An audit of perinatal mortality at King Edward VIII Hospital, Durban

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Declaration

I, Dr NADIYA FRANK, declare as follows:

1. That the work described in this dissertation has not been submitted to UKZN or any other institution for the purposes of an academic qualification, whether by myself or any other party.

2. That my contribution to the project is as follows:

    - Study concept
    - Literature review
    - Formulation of study protocol
    - Data collection
    - Interpretation of Results
    - Final Dissertation

3. That the contributions of others to the project are as follows:
    - Dr T Ibrahim
        - Assistance with study concept
        - Assistance with formulation of data collection form
        - Editing of study protocol
        - Supervising capturing of data onto data collection form
        - Assistance with writing and editing of final manuscript

    - Dr HM Sebitloane
        - Co-Supervisor
        - Assistance with study concept

Dedication

To Ravendran Naicker

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GLOSSARY

Perinatal Death	Antenatal, Intrapartum stillbirths and early neonatal deaths
PNMR	Perinatal Mortality Rate The number of perinatal deaths per 1000 total births. Calculated as: Total number of stillbirths + early neonatal deaths/ Total births x 1000
SBR	Still Birth Rate. Calculated as the total number of stillbirths/ 1000 births
ENND	Early neonatal death. Death within 7 completed days of birth
ENNDR	Early Neonatal Death Rate. Calculated as the number of early neonatal deaths/1000 live births
Primary Obstetric Problem	The most important pregnancy related complication which contributed either directly or indirectly to the case of perinatal mortality.

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Chapter 1

Introduction and Background

The World Health Organisation(WHO) defines a perinatal death as "A death occurring at 22 weeks completed gestation and over, during childbirth and up to seven completed days of life."[1] The WHO further defines a stillbirth as the death of a fetus without the possibility of resuscitation with a birth weight of 500g or more at greater than 22 completed weeks of gestation. [2] The perinatal mortality rate (PNMR) is the number of perinatal deaths per thousand total births and is regarded as the best indicator of obstetric care. The WHO estimates that approximately 5.9 million perinatal deaths occur annually worldwide, equating to 11 deaths per minute. [2] Whilst perinatal mortality is a global problem, it is estimated that 98% of all perinatal deaths occur in low income countries and the PNMR is approximately five times greater in these countries. [2]

Perinatal deaths have decreased over the past few decades in more developed countries due to improved maternal health and changes in obstetric practise. Landmark advancements in neonatal care have included the introduction of penicillin in 1944 for treatment of neonatal sepsis, the decline of respiratory distress syndrome due to antenatal corticosteroids and surfactant therapy as well as the development of incubators and mechanical ventilators. [2] However developing countries, such as South Africa, are still burdened by high rates of perinatal mortality which can be attributed to poor antenatal care, lack of skilled birth attendants during labour and inadequate neonatal care in the immediate postpartum period. It is important to analyse trends in perinatal mortality as the factors contributing to perinatal mortality are largely preventable through basic antenatal services, intrapartum monitoring, emergency obstetric care as well as the provision of adequate neonatal care.

In South Africa, information on perinatal deaths are collected from two sources namely the District Health Information System (DHIS) and the Perinatal Problem Identification Programme (PPIP). The National Perinatal Mortality and Morbidity Committee (NapeMMCo) Report 2012/2013 combined data from the District Health Information System (DHIS) and the PPIP. According to the NapeMMCo Report, the perinatal mortality rate in Kwazulu Natal (KZN) for 2012/2013 was 36.2 per 1000 across all weight categories.

Furthermore this report found that 9 of the 11 districts in KZN were grossly under reporting births and deaths via PPIP. [3] The 2012-2013 Saving Babies Report reported that for the period 1st January 2012 to 31st December 2013, there were 1,412,355 births, 32, 662 stillbirths and 14, 576 early neonatal deaths recorded via PPIP from 588 national

sites.[4]

However, there is a discrepancy between DHIS and PPIP data and KZN was one of the three provinces identified to have incomplete data, along with Gauteng and the Eastern Cape. [4] The South African government introduced various initiatives in 1995 to address the problem of high perinatal mortality. This included improving access to basic antenatal care, the abolition of user fees, improved detection and treatment for syphilis as well as the roll out of the PMTCT programme. [5]

An audit of perinatal mortality in Northern KZN in 1999 found that the most important primary obstetric causes responsible for perinatal mortality were unexplained intrauterine deaths, spontaneous preterm labour, infections, fetal abnormalities and antepartum haemorrhage. [6] These remain amongst the most important causes of perinatal mortality. A study done to evaluate trends in perinatal mortality in the Amajubu District (KZN) from 1999-2012, found that the mean PNMR during this period was 40.9/1000 births. Although perinatal mortality in KZN has shown a decline from the year 2000, largely due to the above mentioned interventions, the PNMR in this province is still unacceptably high.

Literature Review

Antepartum stillbirths

Almost two thirds of perinatal deaths are stillbirths which occur in the antenatal period. However, in the majority of cases, no underlying cause can be found and this is then termed an unexplained still birth.[1] Contributing factors may include intrauterine growth restriction (IUGR), congenital fetal anomalies or infections, maternal disease, isoimmunisation or the complications of pregnancy. According to the Saving Babies Report there are five main primary obstetric causes of deaths namely, unexplained intrauterine deaths, spontaneous preterm birth, intrapartum asphyxia and birth trauma, complications of hypertension and antepartum haemorrhage. [4] Furthermore this report stated that other causes of deaths such as congenital anomalies, infection and IUGR tend to be under reported. [4]

Intrapartum stillbirths

Intrapartum deaths in the term fetus account for approximately 15% of all still births; these are mainly related to adverse events occurring during the delivery process. [2] Prematurity is a major cause of intrapartum stillbirths. Risk factors for intrapartum death include multiple pregnancy, breech presentation and previous caesarean delivery. The rate of delivery related perinatal deaths serves as a marker of the quality of intrapartum care. [1] In 2005, the WHO released a report on the global estimates of intrapartum stillbirths and intrapartum related neonatal deaths. According to this report, intrapartum stillbirths account for approximately 1 million stillbirths annually (26% of total number of stillbirths) and 0.904 million neonatal deaths were associated with acute intrapartum events (23% of all neonatal deaths globally. [7] This represents a large number of potentially preventable perinatal deaths.

Early Neonatal Deaths

The Early Neonatal Death Rate (ENNDR) reflects the quality of intrapartum care, early neonatal resuscitation and the quality of neonatal care. [1] The Saving Babies report on perinatal care in South Africa found that the most important causes of early neonatal deaths were immaturity related and birth asphyxia. [4] The Apgar Scoring system was first introduced in 1952 as a simple measure to assess the health of the newborn. It is determined by evaluating the newborn baby on five criteria namely appearance (colour), pulse rate, reflex irritability, activity and respiratory effort. Each of these criteria is determined at one and five minutes after birth and is scored as 0, 1 or 2 giving an Apgar score of 0-10. A score above 7 is generally regarded as normal. An apgar score of less than 7 at five minutes is associated with a significant increase in risk of neonatal mortality and serious neurological impairments such as cerebral palsy, seizures and mental retardation. [8] A large population based study in Sweden aimed to evaluate the influence of obstetric factors on low apgar scores. They found that five minute apgar scores of less than 7 was associated with primiparity, vaginal breech delivery, birth weight more than 5kg, post dates pregnancy, the second twin and maternal epidural analgesia.[9]

Factors contributing to perinatal mortality

Preterm Birth

It is estimated that globally approximately 13 million preterm births occur annually and that complications from prematurity are the leading cause of neonatal death. [10]
Preterm birth is defined as birth before 37 completed weeks' gestation. This can be further classified as extremely preterm (<28 weeks gestation), very preterm (28-32 completed weeks gestation) and moderate/late preterm (32-36 completed weeks gestation). This distinction is important as neonatal morbidity and mortality increases with decreasing gestational age and birth weight.[10] Preterm infants are at risk for an array of complications including temperature instability, apnoea, respiratory distress, hypoglycemia, infections, necrotizing enterocolitis, seizures, feeding difficulties, jaundice and periventricular leukomalacia. [10]

Although the exact etiology of preterm labour is poorly understood, common known causes of preterm labour include infection/inflammation, uterine over distension from any cause, placental abruption, cervical insufficiency and medically induced preterm labour. The harmful effects of smoking in pregnancy have been well documented and smoking has been causally associated with preterm delivery and preterm birth. Smoking cessation, cervical cerclage and progesterone therapy have shown some success as preventative strategies for preterm labour.[10] Although there have also been developments in neonatal care to reduce mortality from preterm birth, neonatal mortality as a consequence of preterm delivery is still a major global concern.

Intrauterine Growth Restriction (IUGR)

A large proportion of stillbirths are termed 'unexplained.' However, there is now increasing evidence on the link between IUGR and perinatal mortality. According to the 2012-2013 Saving Babies Report almost a third of unexplained stillbirths occurred in those babies who were below the 10^{th} centile for weight according to growth charts. This implies that these Deaths were due to possible underlying growth restriction. [4] Furthermore IUGR may often go undetected in regions with poor antenatal care which also leads to under-reporting of this problem. Another problem highlighted by this report is that the measurement of symphasis fundal height (SFH) is not a reliable method of assessing IUGR and that other methods to detect IUGR for such as ultrasound scans and doppler flow assessment are not freely available in South Africa. [4] A growth restricted fetus is more likely to develop fetal distress and neonatal complications such as hypoglycemia and hypothermia. [11]

Hypertensive disorders

The prevalence of hypertensive disorders in pregnancy is estimated to be between 10-22%. [12] Hypertensive disorders are broadly classified as pre-existing (chronic) hypertension, gestational hypertension, pre-eclampsia and superimposed pre-eclampsia. [13] All hypertensive disorders in pregnancy are associated with increased risk of both adverse maternal and perinatal outcomes. This includes an increased risk of eclampsia, abruptio placenta, IUGR, preterm birth, small for gestational age and low birth weight infants. [12] Women with severe gestational hypertension have increased rates of preterm delivery and low birth weight when compared to women with mild pre-eclampsia. This emphasizes that the absence of proteinuria in these patients may not influence perinatal outcome. [14] Women with chronic hypertension have a 40% risk of developing superimposed pre-eclampsia during pregnancy. Those patients who do not develop superimposed

pre-eclampsia but have severe hypertension which presents prior to 20 weeks gestation, are also at increased risk for adverse perinatal outcomes such as IUGR, preterm delivery and low birth weight infants. [15]

Congenital Anomalies

Approximately 1-3% of all births are associated with congenital malformations. [16] A large prospective study was conducted in the Netherlands over a ten year period. Of the 28983 births, there were 247 cases of perinatal mortality. The incidence of congenital anomalies in this group was 33%. Furthermore lethal congenital malformations were found in 5% of cases in the stillbirth group and 70% of cases the neonatal death group. Central nervous system malformations occurred more commonly in the stillbirth group (45%) while cardiovascular and pulmonary defects were more common in the neonatal group. Other minor congenital malformations also occurred more commonly amongst the perinatal death group without being a contributing factor to the cause of death. [16]

Maternal Diabetes Mellitus

Amongst pregnant women, diabetes mellitus is the most common chronic medical disease and occurs in 0.2-0.5 % of all births.[17] Maternal hyperglycemia is associated with an increase in congenital anomalies, fetal macrosomia, neonatal hyperglycaemia and respiratory distress syndrome, all of which lead to an increase in perinatal mortality.[18]

Multiple Pregnancy

The incidence of twin and higher order multiple pregnancy has increased over recent decades due to an increase of assisted reproductive techniques. Twin pregnancy is associated with a PNMR which is approximately 3-7 fold higher than in singleton births. This is largely due to the association of twin pregnancies with prematurity, low birth weight and IUGR. [19] Furthermore, the second twin is at particular risk for perinatal morbidity and mortality. Although this risk is greatest during the delivery period, antenatal growth discordance has also been associated with increased risk of death of the second twin. [2]

Maternal Obesity

The WHO defines obesity as a body mass index which is greater than 30kg/m2. Obesity has now become a global epidemic and as many as 18-38 % of pregnant patients are obese. [20]

The obese pregnant patient is at increased risk for perinatal morbidity and mortality. This can be attributed to an increase of medical conditions such as hypertension and diabetes, operative vaginal delivery, caesarean section and complications related to fetal macrosomia. [20] However, obesity has also been found to be an independent risk factor for congenital anomalies such as neural tube defects and antepartum stillbirth. [21]

Anaemia in Pregnancy

WHO defines anaemia in pregnancy as a haemoglobin concentration of less than 11g/dL. A large population based study in the United Kingdom found that low Haemoglobin concentration during pregnancy is associated with increased perinatal and neonatal mortality. This is because of the correlation with low haemoglobin concentration and preterm birth as well as fetal growth restriction. This study also showed that the lowest perinatal mortality rate occurred with maternal haemoglobin concentration of 9-11g/dL and that perinatal mortality increased with decreasing maternal haemoglobin concentration. [22]

HIV infection

The effect of HIV on maternal morbidity, mortality and vertical transmission is well established. However, controversy still exists about the effect ofHIV on pregnancy outcomes. Earlier studies suggested that HIV positive women were at risk of adverse events during pregnancy such as an increased risk of IUGR, preterm labour, low birth weight and perinatal mortality. [23] However many of these studies were not well powered and were conducted prior to the initiation of antiretroviral therapy during pregnancy. These, and other confounding factors, have made it difficult to accurately assess the impact of HIV on both the mother and fetus. [24] Since then more well designed studies have been done but the outcomes have varied. To date, the question of HIV infection and its effect on perinatal outcome remains unanswered.

Teenage Pregnancy

In South Africa, pregnancy occurs in approximately 1 in every three women aged 15-19 years. [25] The high rates of teenage pregnancy pose specific medical and social concerns. There is a higher incidence of stillbirths and early neonatal deaths amongst teenage mothers when compared to older mothers. [26] This is related to numerous factors amongst teens such poor nutritional status, a greater likelihood of anaemia, higher incidence of smoking and poor socio-economic status.[27] These factors put teenagers at particular risk for preterm delivery, low birth weight infants, small for gestational age babies and caesareandelivery.

Advanced Maternal Age

This is defined as maternal age 35 years or older. A large WHO multi-country survey involving 29 countries across the world estimated the prevalence of pregnant women with advanced maternal age to be 12.3 %. This study showed that these women were at increased risk for preterm births, stillbirths, Neonatal Intensive care Unit admissions (NICU), low birth weight infants and ENNDS. [28] The risk of adverse maternal and perinatal outcomes increases progressively with advancing maternal age. [29]

Parity

The nulliparous patient is at increased risk of many adverse obstetric outcomes including an increased risk of delivery related perinatal death when compared to multigravid patients. [2] The association of grand mulitparity (more than 4 or 5 births) and perinatal outcomes is less clear. Some studies have shown that grandmuliparity is associated with adverse obstetric and fetal outcomes such as gestational diabetes, hypertensive disorders, preterm labour, antepartum haemorrhage and post partum haeamorrhage [30] whilst others have concluded that grand mulitparity and great grandmuliparity (more than 10 births) should not be classified as a high risk group as the rate of perinatal mortality is low amongst these patients and may even decrease with advancing parity.[31]

Rhesus Disease

Red blood cell alloimmunisation is a disorder due to feto-maternal incompatibility where the transpacental passage of maternal antibodies produces fetal red blood cell destruction which leads to anaemia, hyperbilirubinaemia and fetal hydrops. [32] With greater understanding of Rhesus disease and an increase in both diagnostic and therapeutic interventions, there is now a decrease in perinatal mortality due to rhesus incompatibility.

Syphilis Infection

Syphilis is a chronic infectious disease caused by the organism Treponema Pallidum. Vertical transmission can occur via the placenta or by birth through an infected birth canal if genital lesions are present. Poverty, lack of antenatal care and HIV co-infection are all risk factors for syphilis infection. Syphilis in pregnancy is treated with penicillin which prevents mother to child transmission. Untreated syphilis in pregnancy has been associated with

antepartum death, congenital abnormalities, preterm delivery, low birth weight and the entity of congenital syphilis in the newborn.[33]

Fetal Gender

Studies have been conducted to determine the influence of fetal gender on obstetric and perinatal outcomes. Large clinical studies have demonstrated that pregnancies with male fetuses are more likely to be complicated by obstetric complications such as preeclampsia and abruptio placenta. [34] Male fetuses have higher birthweights than female fetuses and are at greater risk for caesarean section or instrumental deliveries. Furthermore preterm male babies have been found to have poorer neurological outcomes then female infants. [34] The reason for these observed differences in outcomes related to fetal gender is unknown. However knowledge of gender may assist in counseling patients with respect to obstetric and perinatal outcomes. [34]

Mode of Delivery

The rate of caesarean section has increased globally over the past few decades. This has coincided with a decline in perinatal mortality. However, it is difficult to assess the effect of mode of delivery on perinatal mortality. Data which is obtained from observational studies may be compromised by the fact that caesarean section may be undertaken in maternal interest or for an at risk fetus which ultimately influences perinatal outcomes. [2] As the number of caesarean deliveries increase, the number of women who will attempt a trial of labour following caesarean section in a subsequent pregnancy, also increases. Although the absolute risk of perinatal mortality in women attempting vaginal birth following caesarean section is low, the risk is higher than that of planned elective caesarean section.[35] A large prospective study in the United States which aimed to evaluate maternal and perinatal outcomes associated with a trial of labour in women with a previous caesarean delivery, found that the overall risk of adverse perinatal outcome following a trial of labour is approximately 1 in 2000 births. [36]

Preventing Perinatal Mortality

It is crucial that data on perinatal mortality is captured timeously and accurately. Understanding the underlying causes and contributing factors of stillbirths and neonatal deaths would help to reduce perinatal mortality by addressing modifiable patient factors and improving antenatal, intrapartum and neonatal care. The PPIP was first introduced by the Department of Obstetrics and Gynaecology of the University of Pretoria.[37] PPIP is based on the ICA (Identification, Cause, Avoidable factor) audit system and has now been adopted

nationally in South Africa. PPIP forms have incorporated the classification of avoidable factors which helps to identify problem areas and cost effective prevention strategies. [38] In 2011, NaPeMMCO made recommendations to reduce perinatal mortality, these are summarized by the acronym '**HHAPINESS**' which stands for [4]:

- **H**ealth system improvement
- **H**ealth care provider training
- Reduced deaths due to **A**sphyxia
- Reduce deaths due to **P**rematurity
- Reduce deaths due to **I**nfection

- This is incorporated in the **Ne**onatal **S**urvival **S**trategy

In order to achieve HHAPINESS, **The 5 C's** need to be applied namely [4]:

- **Care**: Commitment to Quality: Applicable to health care workers and managers at health facilities
- **Coverage**: Refers to provision of transport from home to institution and between institutions
- **CPAP:** The equipment and skills needed to implement nasal CPAP must be available at all times
- **Contraception**: Emphasizes the importance of preventing unwanted pregnancies
- **Community Involvement**: Refers to importance of engaging community in health care initiatives

Basic Antenatal Care

The aim of antenatal care is to improve maternal health and to aid in the early detection and treatment of pregnancy related complications so as to improve both maternal and fetal outcomes. [39] The role of good quality antenatal care in improving maternal and fetal outcomes has been well established. However there was a lack of consistency regarding the frequency and spacing of these visits as well as what should be offered at each particular visit. This prompted the WHO to introduce a new model of antenatal care in 1998 which comprised fewer clinic visits and focused on interventions known to improve maternal and neonatal outcomes. [40] This model proposed offering four antenatal visits throughout pregnancy if, following a complete history and examination, the woman was classified as being a 'low risk' patient.[40] The WHO then undertook a multicentre randomized control trial to compare this new model of antenatal care with the standard model of care. According to this trial, the new model of antenatal care offered less clinic visits, reduced costs to providers and did not significantly increase adverse maternal and neonatal outcomes.[40] South Africa also follows a model of Basic Antenatal Care (BANC) in which women who are identified as being low risk receive five antenatal visits. The first visit is when the woman initiates antenatal care, subsequent visits are at 20, 26, 32 and 38 weeks of gestation.[39] Approximately 25% of all pregnant women will be identified as not being eligible for BANC at the first antenatal visit. These women are then referred to the appropriate level of care and managed according to specific protocols. [39]

Fetal Monitoring

The goal of antenatal fetal monitoring is to decrease perinatal morbidity and mortality. Methods used include cardiotocograph (CTG) monitoring, ultrasound assessment and maternal perception of fetal movements. [42] CTG monitoring is a form of fetal assessment which simultaneously assesses fetal heart rate, fetal movements and uterine contractions to evaluate if fetal hypoxia is present. There is no current evidence to suggest that antenatal fetal CTG monitoring would significantly reduce perinatal morbidity or mortality.[42] The use of intrapartum CTG has found to have a high false positive rate and poor predictive value. Furthermore, CTG versus intermittent auscultation has been found to be associated with an increase in obstetric interventions, including caesarean section with no improvement in perinatal mortality. Thus CTG is only advocated for those patients considered to be at risk for intrapartum hypoxia. [2] CTG monitoring should be evaluated according to the National Institute of Clinical Excellence (NICE) guidelines. The Canadian Society of Obstetricians and Gynaecologists and others recommend that all pregnant women should be offered a routine ultrasound scan between 18-22 weeks gestation. The rationale for this is that congenital anomalies and poor fetal growth/wellbeing can be detected early in pregnancy, allowing for further investigation and management. [1] This intervention, however, is not often feasible in a resource limited setting. Fetal movements are an indirect measure of fetal central nervous system integrity and function. Maternal perceptions of fetal movements are an inexpensive, non-invasive method of assessing fetal well being. [41] A healthy fetus should move between 3-5 times an hour. In a low risk pregnancy, fetal kick counts can be used to identify an ‘at risk fetus’ and the need to present to a health care facility.

Use of the Partogram

The partogram was first introduced to provide a graphical representation of the progress of labour. It is a summary of maternal and fetal well being which alerts health care workers to adverse labour outcomes. In 1994 WHO made a universal recommendation for use of the partogram as a necessary tool in the management of labour. [43] However, a recent Cochrane review questioned the benefit of the partogram in labour. The authors concluded that based on limited evidence, the partogram cannot be recommended as part of routine labour management and that its’ use should be determined by local practices.[43] In South Africa, all women in labour are expected to have a labour graph completed upon admission to the labour ward.[44]

Induction of Labour

The risk of perinatal mortality increases beyond 37 weeks gestation. Delivery of patients regarded as 'post dates' (>41 completed weeks gestation) and 'post term' (>42 completed weeks gestation) has resulted in a reduction in perinatal deaths when compared to expectant management. [2]

Preventing Neonatal Deaths

Post delivery, good quality early neonatal care is essential. Emphasis must be placed on simple measures to assist the preterm infant. These include Kangaroo Mother Care, exclusive breastfeeding and the early identification and management of problems in this high risk group. The National Department of Health (NDOH) has appointed a neonatal care advisor and a strategy to target 8 high areas that would impact significantly on improved neonatal outcomes. [3] These have been termed the "NDOH Non-Negotiables" and include the following:-

1. Resuscitation
2. Immediate assessment and stimulation
3. Exclusive breastfeeding
4. Immediate thermal care
5. Clean birthing areas
6. Hand washing with soap
7. Kangaroo Mother Care
8. Full Facility care e.g. CPAP

Various interventions have been proposed to the reduce morbidity and mortality of preterm babies. These include the use of antenatal magnesium sulphate for fetal neuroprotection following clinical trials which have demonstrated clear evidence of fetal benefit if administered prior to 30 weeks gestation. [45] Although international practice guidelines are available, there is currently no South African policy on the antenatal use of magnesium sulphate for fetal neuroprotection, accounting for inconsistent use amongst clinicians.

A large study demonstrated that caffeine given to very low birth weight infants (500 – 1250g) resulted in a reduction in bronchopulmonary dysplasia, as well as a decreased likelihood of cerebral palsy and cognitive impairment. [46] It is recommended that caffeine be continued post delivery for a variable duration until such time that the fetus would have reached a gestational age of 34 weeks.

Evidence suggests that the use of therapeutic hypothermia should be offered to babies born at and beyond 36 weeks gestation with moderate to severe Hypoxic Ischaemic Encephalopathy

(HIE). Therapeutic hypothermia must be initiated within 6 hours of delivery and can take the form of whole body cooling or selective head cooling where the aim is a target core temperature of 33.5-34.5 degrees Celsius. [47] Therapeutic hypothermia requires the use of specialized equipment, properly trained staff and intensive systemic care of infants which is often lacking in a resource limited environment.

Autopsy

The rate of perinatal autopsy has declined over the past few decades. This is related to limited resources as well as reluctance on the part of clinicians to offer families an autopsy following a perinatal death. [48] Perinatal autopsy is regarded as the gold standard for determining the cause of a perinatal death. Perinatal autopsy can identify or exclude a cause of death and has been found to change initial diagnosis or yield additional findings in 22-76% of cases. [48] Perinatal autopsy can also assist in identifying genetic disorders which might have implications for future pregnancies. [48] In the immediate period following the death, this knowledge may assist grieving parents to come to terms with their loss and will enable them to undergo pre- pregnancy genetic counseling in a subsequent pregnancy. Furthermore, perinatal autopsy is an important part of medical research as it may add to our knowledge on a particular cause of perinatal mortality and may improve the accuracy of perinatal audit.

The Importance of a Perinatal Audit

Perinatal audits have been adopted globally as a strategy to reduce perinatal mortality. A perinatal audit is a systematic in-depth analysis on antenatal, intrapartum and postnatal care and the repercussions thereof on pregnancy outcome. [49] This is done to improve clinical care and allows policy makers to plan resource allocation so as to improve perinatal outcomes. A perinatal audit aims to identify areas of suboptimal care defined as the failure to use all human and technical resources available to try and avoid fetal death. Areas of suboptimal care may occur during the antenatal period, labour and delivery or may occur postnatally. [50] Perinatal audit on its own cannot improve quality of care. The benefit of the perinatal audit can only be achieved once the audit cycle has been completed. [51] The 'audit cycle' describes the process of identifying cases, analysing results, putting forth recommendations, changing practice and then re-evaluating these changes to determine efficacy. [49]

Rationale for the study

King Edward VIII Hospital is a large tertiary hospital situated in the EThekwini district of KZN. According to the most recent Saving Babies Report, the PNMR for the EThekwini District was 29.7/ 1000 births. [4] At King Edward Hospital, the PNMR for 2013 was 41 per 1000 deliveries. This rate was higher than both the national and the provincial PNMR. Data at this hospital is often collected retrospectively, which could result in inaccurate and incomplete data. An audit of perinatal mortality at King Edward VIII Hospital would provide this large tertiary hospital with invaluable information. This study would allow the calculation of an accurate PNMR and would establish the impact of HIV on perinatal mortality in our local setting. It would assist in identifying areas in which antenatal, intrapartum and postpartum care could be improved so as to reduce perinatal mortality both at King Edward Hospital and draining facilities.

Aim of the Study:

To establish the perinatal mortality, stillbirth and early neonatal death rates at King Edward Hospital and to identify the causes of stillbirths and early neonatal deaths.

Objectives:

1. To identify areas of substandard antenatal, intrapartum or postnatal care at King Edward Hospital and referring institutions.
2. To identify primary obstetric problems.
3. To make recommendations regarding strategies to improve perinatal outcomes.
4. To evaluate the influence of maternal HIV status on perinatal mortality

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CHAPTER 2

An Audit of Perinatal Mortality at King Edward VIII Hospital, Durban

Abstract

Background: According to the WHO, more than 5.9 million perinatal deaths occur annually. The majority of perinatal deaths occur in developing countries, such as South Africa, where patients have limited access to good quality antenatal, intrapartum and postnatal neonatal care. King Edward VIII Hospital in Durban, which offers both regional and tertiary services, was found to have a high perinatal mortality rate (PNMR). An audit of perinatal mortality was undertaken so as to establish the underlying causes of perinatal deaths at this facility. This could reduce perinatal mortality by addressing modifiable patient factors and by implementing appropriate healthcare interventions.

Methods: This was a six month prospective, descriptive study between 1 August 2014 and 31 January 2015 whereby all cases of perinatal mortality at King Edward Hospital were analysed. Information was collated from antenatal records, individual case notes during labour and delivery as well as nursery notes in cases of early neonatal deaths and captured on the data sheet for analysis.

Results: There were 3433 total births, 3324 live births and 148 perinatal deaths at King Edward VIII Hospital, Durban during the 6 month study period extending from 1st August, 2014 to 31st January, 2015. This comprised 95 macerated stillbirths (MSBS 64%), 14 fresh stillbirths (FSBS 9.45%) and 39 early neonatal deaths (ENNDS 26.3%). The PNMR at King Edward Hospital for the study period was 43.11, the Early Neonatal Death Rate (ENNDR) was 11.73 and the Still Birth Rate (SBR) 31.7. 40% of MSBS were unexplained, 33 % were due to abruptio placenta, 14% due to hypertensive disorders of pregnancy and 6% due to fetal anomalies. Abruptio placenta was the commonest cause of death amongst FSBS (57%) followed by birth asphyxia (14%) and spontaneous preterm labour (14%). Spontaneous preterm labour accounted for the majority of ENNDS (38%) followed by birth asphyxia (15%) and intrauterine growth restriction (IUGR 13%) respectively. Avoidable factors were identified in 47 cases (46%). The most significant avoidable factor category was patient related factors (71.6%) followed by health care worker associated factors (20.89%) and administrative problems (7.46%). 38.8% of all patients who delivered during the study period were HIV positive, 61% were HIV negative and 0.12% had unknown HIV status. In cases of perinatal mortality, 43.86% mothers were HIV positive, 53.5% HIV negative and 2.81% HIV were of unknown HIV status. The caesarean section rate for the study period for live births was 49.7% whilst the

caesarean section rate amongst patients with perinatal mortality was 27.46%.

14% of MSBS, 31% of FSBS and 58% of ENNDS were delivered via caesarean section. Amongst patients with perinatal mortality, 21.8% had anaemia and 11.2% had hypertensive disorders during pregnancy.

Conclusion: The PNMR at King Edward Hospital is high. Our study found the main causes of perinatal deaths at King Edward VIII Hospital to be abruptio placenta, unexplained stillbirths, spontaneous preterm labour, hypertensive disease, congenital anomalies and intrapartum asphyxia. Recommendations to decrease perinatal mortality in our setting would include the appropriate management of hypertensive disorders of pregnancy, detection of IUGR, improved intrapartum care and the prevention of preterm deliveries. Each perinatal death must be timeously recorded on the PPIP form and these deaths must be analysed regularly at formal audit meetings. All health care workers involved in maternity care should be encouraged to attend perinatal audit meetings.

INTRODUCTION

The WHO defines a perinatal death as "A death occurring at 22 weeks completed gestation and over, during childbirth and up to seven completed days of life."[1] The Perinatal Mortality Rate (PNMR) is the number of perinatal deaths per thousand total births and is regarded as the best indicator of obstetric care. The WHO estimates that approximately 5.9 million perinatal deaths occur annually worldwide. Whilst perinatal mortality is a global problem, it is estimated that 98% of all perinatal deaths occur in low income countries. [2] South Africa is still burdened by high rates of perinatal mortality which can be attributed to poor antenatal care, a lack of skilled birth attendants during labour and inadequate neonatal care in the immediate postpartum period. It is important to analyse trends in perinatal mortality as the factors contributing to perinatal mortality are largely preventable through basic antenatal services, intrapartum monitoring, emergency obstetric care as well as the provision of adequate neonatal care. A study done to evaluate trends in perinatal mortality in the Amajuba District (KwaZulu Natal) from 1999-2012, found that the mean PNMR during this period was 40.9/1000 births. [3] According to the National Perinatal Morbidity and Mortality (NapeMMCo) Report, the perinatal mortality rate in KZN for 2012/2013 was 36.2 per 1000 across all weight categories.[4] The 2012-2013 Saving Babies Report stated that for the full period 1st January 2012 to 31st December 2013, there were 1,412,355 births, 32, 662 stillbirths and 14, 576 early neonatal deaths recorded via PPIP from 588 national sites.[5] An audit of perinatal mortality in Northern KZN in 1999 found that the most important primary obstetric causes responsible for perinatal mortality were unexplained intrauterine deaths, spontaneous preterm labour, infections, fetal abnormalities and antepartum haemorrhage. [6] These remain amongst the most important causes of perinatal mortality. Despite interventions to reduce perinatal mortality, the PNMR in KZN remains high. In order to determine the PNMR and underlying causes of perinatal mortality at King Edward VIII Hospital in Durban, we conducted a prospective, descriptive study to analyse perinatal deaths at this facility over a 6 month period.

METHODOLOGY

AIM OF THE STUDY

To establish the PNMR, SBR and ENNDR at King Edward Hospital VIII and to identify the causes of stillbirths and early neonatal deaths.

Objectives:

1. To identify areas of substandard antenatal, intrapartum or postnatal care at King Edward Hospital and referring institutions.

2. To identify primary obstetric problems.
3. To make recommendations regarding strategies to improve perinatal outcomes.
4. To evaluate the influence of maternal HIV status on perinatal mortality

LOCATION OF THE STUDY

The study was conducted at King Edward VIII Hospital, which is situated in ward 33 in eThekwini. This is a large hospital in the Southern Hemisphere, offering both regional and tertiary services to both Kwa Zulu Natal (KZN) and the Eastern Cape.

STUDY DESIGN

A prospective study of perinatal mortality from August 2014-January 2015 at King Edward VIII Hospital, Durban.

DATA COLLECTION

We conducted a six month prospective, descriptive study whereby all cases of perinatal mortality at King Edward VIII Hospital was analysed. Information was collated from antenatal records, case notes during labour as well as nursery records and captured on data sheets. The conduct of labour was evaluated according to the NICE Guidelines [7] and local practices [8]. Relevant CTGs were evaluated according to NICE guidelines. [7] The following indices were calculated from data collected: PNMR, SBR and ENNDR.

QUALITY CONTROL

As a means of ensuring quality control, approximately 20 cases of perinatal mortality at King Edward VIII Hospital were reviewed by the investigator prior to the onset of the study. These cases were not included in the study or analysis of results. However, information from these cases was captured on the data sheet and assessed by the supervisor to ensure that relevant information was captured correctly. To ensure ongoing quality control, approximately 10% of all cases entered into the study were audited by the supervisor.

INCLUSION AND EXCLUSION CRITERIA

All identified cases of perinatal mortality born at King Edward VIII Hospital were included and cases of perinatal mortality from referral hospitals were excluded.

DATA ANALYSIS

All data forms were checked for completeness. Data was electronically captured using MS Exel. Descriptive analysis was performed.

The following variables were analysed:

- Maternal demographic data
- Booking blood status: Rhesus, Syphilis Serology and HIV status
- Gestational age, mode of delivery, intrapartum CTG and partogram assessment
- Neonatal data such as Apgar scores, weight and sex of baby, presence or absence of congenital anomalies
- Primary obstetric cause and final neonatal cause of death

Categorical variables are presented as percentages while quantitative variables are summarized using mean, standard deviation and range.

ETHICAL CONSIDERATIONS

Patient confidentiality was maintained. The names of patients were not included in the study and file numbers were used to identify patients. Consent was not required from individual patients as only the charts were reviewed. Permission to conduct the study was obtained from the medical manager of King Edward VIII Hospital as well as the heads of department of both Obstetrics and Gynaecology and Paediatrics. Full Ethical approval granted from the University of KZN Biomedical Research Ethics Committee prior to onset of the study (Reference BE 266/14).

RESULTS

There were 148 perinatal deaths at King Edward VIII Hospital during the 6 month study period from 1st August 2014 to 31st January 2015. This included 95 macerated stillbirths (MSBS 64%), 14 fresh stillbirths (FSBS 9.45%) and 39 early neonatal deaths (ENNDS 26.3%). The total number of births during the study period was 3433 and the total number of live births 3324.The PNMR at King Edward Hospital for the study period was 43.11, the ENNDR 11.73 and the SBR was 31.7. The PNMR, ENNDR and SBR for babies weighing more than 1000g were 25.92, 6.61 and 20.9 respectively. The PNMR was analysed per weight category as shown in Table 1. The absolute number of perinatal deaths per weight category is shown in Figure 1. There were 59 perinatal deaths weighing less than 1000g (32 MSBS, 5 FSBS and 22 ENNDS) 67 perinatal deaths weighing between 1000g- 2499g (48 MSBS, 6FSBS and 13 ENNDS) and 22 perinatal deaths that weighed more than 2500g. (15 MSBS, 3 FSBS and 4 ENNDS) Amongst perinatal deaths, there was a mean birth weight below 2000g, the lowest for ENNDS (1224g). The majority of MSBs (75%), ENNDS (76%) and 50% of FSBS (72%) delivered below 34 weeks gestation (Table 2). 18% of MSBS and 24 % of ENNDS were small for gestational age at delivery. 6 (4.05%) of the perinatal deaths

were complicated by congenital anomalies. (Table 2) Amongst cases of perinatal mortality, 57% involved male fetuses and 43% involved female fetuses.

The most important primary obstetric causes of death are shown in Table 3 and the distribution of primary obstetric causes of death is shown in Figure 2. 40% of MSBS were unexplained, 33% were due to abruptio placenta, 14% due to hypertensive disorders and fetal anomalies (6%). Abruptio placenta was the commonest cause of death amongst FSBS (57%) followed by birth asphyxia (14%) and spontaneous preterm labour (14%). Spontaneous preterm labour accounted for the majority of ENNDS (38%) followed by birth asphyxia (15%) and IUGR (13%).

Cases of abruptio placenta were further analysed to identify possible underlying causes. (Table 4) 6 patients (13%) did not initiate antenatal care. 18 cases (42%) were associated with hypertension in pregnancy and a single case with suspected trauma. There were no other identifiable causes for abruption amongst the other 18 cases (42%).

40% of MSBS were found to be unexplained. (Table 5) 16% of patients did not initiate antenatal care. 26% of unexplained stillbirths were found to be small for gestational age indicating the possibility of undetected IUGR. Amongst these unexplained stillbirths, there were no other associated factors for stillbirth such as maternal malnutrition, stillbirth in previous pregnancy, family history of congenital disorders etc.

Early neonatal deaths were analysed to determine the final neonatal causes of death. (Figure 3) Almost two thirds of early neonatal deaths resulted from extreme multi-organ immaturity (59%). This was due to birth weight less than 1000g with limited neonatal interventions offered. The next most importance causes of ENNDS were hypoxic ischaemic encephalopathy (11%), congenital anomalies (5%) and hyaline membrane disease (5%). 17 of the 39 ENNDS weighed more than 1000g. Of these babies, 10 (61%) were ventilated and
3 placed on continuous positive airway pressure (CPAP). 6 babies weighed between 800-1000g. 2 of these babies were given surfactant and placed on CPAP. 12 babies weighing less than 800g were offered supportive care. 74% of all early neonatal deaths had a septic work up done and were placed on antibiotics.

Avoidable factors were identified in 47 cases (46%) as shown in Table 7. The most significant avoidable factor category was patient related factors (71.6%) followed by health care worker associated factors (20.89%) and administrative problems (7.46%). The distribution of avoidable patient related factors and avoidable health care worker related factors is shown in Figure 4 and Figure 5 respectively.

The most important patient related avoidable factor was a failure to initiate antenatal care. Delay in referral to appropriate level of care was the most important avoidable health care related factor. Another important avoidable health care worker related factor was the misinterpretation of CTG and missed diagnosis of fetal distress. There were a total number of 5 cases of avoidable administrative related factors, 4 cases where there were no Neonatal Intensive Care Unit (NICU) beds or ventilators available and 1 case of a delay in transport to referral institution.

Perinatal deaths were analysed in terms of maternal HIV status. (Table 8) 38.8% of all patients who delivered during the study period were HIV positive, 61% were HIV negative and 0.12% were HIV unknown. Amongst patients with perinatal mortality, 43.86% were HIV positive, 53.5% HIV negative and 2.81% HIV were of unknown HIV status. 98% of mothers with live births and 80.6% of patients with perinatal mortality were on ARVS.
An analysis of maternal characteristics was performed (Table 8). The mean age of our study population was 27 years (14-43 years) and the mean parity was 2 (1-5). Maternal age did not significantly affect perinatal mortality. Amongst patients with perinatal mortality, 6 patients were Rhesus negative (4.2%). Syphilis disease was not found to be a significant contributing factor. The caesarean section rate for the study period for live births was 49.7% whilst the caesarean section rate amongst patients with perinatal mortality was 27.46%. 14% of MSBS, 31% of FSBS and 58% of ENNDS were delivered via caesarean section. This represents delivery in maternal interest or caesarean delivery due to previous obstetric history which precluded normal vaginal delivery. Amongst cases of perinatal mortality, 21.8% and 11.2% of mothers had anaemia and hypertensive disorders respectively. Overall 1.8% of patients with live births and 13.38% with perinatal mortality were unbooked. Of those with perinatal mortality who initiated antenatal care, 39% booked early and 48% booked late.

DISCUSSION

According to the 2012-2013 Saving Babies Report, the KZN PNMR was 32.99, the SBR 26.21 and the ENNDR 12.10 [5]As per the District Health Barometer for 2014-2015, the national average SBR was 20.7 and the inpatient ENNDR was 10.1.[9] The PNMR at King Edward Hospital for the study period was 43.11, the ENNDR 11.73 and the SBR 31.7. Compared to national statistics above, the study found the PNMR and SBR at King Edward Hospital to be significantly higher whilst the ENNDR was similar.

It is important to calculate perinatal indicators for babies weighing more than 1000g as they are prioritized in a resource limited setting to receive specific neonatal interventions such as ventilation. As per the Saving Babies Report, for babies weighing more than 1000g, the provincial PNMR was 27.83, SBR 19.7 and ENNDR 8.30. [5] The Ethekwini district, to which King Edward Hospital belongs, had a PNMR of 29.73, a SBR of 22.87 and an ENNDR of 7.02 for babies weighing more than 1000g.[5] Our study found the PNMR, ENNDR and SBR for babies weighing more than 1000g were 25.92, 6.61 and 20.9 respectively. These rates are similar to national data as above.

The perinatal indicators both in the study population and in the national statistics are significantly higher than that of first world countries. According to the European Perinatal Health Report 2010, the PNMR was less than 4 per 1000 births in 9 European countries.[10] This is in stark contrast to the PNMR in African countries. According to the WHO, the PNMR for Africa is 62 per 1000 births.[11] Whilst South Africa has a lower PNMR than other African countries, the PNMR is still significantly higher than developed countries. The lower perinatal mortality rate in these well resourced countries may be due to better antenatal, intrapartum and neonatal care as well as lower rates of maternal HIV infection.

The main primary obstetric causes of perinatal deaths identified by the 2012-2013 Saving Babies Report were unexplained stillbirths, spontaneous preterm labour, intrapartum asphyxia, hypertensive disorders of pregnancy and antepartum haemorrhage. [5]
Our study demonstrated similar findings with the main causes of perinatal deaths in the study being abruptio placenta, unexplained stillbirths, spontaneous preterm labour, hypertensive disease, congenital anomalies and intrapartum asphyxia. This suggests that the management

of hypertensive disorders of pregnancy, detection of possible IUGR, improved intrapartum care and prevention of preterm deliveries are key strategies in order to decrease the number of perinatal deaths in our country.

Forty percent of MSBS in the study were classified as unexplained. This is comparable to the Saving Babies Report stated that 1/3 of unexplained still births occurred in fetuses weighing below the 10th centile, suggesting possible IUGR. [5] 26% of unexplained stillbirths and 24% of ENNDS in the study were small for gestational age. These findings were similar to a recent study on perinatal mortality in Mpumalanga in which 21.9% of babies had a birth weight less than the 10th centile. [12] Although a single symphasis fundal height (SFH) measurement is a crude assessment of fetal growth, serial measurements can establish a trend in fetal growth. Serial measurements should be plotted on fetal growth charts within antenatal records. This would assist in the identification and referral of small for gestational age fetuses. Cases of suspected IUGR should be referred for ultrasound assessment.

The induction of pregnancies beyond 41 weeks gestation is one of the measures proposed to reduce perinatal mortality. An early accurate calculation of gestational age determined by early ultrasound scan would aid in the detection of IUGR and timeous referral of prolonged pregnancies. In many European countries, early ultrasound is routinely performed by midwives.[13] The institution of such a practise in South Africa would avoid referral to higher levels of care for ultrasound and would ensure that a larger proportion of patients have an early ultrasound scan. However, this would entail large scale training of midwives which may not be feasible for a developing country.

Abruptio placenta was found to be a significant cause of perinatal mortality. The most commonly identified risk factor in the study was maternal hypertensive disease which was present in 42% of cases. Other risk factors for abruption include an abruption in a previous pregnancy, blunt trauma to the maternal abdomen, sudden rupture of membranes in patients with a twin pregnancy or polyhydramnios, chorioamnionitis, as well as maternal smoking and drug use, in particular the use of cocaine. In 39.5% of cases, no underlying risk factor was identified. However, it is unclear if this was due to a failure to identify a risk factor or the true absence of a risk factor. Although 4% of the study population had had an abruption in their previous pregnancy, these patients initiated antenatal care later than 20 weeks gestation. Ideally these patients should have been counselled on the risk of recurrence of abruption in a subsequent pregnancy and the importance of early initiation of antenatal care.

Amongst early neonatal deaths, spontaneous preterm labour and birth asphyxia were the most important primary obstetric causes of death. The adverse effect of prematurity on perinatal outcomes is well established. The majority of early neonatal deaths (56%) were born with a birth weight of less than 1000g. According to the most recent South African Maternity care guideline, all mothers in preterm labour with a gestational age between 26-33 weeks or fetus with an estimated fetal weight between 800g -1999g should receive antenatal steroids for fetal lung maturity.[14] All of the patients in the study that qualified for steroid administration received a course of antenatal steroids. In a resource limited setting, babies weighing less than 1000g are not offered ventilation. This is because studies in South Africa have shown that the survival rate for babies born between 800-900g is approximately 37% and between 900-1000g is less than 50%. [15] The subset of babies that weighed between 800-1000g, were offered continuous CPAP, surfactant and antibiotic therapy however the outcomes were poor. As mentioned earlier, the use of antenatal magnesium sulphate for fetal neuroprotection in early preterm babies is inconsistent among clinicians at King Edward VIII Hospital. Caffeine is available in our institution for use in very low birth weight babies in order to reduce neonatal bronchopulmonary dysplasia however its long duration of administration often limits both its use and benefit. Therapeutic hypothermia in near term and term infants born with HIE has not been introduced at King Edward VIII Hospital.

Birth Asphyxia was stated as the cause of death and hypoxic ischaemic encephalopathy as the final neonatal cause of death in 4 cases of ENND. However, it must be noted that the strict criteria for diagnosis of birth asphyxia was not implemented. This would include, amongst others, an underlying hypoxic event during labour, a metabolic acidosis at birth and early moderate to severe neonatal encephalopathy. [16] Thus it is unclear if the ENNDS in the study due to birth asphyxia and hypoxic ischaemic encephalopathy were a correct diagnosis as no cord blood gas was taken immediately post delivery.

Deaths related to adverse intrapartum events were influenced by either administrative or healthcare worker factors. Delays in caesarean section due to limited availability of emergency theatre facilities are the constraints of a resource limited setting. Furthermore failure to detect intrapartum problems such as cephalopelvic disproportion, malpositions, malpresentations and failure to correctly interpret CTG findings represented potentially preventable healthcare worker related factors.

Approximately 1-3% of all births are associated with congenital malformations. [17] 4.05% of cases of perinatal mortality in the study had congenital abnormalities. The South African Maternity Care Guideline recommends that all women have a detailed fetal ultrasound at 18-22 weeks if possible.[14]

There were more cases of perinatal deaths involving male fetuses compared to female fetuses. This is consistent with the literature that pregnancies with male fetuses have poorer obstetric, intrapartum and neonatal outcomes compared to pregnancies with female fetuses. Although the underlying etiology for this is unknown, knowledge of fetal gender may aid with counseling of patients particularly in high risk obstetric cases.
Patients require ongoing antenatal education regarding the so called 'danger signs' of pregnancy including vaginal bleeding, continuous abdominal pain, spontaneous rupture of membranes and reduced fetal movements. Patients are encouraged to present immediately to their nearest health facility if such danger symptoms occur. Late patient presentation despite adequate antenatal education is due to other factors such as low socio-economic status, limited emergency transport services and limited access to health facilities which may be situated further away from rural areas.

There were no significant differences in perinatal mortality in HIV positive versus HIV negative women. This could be explained by the fact that the majority of HIV positive women in the study were initiated on HAART. However, the numbers in the study may be too small to draw reliable conclusions on the impact of HIV on perinatal mortality. The number of HIV positive pregnant women on HAART is likely to increase in the future as the new national ARV guidelines advocate lifelong ARVS for all HIV positive women diagnosed during pregnancy, irrespective of their cd 4 count. [14]

Syphilis infection was not found to contribute to perinatal mortality amongst this cohort of patients'. This may be due to the low overall prevalence of 1.5% of syphilis amongst pregnant patients attending public antenatal clinics in South Africa. [18] Furthermore, KZN was found to have the lowest prevalence of syphilis (0.3%) amongst all the provinces. [18]

4% of patients with perinatal mortality were rhesus negative. In all but a single case, other possible underlying causes for perinatal mortality were identified. It is, therefore, unclear to what degree rhesus alloimmunization contributed to these deaths. The National Institute of Clinical Excellance (NICE) advocates routine antenatal anti D prophylaxis at 28 and 34 weeks in all rhesus unsensitized mothers. [19] The rationale for this practise is that sensitizing events may be clinically unrecognized. Currently in South Africa, anti D immunoglobulin is administered following sensitizing events in pregnancy and within 72 hours post delivery. [14]This is a more cost effective strategy for a developing country such as South Africa.

Anaemia in pregnancy is associated with both maternal and fetal complications. The South African Maternity Care Guidelines advise that a pregnant woman with a haemogloblin concentration less than 10g/dl during should be assessed and treated for anaemia. [14] Anaemia in the study was similarly defined and was found to be a contributing factor in 21% of patients with perinatal mortality.

Avoidable factors in cases of perinatal mortality can be classified as patient related, healthcare worker related or administrative related. Avoidable factors were identified in 46% of cases. The most significant patient related factor was a failure to initiate antenatal care.
Antenatal care aims to optimise the status of pre-existing maternal medical conditions, to

screen for treatable conditions during pregnancy, to identify patients as ‘high risk’ and to refer patients to appropriate levels of care. Attendance of antenatal care may not be able to predict or prevent all possible maternal and fetal complications. However, it provides an opportunity for patient education, the detection of maternal and fetal disease as well as the institution of specific treatment where possible.

Patients should be thoroughly screened by history and physical exam at the first antenatal visit so that they are referred at the outset to the appropriate level of care. Patients are then classified as being either low or high risk. Low Risk patients are scheduled to follow the Basic Antenatal Care (BANC) programme where patients are managed at their primary health care facility with a limited number of antenatal visits. The first visit should ideally take place at 12 weeks of gestation, with following visits at 26, 32 and 38 weeks. [20] Although approximately 25% of patients may not qualify for BANC following the identification of risk factors, this policy does ensure that patients are managed at appropriate levels of care. [20]

One of the District Health Barometer targets is that 65% of all pregnant patients initiate antenatal care prior to 20 weeks gestation. [9] Ideally all patients should initiate antenatal care within the first trimester, allowing for accurate dating of the pregnancy and early identification of possible problems. 13.8% of patients with perinatal mortality did not initiate antenatal care and of those who attended antenatal care, 48% of patients booked later than 20 weeks gestation.

Possible reasons for not initiating antenatal care include a lack of knowledge on the importance of early antenatal care, poor socioeconomic circumstances and limited access to health facilities. Health care worker barriers to accessing antenatal care may include turning away patients who do not live in that particular drainage area, instructing patients to return for booking later in pregnancy or on particular days only. Amongst teenage pregnancies, late booking follows an attempt to conceal the pregnancy from family members or school colleagues. Communities need to be educated on the importance of early initiation of antenatal care and the government needs to address underlying obstacles to accessing health care. This may include increased access to pregnancy testing, mobile antenatal clinics in rural areas and allowing all pregnant patients to initiate antenatal care at the earliest possible gestation and at any health care facility.

The most commonly identifiable avoidable healthcare worker related factor was a delay in referral to an appropriate level of care. This emphasizes the importance of standardized management protocols for specific obstetric conditions as well as adherence to existing referral criteria. The National Maternity Care Guidelines provide a framework for antenatal, intrapartum and immediate postpartum care which can be instituted both at the local and district health facility.[14] Healthcare workers should be encouraged to seek telephonic advice from their referral institutions in cases of uncertainty.

There were 5 cases of perinatal mortality involving avoidable administrative factors. This involved cases where there were no NICU beds/ ventilators available and a lack of transport to referral centres. These factors are the consequences of working in a resource limited setting and require support and commitment from the government to improve infrastructure. Despite a lack of resources, all healthcare workers must be trained in neonatal resuscitation and simple measures as outlined by the NaPeMMCo Report to improve neonatal survival.[4] These measures must be instituted whilst awaiting neonatal transfer to a higher level of care. This is particularly important for primary care facilities.

King Edward VIII Hospital receives obstetric referrals from 5 regional hospitals, 2 district hospitals and 4 local clinics. The study identified several strategies in order to improve the PNMR at King Edward VIII Hospital and its referral centres. In order to achieve a meaningful analysis of perinatal deaths, the Perinatal Problem Identification Programme (PPIP) needs to be implemented. This entails correctly completing relevant PPIP forms following a perinatal death and capturing this data on PPIP computer programs. This practise can help to identify modifiable risk factors contributing to perinatal mortality. Feedback in this regard must be provided to health care workers both at King Edward VIII Hospital as well as referral centres.

Perinatal statistics must take into account the number of deliveries at referral centres in order to calculate an accurate perinatal mortality rate. Perinatal audit meetings are only be useful if attended by all relevant stakeholders. All members of staff should be encouraged to regularly attend perinatal audit meetings. Substandard antenatal, intrapartum and postnatal care should be highlighted during these meetings so as to decrease the number of avoidable perinatal deaths.

A large proportion of pregnancies within our population are unplanned. Addressing the contraceptive needs of our patients is an important strategy to prevent both unwanted pregnancies and perinatal mortality. Ideally antenatal care should be initiated prior to 20 weeks gestation. Antenatal care must focus on comprehensive patient assessment particularly with regards to optimising maternal health, nutritional status and the detection of IUGR. An effort must be made to assist those antenatal facilities which refer to King Edward Hospital in order to improve antenatal care at these institutions. This could be achieved by means of an outreach programme focussing on various aspects of patient care or by training workshops for staff members at local health facilities.

Patients of advanced maternal age (>37) should be appropriately counselled and offered screening for congenital anomalies. Ideally all antenatal patients should have a detailed fetal anomaly scan at 18-22 weeks gestation. All HIV positive mothers should be initiated on FDC at the first antenatal visit and screened for tuberculosis at all antenatal visits. Patient who screen negative for TB, should be started on Isoniazid Preventative Therapy (IPT). Patients with positive syphilis serology should be treated appropriately according to national protocol. Rhesus negative patients should be screened for the development of atypical antibodies and they should receive rhesus immunoglobulin post delivery and following any possible sensitizing event. Patients at high risk for pre-eclampsia should be initiated on low dose aspirin prophylaxis ideally prior to 16 weeks gestation. All pregnant patients should be initiated on daily calcium supplementation. Patients found to be anaemic should be started on daily haematinics.

King Edward Hospital has recently implemented use of the SBAR (Situation, Background, Assessment and Recommendation) form. This is a communication tool which allows patient information to be conveyed in a standardised and structured manner when patients are referred between health institutions. This allows for a common understanding of the patients current problem and allows for an efficient plan of management. All labour ward staff should be encouraged to complete this form when accepting patients from other health facilities. This process should be audited to evaluate the impact on perinatal mortality.

All staff members should familiarise themselves with the National Maternity Care Guidelines. Regular ESMOE (Essential Steps in the management of Obstetric Emergencies) training and unscheduled 'fire drills' in labour ward will assist in the prompt and efficient management of obstetric emergencies. Regular staff training should focus on intrapartum care particularly on the clinical assessment of patients in labour, completion of the partogram and interpretation of CTG. The partogram must be correctly completed as it serves as a tool to identify poor progress in labour. The CTG must be interpreted according to the NICE Guidelines and healthcare workers should be encouraged to document their interpretation of the CTG. This practise serves to encourage health care workers to pay more careful attention to CTG interpretation and allows for timeous action to be taken should CTG demonstrate fetal compromise. Documentation in the maternity record during labour is particularly important and this should be a detailed and accurate account of the clinical assessment.

Ideally all fetuses with fetal distress should have cord blood taken at birth for arterial cord blood analysis and a diagnosis of birth asphyxia should only be made based on specified blood gas criteria. This allows for more accurate identification of adverse intrapartum events and is particularly important in cases of medicolegal litigation. Additionally cord blood should be taken for fetal karyotyping in cases of unexplained stillbirths or in neonates born with dysmorphic features. This will assist in counseling patients on the risk of recurrence in a future pregnancy. If cord blood cannot be taken, as in macerated stillbirths, a neonatal skin sample can be taken for DNA analysis. Placental tissue can be sent for histological or microbiological analysis in cases of suspected fetal infection. Additionally, the option of a neonatal autopsy can be discussed with the parents in order to determine a possible cause of death, to offer closure to grieving parents as well as assist in counseling for future pregnancies. Although the above services are all available at King Edward VIII Hospital, they are not routinely utilized and a clinical protocol regarding the procedure to be followed following a stillbirth needs to be drafted so as to improve clinical practice.

A postnatal visit should be scheduled at 6/52 post partum to further discuss the perinatal loss, to offer maternal support, to identify possible underlying causes and to clarify any implications to future pregnancies. The patient should be encouraged to use contraception, plan her next pregnancy and ideally attend a pre-pregnancy clinic to optimise maternal health. The importance of early initiation and compliance with antenatal visits should be emphasized.

It is important to note that perinatal mortality is influenced by greater socio-economic and infrastructural factors beyond the control of patients or health care workers. This requires commitment from government and policy makers to improve resources in an effort to reduce perinatal deaths.

Perinatal mortality at King Edward VIII Hospital is a significant problem. Strategies to decrease perinatal mortality require focus on identifying patients with antenatal risk factors which are amenable to intervention, intensifying efforts to identify possible causes of unexplained stillbirths and to reduce early neonatal deaths mainly by improving the survival rates of preterm babies. Lastly all practitioners involved in maternal and neonatal care must adhere to national recommendations regarding strategies to decrease perinatal mortality.

Limitations of the Study

The main limitation of the study was poor record keeping of events leading to perinatal deaths. Documentation was noted to be particularly poor amongst patients with unexplained stillbirths. In the majority of cases, there was no record of further maternal history and clinical assessment aimed at identifying possible risk factors for these deaths. This needs to be rectified to enable a meaningful analysis of unexplained stillbirths. In almost all cases, there was no record of counselling the mother on the possible underlying cause of the perinatal death and advising her regarding risk during subsequent pregnancies.

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Table 1 Mortality Rates per weight category

Per Weight Category (g)	PMNR(/1000) n=148	ENND(/1000) n=39	SBR(/1000) n=109
All Deliveries	43.11	11.73	31.7
500-999g	17.18	5.11	10.7
+1000g	25.92	6.61	20.9
1000-1499g	7.86	2.10	5.82
1500-1999g	7.28	1.20	6.11
2000-2499g	4.3	0.90	3.7
>2500g	6.1	0.90	5.24

Table 2: Perinatal Demographic Data of all deliveries

	MSBS n=95	FSBS n=14	ENNDS n=39 (%)	TOTAL
Male	52 (55 %)	10 (71 %)	22 (58 %)	84 (56.7%)
Female	43 (45 %)	4 (29%)	17 (42%)	64 (43.2%)
Mean Birth Weight	1565g (500-4200g)	1857g (500-4200g)	1224g (500-4200g)	1514g (500-4200g)
Mean Gestational Age	30.1 wks (25-43wks)	32.2 wks (25-43wks)	29.4wks(25-43wks)	30.1 (25-43wks)
<34 Weeks	71 (75)	7 (50)	29 (76)	107 (72.29)
SGA	17 (18)	0 (0)	9 (24)	26 (18.30)
AGA	76 (80)	14 (100)	29 (76)	119 (80.4)
LGA	2 (2)	0 (0)	0 (0)	2 (1.35)
Congenital Anomalies	0 (0%)	1 (7%)	5 (13)	6 (4.05)

Table 3 Primary Obstetric cause of Death

Primary Obstetric Cause of Death	MSB (95)	FSB (14)	ENND (39)	Total PND	PNMR
Abruptio Placenta	31	8	4	43	11.9
Unexplained SB	38	0	0	38	11.06
Spontaneous Preterm Labour	0	2	15	17	4.95
Hypertensive Disorders	13	0	3	16	4.6
Fetal Anomaly	6	1	2	9	2.62
Birth Asphyxia	0	2	6	8	2.33
IUGR	2	0	5	7	2.03
Premature ROM	3	0	1	4	1.16
Maternal Disease	1	0	1	2	0.58
Ruptured Uterus	1	1	0	2	0.58
Miscellaneous	0	0	2	2	0.58

Table 4 Analysis of deaths due to Abruptio Placenta

	MSB n=31	FSB n=8	ENND n=4	Total PNDS n=43
Unbooked	4	0	2	6
Associated with Hypertension	18	0	0	18
HIV Positive	4	6	2	12
HIV on Treatment	3	6	2	11
HIV Negative	27	2	2	31
Weight				
500 – 999g	3	3	3	9
1000-1999g	15	0	1	16
>2000g	13	5	0	18

Table 5 Analysis of Unexplained Stillbirths

	Number of Deaths (n=38)
Unbooked	6 (16%)
Booked	32 (84%)
Single Pregnancy	32 (84%)
Multiple Pregnancy	3 (16%)
HIV Positive	13 (34%)
HIV Negative	14 (37%)
Weight	
500-999g	17 (45%)
1000-1999g	16 (42%)
>2000g	5 (13.1%)
SGA	10 (26%)

Table 6 Avoidable Factors/ Substandard Care

Avoidable Factors	SB	ENND	PND
Administrative Problems	1	4	5 (7.46%)
Health Care Worker Associated	12	2	14 (20.89)
Patient and Family Associated	41	7	48 (71.6%)

Table 7: HIV and Perinatal Mortality

	MSB n=91	FSB n=14	ENND n=39	Live Births n=3291	Total Perinatal Deaths
HIV Positive	34 (37)	11 (85)	17 (45)	1275 (38.8)	62 (43.6%)
Negative	54 (59)	2 (15)	20 (53)	2012 (61)	76 (53.5%)
Unknown	3 (3.2)	0 (0)	1 (2)	4 (0.12)	4 (2.81)
Mean cd4	471±255	448±180	357±213		
On ARVS	26 (42)	9 (15)	15 (24)	1245 (98)	50(80.6%)
Not on ARVS (indicated)	8 (13)	2 (3.2)	2 (3.2)	30 (2)	12(19.35%)

Table 8: Maternal Characteristics of all patients

	MSBS (%)	FSBS	ENNDS	Live Births	Total Perinatal mortality
AGE					
≤18	9 (10)	0 (0)	2 (5)	181(5)	11 (7.74)
19-34	73 (80)	10 (77)	32 (84)	2826(86)	115 (80.98)
≥35	9 (10)	3 (23)	4 (11)	284(9)	16 (11.26)
Parity					
0	43(47)	1(8)	13(34)		57 (40.14)
≤2	38(42)	10(77)	22(58)		70 (49.29)
>2	10(11)	2(15)	3(8)		15 (10.56)
RH Negative	5(5)	0(0)	1(2.5)	67(2)	6(4)
Syphilis Positive	1(1.09)	0(0)	0(0)	45(1.36)	1(0.7)
Mode of Delivery					
NVD	78(86)	9(69)	16(42)	1653(51)	103 (72.5)
C/S	13(14)	4(31)	22(58)	1638(49)	39 (27.46)
Singleton	87(96)	12(92)	35(92)	3209(98)	134 (94.3)
Multiple pregnancy	4(4)	1 (8)	3(8)	82(2)	8 (5.63)
Anaemia	22(24)	4(31)	5(13)	-	31 (21.8)
Hypertensive Disorders of Pregnancy	13(14)	0(0)	3(8)	-	16 (11.26)
Antenatal Care					
Unbooked	13(14)	3(23)	3(8)	60(2)	19(13)
Booked<20 weeks	34(37)	4(31)	18(47)	-	56(39)
Booked>20weeks	44(48)	6(46)	17(45)	-	67(48)

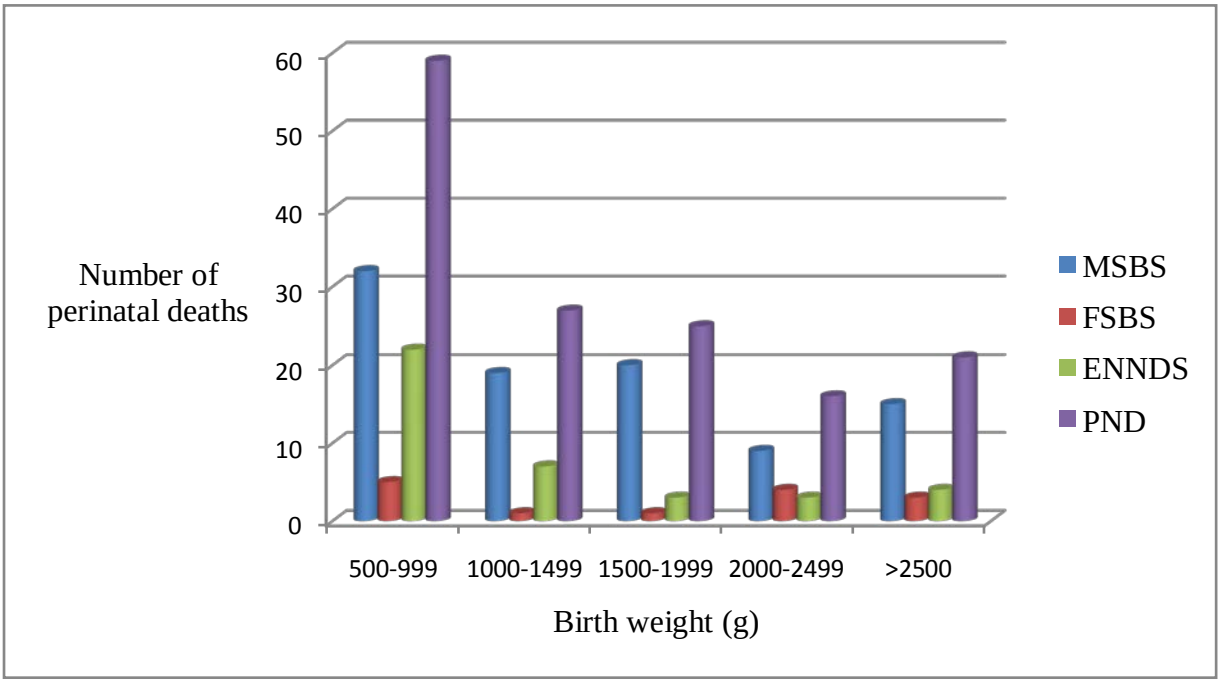

Figure 1 Distribution of Perinatal Deaths per weight category

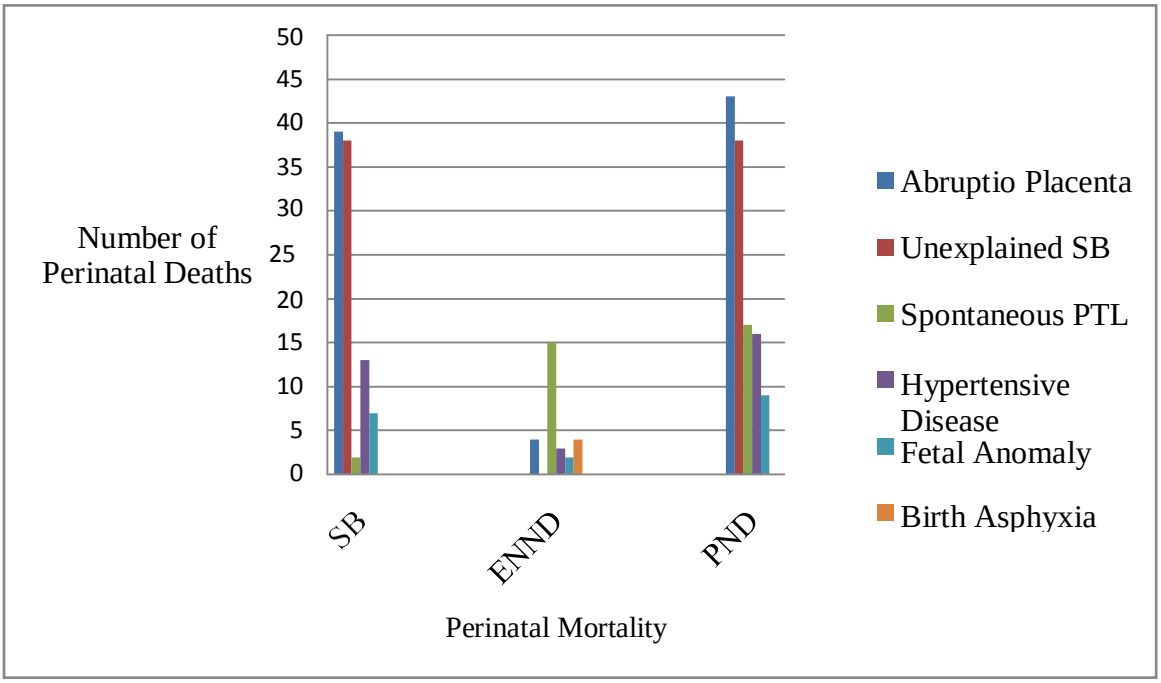

Figure 2 Distribution of Main Primary Obstetric Causes of Death

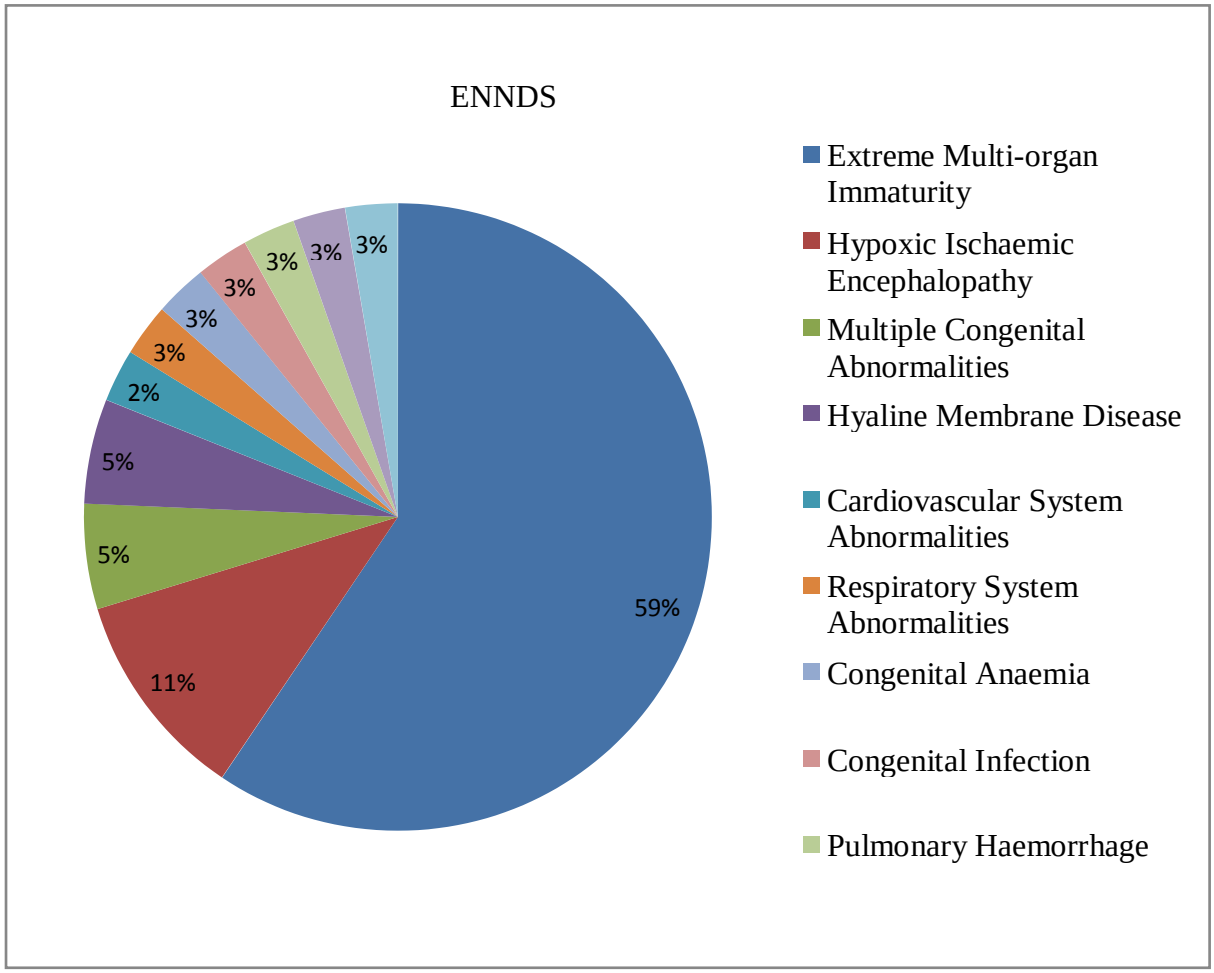

Figure 3 Final Neonatal Cause of Death

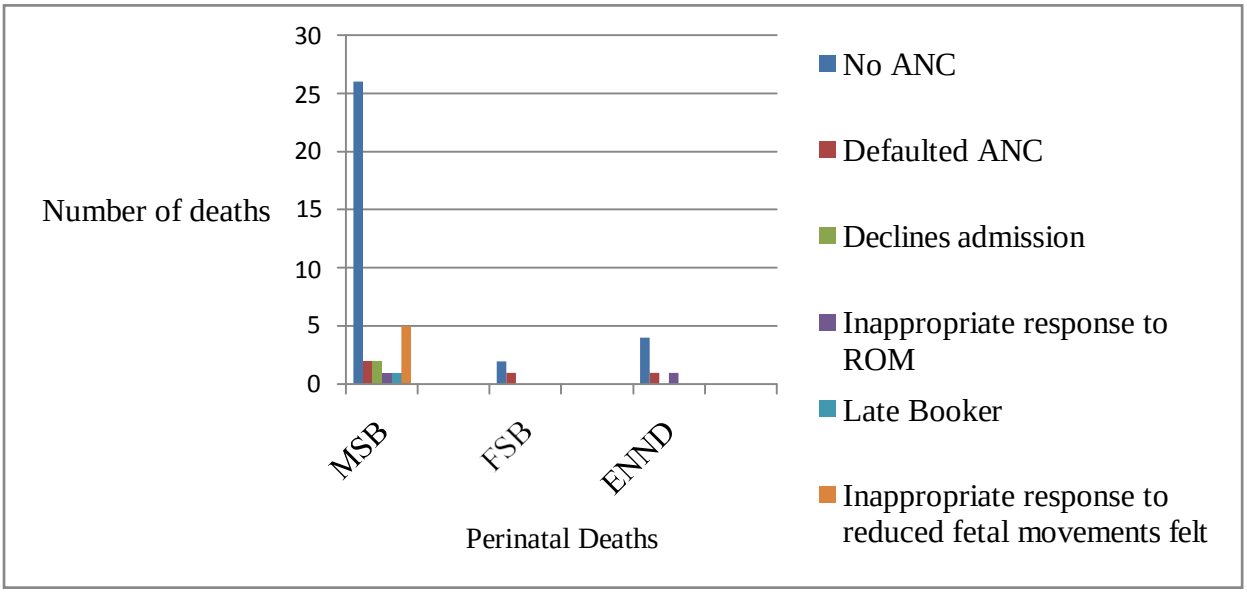

Figure 4 Distribution of avoidable patient related factors

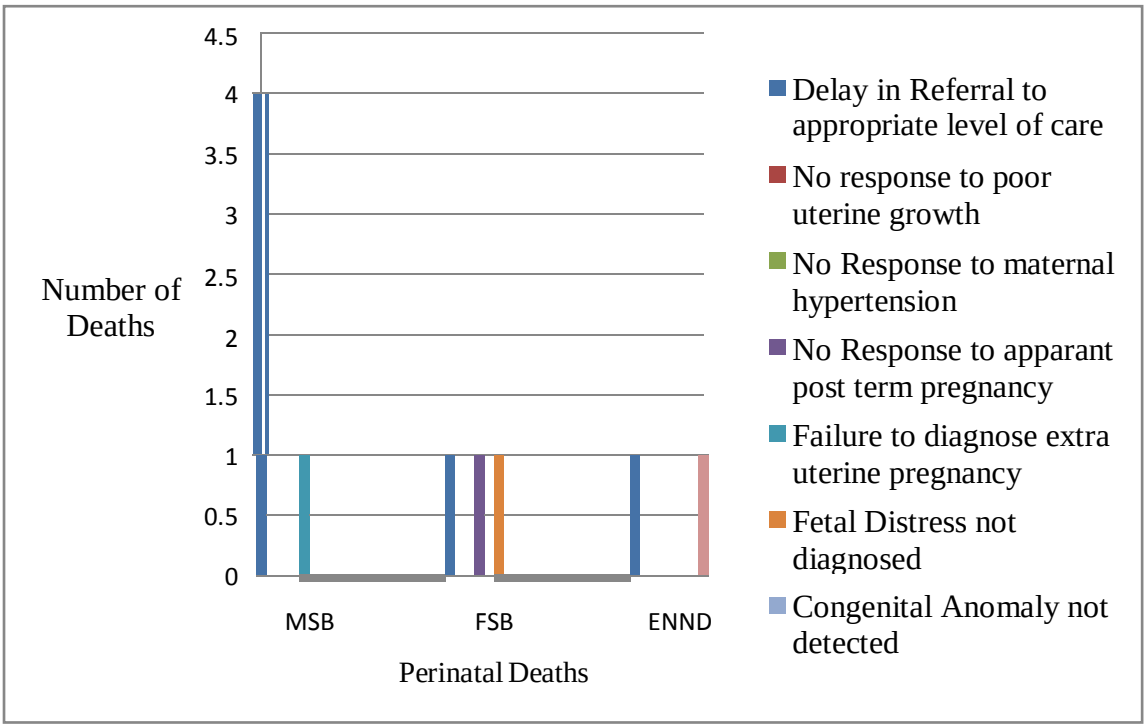

Figure 5 Distribution of avoidable healthcare worker related factors

CHAPTER 3

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CHAPTER 4

APPENDICES

APPENDIX 1

Expedited Ethics Approval

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

23 June 2016

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Approved: 14 August 2016
Expiration of Ethical Approval: 13 August 2017

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APPENDIX 2

Approval from Department of Health

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel.: 033 – 3953189
Fax.: 033 – 394 3782
Email.: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM 200/14
Enquiries : Mr X Xaba
Tel : 033 – 395 2805

Dear Dr ND Frank

Subject: Approval of a Research Proposal

1. The research proposal titled **'An audit of perinatal mortality at King Edward Hospital'** was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at King Edward VIII Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 07/08/14

APPENDIX 3

Data Collection Form

An Audit of Perinatal Mortality at King Edward VIII Hospital – Data Sheet Maternal Data

File No	Age	Gravidity	Parity

	Negative	Positive	Unknown
Rh			

	Neg	Pos	Unknown	Treated
Syphilis Serology				

	Positive	Negative	Unknown	CD4 Count	FDC at 1st visit
HIV					Yes
					No

	Yes	No
Booked		
Booked <20 weeks		

Single Pregnancy	Multiple Pregnancy

SGTT if indicated	Yes	No	N/A

	Yes	No
wt >100kg		
Anaemia in pregnancy (Hb<10g/dl)		

	Yes	No
Documentation of CTG assessed in labour		
Correct CTG assessment (NICE Guidelines)		

Partogram Plotted Appropriately		

	Yes	No
NVD		
Assisted NVD		
C/S		

Gest Age	known	uncertain									
Gest Age calc by	Dates	U/S	Exam								
Gest. Age (weeks)	<28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	>42		
Sex	Male	Female									
Weight(KG)	500g-1kg	1-1.5	1.5-2	2-2.5	2.5-3	3-3.5	3.5-4	>4			
Growth	SGA	AGA	LGA								
Apgars 1min	0	1	2	3	4	5	6	7	8	9	10
Apgars 5min	0	1	2	3	4	5	6	7	8	9	10

Neonatal Data

	Yes	No	N/A
Received 2 doses of steroids			
Need for Resuscitation post delivery			
Congenital Anomalies			
Neonatal Septic work up done			
Antibiotics Given			
CPAP offered			
Baby Ventilated			
Blood Culture Positive			

FBC at Birth	WCC	Hb	Plt

Summary of Case

Name of Antenatal Clinic Attended: No of visits:

MSB FSB ENND

Primary Obstetric Cause of Death:

Final Neonatal Cause of Death:

Past Obstetric History:

Year	Mode of Delivery	Birth weight	Complications

Avoidable Factors:

Patient Related:

Health Provider Related:

Administrative: