective effect in reduction of neonatal deaths in India.

2.9.2 Interventions to reduce prematurity-related deaths

Barros *et al.* (2010:1) suggested some interventions that reduce neonatal deaths due to prematurity in low- and middle-income countries, such as:

(1) Antenatal steroids to be given to all pregnant women experiencing preterm labour;

(2) Antibiotics to be given to all pregnant women experiencing prolonged rupture of membranes and for premature rupture of membranes;

(3) Vitamin K to be given to neonates immediately after birth in order to prevent internal hemorrhage;

(4) Case management for neonatal sepsis and pneumonia;

(5) Delayed cord clamping;

(6) Room air vs 100% oxygen during resuscitation;

(7) Consider hospital-based kangaroo mother care;

(8) Initiation of prompt breast feeding;

(9) Providing warmth to all neonates or thermal care;

(10) All premature neonates to be given surfactant therapy immediately after birth to assist in lung maturity and at the same time preventing respiratory complications common in preterm neonates;

(11) Application of continued distending pressure to the lungs for RDS.

Titaley & Dibley (2015) emphasised that antenatal steroid therapy is very real in avoiding neonatal mortality and morbidity. When it is well implemented, this intervention has the potential to save up to 500 000 neonatal deaths per year. Pregnant women with early rupture of membranes should be given antibiotics to lessen the occurrence of infection. Health education should be given about the dangers of smoking while pregnant. Advice should be given to those pregnant women who smoke to halt smoking during pregnancy in order to reduce the occurrence of intrauterine growth restriction and other complications (Saugstad, 2011). Titaley & Dibley (2015) assert that prescribing IFA supplements during ANC can reduce the risk of early neonatal death by 49–51%, and could also reduce neonatal deaths by 48–49%. Supplementation with IFA increases the neonate's chances of surviving and increases their birth weight in those women at risk of developing iron deficiency during pregnancy (Aranda, Ribot, Garcia, Viten & Arija, 2011). Studies conducted in China and Indonesia testified to noteworthy declines in early neonatal mortality among neonates whose mothers were prescribed IFA supplements during pregnancy, compared to those whose mothers did not receive IFA or only received folic acid (Titaley & Dibley, 2015; Zeng *et al*., 2008).

2.9.3 Interventions during labour and birth for deterrence of intrapartum-related neonatal death

Velaphi & Rhoda (2012:69-70) suggested some recommendations that could be implemented in order to reduce intrapartum-related neonatal deaths, as follows:

(1) Giving or implementing plain and inclusive emergency obstetric care (EMOC).

(2) Classifying pregnant women who are at risk of developing some complications during ANC and promoting clean delivery to avoid infections of mother and newborn.

(3) Administration of antibiotics to all pregnant women who are experiencing preterm labour; oxytocic drugs be administered to women experiencing postpartum hemorrhage and steroids in preterm labour, with continuous monitoring of women in labour.

(4) Pregnant women experiencing complications during the antenatal period should be referred to a tertiary institution with advanced technology early (for example pregnancy-induced hypertension and diabetes).

(5) Immediate care of neonates with complications during birth, such as neonatal resuscitation and post-resuscitation management and ongoing neonatal care during the postnatal period.

Wall *et al.* (2010) identified some interventions and assistance for the non-breathing newborn baby, for instance stimulation and bag-mask ventilation. Simple, inexpensive, and real methods are accessible for low-resource settings, including community-based strategies to increase skilled birth attendance, and partograph use by frontline health workers (Wall *et al*., 2010). Improved accessibility to both basic and EMOC detection and clinical management of obstetric complications, including provision of instrument delivery (such as vacuum, forceps,

caesarean section, blood transfusion) and simplified neonatal resuscitation training helping babies to breathe are some of interventions that have been proved to play a crucial role in reduction of neonatal deaths (Wall *et al*., 2010).

Yakoob *et al.* (2011) emphasized that implementing these strategies could save an estimated total of 591 000 lives of neonates who are currently dying from intrapartum-related factors such as birth asphyxia annually. The authors further stated that around 814 000 neonates could be saved by providing worldwide access to comprehensive obstetric care and ensuring that all deliveries are done by skilled birth attendants. It has been found that using comprehensive obstetric care is expected to decrease neonatal deaths causes such as infections and preterm birth complications remarkably (Yakoob *et al.*, 2011).

2.10 Conclusion

The literature cited in this chapter discussed topics and subtopics related to the study on the factors contributing to neonatal deaths in general and in Namibia in particular. Areas covered included neonatal mortality, causes of early neonatal deaths, causes of late neonatal deaths, skilled birth attendants, ANC and avoidable and unavoidable factors. Lastly, it also included strategies to reduce neonatal deaths. This chapter briefly covered the literature, including the fact that major factors contributing to neonatal deaths include infections, complications of preterm birth, intrapartum-related neonatal deaths, congenital abnormalities and birth asphyxia. However, the literature cited concludes that most of the complications could be avoided if strategies to reduce neonatal deaths are fully implemented.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Chapter three focuses on the research methodology used to conduct the study. It presents the research approach, design and data collection that were undertaken in this study. The chapter also discusses the research setting, study population, sampling, instruments, pilot study, data analysis, validity, reliability and ethical considerations.

3.2 Research approach and Research design

The purpose of this study was to investigate factors contributing to neonatal deaths in a national hospital in Namibia using retrospective records. Therefore a quantitative research approach was chosen as the appropriate research method to gather, quantify and analyse the data. Quantitative approaches are about enumerating data to enable generalisation of the results from the sample to the population of interest (Houser, 2013). Quantitative methods use planned measures and objective tools to gather evidence.

A descriptive design was used in order to audit the records for factors that contribute to neonatal deaths in this hospital. Burns & Grove (2009) state that descriptive design is the examination and description of phenomena that happen in reality, offering a precise account of features of specific individuals, situations or groups. A descriptive design is valuable in obtaining knowledge in an area where little research has been conducted or where little is known about the phenomena under investigation, which is the case in this study (Houser, 2013). In a retrospective study the researcher studies events that have already occurred and have been recorded and have their explanation in the past (Houser, 2013; Polit & Beck,

2008). In this study events that had already occurred that led to neonatal deaths were collected and analysed, by auditing death records of neonates who died while admitted at a national hospital in Namibia. These events could not be manipulated or controlled to affect the phenomenon under study

3.3 Research setting

The setting for this study was a national hospital in Namibia where all the neonates with birth complications from various regions are admitted. According to the Namibian Statistics Agency, Namibia's 2011 population and housing census (2014) shows that Windhoek District has a total population of 342 141, with almost equivalent numbers of women and men, with a growth rate of 3.1% per annum in 2011, growing continually due to influx from all over Namibia. There are 12 government health facilities (seven primary healthcare clinics, two primary healthcare centres, and two big hospitals, of which one is an intermediate hospital and another national referral hospital for specialized care). The neonatal ward which is based at the national referral hospital has a bed capacity of 32, including a neonatal ICU, but due to overflow of neonates with complications the ward had exceeded its bed capacity to 52 admissions. It is currently faced with shortages of HCPs. The HCPs are currently 32 nurses, 4 doctors and 2 doctors who specialize in neonatal care.

3.4 Population and sampling

According to Lloyd & De Witt (2013), the population for a study is a well-defined set that has certain specific characteristics. In this study the population consisted of records of all neonates who died while admitted at a national hospital before 28 completed days of life during the stated period. The population was all the records (n=231) of neonates who died while admitted at a national hospital in Khomas district, Namibia, from 1 January to 31

December 2013. This period was selected because of the highest rates of neonatal deaths recorded during this period.

Although medical records are known to be incomplete, in this study all the neonatal death records were previously reviewed during the routine hospital mortality and morbidity meetings, and consensus was reached before the neonatal deaths notification form was completed. A copy of the summary from the mortality and morbidity meeting is placed in the medical record. However, there were some files without copies of the summary, so there was a possibility that the cause of death in some neonates was not properly diagnosed or errors may have crept in to the hospital charts.

3.5 Inclusion and exclusion criteria

Inclusion criteria are defined as records that are suitable to be included in the study – indispensable features that the record must pose in order to participate in the study (Polit & Beck, 2010). The inclusion criteria for selecting the records were that the neonates should have been admitted in the institution and should have died within 28 days of life. The exclusion criteria are standards set out before a study and these standards are used to determine whether an individual should be excluded from the study (Burns and Groove, 2011). Exclusion criteria covered the records for all stillbirths and infants who died after 28 days of life, and neonates who died outside of the study period or at home.

3.6 Instruments

The audit tool used in this study was developed by the researcher based on the literature on the causes of neonatal deaths in less developed countries. The researcher also used the training modules on neonatal resuscitation as prepared by the NPR of the American Heart

Association (Kattwinkel *et al*., 2010). Part of the audit tool was adopted from a tool used for investigating the causes of neonatal deaths in South Africa by Ndlovu (2013) & Ramoboea (2014). The tool was checked by the supervisors and experts in the field who are knowledgeable on matters concerning maternal and neonatal care. They were consulted about the structure and content of the tool.

The tool has four sections in which extracted data from the records would be captured. The first section captured the demographic information of the neonate who died in the hospital, the second section captured information on identifiable causes of early neonatal death in each record, the third section captured the causes of late neonatal death in each record, and the fourth section captured any factors which could be classified as avoidable and or unavoidable factors of neonatal deaths in the records.

3.7 Validity and reliability

The quality of a research instrument is indicated by its validity and reliability. According to Burns & Grove (2010), the validity of an instrument is an indication of how well the instrument reproduces the abstract concept being examined, whilst reliability deals with the consistency of the measurement instrument.

3.7.1 Validity

Validity has to do with whether "the items in the tool are representative of the content domain that the researcher intends to measure" (LoBiondo-Wood *et al*., 2013). In this study internal, content and face validity were ensured.

Internal validity refers to the extent to which the results and the implications of the methods used to obtain the results could be trusted (Cullen, Watson & Zakeri, 2008). To ensure the

internal validity of the assessment tool, the audit tool in this study was pre-tested to confirm whether it was able to collect data to meet the study objectives, for instance part of resuscitation, drugs given to neonate was not clear stated and changes were done accordingly.

According to Polit & Beck (2008), **face validity** refers to the extent to which an instrument looks as though it is measuring what it purports to measure. Face validity was ensured by supervisors checking if the instrument appeared to measure what it was supposed to measure; inputs were given and corrections were made accordingly.

Content validity was ensured by the extent to which the audit tool represented the full domain of the content related to phenomena related to factors contributing to neonatal deaths. One medical doctor who is an expert in neonatology was consulted to check the extent to which the instruments would represent the full domain of the content of the phenomenon related to neonatal deaths under investigation. The subject expert assessed the clarity, relevance and simplicity of the content of the instrument. The tool was tested on five records before the actual study to ensure that all important areas of concern were reflected in it.

Table 1 below shows the audit tool question.

Table 1: Content validity of the tool

Objective	**Variables**	**Audit tool question**
1	Causes of early neonatal deaths	2.1 - 2.10
2	Causes of late neonatal deaths	3.1 - 3.9
3	Avoidable and unavoidable factors	4.1 - 4.2.1

3.7.2 Reliability

According to LoBiondo-Wood *et al.* (2013), reliability means that all items in an instrument measure the same concept or characteristic, and the stability of an instrument, even if the scores are obtained at separate times. In this study reliability of the audit tool was ensued by piloting the tool and training two data collectors how to use the tool. The trainees were assessed by conducting a test-retest prior to collecting data with the tool, to ensure that it was stable and consistent. Pilot test was conducted on 5 randomly selected records (which were not included in the actual study) to determine the feasibility of data collection tool from records and gain insight into the institution's record retrieval procedure. The pilot test has shown that the data collection tool and variables were feasible, no irregularity and the potential reliability concerns of the study. It also ensured that the records coded were representative of the total population of records.

Reliability was enhanced by test-retest to determine the internal consistency of the tool. According to Dane *(2010)* test-retest is an estimate of reliability that involves comparing two administrations of the same test to the same records. Since the test is administered twice to the same records and same people, the true score has to be relatively constant.

Test-retest was obtained by allowing trainees to take and retake the test after 5 days and comparing their performances. The trainees which are both HCPs participated in the pre- and post-test. Each particular score on the first administration was correlated with their scores on the second administration. The test-retest result was 0.895, which is within the range of good reliability. There was no difference in the first and second scores of all the records, thus the correlation was stronger and hence the test-retest reliability was good.

3.8 Pilot study

A pilot study is the procedure carried out to test a new tool and to check whether it is able to collect the data required to meet the study objectives, and identify problem areas in the tool to be corrected. The purpose of pilot testing the tool is to determine its quality and relevance of items included in the tool. This also helps in assessing appropriateness of the tool for the target population (LoBiondo-Wood & Haber, 2013). A pilot study was carried out on five files of neonates, which were later excluded from the study as some changes were made to refine the tool.

3.9 Data collection

Burns & Grove (2011), assert that data collection could be defined as the procedure of gathering data from these participants. Data were collected after the researcher attained consent from all required authorities. The researcher reviewed only 231 instead of 331 neonatal deaths recorded in the hospital during the study period from 1 January 2013 to 31 December 2013. Archival records were retrieved with the assistance of the clerks in the archives department and the researcher assessed the notes from recorded cases. Data were collected in the records section, where all files of patients are kept under lock and key. A record was not removed from the records section to maintain confidentiality. Data were collected on mode of delivery, complications during delivery, Apgar scores, resuscitation, and birth weight, causes of early and late neonatal deaths, avoidable factors and unavoidable factors. In addition, the researcher was present during the data collection process so that if the data collectors encountered problems they could resolve them.

3.10 Data analysis

Data analysis is defined as the process of cleaning, transforming, inspecting and modeling data with the goal of uncovering valid information, supporting decision-making and suggesting conclusions (Hair *et al*., 2008). Data analysis was done in consultation with my supervisors.

Data from the audit tool were entered and analysed using the Statistical Package for Social Science (SPSS), data analysis software (Version 24). Frequencies and proportions were used to describe categorical data and means and standard deviation were used for continuous data. According to Burns &Grove (2009) descriptive statistics permit the researcher to classify data expressively to enable a better understanding of them. The descriptive statistical approach was adopted in the analysis of data. The variables were measured to make sense out of the data. The frequency of a particular response such as age at death, gender, mode of delivery, causes of death as recorded at death, complications present during delivery (if yes, type present), causes of early neonatal death, causes of late neonatal death, avoidable factors and non-avoidable factors, were calculated in percentages and the data were illustrated using pie chart and tables.

3.11 Ethics statement

Ethical approval was obtained from the University of the Western Cape Senate Research Committee. The study used data available in medical records to the researcher as a practitioner at the hospital. However, sensitive information regarding HIV status was handled responsibly and permission was requested from the management of the hospital and the

provincial Department of Health before the collection of data. Reporting was collective and no names or identifying information on the neonates were reported. The study ensured that all the information obtained from the patients' files remained confidential and would not be disclosed to anyone other than the research supervisors. Privacy is considered as an individual's right to decide the time, degree and overall situations under which personal information will be shared or withdrawn from others (Burns & Grove, 2011). In this study it was the researcher's accountability to guarantee that the information obtained was kept private, and no-one else had access to it, except the supervisors. The identifiable details of the participants were removed and codes were used instead to maintain anonymity.

According to Burns & Grove (2011) breach of privacy can happen when a researcher intentionally or unintentionally permits an unapproved person to get access to the study's raw material. The research tools used in this study were kept under lock and key in a cabinet to prevent unapproved persons from getting access to the raw data. Burns & Grove (2011) also state that the principle of justice includes subjects' right to fair selection and treatment. In this study the subject's records were only selected if they met the requirements for the study, not simply because they were available.

3.12 Conclusion

This chapter covered the methodology of the study into factors contributing to neonatal deaths in 2013 at a national hospital in Namibia, emphasizing the research design, research setting, population, sampling, instruments, pilot study, data analysis, validity and reliability, ethics statement.

The following chapter deals with the results of the study.

CHAPTER FOUR

RESULTS

4.1 Introduction

Chapter four presents the findings of the study based on the original research objectives, which were: (a) to identify the causes of early neonatal death, (b) to identify the causes of late neonatal death, and (c) to identify the avoidable and unavoidable factors contributing to neonatal death.

The findings are presented in four sections: section one presents demographic information; section two presents' causes of early neonatal deaths and late neonatal deaths; and section three presents avoidable and section four non-avoidable factors. The findings are presented in tables, and pie chart for easy understanding, together with descriptions and deductions.

4.2 Sample realization

In this study it was anticipated that all the records of neonates who died while admitted at a national hospital in Khomas district in Namibia from 1 January to 31 December 2013 (n=333) would be used. However, the researcher only accessed 246 of the 333 files, and was unable to locate the other 87 files because the hospital underwent reconstruction and some files were misplaced. Of the 246 files, 5 files were used for pre-testing the instrument and hence were excluded from the actual study. Also, neonatal records of information on 10 files were incomplete, and therefore not used for the study. This left a total of 231 files that were used in this study.

4.3 Section one: Demographic characteristics of respondents

The demographic data provided the researcher with a description of the sample population. The researcher examined the following items: age at death, gender, complications present during delivery, and types of complications.

4.3.1 Age at death and gender

Age at death	Frequency	%
Less than 7 days	155	67.1
8 days to 28 days	76	32.9
Total	231	100
Gender		
Male	117	50.6
Female	112	48.5
Ambiguous genitals	2	0.9
Total	231	100

Table 2: Age at death and gender

The audit included neonates (n=231) and according to the data collected the results show that the majority of the neonates that died 67.1% (n=155) were early neonatal deaths (death during the first 7 days of life) while 32.9% (n=76) were late neonatal deaths (death after 7 days of life but before 28 completed days of life).

The results also show that males 50.6%, (n=117) died compared to females 48.5%, (n=112), and 0.9% (n=2) had ambiguous genitals.

4.3.2 Delivery mode and complications during delivery

		Frequency	%
Delivery mode	Normal vertex delivery	127	55.0
	Caesarean section	77	33.3

	Vacuum delivery	2	0.9
	Breech delivery	14	6.1
	Not recorded	11	4.7
	Total	231	100
Complications present during delivery	Yes	175	75.8
	No complications	14	6.1
	Not recorded	42	18.1
	Total	231	100

Table 3: Delivery mode and complications present during delivery

Table 3 shows that of 55.0% (n=127) of neonates were delivered by normal vertex delivery (NVD), 33.3% (n=77) were delivered by caesarean section, and 6.1% (n=14) by breech delivery. Eleven or 4.7% (n=11) of deliveries did not record the type of delivery. The records showed that only two of neonates were delivered by vacuum delivery.

Table 3 also shows that 75.8% (n=175) of mothers faced complications during delivery, with 6.1 % (n=14) having no complications and 18.1% (n=42) giving no record of whether there were complications or not.

4.3.3 Types of complications

Types of complications		
	Frequency	**%**
Preterm labour	70	30.3
Eclampsia	42	18.2
Not recorded	42	18.1
Prolonged labour	20	8.7

Foetal distress	16	6.9
No complications	14	6.2
APH	9	3.9
Twin pregnancy	8	3.5
Diabetes	5	2.2
Cardiac condition	4	1.7
Cord prolapse	1	0.3
Total	231	100

Table 4: Types of complications during delivery

Complications faced by mothers during delivery varied from mother to mother (Table 4), with 30% (n=70) having preterm labour, followed by eclampsia in 18.2% (n=42). Some files did not record whether women presented with complications or not (18.2%, n=42), with prolonged labour in 18.7% (n=20), APH in 3.9% (n= 9), foetal distress in 6.9% (n=16), twin pregnancy in 3.5% (n=8), diabetes in 2.2% (n=5), a cardiac condition in 1.7% (n=4), cord prolapse in 0.4% (n=1), and no complications in 6.1% (n=14).

4.3.4 Babies' weights at death

		Frequency	%
Babies' weight at death (g)	500–999	75	32.5
	1000–1499	50	21.6
	1500–1999	29	12.6
	2000–2499	11	4.8
	2500 and above	62	26.8
	Not recorded	4	1.7
	Total	231	100.0

Table 5: Babies' weight at death (g)

Table 5 reveals that neonatal deaths decreased with increasing birth weight. The lowest birth weight range, 500 – 999g, has the highest 32.5%, (n=75) proportion of neonatal deaths; while that of 1000–1499g has 21.6% (n=50) of neonatal deaths, that of 1500–1999g has 12.6% (n=29) of neonatal deaths, that of 2000–2499g has 4.8% (n=11) neonatal deaths, and 1.7% (n=4) were not recorded. What was unusual was that the birth weight range of 2500g and above had 26.8% (n=62) of neonatal deaths.

4.3.5 Recorded cause of death as recorded

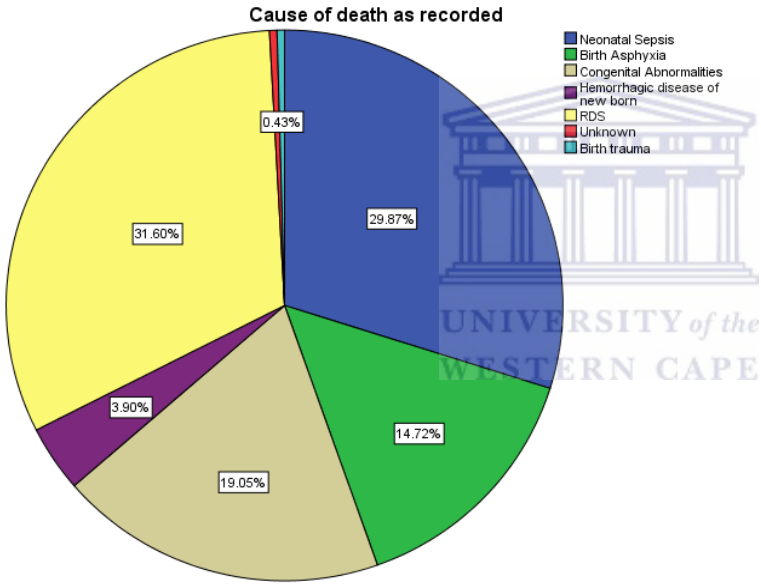

Figure 1: Cause of death as recorded.

The results in Figure 1 indicate that neonatal sepsis caused 29.87% (n=71) of neonatal deaths, RDS 31.60% (n=73), birth asphyxia 14.72% (n=33), congenital abnormalities 19.05% (n=44), haemorrhagic diseases 3.90% (n=8), unknown causes 0.43% (n=1) and Birth trauma 0.43% n=1.

4.4 Section two: Causes of early and late neonatal deaths

This section presents the results on causes of early and late neonatal deaths, and highlights the number of days that the neonate stayed in the neonatal unit before death. It is divided into two subsections, similar to the subsections in the audit tool. The results are displayed in tables with descriptions. This section answers the following research objectives: to identify the causes of early neonatal deaths; and to identify the causes of late neonatal deaths.

4.4.1 Number of days in neonatal unit before death

Number of days in hospital for early neonatal death	**Frequency**	**%**
24 hours	30	12.9
7 days	125	54.2
Number of days in hospital for late neonatal death		
8-14 days	48	20.9
14 -28 days	**28**	**12.0**
Total	231	100

Table 6: Number of days in neonatal unit before early or late neonatal death

As indicated in Table 6, only 12.9% (n=30) of the neonates in the width current study died within 24 hours, 54.2 (n=125) stayed for up to 7 days. Table 6 also reveals that a substantial number of neonates 20.9%,(n=48) died during the late neonatal period, stayed from day 8 up to 14 days before death, 12.0% (n=28) stayed for more days but died before 28 days of life as illustrated above.

4.4.2 Causes of early and late neonatal deaths

		Frequency	%
Causes of early neonatal deaths	RDS	56	24.2
	Neonatal sepsis	28	12.1
	Birth asphyxia	27	11.7
	Congenital abnormalities	34	14.7
	Haemorrhagic diseases of newborns	9	3.9
	Unknown	1	0.4
Causes of late neonatal deaths	Neonatal sepsis	41	17.7
	RDS	17	7.4
	Congenital abnormalities	9	4.0
	Birth asphyxia	7	3.1
	Birth trauma	1	0.4
	Unknown	1	0.4
	Total	231	100

Table 7: Causes of early neonatal and late neonatal deaths

The causes of early and late neonatal deaths are summarized in Table 7. The results indicate that 24.2. % (n=56) of early neonatal deaths were caused by RDS, followed by neonatal sepsis 12.1%, (n=28), birth asphyxia 11.7%, (n=27), congenital abnormalities 14.7%, (n=34), hemorrhagic diseases of newborns 3.9%, (n=9), unknown causes .0.4 % (n= 1).

The causes of late neonatal deaths of the participants are summarized above. The results show that the late neonatal deaths, neonatal sepsis accounting for 17.7% (n=41) of them, followed by RDS 7.4%, (n=17), congenital abnormalities 3.9%, (n=9), birth asphyxia 3.1%, (n=7), birth trauma 0.4%, (n=1), unknown causes 0.4%, (n=1) as described above.

4.5 Section three: Avoidable factors related to HCPs

This section describes the avoidable factors related to HCPs, thus addressed the reseach objective to identify the avoidable factors contributing to neonatal deaths.

4.5.1 Apgar score

		Frequency	%
	<3/ 10 - <3 /10	39	16.9
	3-6 /10 3-6 /10	81	35.1
	>7 / 10 > 7 /10	65	28.1
	Not recorded	46	19.9
	Total	231	100.0

Table 8: Apgar scores at 1 and 5 minutes.

Results in table 8 show that 16.9% (n=39) of neonates had a low Apgar score of <3/10 at 1 minute and maintained a similar Apgar score of <3/10 at 5 minutes. Of neonates who died, 35.1% (n=81) had a low Apgar score of 3–6/10 at 1 minutes and no improvement (3–6/10) at 5 minutes. However, 28.1% (n=65) of neonates who died had a normal Apgar score of >7/10 at 1 and 5 minutes. In 19.9% (n=46) of cases Apgar scores at birth were not ascertained or recorded.

4.5.2 Resuscitation: Steps taken to resuscitate and duration of resuscitation

		Frequency	%
Resuscitation	Yes	81	35.1
	No resuscitation needed	63	27.3

	Not recorded	87	37.6
	Total	231	100
Steps taken to resuscitate	Suctioning bag and mask ventilation	56	24.2
	Suctioning, intubation	20	8.7
	Ventilation and cardiac massage or chest compression	4	1.7
	Not recorded	96	41.6
	No steps taken to resuscitate the neonate	55	23.8
	Total	231	100
Duration of resuscitation	< 5 minutes	3	1.3
	5-10 minutes	5	2.2
	>10 minutes	7	3.0
	Not recorded	154	66.7
	No resuscitation needed	62	26.8
	Total	231	100

Table 9: Steps taken for resuscitation and duration of resuscitation

Table 9 shows that of the total of number of neonates who died (n= 231) recorded in this study, only 35.1% (n=81) were resuscitated; in 27.3% (n=63) no resuscitation was done, while in 37.6% (87) it was not recorded whether resuscitation was done or not. The table also shows the steps taken to resuscitate the neonates. In 24.2% (n=56) of the neonates suctioning and bag and mask ventilation was used, in 8.7% (n=20) suction and intubation was used, in 1.7% (n=4) ventilation and cardiac massage or chest compression was used, while in 23.8% (n=55) no steps were taken or no resuscitation was needed, and in 41.6% (n=96) the types of steps taken were not recorded

Table 9 shows that the duration of resuscitation in the neonates varied, with 1.3% (n=3) neonates being resuscitated for < 5 minutes, 2.2% (n=5) resuscitated for 5–10 minutes, and 3.0% (n=7) resuscitated for > 10 minutes; in 66.7% (n=154) is was not recorded whether resuscitation was done or not, while in 26.8% (n=62) no resuscitation was needed.

4.5.3 Drugs administered

		Frequency	%
Drugs given	Yes	25	10.8
	No	95	41.6
	Not recorded	110	47.6
	Total	231	100
Types of drugs given	Adrenaline	25	10.8
	No drugs given	95	41.6
	Not recorded	110	47.6
	Total	231	100

Table 10: Drugs administered and types given

Table 10 shows that of the total sample of 231 neonates who died, only 10.8% (n=25) were given drugs, 41.6% (n=95) were not given drugs, and in 47.6% (n=110) of cases it was not recorded whether drugs were given or not during resuscitation.

The results indicate that 10.8% (n=25) were given adrenaline, 41.1% (n=95) were given no drugs as indicated in the records, and 47.6% (n=110) had nothing recorded in the files to indicate whether drugs were given or not.

4.5.4 Assessment done of neonates who died and records of immediate management

		Frequency	%
Assessment	Yes	197	85.3
	No	16	6.9
	Not recorded	18	7.8
	Total	231	100
Record	Referred	201	87.0
	Not referred	16	6.9
	Not recorded	14	6.1
	Total	231	100

Table 11: Assessment and record of immediate management

Table 11 shows that assessment was carried out on 85.3 % (n=197) of the neonates who died, while 6.9% (n= 16) had no assessment and 7.8% (n=18) it was not recorded whether assessment was done or not. The results show that of the neonates who died, 87.0% (n=201) were referred on time and 6.9% (n= 16) were not referred on time, while in 6.1% (n=14) nothing about referral was recorded.

4.6 Section four: Unavoidable factors

This section presents the results on unavoidable factors. In this study congenital abnormalities are considered as unavoidable factors (Table 12). This section addresses the study objective to identify unavoidable factors that contributed to neonatal deaths.

4.6.1 Congenital abnormalities present at birth and types of such abnormalities

		Frequency	%
Congenital abnormalities	Yes	44	19.0
	No	187	81.0
	Total	231	100
Types of abnormalities	Multiple abnormalities	11	4.8
	Congental heart disease	12	5.1
	Hydrocephalus	6	2.6
	Gastrochisis	6	2.6
	Duodenal atresia	2	0.9
	Down syndrome	2	0.9
	Spina bifida	2	0.9
	Not recorded	3	1.2
	No abnormalities	187	81.0
	Total	231	100

Table 12: Congenital abnormalities present at birth and types

Table 12 reveals that of the neonates who died, 81.0% (n=187) had no congenital abnormalities while 19.0% (n=44) died due to congenital abnormalities. The table also shows the types of congenital abnormalities which contributed to early and late neonatal deaths, which included multiple abnormalities – 4.8% (n=11) , congenital heart disease 5.1% (n=12), hydrocephalus – 2.6% (n=6), gastroschisis – 2.6% (n=6), duodenal atresia

0.9 (n=2), and spina bifida – 0.9 (n=2). In 1.2% (n=3) these were not recorded and 81.0% (n=187) had no congenital abnormalities.

4.7 Conclusion

This chapter presented the findings from the study investigating factors contributing to neonatal deaths at a national hospital in Namibia in 2013. It can be concluded that early neonatal deaths are more common than late neonatal deaths. RDS made a major and severe contribution to early neonatal death, while neonatal sepsis was the greatest cause of late neonatal deaths.

In addition, an interrelationship between HCPs, patient-related factors, administrative factors and unavoidable factors was evident and highlighted.

CHAPTER FIVE
DISCUSSION

5.1 Introduction

The world was aiming to reduce neonatal deaths by two-thirds by 2015, and most of the less developed countries, including Namibia, were unable to attain this goal. This chapter presents a discussion of the study findings on causes of neonatal deaths. The discussion centred on demographics information which represents causes of neonatal deaths in general, and the causes of early and late neonatal deaths. Avoidable factors which include HCP-related factors as well as unavoidable factors, which included congenital abnormalities, are also discussed.

5.2 Neonatal death and gender

The results of this study have demonstrated that sixty seven percent of neonatal deaths in this sample were early neonatal deaths, and thirty three percent were late neonatal deaths. This reveals that early neonatal deaths are more common than late neonatal deaths. High rate of early neonatal deaths could points to a possible lack of quality care rendered to neonates at this vulnerable period of life. As early neonatal deaths are linked to poor care rendered to neonates during intrapartum and immediately after birth.

This is similar to the findings of a study by Chowdhury *et al.* (2010) in Bangladesh, which reported the rate of early neonatal deaths as 28.6/1000 live birth in a government facilities: 37.3% occurred on the day of birth, 74.4% within the first 3 days, and 84.1% within the first week of life. However, the study carried out in Bangladesh did not determine the cause of neonatal death after the first week of life (Chowdhury *et al*., 2010).

The findings of this study on neonatal deaths are similar to the study on neonatal mortality carried out in Cuiabá city in Brazil in South America in 2013, which identified that a high

percentage of deaths was found to occur in the early neonatal period – in these cases 72.7% and 75% respectively in the first week of life (Gaiva, Bittencourt & Fujimori, 2013). The high incidence of deaths in the first month of life were found to happen in the early neonatal period, with most early neonatal deaths (46.9%) occurring in the first 24 hours (Gaiva, Bittencourt & Fujimori, 2013).

This study revealed lower rates of early neonatal deaths than that conducted by Galjaart (2007), which found that of all the neonatal deaths, 50% took place in the first day of life and 75% in the first week of life. As for the late neonatal period, in the current study thirty three percent were late neonatal deaths which higher, compared to 25% of neonates who died within 8–28 days in the study conducted by Galjaart (2007).

Loooking at the gender categories of neonatal death, this study has shown that fifty percent of the neonates who died were male while around fourty eight percent were female victims**.** This shows that more male than female neonates died, although there was not much difference. This finding is similar to that of a study in North Central Nigeria, where more males than females died although this differemce was not significant (Onwuanaku *et al*., 2011). Another study carried out in Malaysia identified lower deaths among females neonate compared to males during the first month of life, as cited in (Malik *et al*., 2016), which is consistent with the current study results.

The findings of this study on the impact of gender is also supported by findings of study conducted by Jehan *et al.* (2009) , who identified that neonatal deaths were somewhat higher among males than females. The only explanation for this may be that male neonates have approximately a two times higher incidence of sepsis and RDS than females. Although the

current study did not investigate the factors responsible for such differences, according to the literature this difference is due to biological advantages enjoyed by female neonates and the increased vulnerability of male neonates in early life to environmental stresses (Chowdhury *et al*., 2010).

5.3 Causes of death as recorded

The results of this study show that around thirty percent of n=231neonates died as a result of neonatal sepsis while thirty one percent died from RDS. This study also revealed that fourteen percent of the deaths were caused by birth asphyxia. This reveals how these preventable diseases still cause neonatal deaths in the participating hospital.

This correlated with previous studies conducted by Udo *et al*. (2008) and Bucens *et al.* (2013), where infection, prematurity, asphyxia and congenital abnormalities were the main causes of neonatal deaths during the early and late neonatal period. This is also similar to the results of a study conducted by Ersdal *et al.* (2012), which documented the main causes of neonatal deaths as infections and prematurity.

5.4 Mode of delivery

Pertaining to the mode of delivery, the study identified that fifty five percent of the neonates who died were delivered via NVD, while around thirty three percent were delivered by caesarean section. This reveals that NVD was more common than caesarean section in the hospital under study, although this did not yield good results in terms of neonatal death prevention, as neonates who are born via NVD are known to have good chance of surviving. This higher rate of neonates dying after being born via NVD is contrary to the findings of Tan, Subramaniam & Omar (2007), who found that women who gave birth via NVD have a

low rate of neonatal admission compared to those delivered by emergency caesarean section which has more complications.

The other concern identified by this study is that thirty three percent of neonates who died were born via caesarean section. This is not surprising because neonates born via C/S are associated with neonatal death. This result is in support with a recent study conducted by Abdulhameed, Aljammas & Ramzi (2016) in Iraq, where the researchers identified those neonates who died were born via caesarean section. The same study identified caesarean section as associated with early neonatal death, with a *p*-value of 0.001, which was significant when compared to NVD (Abdulhameed *et al*., 2016).

In the case of vacuum-assisted vaginal delivery, this study demonstrated that less than one percent of case vacuum-assisted delivery was used, with no forceps instrument delivery at the hospital under study. The researcher feels that lack of using instrument delivery, might point at deficiency of knowledge and experience among HCPs. However, the justification for this was not investigated. Vacuum and forceps delivery are some of the nine emergency obstetrical and neonatal care techniques that can save the life of a woman and her neonate during a complicated delivery, for instance a prolonged second stage of labour.

A study done by Nolens *et al*. (2016) identified the vacuum extraction delivery rate as 0.6% due to the inability of HCPs to use the vacuum. However, it increased from 0.6% to 2.4% of deliveries when training of HCPs was implemented (Nolens *et al*., 2016). Audit of a programme to increase use of vacuum extraction that was carried out at Mulago Hospital, Uganda, revealed that there was a decline in intrapartum stillbirths from 34 to 26/1000 births when vacuum extraction was implemented (Nolens *et al*., 2016). Therefore studies are required to find out why the mentioned instruments such as vacuum and forceps were not

being used in the participating hospital. The training of HCPs on instruments delivery would increase their knowledge, thereby reducing neonatal mortality and morbidity.

Another factor that influenced neonatal deaths in this study was breech delivery, with six percent. Breech presentation and obstructed labour are known to increase the risk of neonatal death more than sixfold (Lawn *et al*., 2005).

5.5 Complications present during delivery

Another critical issue that emerged from this study was that seventy five percent of the women presented with complications before delivery. These complications varied, with thirty percent having preterm labour, and eighteen percent having eclampsia. This means that preterm labour and eclampsia affected most women in the current study. This is similar to the findings of a study conducted in Iraq on perinatal mortality types, which found preterm labour and hypertension-related conditions such as pre-eclampsia to be the most common maternal risk factors associated with neonatal deaths (Abdulhameed *et al*., 2016). According to Abdulhameed *et al.* (2016) eclampsia causes intra-uterine growth restriction and chronic anoxia because of uteroplacental insufficiency, which in return affects the neonate.

The maternal complications rate observed in the current study is in agreement with a study by Mmabaga *et al*. (2011) in Northern Nigeria that identified maternal conditions during the antenatal period such as preterm labour and hypertensive- and intrapartum-related complications contributing to most neonatal deaths. The same study identified factors such as APH caused by placenta abruption (65.5%) and premature rupture of membranes as the complications most often leading to neonates being transferred to neonatal ICU (Mmbaga *et al*., 2011).

Other conditions that influenced neonatal deaths in the current study were prolonged labour nineteen percent and foetal distress with seven percent. The researcher is of the opinion that the lack of close monitoring of mothers during labour might led to prolonged labour or obstructed labour and foetal distress. As neonatal deaths caused by the factors mentioned above are an indicator of inadequate care rendered to women during labour, these are considered avoidable factors. The assumption above is supported by Andargie *et al.* (2013), who mentioned that obstetric complications such as prolonged first and second stage of labour increase neonatal deaths when women are not managed correctly. This is supported by Buchmann (2014), who stated that major causes of neonatal death include foetal distress that was not noticed during the intrapartum period – which was one of the most avoidable factors contributing to neonatal deaths in sub-Saharan Africa.

5.6 Baby's weight and neonatal deaths

This study demonstrated that a birth weight of 500-999 grams contributed to thirty two percent of neonatal deaths, followed by 1000-1499 with twenty one percent and twelve percent of neonates who died weighed 1500- 1999 grams . It is evident that neonatal deaths decrease with increased birth weight. This study reported a higher rate of deaths in these weight ranges compared to study by D'Sa, Pinto & Anousha (2016), where neonates of less than 2500g accounted for 32.5% of neonatal deaths and neonates above 2500 g for 18.9%.

In this study a birth weight of less than 2500 g is seen as an imperative cause of early and late neonatal death. The researcher as an employee at the institution under study might argue that given the fact that the study setting is the only main national referral hospital for high-risk pregnancies and severely premature neonates covering the south and central regions, it increases the incidence of deaths in those weighing less than 2500g. An increased incidence

of deaths due to low birth weight or less than 2500g might be also related to the increased number of high-risk pregnancies (such as women with severe eclampsia and eclampsia), late referral to hospital, and poor surveillance, resuscitation and transfer.

The assumptions above are supported by study conducted by Woldeselassie (2005) in Namibia, where 60% of neonates weighed less than 2500g, attributed to referral of pre-eclampsia and eclampsia in the same setting. However, due to lack of research in the study setting and country at large, the researcher could not find enough evidence to support these assumptions.

The neonatal deaths in those weighing less than 2500g that was observed in this study are consistent with the findings of Rajab & Ghareba (2013), who reported higher neonatal mortality of 70.69% for low birth weight. Nevertheless most neonatal death could be avoided with simple care such as proper resuscitation at birth, warmth, feeding, hygiene and early treatment of infections (Rajab & Ghareba, 2013). Furthermore this study's findings on the less than 2500g neonates correlate with findings of Ramaboea (2014) that 40–80% of neonates had low birth weight as the reason for neonatal illness and deaths. Kinney *et al.* (2010) reported a high incidence of low birth weight which accounted for up to 90% of newborns who died, compared to more than a half of those weighing more than 2500g reported in this study. In their study carried out in South Africa Baki *et al.* (2012) revealed that low birth weight was a risk factor for neonatal deaths. The low birth weight or premature neonates have an immature immune system, making them prone to infections and other complications such as feeding problems. Their lungs have not yet developed and therefore they are confronted with complications in adaptation to extra-uterine life. In addition, they

are unable to tolerate the mechanical pressure of labour, and unable to produce their own heat, that makes them prone to hypothermia (Baki *et al*., 2012).

All of the above mentioned issues put low birth weight neonates at much higher risk of neonatal death. According to the WHO, as cited in Malik *et al*. (2016), almost half of the low birth weight deaths in low-income settings are due to a lack of feasible and cost-effective care, for instance warmth, breastfeeding support, and basic care for infections and breathing difficulties. This could explain low birth weight as one of the major causes of neonatal deaths in this current study.

This study has shown that around twenty six percent of the neonates who died weighed above 2500g. These are full-term neonates who could have a higher chance of survival. This alarming result might indicate poor care rendered to women during labour and to neonates immediately following birth. The researcher is of the view that perhaps the neonates might have suffered from birth asphyxia; however, it was beyond the scope of this study to determine factors influencing the deaths of term neonates. The assumption above is in agreement with a neonatal study conducted in Mumbai were asphyxia caused more than one-third of neonatal deaths. The same study found that one-third of deaths from asphyxia was associated with obstetric complications (Fottrell *et al*., 2015). This is supported by the study conducted by Lansky *et al.* (2014) in Brazil which identified that intrapartum asphyxia caused 18% of neonatal deaths, and neonates who died were full-term.

5.7 Causes of early neonatal deaths from 0-7days of life

This study has shown that there are various causes of early neonatal death, which is death of a neonate at between 0 and 7 days of life. The results show that twenty four percent of early

neonatal deaths were caused by RDS. RDS is defined as an acute lung disease which affects newborns, caused by lack of surfactant which causes the alveoli to collapse and become non-compliant. It is more common in neonates born before 37 weeks of pregnancy (Patrick, 2008). Hole *et al*. (2012) in their study identified that RDS is mostly caused by prematurity.

The researcher is of the opinion that twenty four percent of early neonatal deaths caused by RDS might be related to high proposition the deaths of those weighing less than <2500g reported in this study. However, as this study was conducted at a tertiary hospital that has an ICU and enough equipment's and medicine such as surfactant, which enhances lung maturity when administered immediately after birth, the neonates could had a good chance of survival. The survival of neonates under such conditions mostly depends on the immediate neonatal care in the delivery room and in neonatal ICUs, mainly in the first week of life – the period of utmost vulnerability. In the literature it is well documented that surfactant administration immediately following birth reduces early neonatal mortality, when the neonate is given proper or adequate attention (Barria-Pailaquilen *et al*., 2011).

The findings of this study correlate with those of Jain *et al*. (2013), where RDS was the leading cause contributing mainly to early neonatal deaths. The main causes of death were low birth weight and prematurity. Another study conducted in Baghdad identified that the causes of early neonatal deaths were mainly respiratory problems (Hameed & Fibms,2012).
In this study congenital abnormalities were accountable for around fourteen percent of early neonatal deaths, which mostly occurred within 24 hours following birth. This is a lower result than in the study by Sankar *et al.* (2016), were congenital abnormalities caused 78.4% of early neonatal deaths with up to 40% in the first day of life. The WHO (2006) observed that the direct cause of early neonatal deaths is congenital malformation (10%).

Sepsis was also among causes of early neonatal deaths, responsible for twelve percent of early neonatal deaths in the current study. This finding is similar to those of Sankar *et al*. (2016), who found that less than one-half of total deaths secondary to sepsis occurred in the first week of life.

In this study birth asphyxia was responsible for eleven percent of early neonatal deaths, which is similar to finding of study done by Kouema *et al*. (2015), where birth asphyxia caused 11.1% of early neonatal deaths. Similarly, in a study done by Manandhar *et al*. (2010) birth asphyxia caused 37% a rate of early neonatal deaths three times higher than in this study. This variation could be due to the contextual difference between this study and the other two studies mentioned above. Birth asphyxia is mostly due to complications of birth, for instance obstructed labour or prolonged first and second stage of labour. The current study reported eight percent of cases of prolonged labour as one of the complication faced by women during labour, which might lead to birth asphyxia. Birth asphyxia is an indication of absence of good-quality obstetric care. These results above are supported by those of Andreasen, Backe & Oian (2013), who found that inadequate foetal monitoring, poor quality of care, and lack of skills of the health personnel were associated with birth asphyxia.

The present study results on asphyxia are not surprising, since globally it is well documented that around 60% of early neonatal deaths (within the first 7 days of life) are associated with birth asphyxia, which is a failure to initiate spontaneous respiration at birth (Ersdal *et al*., 2012). In sub-Saharan Africa birth asphyxia is responsible for about 280 000 early neonatal deaths per year, especially on the first day of life (Lawn *et al*., 2006, as cited in Kouema *et al*., 2015). In less developed countries 65% of neonates died as a result of birth asphyxia,

while in developed countries 28% of early neonatal deaths are due to preterm births followed by 7% due to congenital abnormalities (Beck *et al*., 2010).

The present study reported a low incidence of early neonatal deaths due to birth asphyxia, contrary to the findings of the study conducted by Ersdal *et al.* (2012), where birth asphyxia was responsible for 60% of early neonatal deaths. The findings of this study on birth asphyxia are also contrary to those of a survey conducted by the MoHSS (2014) in Namibia, that found almost half of early neonatal deaths were chiefly due to birth asphyxia. This might be because the above survey included many hospitals around the country, while the present study targeted just one referral hospital.

In short, early neonatal deaths (during the first week of life) are mainly due to complications of pregnancy and childbirth. According to Velaphi & Rhoda (2012), birth asphyxia could be prevented if all pregnant women received appropriate care during ANC, labour and at birth. This means all pregnant women should have access to a skilled birth attendant.

5.8 Causes of late neonatal deaths (from 8 days of life but before 28 days)

Over the years the number of neonates dying from sepsis has decreased significantly due to introduction of a combination of antibiotics and hygiene techniques (Oza *et al*., 2014). However, in the current study neonatal sepsis caused around seventeen pecent of the late neonatal deaths. The high death rate caused by sepsis during the late natal period is a matter of concern, and demonstrates the burden that neonatal sepsis has brought to neonatal management at the participating neonatal unit.

Neonatal sepsis can be either from maternal causes or it could be hospital acquired (Saugstad, 2011). The common maternal causes are infection of the mother with group B streptococci during pregnancy, early rupture of maternal membranes (almost 24 hours before delivery), and premature birth of the baby and infection of the placental tissue or amniotic fluid (Saugstad, 2011).

Saugstad (2011) argues that nosocomial infection or the hospital environment might play a major role in transmission of infection from one neonate to another. As in the study setting, many neonates were accommodated in one room, which might have put them at risk of spreading infection from one neonate to another. Although this study was not aimed at collecting data to identify the factors influencing the high rate of infections among neonates, the literature stated that late-start neonatal infections are often a result of a poor hospital environment (Saugstad, 2011). Insufficient infection control practices among HCPs such as invasive procedures, indwelling catheters and unselective and prolonged use of antibiotics in neonates are the chief causes of late infections, as mentioned in the literature (Saugstad, 2011). Neonatal infections can be acquired in hospital or at home as a complication of treatment or poor hygienic conditions (Saugstad, 2011). Some sources of infection include unhygienic cord care and feeding practices causing diarrhoea. Thus, the factors listed above are associated with nosocomial infection during the late neonatal period.

Pertaining to neonatal sepsis, the findings are supported by studies conducted by Bartram et al. (2015), Kouema et al. (2015) and Jain et al. (2013), who identified that sepsis was a significant cause of death mostly in the late neonatal period. Furthermore, Bartram et al. (2013) discovered that neonatal sepsis was responsible for nearly half of the late neonatal deaths, many of which are blamed on inadequate hygiene.

In this study death due to birth asphyxia, RDS and congenital abnormalities were also common during 8–28 days after birth. This is similar to findings in the study by Oza *et al*. (2014), that the three leading categories of causes of neonatal death are preterm, RDS, and infection during the late neonatal period.

5.9 Avoidable and unavoidable factors contributing to neonatal deaths

5.9.1 Apgar score

It is an international standard that all newly born neonates should be given an Apgar score at 1 and 5 minutes after delivery, to know whether the baby might require resuscitation or not (Department of Health, 2007). This study has shown that sixteen percent of neonates who died at the hospital under study had an Apgar score of 3–6/10 at 1 minute and remained the same at 5 minutes. This means that these neonates had a high chance of surviving if proper care, such as proper resuscitation, was rendered to them. Furthermore two-thirds of the neonates who died in the current study had normal Apgar scores of > 7/10 at both 1 and 5 minutes; in other words, they were healthy neonates and could have had a high rate of survival.

The analysis in this study was based solely on what was recorded on the neonatal death files. Therefore this study did not look at whether the neonates were given a correct Apgar score at birth or not. However, the researcher is of opinion that perhaps some neonates were accorded incorrect Apgar scores. Failing to ascertain the correct Apgar score for neonates at birth could badly influence their outcomes. These findings are supported by Ramaboea (2014) in South Africa; who identified that 13% of the neonates who died in that study had an Apgar score below 3/10 at 1 minute and 27% an Apgar score below 7/10 after 5 minutes.

It is worth noting that in this study thirty five percent of neonates who had an Apgar score of < 3/10 at 1 minute and remained the same at 5 minutes were big neonates weighing > 2500g above. According to the records, most of neonates who died developed brain injury before death due to asphyxia, and presented with hypoxic ischaemic encephalopathy. These findings are supported by Lansky *et al.* (2014), who found that intrapartum asphyxia in Brazil caused 18% of neonatal deaths; the neonates who died were full-term neonates and 40.9% had an Apgar score < 7 at 5 minutes.

Nelson *et al.* (2015) revealed that low Apgar scores at 1 and 5 minutes were indicative of greatly risk of neonatal death. The findings of this study are almost similar to those of a study conducted in Brazil where 58% of neonates who died had a > 4 Apgar score at 1 minute (Oliveira *et al*., 2012). A similar study identified that an Apgar score <7 can put neonates at risk of developing severe neurological impairment (Ehrenstein *et al*., 2009).

5.9.2 Resuscitation

This study has indicated that in the case of resuscitation thirty five percent of neonates who died, their records showed that they were resuscitated at birth. It further emerged that around thirty seven of these neonates it was not recorded whether they needed resuscitation during birth or not, and twenty seven percent no resuscitation was carried out. With thirty five percent of neonates being resuscitated, it could be assumed that neonates could have a 10% rate of survival – but this assumption was proven fruitless as all neonates died. This assumption could be supported by the findings of Lloyd & De Witt (2013), who identified that neonatal deaths caused by intrapartum asphyxia were related to HCP-related avoidable factors in 44% of cases, as no proper resuscitation was recorded.

The current study reported low findings compared to study conducted by Ramaboea (2014) in South Africa, which found that only 52% of neonates who needed resuscitation were resuscitated at birth. Providing enough equipment required during neonatal resuscitation and training of HCPs on neonatal resuscitation to reduce neonatal deaths is paramount (Velaphi & Rhoda, 2012). The NRP plays a major role in preventing deaths and problems of cerebral palsy due to asphyxia. One study reported that when resuscitation has been conducted by skilled personnel it has the potential to prevent 192 000 intrapartum-related neonatal deaths worldwide per year, and 5–10% of deaths related to preterm complications (Hole *et al*., 2012).

The above results therefore warrant the implementation of a neonatal resuscitation education programme for health personnel and workshops about the importance of record-keeping at the participating hospital.

5.9.3 Steps taken to resuscitate the neonate

The study results show that forty one percent of neonates who were resuscitated it was not recorded which steps of resuscitation were carried out on them. Twenty four percent of neonates suctioning and bag and mask ventilation was used, in eight percent suction and intubation was used and only one percent in ventilation and cardiac massage or chest compression was used. This is alarming, and might point to a possible lack of understanding of the steps to resuscitate neonates, or could be due to negligence among the health personnel in record-keeping.

This study results concerning steps take to resuscitate the neonate are in consistent with those of a study done by Ramaboea (2014) in South Africa, where 32% of neonates were resuscitated by suctioning bag, 32% using a mask and (6%) were suctioned and intubated. In

a study conducted by Sepeku & Kohi (2011) in Tanzania only 40% of all asphyxiated neonates had suctioning done on them. This is not surprising since implementing the NRP in developing countries has been particularly challenging (Ersdal *et al*., 2012). Techniques of securing or opening a neonate's airway, suctioning, ventilation, administering oxygen, chest compressions and giving required medicine are all part of the NRP and could play a major role in neonatal death reduction (Kattiwinkel, 2006).

5.9.4 Duration of resuscitation

This study demonstrated that close to sixty six percent of neonates who died did not have the duration of resuscitation recorded. This worrisome observation means that it was difficult to determine how adequate their resuscitation procedures were, as nothing was recorded to prove that required care was offered. Pertaining to duration of resuscitation not recorded, this study reported lower results 66.6% than in a study conducted by Ndlovu (2013), which reported that in 71% of neonates who died, no duration of resuscitation was recorded. Berglund *et al*. (2008) revealed that the crucial time to initiate resuscitation is within 10 minutes in cases of severe asphyxia. In line with this, Lee *et al*. (2011) stated that teaching neonatal resuscitation in the hospitals decreases the occurrence of intrapartum-related deaths, as most of the neonates only require instant management such as drying, warming and simple neonate care. Training HCPs in neonatal resuscitation has been testified to reduce early neonatal deaths by 38% (Velaphi & Rhoda, 2012).

The requirement for help or resuscitation during birth is always unforeseen. Therefore ongoing training about neonatal resuscitation among the HCPs is of paramount importance.

5.9.5 Drug administration

This study identified that in a substantial number of neonates (close to a half) who subsequently died, it was not recorded whether the required drugs were administered during resuscitation or not. Analysis of the documents revealed that the only resuscitative drug given was epinephrine.

The findings of this study are consistent with those of Sepeku and Kohi (2011) in Tanzania; they identified that 45% of asphyxiated neonates had not received required medicines during resuscitation. The same study found that this was due to insufficient knowledge on how to administer drugs; when to administer them; and which drug to administer. This is also supported by a study conducted by Ndlovu (2013) in South Africa, which found that only 2% of neonates received resuscitation; however the study did not state why drugs were not given.

5.9.6 Assessment

According to the current study findings, an assessment was done on more than eighty five percent of the neonates who died. Although an assessment was carried out on most of the neonates during delivery, it did not play a major role in prevention of neonatal deaths. This is similar to findings of a study in South Africa by Ndlovu (2013), where in 88% of the neonates assessments were done, with no record of further assessment in the remaining 12%.

5.9.7 Record of immediate management of the problem

The study findings revealed that of the neonates who died, eighty seven percent were referred on time from the place of delivery to a neonatal unit. This shows that although most neonates were referred on time, this did not impact much on prevention of neonatal deaths. Immediate management of neonates can be hindered if health personnel do not have the skills and

knowledge of what to do, and the proper equipment. The higher incidence of HCP-related avoidable factors and concurrent avoidable neonatal deaths identified here are in agreement with findings of previous studies conducted in Africa by Nyamtema *et al*. (2010), where health worker-oriented factors were the most common, accounting for 67.7% of neonatal deaths. In the same study by Nyamtema *et al.* (2010) it was identified that deficient health worker practices caused most deaths and accounted for 28.5% of maternal and perinatal deaths. This finding was also supported by Merali *et al.* (2014) in their audit, which found that most of the avoidable factors that attributed to neonatal deaths were substandard practice by health workers. Most of the neonatal deaths were thought to be avoidable if the HCPs had performed better.

5.9.8 Unavoidable factors

The current study demonstrated that around nineteen percent of neonates died of congenital abnormalities, which was a great burden of these unavoidable factors on early and late neonatal deaths. It seems that these unavoidable factors were difficult to control and impacted neonatal deaths severely; most affected neonates in this study died within 24 hours following birth.

This study reported a higher rate 19% of congenital abnormalities as unavoidable factors than a survey conducted by Indongo (2014) in Namibia, which reported 11.3% of neonatal deaths as caused by congenital abormalities. A possible explanation for such a difference might be that the survey targeted many hospitals around the country while the current study targeted one tertiarly hospital to which all neonates with severe abnormalities are referred from other regions. Thus the results of the two studies should be compared with caution.

Kouame *et al.* (2015) in Abidjan, Cote de Ivoire, identified a higher rate of 65% of neonatal deaths due to congenital abnormalities compared to the current study where around 19% of neonatal deaths were due to congenital abnormalities. Both studies reported that deaths were more common on the first day of life. Another study conducted by Mah-Mungyeh *et al.* (2015) in Cameroon identified congenital abnormalities as accounting for 10.54% of neonatal deaths, which is low compared to the current study. Most of these deaths were unavoidable and occurred within the first 24 hours. A study conducted in Libya revealed that congenital abnormalities caused 17 % of neonatal deaths (Alburke *et al.*, 2015), which is also low compared to the current study.

5.10 Conclusion

This chapter highlighted and discussed the findings of the study with reference to the literature. Demographic and socio-economic characteristics of the neonates died in the hospital were also analysed. The study indicated that early neonatal deaths are more common than late neonatal deaths. It also revealed that both early neonatal deaths and late neonatal deaths are caused by conditions such as RDS, congenital abnormalities, neonatal sepsis and birth asphyxia. Congenital abnormalities were one of the unavoidable factors involved in neonatal deaths.

The next chapter concludes the study and makes recommendations based upon its findings.

CHAPTER SIX

CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter the research findings of this study are summarised and presented. Based on these findings, conclusions are drawn, from which recommendations for practice and further researches are formulated. The study was aimed at investigating factors contributing to neonatal deaths in a national hospital in Namibia in 2013 through auditing death records.

The study was meant to address the following study objectives: to identify the causes of early neonatal deaths in the first 7 days of life; to identify the causes of late neonatal deaths from 8 days of life up to 28 completed days of life; and to identify the avoidable and unavoidable factors contributing to neonatal deaths at a national hospital in Namibia.

6.2 Conclusion

The following deductions have been drawn from the study findings and have been clarified in agreement with the research objectives. The study concluded that early neonatal deaths were more common than late neonatal deaths. The study revealed that causes of early and late neonatal deaths were similar, although happening at different stages. It was found that early and late neonatal deaths are caused mainly by RDS, congenital abnormalities, neonatal sepsis and birth asphyxia.

The study further identified that regarding avoidable factors, factors related to healthcare workers was responsible for neonatal deaths at this national hospital in Namibia. Various voidable HCP-related factors contributed to the neonatal deaths. Avoidable HCP-related factors that were revealed included the fact that while more than 10% of neonates who died were given required drugs, more than 40% of neonates who died were not given drugs, and

for closer to half it was not recorded whether the drugs were given or not. Regarding resuscitation, 35% were resuscitated and for more than 37% it was not recorded whether they were resuscitated or not. In terms of duration of resuscitation, less than 2% of neonates were resuscitated for < 5 minutes, more than 2% were resuscitated for 5–10 minutes, and 3% were resuscitated for >10 minutes. In a high proportion – more than half – the duration of resuscitation was not recorded.

It further emerged that assessment was carried out on more than 85% of the neonates who died, but this did not yield good results in terms of neonatal death prevention. Also, although more than a half of these neonates who died were referred on time, this also did not yield a good result for prevention of neonatal death either. Congenital abnormalities were one of the unavoidable factors linked to neonatal death in this study.

Therefore this study concluded that most neonatal deaths are related to actions or inactions of the healthcare providers and could be avoided.

Reducing neonatal deaths requires a multifaceted approach, giving attention to neonatal resuscitation training programmes. Further research is required to assess the knowledge, skills and behaviours of HCPs. This study emphasises the urgency for improving care of neonates through effective implementation of the EMOC guidelines. The researcher is of the opinion that the findings of this study will assist policy makers and authorities to develop innovative approaches that will be effective in reducing neonatal deaths.

6.3 Limitations of the study

The study had the limitation of having a retrospective design, and therefore its validity could only apply to the studied population. The data gathering was also wearisome and time-consuming, as the hospital had gone through reconstruction and some files were misplaced. The researcher only gained access to 246 files instead of 333 files; having more files to assess

could have increased the power of the evidence of this study. Time and financial constraints limited the researcher from including more research sites to increase the power of the evidence and recommendations. Record-keeping on documents was poorly done, both by medical and nursing staff. As the data were taken from hospital records retrospectively, there was a possibility that the cause of death in some neonates was not properly diagnosed, or error may have crept into the hospital charts.

6.4 Recommendations

6.4.1 Recommendations for training and practice (regarding HCP-related factors)

- HCPs must have knowledge, skills and greater understanding of the importance of interventions in reduction of neonatal deaths, such as implementing the EMOC guidelines, NRPs, as well as maintaining sterile procedures during birth and postnatal care
- There is a need for education and training of HCPs on labour monitoring in order to minimise the chances of prolonged labour and foetal distress.
    - Skills training would need to include CTG interpretation, NRPs and implementing of EMOC guidelines.
    - Education and training of HCPs on the importance of record keeping.
    - There is also a need to look at aspects of care that were not recorded – such as duration of resuscitation and nature of drugs given – which should be addressed during in-service education sessions.
    - Monthly audits of neonatal mortality should be done. Any reduction in neonatal mortality rates should be emphasized, and efforts need to be made to improve

these figures. A graph on the neonatal deaths to be placed in the staff area of the neonatal unit should display this trend over time.

6.4.2 Recommendations for clinical practice

- Emphasis should be stressed on the importance of auditing records of inpatients on a continuous basis.
- Implementation of national maternal and neonatal guidelines.
- Strengthening of programmes available on maternal and neonatal services.

6.4.3 Recommendations for the community (regarding patient-related factors)

- The community needs to be educated on the significance of early attendance of the antenatal clinic and its benefits.
- Awareness campaigns need to be steered on health services available on maternal and neonatal care.
- Pregnant women and the community at large need to be educated about danger signs in pregnancy.

6.5 Implications of the study

Based on the findings of this study it could be inferred that lack of quality care during delivery and postnatal care contributed to an increase in neonatal deaths at the national hospital in 2013. There has been no previous study in this setting which has focused on factors contributing to neonatal deaths. Therefore the researcher is of the opinion that the findings of this study will assist the hospital management, policy makers and authorities to develop innovative strategies to reduce neonatal deaths.

6.5.1 Areas for further research recommended by the researcher

- Further research regarding the knowledge, skills and behaviors of HCPs needs to be conducted.
- Development of appropriate intervention strategies to reduce neonatal mortality and morbidity at the regional hospital.
- Research to identify factors contributing to the high rate of infection among the neonates in the neonatal unit.
- Identification of the factors contributing to the high rate of preterm delivery.
- Determination of the HCPs' knowledge and ability in interpreting foetal heart rate patterns.
- Assessment of the knowledge and attitudes of HCPs on maternal and neonatal care.
- Evaluation of the utilisation of maternity services by the community at large.
- Determination of the availability of human and material resources within maternal and neonatal services.

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APPENDICES

APPENDIX A : DATA COLLECTION TOOL

SECTION ONE: Demographic and general information

Age at death

Gender----------

Causes of death as recorded……

1. Mode of delivery

Normal vaginal delivery	**Caesarean section**	**Vacuum delivery**	**Forceps delivery**	**Breech delivery**	**Not recorded**

1.2. Complications present during delivery

	Yes	**No**	**Not Recorded**
Complication			

If yes, specify the complication……..

1.3 Baby's weight at death:……

SECTION TWO

Number of days in neonatal unit until death	**Record the number of days**
2.1 ≤7 days	

Causes of early neonatal death. Please tick if any these causes are recorded.

2.1 Birth asphyxia	
2.2 Congenital abnormalities	
2.3 Neonatal sepsis	
2.4 Hemorrhagic disease of new born	
2.5 Respiration distress syndrome	
2.6 Sudden cot death	
2.7 Aspiration of feed	
2.8 Unknown	

SECTION THREE

Number of days of day in neonatal unit until death	**Record the number of days**
3.1 8 – 28 days	

Causes of late neonatal death. Please tick if any these causes are recorded

3.1 Birth asphyxia	
3.2 Congenital abnormalities	
3.3 Infection	
3.4 Respiratory distress syndrome	
3.5 Birth trauma	
3.6 Sudden cot death	
3.7 Aspiration	
3.8 Unknown	

SECTION FOUR: Avoidable and Unavoidable factors

Avoidable factors

Apgar scoring assessment at 1 minute and 5 minutes:

Apgar score		**Answer**
1 minute	5 minutes	
4.1. < 3/10	< 3/10	
4.2. 3 – 6/10	3 – 6/10	
4.3. >7/10	>7/10	
Not recorded		

Resuscitation recorded:

	Yes	**No**	**Not recorded**
4.4. Resuscitation			

If yes, which steps were taken to resuscitate the baby:

Steps taken for resuscitation	**Answer**
4.5. Suctioning only	
4.6. Suctioning and bag and mask ventilation	
4.7. Suctioning and intubation	
4.8. Ventilation and cardiac massage or chest compression	
4.9. Not recorded	

Drugs given

4.10 Drugs given	Yes	No	Not recorded

If yes, state the type of drugs……

Duration of resuscitation

4.11.Duration of resuscitation	< 5 minutes	5-10 minutes	>10 minutes	**Not recorded**

Assessment

4.12 Assessment done	**Yes**	**No**	**Not recorded**

4.13 Record of immediate management of problems:

	Referred	**Not referred**	**Not recorded**
Referred			
Others			

Unavoidable factors

Congenital abnormalities present

	Yes	**No**	**Not recorded**
4.2.1 Congenital abnormalities			

If yes, please state the type……..

APPENDIX B: ETHICS CLEARANCE CERTIFICATE FROM (UWC)

UNIVERSITY of the
WESTERN CAPE

DEPARTMENT OF RESEARCH DEVELOPMENT

10 December 2015

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape approved the methodology and ethics of the following research project by:
Mrs SK Hatupopi (School of Nursing)

Research Project:	Investigating factors contributing to neonatal deaths in 2013 in a Regional Hospital in Namibia.
Registration no:	15/7/272

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Private Bag X17, Bellville 7535, South Africa
T: +27 21 959 2988/2948 . F: +27 21 959 3170
E: pjosias@uwc.ac.za
www.uwc.ac.za

APPENDIX C : CONSENT FROM THE MoHSS IN NAMIBIA

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198 | Ministerial Building | Tel: 061 – 203 2510
Windhoek | Harvey Street | Fax: 061 – 222558
Namibia | Windhoek | E-mail: eshaama@mhss.gov.na

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3
Enquiries: Ms. E.N. Shaama

Date: 19th January 2016

Ms. Saara K. Hatupopi
P.O. Box 98533
Pelican Square
Windhoek
Namibia

Dear Ms. Hatupopi

Re: Investigating factors contributing to neonatal deaths in 2013 in a Regional Hospital in Namibia.

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

3.1 The data to be collected must only be used for completion of your Master's Degree in Nursing Education;
3.2 No other data should be collected other than the data stated in the proposal;
3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects' information should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
3.4 A quarterly report to be submitted to the Ministry's Research Unit;

3.5 Preliminary findings to be submitted upon completion of the study;

3.6 Final report to be submitted upon completion of the study;

3.7 Separate permission should be sought from the Ministry for the publication of the findings.

Yours sincerely,

Andreas Mwoombola (Dr)
Permanent Secretary

PERMANENT SECRETARY
2018 -01- 25
REPUBLIC OF NAMIBIA
MINISTRY OF HEALTH AND SOCIAL SERVICES

"Health for All"

UNIVERSITY of the
WESTERN CAPE