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AN AUDIT OF PERINATAL MORTALITY AND MORBIDITY AT A DISTRICT HOSPITAL

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A RESEARCH REPORT SUBMITTED TO THE FACULTY OF HEALTH SCIENCES, UNIVERSITY OF THE WITWATERSRAND, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN THE FIELD OF HOSPITAL MANAGEMENT

JOHANNESBURG

AUGUST 2012

DECLARATION

I, Fridah Busisiwe Gillian Nyathi, declare that this research report is my own work. It is being submitted for the degree of Master Public Health in the field of Hospital Management at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or for any examination at this or any other University.

August, 2012

DEDICATION

I dedicate this work to:

My husband, Zachariah, for the inspiration and support he gave me throughout my studies.

My children Castro and Craig, for your never ending love.

My mother Sannie, for being my pillar and for shaping my future.

Lastly, to all my family and friends, for all the support you gave me, may God bless you all.

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ABSTRACT

BACKGROUND: Globally, perinatal mortality accounts for a large proportion of child deaths. Perinatal mortality rate (PNMR) is taken as an index of efficient obstetric care, and also serves as an indicator for the Millennium Development Goals (MDGs) 4 and 5, that is related to infant mortality rate and improving maternal health (Day, Monticelli, Barron, et al., 2010). In developed countries, perinatal mortality rate has shown a marked decrease over the past few years. This is mostly due to the changing patterns in reproductive health, improved socio-economic factors and quality of maternal and child care (World Health Organization, 2006). However, developing countries are still struggling to curb perinatal deaths. In South Africa, there has been a gradual decline in the PNMR in public health facilities from 38.6 in 2003/2004 to 31.0 per 1000 live births in 2008/2009. However, there has been a slight increase to 32.8 per 1000 live births in 2010/2011 (Day, Barron, Massyn, et al., 2012). In the Mpumalanga province, the PNMR has decreased slightly from 34.9 per 1000 live births in 2008/2009 to 33.2 per 1000 live births in 2010/2011. Carolina Hospital itself has a PNMR which is far too high at 43 per 1000 live births from January to June in 2008/2009. It is assumed that because the sub-district is underserved with primary health care facilities as well as having a poor attendance of antenatal care services by pregnant women, this has subsequently had a negative effect on perinatal care. However, this has never been formally assessed.

AIM: The aim of the study was to describe the perinatal mortality and morbidity, and to identify the causes and avoidable factors of perinatal mortality and morbidity at Carolina Hospital for the period 1st April 2009 to 31st March 2011.

METHODOLOGY: The setting for the study was the maternity unit of Carolina Hospital, a district hospital in the Gert Sibande district, Mpumalanga. It comprised of a retrospective record review of data from the maternity registers and the Perinatal Problem Identification Programme (PPIP); from the 1st April 2009 to the 31st March 2011. All the records of perinatal deaths (N=94) and admissions (N=35) of babies 7 days old and younger during the study period were included in the study and no sampling was done for these two groups of patients. For all other delivery records,

systematic sampling was utilized by choosing every tenth record listed on the sampling frame. Data was extracted from the PPIP and maternity registers using data extraction sheets. Data was captured onto a Microsoft excel based spreadsheet, imported into and analyzed with EPI-Info software version 3.5.1 using descriptive and analytic statistics. Data was collected the number of perinatal deaths, admissions, total number of deliveries, neonatal and maternal profile, causes of perinatal mortality and morbidity and factors associated with perinatal mortality and morbidity

RESULTS: During the period of the study there was a total of 1 604 deliveries with 94 perinatal deaths and 35 perinatal admissions. The perinatal mortality rate was 61.4 per 1000 live births with a stillbirth rate of 47 per live births; and an early neonatal death rate of 14.4 per 1000 live birth. Nine percent of the mothers were unbooked, and this accounted for 11.4% of perinatal morbidity and 17% of the mortality which occurred during the study period. Over a third (34%) of the perinates who died were born from HIV positive mothers; whilst more than halve (54.3%) of those perinates who were admitted during the perinatal period were born from HIV positive mothers. Over two thirds (63.2%) of the perinatal deaths were below 2500g while half (45.7%) of admissions were below this birth weight. Intrauterine death (40.4%) was the leading cause of perinatal mortality at Carolina Hospital for the two years of study. Over the two year study period, patient related factors were the highest avoidable factors given, accounting to 72.9% of the total while health care related avoidable factors accounted to 39.5% of the perinatal mortalities and morbidities.

CONCLUSION: The study found that there was a high PNMR and high still birth rate at Carolina Hospital. The majority of the avoidable factors were patient related. The reasons for this included late booking, delay in seeking medical attention during labour, never initiating antenatal care, infrequent visits to the clinic, and inappropriate response to poor fetal movement. In order to achieve the Millennium Development Goal 4 more attention should be given to reducing perinatal deaths. These indicate a need to strengthen the quality of ANC rendered, especially in the primary health care facilities.

RECOMMENDATIONS: There is a need to strengthen maternal and child health services in the maternity unit of Carolina Hospital, and in the surrounding clinics within the Albert Luthuli sub-district. Clinical governance should be strengthened within Carolina Hospital. There is also a need for maternal and child health specialist outreach services within the Gert Sibande district health as a whole.

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GLOSSARY OF TERMS

Avoidable factor: Action which may have prevented the death of the baby. These factors are classified as health care provider related, patient related and health system/administrative related. For example, if the mother attended antenatal care and the heath care worker failed to screen her for blood pressure; then the avoidable factor will be health care provider related. If the baby is born dead due to hypertension and the mother failed to attend antenatal care; the avoidable factor will be patient related. In cases where the mother attended antenatal care and the health care provider wanted to screen her for blood pressure but the equipment for performing a blood pressure test was not available, then the avoidable factor is due to health system factors (Pattinson, 2003).

Early Neonatal death: Newborn babies who die within the seven days of life (World Health Organization, 2006).

Early Neonatal death rate: Number of early neonatal deaths out of 1000 total live births (Pattinson & Tlebere, 2001).

Gestational age: Interval in completed weeks which has elapsed between the first day of the last menstrual period of the mother and her expected date of delivery (World Health Organization, 1972).

Low birth weight: An infant born weighing less than 2500 grams regardless of gestational age. Low birth weight may be divided into very low birth weight (less than 1500g and extremely low birth weight (less than 1000g) (World Health Organization, 2004).

Perinatal mortality: Stillbirths and deaths in the first seven days of life. The "perinatal period starts at the beginning of fetal viability (28 weeks gestation or 1000g in South Africa and ends at the end of the 7th day after delivery" (Pattinson, & Tlebere, 2001).

Perinatal mortality rate: Number of stillbirths and early neonatal deaths per 1000 live births (Pattinson, & Tlebere, 2001).

Perinatal morbidity: Sick neonates admitted in their first seven days of life. This excludes babies who are kept in the maternity unit as lodgers due to the fact that their mothers have been admitted. It also excludes newborn babies with a satisfactory condition kept in the maternity ward for the six hours of observation post delivery.

Perinatal problem identification programme: An audit tool for evaluating perinatal care (Pattinson, 2009).

Stillbirth: “Death prior to the complete expulsion or extraction of the product of conception from its mother irrespective of the duration of pregnancy” (World Health Organization, 2006).

Stillbirth rate: Number of stillborn infants per 1000 total births (Day, Monticelli, Barron, et al, 2010).

LIST OF ABBREVIATIONS

ALOS	Average length of stay
ANC	Antenatal care
APH	Antepartum haemorrhage
BANC	Basic Antenatal Care
CHC	Community Health Centre
DHIS	District Health Information System
ENMR	Early neonatal mortality rate
GSDM IDP	Gert Sibande District Municipality Integrated Development Plan
HCT	Human Immunodeficiency Virus counseling and testing
HIV	Human Immunodeficiency Virus
HT	Hypertension
MDG	Millennium Development Goal
MMR	Maternal mortality rate
MS	Microsoft
NDOH	National Department of Health
NMR	Neonatal mortality rate
PMTCT	Prevention of Mother-to-Child Transmission of HIV
PNMR	Perinatal Mortality Rate
PPIP	Perinatal problem identification programme
SBR	Stillbirth rate
WHO	World Health Organization

CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

The purpose of this study was to conduct an audit of the perinatal mortality and morbidity at Carolina Hospital, a district hospital in the Mpumalanga province. This introductory chapter will cover the background of the study, problem statement, literature review, justification of the study and its aims and objectives.

1.2 BACKGROUND

1.2.1 Background of the study

Globally, over one hundred and thirty million babies are born every year, and a significant number of those babies die soon after birth. A perinatal death occurs as a result of poor maternal health, inadequate care during the antenatal period and delivery, poor hygiene during delivery and the first hours after birth and poor newborn care (World Health Organization, 2006). In developed countries, where perinatal mortality rates have shown a marked decrease over the past years perinatal deaths are not perceived to be a challenge because of the low frequency of its occurrence. This reduction in rate is mostly due to the changing patterns in reproductive health, improved socio-economic factors and quality of maternal and child care (World Health Organization, 2006). However, developing countries are still struggling to curb perinatal deaths. Mortality and morbidity in the perinatal period are mostly caused by preventable and treatable conditions; therefore regular perinatal audits help in identifying factors that cause perinatal deaths and morbidity (Shrestha, Manandhar, Dhakal, & Nepal 2006).

1.2.2 Background of Gert Sibande district

Carolina Hospital is situated on the South Eastern part of Mpumalanga Province in the Albert Luthuli municipality, Gert Sibande District. Gert Sibande district is one of

three districts in the Mpumalanga Province of South Africa. There are eight district hospitals, one regional and two TB specialised hospitals in the district. There are 22 community health centres, 50 clinics and 949 mobile points. The 2007 census estimates indicated that Gert Sibande district has a population of 890 699 people (Statistics South Africa, 2008). The population is mainly Africans (90.7%) with a majority of females (50.7%). The unemployment rate within the Gert Sibande District is 23.5%, which results in a higher dependency on the Public Health System (Gert Sibande District Municipality, 2010).

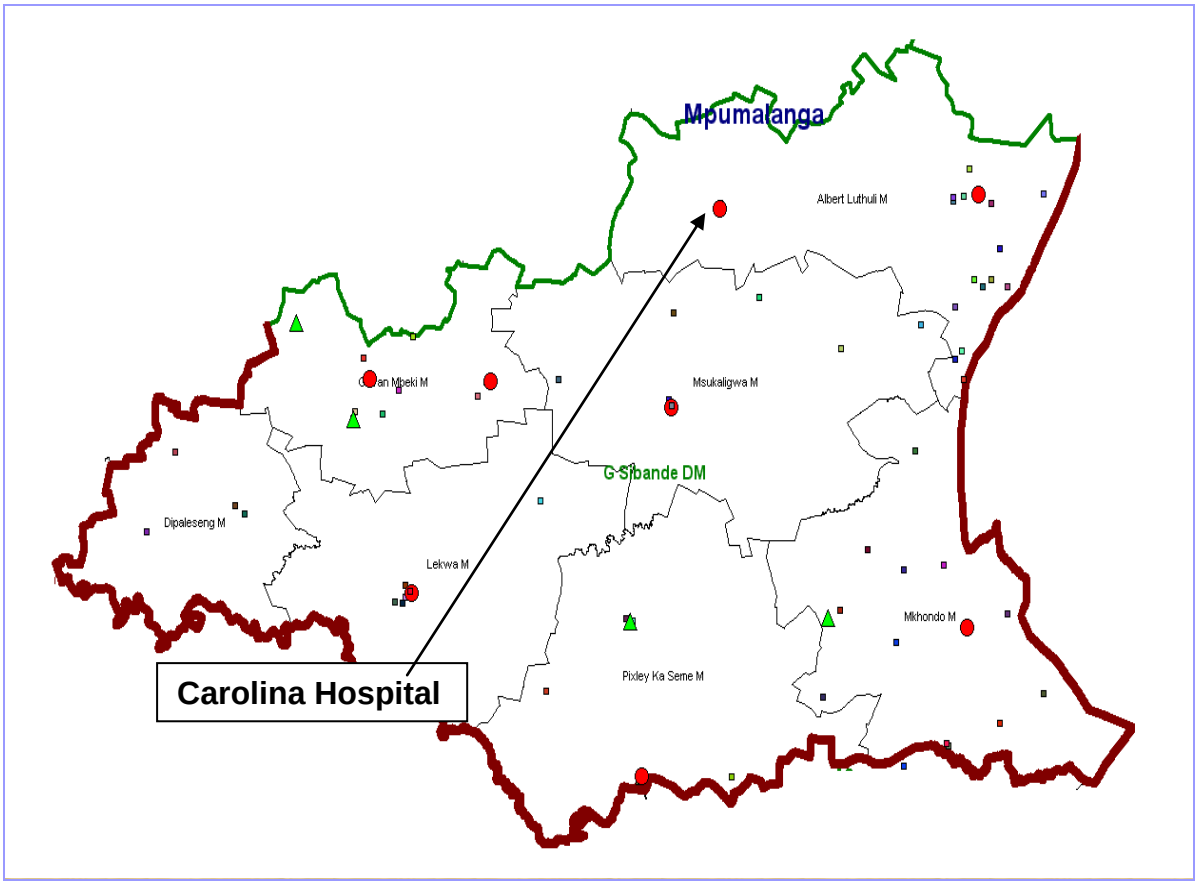

Figure 1.1 Carolina District Hospital in Gert Sibande district, Mpumalanga province

Carolina Hospital

Carolina Hospital provides level one services with eighty approved beds and seventy five useable beds in four inpatient wards: maternity, paediatrics, medical and surgical male and female wards. The hospital renders services to the community of Lothair,

Warburton, Breyten, Hendrina, Badplaas and surrounding farms. There are two clinics near Carolina Hospital; Silobela and Carolina Town clinic which also provide health services to the community of Chief Albert Luthuli municipality. Pregnant women access maternity services from these two clinics, mobile points and other surrounding clinics in the Chief Albert Luthuli sub-district. Although patients requiring normal deliveries are expected to deliver at their nearest clinics, most women prefer to deliver at Carolina Hospital, mostly because there is no community health centre (CHC) in the area. Although the hospital is just a walking distance away for some pregnant women, others access the hospital by taxi and private transport or ambulance. The maternity ward has twenty one adult beds and six cot beds with a total of twenty seven beds. There is an average of fifty to seventy deliveries per month. Deliveries are done by registered midwives; however, medical doctors assist with the deliveries of complicated cases. There are nine midwives, five enrolled nurses and one doctor allocated at the maternity unit. Services at the maternity unit include antenatal care, including a high risk antenatal clinic, delivery, nursery, kangaroo mother care and postnatal care. Women with high risk pregnancies are examined by medical doctors on admission to exclude complications.

Perinatal mortality in Carolina Hospital

Amongst the eight hospitals in the Gert Sibande District, Carolina Hospital has a PNMR which is usually higher than that of the other district hospitals. For a number of years much effort has been made to minimize the high perinatal mortality and morbidity in the facility, however, this remains high. The average PNMR for South Africa for 2008/2009 was 31.4 per 1000 live births (Day, Monticelli, Barron, et al., 2010). In 2006/2007, the PNMR for South African district hospitals was 34.8 per 1000 live births (Pattison, 2009). In Mpumalanga, the average PNMR for 2008/09 was amongst the highest in the country at 34.9 per 1000 live births with the highest in Nkangala district at 44 per 1000 live births (Day, Monticelli, Barron, et al., 2010). The PNMR for Carolina Hospital at 43 per 1000 live births from January to June in 2008/2009 is a matter for concern as one death is a death too many. The PNMR is a sensitive indicator of the health status of women and the quality of obstetric and child health care services (Shrestha, et al., 2006).

1.3 STATEMENT OF THE PROBLEM

Globally, there are estimated 3.3 million stillbirths and three million neonatal deaths per annum (World Health Organization, 2006). This is a cause for concern especially as the target for the fourth Millennium Development Goal (MDG) is to reduce by two-thirds the under-five mortality rate by 2015 (World Health Organization, 2006). The perinatal period is recognized as the most critical period in life because of the various problems which are faced by the neonate (Hoque, Haaq & Islam, 2011). During this period, some of the neonates end up being admitted (26%) as observed in a study conducted at Empangeni hospital in the KwaZulu-Natal province (Hoque, Haaq & Islam, 2011). Carolina Hospital is one of the hospitals in the Gert Sibande district which has a PNMR which is far too high. This raises a question on the quality and effectiveness of maternal health services within the whole sub district of the Albert Luthuli municipality. It is assumed that because the sub-district is underserved with primary health care facilities there is poor attendance of antenatal care services by pregnant women, which subsequently has a negative effect on perinatal care (Mpumalanga Department of Health Service Transformation Plan, 2008). However, this has never been formally assessed.

1.4 LITERATURE REVIEW

1.4.1 Perinatal mortality rate

Globally, perinatal mortality accounts for a large proportion of child deaths (WHO, 2006). The perinatal period starts at the period of fetal viability (28 weeks of gestation) and ends at the end of seven days after delivery. Perinatal mortality is death that occurs during this period and it is the sum of stillbirths and early neonatal deaths (Pattinson & Tlebere, 2001). Communities with very low socio-economic status usually have higher perinatal mortality rates. A high perinatal mortality rate can also be linked to the health status of mothers. In most instances, a high PNMR reflects the socio-economic status of the women. This includes poor nutritional status, low literacy levels, early marriage and child birth. In addition, mortality during the perinatal period is considered to be an important indicator for maternal and child

care. Poor attendance of antenatal care (ANC), poor utilization of healthcare services in general and deliveries by poorly skilled healthcare personnel also contribute to poor maternal and perinatal health outcomes (Claeson, Bos, Mawji, et al., 2000; de Jonge, van der Goes, Ravelli, et al. 2009).

1.4.2 Global trends in perinatal mortality and morbidity

The WHO global estimate on PNMR for the year 2000 was 47 per 1000 live births; 10 per 1000 live births in developed countries, 50 per 1000 live births in developing countries and 60 per 1000 live births in least developed countries. The highest values were particularly noted in Africa at 62 per 1000 live births, with a peak in the middle and western Africa with a PNMR of 75 and 78 per 1000 live births respectively. The PNMR for Asia was 50 per 1000 live births, followed by Oceania at 42 per 1000 live births. The PNMR for Europe remained constant from 1985 to 2000 (World Health Organization, 2006). Stillbirths account for half of the perinatal deaths and third of the stillbirths occurred during delivery (fresh stillbirths). These intrapartum deaths could have potentially been avoidable with skilled care (Stanton, Lawn & Rahman, 2006; World Health Organization, 2006).

Bhutta, Darmstadt, Haws, et al. (2009) are of the view that financial, geographic, and cultural barriers to seeking care, as well as perceptions of poor quality of services at health facilities, discourage the use of services which contributes to poor perinatal health outcomes. Inequities in the distribution of health care resources in developing countries contribute to the high PNMR as well, especially as a greater proportion of the health care services reach urban rather than rural communities (Yu, 2003). This is also true for some developed countries.

Reducing the PNMR is crucial and essential for the achievement of the MDG goal 4. Prevention, early detection and management of diseases, early detection of complications during pregnancy and delivery as well as the provision of quality child care are strategies for improving survival of the fetus and newborn baby (World Health Organization, 2006; World Health Organization, 2002). Conditions of the neonate do not only influence the PNMR, but also influences morbidity as the causes

for both are interrelated. Tomashek, Crouse, Iyasu, et al. (2006) reported on the common causes of morbidity in the perinatal period, which includes jaundice, respiratory conditions such as respiratory distress syndrome, maternal causes of perinatal morbidity such as chronic hypertension, birth trauma and prematurity. Other causes of perinatal morbidity include birth asphyxia, intra-uterine growth restrictions, perinatal infections and congenital malformations.

In a study conducted in Lybia, it was observed that an estimated 85% of newborns were admitted due to different illnesses during the early neonatal period, whilst about 15% of the babies were admitted during the late neonatal period (between the 7th and the 28th day of age). This indicates that although the early neonatal period forms one quarter of the neonatal period, most admissions occurred during that period. The causes of the morbidity in this study were prematurity, birth asphyxia, congenital malformations, neonatal infections and other reasons (Abushhaiwia, Ziyani & Dekna, et al., 2010). According to the survey report on Saving Babies in South Africa (Pattinson, 2000), some of these are avoidable causes of perinatal mortality and morbidity, and therefore, if corrective measures are implemented, the problem can be minimized.

1.4.3 South African trends in perinatal mortality

South Africa is one of the twelve countries in which the mortality rates for children has increased since the Millennium Development Goal declaration in 1999 (Day, Barron, Massyn, et al., 2012). A more recent trend based on the District Health Information System (DHIS) has shown a gradual decline in the PNMR in public health facilities from 38.6 in 2003/2004 to 31.0 per 1000 live births in 2008/2009. However, there has been a slight increase to 32.8 per 1000 live births in 2010/2011 (Day, Barron, Massyn, et al., 2012). From 2008/2009 to 2010/2011, there has been a marked increase of PNMR in some of the provinces. These included the Free State which increased from 37.9 to 43 per 1000 live births, Northern Cape which increased from 32.7 to 38.3 per 1000 live births, North West which increased from 33.1 to 37.8 per 1000 live births. A slight increase has also been noticed in Gauteng (29.6 to 32.1 per 1000 live births) and KwaZulu–Natal (28.3 to 32.6 per 1000 live

births). Two of the provinces however recorded a decrease in the PNMR, and this included the Western Cape from 25.9 to 24.4 per 1000 live births, and Mpumalanga from 34.3 to 33.2 per 1000 live births (Day, Barron, Massyn, et al., 2012).

On comparing districts within the Mpumalanga Province, the PNMR was highest at Nkangala district at 36.2 per 1000 live births in the year 2010/2011, followed by Gert Sibande district at 33.2 per 1000 live births and Enhlanzeni district at 31.8 per 1000 live births (Day, Barron, Massyn, et al., 2012).

1.4.4 Perinatal Problem Identification Programme

In South Africa, every facility which conducts deliveries should hold regular perinatal mortality and morbidity meetings to discuss perinatal deaths. Perinatal mortality and morbidity meetings should be held on monthly basis and should include staff involved in mother and child health care. Details of death are discussed during this period with an emphasis for identifying the causes of death and avoidable factors (National Department of Health, 2008). To facilitate this process the Perinatal Problem Identification Programme (PPIP) has been developed and its use is highly recommended (National Department of Health, 2008). The PPIP is a computer based programme that was developed by the Medical Research Council's Maternal and Infant Health Care Strategies Research Unit in the 1990's and field tested in 1996 (Pattinson, 2000). It has been in use in public facilities nationally since 2000.

Using the PPIP data, a first report on Saving Babies, a perinatal survey report for South Africa was published in 2000. Subsequent reports covered the year 2001, 2002, 2003, 2003-2005, 2006-2007 and 2008-2009. All of these reports described the magnitude of the problem of perinatal mortality in South Africa, the causative factors of these deaths and recommended strategies for improving care in health facilities. As a strategy to improve the perinatal care within the Albert Luthuli sub-district, Carolina Hospital has been implementing PPIP since 2006. In order to strengthen child health strategies, Carolina Hospital has also developed its own Excel audit tool for identifying avoidable causes of perinatal morbidities in the facility. Maternity as well as the admission registers of the perinates are used as sources of

data for perinatal morbidities. Data capturers collect the perinatal data on a daily basis. Auditing of perinatal mortality and morbidity is done as a teamwork comprising of healthcare professionals inclusive of midwives, doctors, nurses, and hospital management. The records are assessed in detail to identify what might have probable caused the mortality or morbidity of the neonate. A list of codes and associated descriptions of avoidable factors as outlined in the PPIP programme are utilized to categorize the causes for mortalities. The tool used by the hospital for morbidities contains the date of birth of the baby, date of admission, diagnosis, gender, weight, gestational age and perinatal outcomes. Instances where a specific action related either to the health care provider, the patient or administrative factors may have prevented the death or admission of the baby is categorized as an avoidable factor.

1.4.5 Primary obstetric causes of perinatal mortality in South Africa

Garssen and Meulen (2004) are of the view that different risk factors have contributed to perinatal mortality and morbidity in recent years. The sixth report on perinatal care in South Africa presents the primary causes of perinatal deaths as outlined in Table 1.1 (Pattinson, 2009).

Table 1.1: Primary causes of perinatal mortality in South Africa

Cause of perinatal death	Percentage
Unexplained intrauterine death	24%
Spontaneous preterm births	23%
Intrapartum asphyxia and trauma	17%
Hypertensive disorders	13%
Antepartum haemorrhage	10%
Infections	5%
Fetal abnormality	4%
Intrauterine growth restriction	2%
Pre-existing medical condition	2%

Source: Saving Babies 2006-2007: Sixth perinatal care Survey of South Africa (Pattinson, 2009).

Garssen (2004) is of the view that perinatal mortality and morbidity is highest amongst babies of teenage mothers and women 40 years and older. This can be extended as it has been found that women above 34 years of age have a higher PNMR related to unexplained stillbirths, spontaneous preterm births, intrapartum asphyxia, and in addition, complications of hypertension (HT), antepartum haemorrhage (APH), fetal abnormalities and pre-existing medical conditions (Pattison, 2009).

On considering the obstetric cause of death for PNMR per birth weight category; the highest death rate was found in the lowest weight category with spontaneous preterm birth, complications of HT and APH being the common causes of death (Pattinson, 2009). Birth weight is a strong predictor for perinatal mortality (World Health Organization, 2004). Birth weight is affected by fetal growth and to a larger extent by the mother's nutritional status during pregnancy (World Health Organization, 2004). The WHO defines low birth weight as birth weight of less than 2500g on delivery (World Health Organization, 2004). In South Africa, the mortality rates of babies with a weight category from 1000 grams (444.6 per 1000 live births) to 1999g (183.2 per 1000 live births) is more common in district hospitals (Pattinson, 2009).

When comparing PNMR between levels of care, the Saving Babies Report indicated that most perinatal deaths occurred in district hospitals. The main causes of these deaths were unexplained stillbirths, spontaneous preterm births, and intrauterine hypoxia and birth trauma (Pattinson, 2009). In 2006/2007, the PNMR for South African district hospitals was 34.8/1000 live births. About thirty five percent (35.9%) of the perinatal deaths were due to early neonatal deaths whilst 64.1% were stillbirths.

1.4.6 Avoidable factors and missed opportunities associated with perinatal mortality and morbidity in South Africa

Pattinson (2009) and Dott, Orakail, Eadi, et al. (2005) are of the view that a substantial proportion of perinatal deaths are avoidable. Avoidable factors may be

patient related, administrative, and health care provider related. A list of potential avoidable factors is outlined in Table 1.2.

Table 1.2: Factors associated with avoidable perinatal mortality in South Africa

Patient related
Never initiated antenatal care
Booked late in pregnancy
Infrequent attendance at antenatal care
Delays in seeking medical attention during labour
Inappropriate response to decreased fetal movements
Inappropriate response to rupture of membranes
Inappropriate response to antepartum haemorrhage
Administrative
Transport delays – Patient to health institution
Transport delays – Between health institutions
Syphilis serology not done
Insufficient staff
Inappropriately trained staff
Insufficient neonatal intensive care facilities
Inadequate facilities
Transport delays – Patient to health institution
Health care provider related
a)Antenatal care
Overestimated fetal size
No response to poor past obstetric history
No response to glycosuria
No response to poor uterine fundal growth
No response to hypertension
No response to abnormal fetal position

No response to apparent post-term pregnancy
No response to positive syphilis serology
No response to report of poor fetal movements
Multiple pregnancy not diagnosed
b)Intrapartum care
Partogram not used
No response to poor progress in labour
Signs of fetal distress interpreted incorrectly
Second stage prolonged without intervention
Inappropriate use if forceps/vacuum
Fetus not monitored
c) Delays
Delay referring patient to secondary/tertiary unit
Delay in calling for assistance
Delay in doctor responding to call
Transport delays – Patient to health institution

Source: Saving Babies 2006-2007: Sixth perinatal care Survey of South Africa (Pattinson, 2009)

The sixth report on perinatal care in South Africa indicates that the district hospitals have the highest proportion of avoidable factors related to health care providers (56.7%) and administrative challenges (63.7%). The quality of care is poor in these levels of care; and is related mostly to the inadequate management of intrapartum asphyxia, birth trauma and spontaneous preterm birth (Pattinson, 2009).

Administrative related factors are also high in South African district hospitals (Pattinson, 2009). Most deaths related to administrative related avoidable factors were related to spontaneous preterm and birth intrapartum asphyxia. The most common cause for this avoidable factor was lack of adequate neonatal facilities (Pattison, 2009). This indicates that the quality of care is poor in this level of care;

therefore, it is important that attention be given to district hospitals to address the challenge of infant deaths (Pattison, 2009).

Over the years, patient related factors have been the most common causes of perinatal mortality (36.5%) (Pattinson, 2009). Those avoidable factors included lack of recognition of a problem and lack of access to health care facilities. Lack of recognition of a problem which accounted for 24% of the patient related avoidable factors includes lack of response to poor fetal movements, ruptures of membranes and antepartum haemorrhage. Lack of access to health care facilities accounted for 64% of the patient related avoidable factors and included delays or insufficient attendance to antenatal care, and delays in seeking medical attention during labour (Pattinson, 2011). These challenges could be addressed if there are constant messages on when to attend antenatal care, if transport is planned for utilisation when the woman goes into labour; and if the woman is made aware of what to do in case of decreased fetal movement (Pattinson, 2009; National Department of Health, 2007).

1.5 ANTENATAL CARE

The antenatal period is the time to prepare the best possible pregnancy outcome for both the mother and the baby (National Department of Health, 2007). This may be achieved by screening and treating any pregnancy problems. This period gives the health care provider the opportunity to give information related to pregnancy (National Department of Health, 2007). During antenatal care the pregnant woman should be offered an antenatal card (National Department of Health, 2007), which is a record of her pregnancy from the time of confirmation of the pregnancy until the time of delivery. "After one antenatal visit, the pregnant woman can be regarded as booked" (National Department of Health, 2007). During delivery, the antenatal card guides the health care providers on activities performed on the woman, any risk factors identified as well as any treatment given during the antenatal period.

The Guidelines for Maternity Care in South Africa (National Department of Health, 2007) clearly indicates that women should visit the health care facility for

confirmation of pregnancy as soon as they suspect that they are pregnant for early antenatal booking and regular antenatal care. However, there is still a challenge in women adhering to the set standard for the attendance of antenatal care. In Sub-Saharan Africa, women presenting for antenatal care are most likely to wait until the second and third trimester (World Health Organization, 2003a). This means that sometimes it may be too late to identify some risk factors. Sometimes the pregnant women may have one antenatal visit before delivery; therefore the results of blood tests, etc cannot be acted on. In addition, if some risk factors are identified, it is sometimes very late to take appropriate action for correcting the problem. Some conditions develop over the pregnancy; so looking at trends, e.g. significant weight gain over the pregnancy indicates risk which may not be picked up if the patient comes late.

The World Health Organization developed a package of care known as the Integrated Management of Pregnancy and Childbirth: Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Practice (World Health Organization, 2003b); which is a quality improvement package for maternal and child health services. This package of care has been adapted by Pattinson to suit South African conditions into an Implementation Package for Basic Antenatal Care (BANC) (Pattinson, et al. 2006). The BANC package describes the minimum antenatal care which pregnant women should receive. It provides guidelines for assessing pregnant women. During the first ANC visit pregnant women with uncomplicated pregnancies are enrolled into the BANC programme, however, those with complications are classified as high risk pregnancies. On subsequent visits, women on the BANC programme are reassessed to determine if they still meet the BANC criteria or whether they need referral for further management. A pregnancy is classified as high risk based on a list of factors such as poor obstetric history, maternal age (age below sixteen years and above thirty four years, general medical conditions, example diabetes mellitus, parity of greater or equal to five, etc (National Department of Health, 2007).

During the antenatal care (ANC), routine investigations are conducted to minimize adverse outcomes through interventions for reducing infections, and managing the

health status of the woman. Tests for Human Immunodeficiency virus (HIV), syphilis serology, and Rhesus factor, haemoglobin and urine dipstick testing for proteins and glucose are conducted (National Department of Health, 2007). In South Africa the potential of health services, including the ANC as an entry point for HIV testing and counselling has strengthened the integration of the prevention of mother to child transmission of HIV (PMTCT) services into maternal child health services (National Department of Health, 2007). The PMTCT package include primary HIV prevention programmes for women of child-bearing age, HIV counselling and testing, safe infant feeding counselling and support, safe obstetric practices and dual therapy to both the mother and baby(National Department of Health, 2007).

1.6 JUSTIFICATION FOR THE STUDY

The high perinatal mortality and morbidity is a global public health challenge. Identifying avoidable causes of perinatal mortality and morbidity at Carolina Hospital will improve the quality of obstetric and perinatal care. Many studies have been done on perinatal mortality and morbidity globally and even in other facilities in South Africa; however, there has been no audit on perinatal mortality and morbidity at Carolina Hospital.

1.7 RESEARCH QUESTION

What are the causes of perinatal mortality and morbidity at Carolina Hospital?

1.8 STUDY OBJECTIVES

1.8.1 Broad objective

To conduct an audit of the perinatal mortality and morbidity rate at Carolina Hospital for the period 1st April 2009 to 31st March 2011.

1.8.2 Specific objectives

The specific objectives of the study were:

1. To determine the perinatal mortality rate (PNMR) at Carolina Hospital between April 2009 and March 2011.
2. To describe the profiles of:
    a. perinatal deaths and perinatal admissions in Carolina Hospital during the period of the study (in terms of birth weight and mode of delivery).
    b. mothers of perinatal deaths and admissions in Carolina Hospital during the period of the study (in terms of age, gestational age of pregnancy, antenatal status, HIV status and risk category).
3. To describe the causes of perinatal mortality and morbidity at Carolina Hospital between April 2009 and March 2011.
4. To determine the factors related to the administration (health system), health care provider, and patient which are associated with perinatal death and morbidity in Carolina Hospital during the time of the study.

CHAPTER 2
METHODOLOGY

The methodology for this study was selected on the basis of its aims and objectives. In this chapter the following are discussed: study design, study setting, study scope, study period, study population, data management, pilot study and ethical considerations.

2.1 STUDY DESIGN

A cross-sectional study design was used for this study, comprising of a retrospective review of maternity records from the 1st April 2009 to 31st March 2011. This included data from the maternity registers, patients' records and the Perinatal Problem Identification Programme (PPIP) including the hospital audit tool used for perinatal morbidity.

2.2 STUDY SETTING

The study took place at the maternity unit of Carolina Hospital, a district hospital in the Gert Sibande district, Mpumalanga.

2. 3 STUDY SCOPE

The study was based on a retrospective review of data from the maternity registers, patients' records and the PPIP for two years (1st April 2009 to 31st March 2011). No primary data was collected for this study.

2.4 STUDY PERIOD

The study period was two years (1st April 2009 to 31st March 2011) based on the financial years.

2.5 STUDY POPULATION AND SAMPLING

Data from the maternity registers was collected for all the perinatal deaths (N=94) and admitted babies (N=35) who stayed at the facility for seven days or less during the study period and no sampling was done for these two groups of patients. This excluded babies who were kept in the maternity unit as lodgers due to the fact that their mothers had been admitted. It also excluded newborn babies with a satisfactory condition kept in the maternity ward for the six hours of observation post delivery. Neonates who stayed in the hospital for more than seven days were not included in the study as seven days was used as a cut off for babies who fall within the perinatal period.

For all other delivery records, systematic sampling was utilized by choosing every tenth record listed on the sampling frame. There were approximately 1604 records in total and when the patients with perinatal deaths and admissions were removed, a sample size of 1475 remained and therefore 146 records were sampled of perinates who were born alive, were well and discharged (N=146). This made up a total sample size of 275.

2.6 DATA MANAGEMENT

2.6.1 Study instrument

MS Excel based data collection tools were designed to capture the data (Annexure A-D).

Tool 1 (Annexure A)

- Data collection sheet for specific objective 1.
- Source of data: PPIP and Maternity registers.
- Data collected: Total number of deliveries, discharge or transferred out (alive), fresh stillbirths, macerated stillbirths and early neonatal deaths.

Tool 2 (Annexure B)

- Data collection sheet for specific objective 2.
- Source of data: PPIP and Maternity registers.
- Data to be collected: Admission date, maternal age, antenatal status, HIV status, on PMTCT, gestational age, risk category, maternal outcome, birth weight, mode of delivery, perinatal status, outcome date (maternal) and outcome date (neonate).

Tool 3 (Annexure C)

- Data collection sheet for specific objective 3 and 4.
- Source of data: PPIP and Maternity registers.
- Data to be collected: Cause of death, avoidable factors (patient, administrative and health care providers). The PPIP has a list of avoidable factors, each with a code that identifies it.

Tool 4 (Annexure D)

- Data collection sheet for specific objective 3 and 4.
- Source of data: PPIP including hospital audit tool.
- Data to be collected: Cause of admission, avoidable factors (patient, administrative and health care provider).

2.6.2 Variables

The variables which were used for the study are outlined in Table 2.1.

Table 2.1: Variables

Specific Objectives	**Variable**
Objective 1	Perinatal mortality rate - Total number of deliveries - Number of fresh stillbirths - Number of macerated stillbirths - Number of early neonatal deaths

Objective 2	Maternal profile - Maternal age - Gestational age - Antenatal status (Booked/unbooked) - HIV status and PMTCT programme participation - Risk category - Length of stay - Maternal outcome
	Neonatal profile - Birth weight (in grams) - Mode of delivery - Length of stay - Perinatal outcome
Objective 3	Causes of perinatal mortality and morbidity - Primary obstetric causes (as listed in Table 1.1)
Objective 4	Factors associated with perinatal mortality and morbidity - Avoidable factors (as listed in Table 1.2)

2.6.3 Data collection

This study utilised information from the maternity registers and the. This data was extracted from the maternity registers and PPIP onto the MS Excel based data collection tools (spreadsheet) (Annexure A to D). The researcher personally captured the data.

2.6.4 Data analysis

The data collected for this study was entered into the MS Excel based spreadsheet. The data was checked for errors and cleaned. The spreadsheet was imported to

EPI-Info software version 3.5.1 for analysis. Patient's names were not entered into the data collection tool. Instead codes were used to identify patients. The following statistics were used for the study:

Descriptive analysis:

Measures of central tendency (mean or median) and measures of dispersion (standard deviation or inter-quartile range) were obtained for continuous variables such as maternal age, gestational age and average length of stay based on the distribution of the data. Categorical variables such as antenatal status, HIV status and risk factors were summarized using frequencies and proportions.

Analytical statistics:

A comparative analysis of the maternal and perinatal profiles across the two years was done (1st of April 2009 to the 31st March 2010, and 1st of April 2010 to the 31st March 2011). In addition, a comparison of the maternal and perinatal profiles by perinatal outcomes was also done. The variables listed in Table 3 were tested. For continuous variables, T-test and Mann-Whitney's U test were used based on the distribution of the data. For categorical variables, Chi-square test and Fisher Exact test were used depending on the expected cell sizes for each analysis. The difference in values was considered to be statistically significant if the p-value was <0.05.

2.7 PILOT STUDY

The data collection tool was pilot tested by looking at the first ten records of March 2009. This was done to determine the feasibility of the study and detect flaws in the data collection tool. No changes were made to the tool after the pilot study was done. The researcher gave the tool codes to make it user friendly and continued to use it as it was developed.

2.8 ETHICAL CONSIDERATIONS

Permission to conduct this study was obtained from the Mpumalanga Department of Health (Appendix E). In addition, permission was obtained from the University of the Witwatersrand Human Research Ethical Committee (Medical) before commencement of the study (M110733). Confidentiality and anonymity was maintained at all times in the collection, capturing, and reporting of information. No personal data was recorded in the data collection tools (spreadsheet). Each record was allocated a unique record number to correspond with the data collection tool for verification of data. Records that linked the file number and study number were kept in a locked cabinet. Access to patient information was limited to the researcher in order to protect patient privacy. All data is presented in aggregate. No interviews were conducted and no intervention was done as part of this study.

CHAPTER 3
RESULTS

The results obtained from the analysis of data are presented in this chapter.

3.1 PERINATAL MORTALITY RATE

During the period of the study there was a total of 1 604 deliveries with 94 perinatal deaths and 35 perinatal admissions. The perinatal mortality rate was 61.4 per 1000 live births with a stillbirth rate of 45 per 1000 births; and an early neonatal death rate of 14.4 per 1000 live births (Table 3.1).

Table 3.1: Perinatal mortality rate

Year	Month	Total number of deliveries	Discharge/ transferred out (Alive)	Fresh stillbirth	Macerated stillbirth	Early neonatal death
2009	April	62	57	4	1	0
2009	May	79	71	5	0	3
2009	June	70	65	4	0	1
2009	July	72	68	1	3	0
2009	August	63	62	1	0	0
2009	September	67	63	1	3	0
2009	October	69	62	2	4	1
2009	November	69	63	0	6	0
2009	December	53	44	4	2	3
2010	January	55	52	0	2	1
2010	February	56	55	0	0	1
2010	March	75	69	2	1	3
2010	April	80	78	0	1	1
2010	May	77	75	0	2	0
2010	June	55	51	0	2	2
2010	July	82	79	0	1	2
2010	August	64	58	0	5	1
2010	September	59	56	1	1	1
2010	October	65	60	0	4	1
2010	November	57	56	0	0	1
2010	December	62	60	1	1	0
2011	January	59	57	1	1	0
2011	February	63	61	1	1	0
2011	March	91	88	2	1	0
TOTAL		1604	1532	30	42	22
Rate/1000 births (Live births for END)				***18.70***	***26.18***	***14.36***
Stillbirth rate/1000 births					***44.89***	
Perinatal mortality rate/1000 live births						***61.36***

3.2 PROFILE OF PATIENTS OVER THE TWO YEAR STUDY PERIOD

For the remainder of the chapter, data is presented from record reviews from all of the perinatal deaths (N=94), all perinatal admissions (N=35) and a sample of perinates who were born alive, were well and discharged (N=146). This made up a total sample size of 275.

3.2.1 Profile of mothers in Carolina Hospital compared over the two year study period

3.2.1.1 Age of mothers

The mean age of the mothers was 24.9 years. The p-value of 0.6503 indicates that there was no statistically significant difference in maternal age across the years. The difference between the mean and median indicates that the data is skewed (Table 3.2).

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Table 3.2: Age of mothers by year

Maternal age (in years)	Mean	Std Dev	Median	Range	p value
2009/2010 (N=149)	24.7	6.7	23.0	13 – 41	0.6503
2010/2011 (N=126)	25.2	6.9	23.5	14 - 50	
Total (N=275)	24.9	6.8	23	13 – 50	

* Mann-Whitney test done

3.2.1.2 Antenatal status

A large proportion of the mothers (90.9%) were booked, whilst 9.1% were unbooked. The p-value of 0.0462 indicates that there was a significant increase in the percentage of mothers who had been booked across the two years (Table 3.3).

Table 3.3: Antenatal status of mothers by year

Antenatal status	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
Booked	250 (90.9%)	131 (87.9%)	119 (94.4%)	0. 0462
Unbooked	25 (9.1%)	18 (12.1%)	7 (5.6%)	

* Fischer Exact test done

3.2.1.3 HIV Status

Out of 275 mothers, 35.6% were reactive to the HIV antibody (Table 3.4). There was however a statistically significant difference (p value 0.0000) between the percentage of the mothers who were reactive to the HIV virus against those who were non-reactive and unknown across the two year period.

Table 3.4: HIV status of mothers by year

HIV status	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
Nonreactive	136 (49.5%)	57 (38.3%)	79 (62.7%)	0.0000
Reactive	98 (35.6%)	58 (38.9%)	40 (31.7%)	
Unknown	41 (14.9%)	34 (22.8%)	7 (5.6%)	

* Chi-square test done

3.2.1.4 Prevention of mother to child transmission of HIV (PMTCT) programme

Just over a third (34.5%) of the mothers were on the PMTCT programme (Table 3.5). There was no statistically significantly difference between the percentages of mothers on the PMTCT programme within the two years of the study (p value 0.1001).

Table 3.5: Mothers on PMTCT by year

On PMTCT	Total (N=275)	2009/2010 (N=148)	2010/2011 (N=126)	p value
No	180 (65.5%)	92 (61.7%)	88 (69.8%)	0.1001
Yes	95 (34.5%)	57 (38.3%)	38 (30.2%)	

* Chi-square test done

3.2.1.5 Gestational age

The gestational age of the mothers' of perinates ranged between 28 to 40 weeks (Table 3.6). There was a statistical significant difference in terms of gestational age within the two years of the study (p value 0.0000).

Table 3.6: Gestational age of mothers by year

Gestational age	Mean	Std Dev	Median	Range	p value
2009/2010 (N=148)	37.5	3.9	40	28 - 40	
2010/2011 (N=126)	39.3	2.1	40	28 - 40	0.0000
Total (N=275)	38.4	3.0	40	28 - 40	

* Mann-Whitney test done

3.2.1.6 Risk category

The risk category is presented in Table 3.7. A high proportion of the mothers (91.3%) had a low risk pregnancy. There was a marginally significant difference in terms of risk categories across the two years of study (p value 0.0653).

Table 3.7: Risk category of mothers by year

Risk category	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
High	24 (8.7%)	17 (11.4%)	7 (5.6%)	0.0653
Low	251 (91.3%)	132 (88.6%)	119 (94.4%)	

* Chi-square test done

3.2.1.7 Maternal outcome

The maternal outcomes are described in Table 3.8. The majority of the mothers were discharged home (98.2%); however, 0.7% of the mothers died. There was no statistically significant difference in the maternal outcome within the two years of study (p value 0.2758).

Table 3.8: Maternal outcome by year

Maternal outcome	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
Death	2 (0.7%)	1 (0.7%)	1 (0.8%)	0.2758
Discharged	270 (98.2%)	145 (97.3%)	125 (99.2%)	
Transferred	3 (1.1%)	3 (2%)	0 (0%)	

* Fisher Exact test done

3.2.1.8 Length of stay of the mothers

The length of stay of the mothers is presented in Table 3.9. The average length of stay of the mothers was 1.7 days.

Table 3.9: Length of stay of the mother by year

Average length of stay	Mean	Std Dev	Median	Range	p value
2009/2010 (N=148)	1.6	1.4	1.0	0 – 7	0.8015
2010/2011 (N=126)	1.8	1.8	1.0	0 – 7	
Total (N=275)	1.7	1.6	1.0	0 – 7	

* Mann-Whitney test done

3.2.3 Profile of perinates in Carolina Hospital over the two year study period

3.2.3.1 Birth weight

The distribution of the birth weight of the perinates is presented in Table 3.10. The birth weight of perinates between 500-999 grams was 6.9%. A statistically significant difference was observed amongst the perinates in terms of birth weight (p value 0.0036).

Table 3.10: Birth weight of the perinates

Birth weight	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
500 – 999g	19 (6.9%)	17 (11.5%)	2 (1.6%)	0.0036
1000 – 1499g	30 (10.9%)	21 (14.1%)	9 (7.1%)	
1500 – 1999g	17 (6.2%)	9 (6.0%)	8 (6.3%)	
2000 – 2499g	25 (9.1%)	14 (9.4%)	11 (8.7 %)	
2500+g	184 (66.9%)	88 (59.1%)	96 (76.2%)	

* Fischer Exact test done

3.2.3.2 Mode of delivery

The mode of delivery of the perinates is presented in Table 3.11. There were no statistically significant differences in terms of mode of delivery within the two years of study (p value 0.2000).

Table 3.11: Mode of delivery of the perinates

Mode of delivery	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
Breech	9 (3.3%)	7 (4.7%)	2 (1.6%)	0.2000
Caesarian section	45 (16.4)	20 (13.4%)	25 (19.8%)	
Forceps	1 (0.4%)	1 (0.7%)	0 (0%)	
NVD	220 (80%)	121 (81.2%)	99 (78.6%)	

* Fischer Exact test done

3.2.3.3 Length of stay of the perinates

The distribution of the average length of stay of the perinates is presented in Table 3.12. There was no significant difference in the average length of stay of the perinates within the two years of study (p value 0.2321).

Table 3.12: Average length of stay of the perinates (N=275)

Average length of stay	Mean	Std Dev	Median	Range	p value
2009/2010(N=148)	1.5	1.9	1.0	0 - 7	0.2321
2010/2011 (N=126)	1.7	2.0	1.0	0 - 7	
Total	1.6	1.9	1.0	0 - 7	

* Mann-Whitney test done

3.3 PERINATAL OUTCOMES

The perinatal outcomes are described in Table 3.13. Nearly eleven percent (10.9%) of the perinates were fresh stillbirths, whilst 14.9% of the perinates were macerated stillbirths, and 8.4% were early neonatal deaths. The differences in the perinatal outcomes between the two years under study were found to be statistically significantly different (p value 0.0207). Of note, there was a decrease in fresh stillbirths and to some degree early neonatal deaths from 2009/2010 to 2010/2011.

Table 3.13: Perinatal outcomes

Perinatal outcomes (detailed)	Total (N=275)	2009/2010 (N=149)	2010/2011 (N=126)	p value
Admission	35 (12.7%)	18 (12.1%)	17 (13.5%)	0.0207
Early neonatal death	23 (8.4%)	15 (10.1%)	8 (6.3%)	
Fresh stillborn	30 (10.9%)	24 (16.1%)	6 (4.8%)	
Macerated stillborn	41 (14.9%)	22 (14.8%)	19 (15.1%)	
Well (Discharged)	146 (53.1%)	70 (47.0%)	76 (60.3%)	

* Chi-square test done

3.4 PROFILE OF PATIENTS BY PERINATAL OUTCOME

3.4.1 Profile of mothers in Carolina Hospital by perinatal outcome

3.4.1.1 Age of mothers by perinatal outcome

The p-value of 0.5546 indicates that there was no statistically significant difference in maternal age by perinatal outcome (Table 3.14).

Table 3.14: Age of mothers in years by perinatal outcome

Perinatal outcome	Mean	Std Dev	Median	Range	p value
Admission (N=35)	24.3	6.9	23.0	16 – 41	0.5546
Death (N=93)	25.3	6.7	24.5	13 – 41	
Well (N=146)	24.9	6.8	23.0	15 – 50	

*Mann-Whitney test done

3.4.1.2 Antenatal status

A statistically significant difference (p value 0.0015) was noted in the percentage of booked mothers amongst perinates who were discharged (96.6%) compared to those who were admitted (88.6%) or died (83%) (Table 3.15).

Table 3.15: Antenatal status of mothers by perinatal outcome

Antenatal status	Admission (N=35)	Death (N=94)	Well (N=146)	p value
Booked	31 (88.6%)	78 (83.0%)	141 (96.6%)	0.0015
Unbooked	4 (11.4%)	16 (17.0%)	5 (3.4%)	

* Fischer Exact test done

3.4.1.3 HIV Status

There was a statistical significantly difference (p value 0.0141) in the percentage of the HIV positive mothers whose babies were admitted (54.3%) in the perinatal period

as compared to 34% of perinates who had died and 32.2% of those who were discharged (Table 3.16).

Table 3.16: HIV status of mothers by perinatal outcome

Antenatal status	Admission (N=35)	Death (N=94)	Well (N=146)	p value
Non reactive	13 (37.1%)	41 (43.6%)	82 (56.2%)	0.0141
Reactive	19 (54.3%)	32 (34.0%)	47 (32.2%)	
Unknown	3 (8.6%)	21 (22.2%)	17 (11.6%)	

* Fischer Exact test done

3.4.1.4 Prevention of mother to child transmission of HIV (PMTCT) programme

A statistically significant difference was found between the percentage of mothers on the PMTCT programme and perinatal outcome (p value 0.0280). A third (29.8%) of perinates who had died had mothers on the PMTCT programme (Table 3.17).

Table 3.17: Mothers on PMCT by perinatal outcome

On PMTCT	Admission (N=35)	Death (N=93)	Well (N=146)	p value
No	16 (45.7%)	66 (70.2%)	98 (67.1%)	0.0280
Yes	19 (54.3%)	28 (29.8%)	48 (32.9%)	

* Chi-square test done

3.4.1.5 Gestational age

There was a statistically significant difference in terms of gestational age and the perinatal outcome (p value 0.0000) with babies who died having a lower gestational age (36.2 weeks) than those who were admitted (38.1 weeks) or discharged well (39.7 weeks) (Table 3.18).

Table 3.18: Gestational age of mothers by perinatal outcome

Gestational age	Mean	Std Dev	Median	Range	p value
Admission (N=35)	38.1	3.1	40	30 - 40	0.0000
Death (N=94)	36.3	4.6	40	28 - 40	
Well (N=146)	39.7	0.9	40	33 - 40	

* Mann-Whitney test done

3.4.1.6 Risk category

The risk category distribution is presented in Table 3.19. A high proportion of perinates who were admitted (85.7%) or died (90.4%) were born by mothers who were classified to be a low risk pregnancy. There was thus no statistically significant difference found in the risk category of pregnancy by perinatal outcome (p value 0.3519).

Table 3.19: Risk category of pregnancy by perinatal outcome

Risk category	Admission	Death	Well	p value
High	5 (14.3%)	9 (9.6%)	10 (6.8%)	0.3519
Low	30 (85.7%)	85 (90.4%)	136 (93.2%)	

*Chi-square test done

3.4.1.7 Maternal outcome

The maternal outcomes are described in Table 3.20. As expected, there was no statistically significant difference in the maternal outcome by perinatal outcome in the study (p value 0.1126).

Table 3.20: Maternal outcome by perinatal outcome

Maternal outcome	Admission	Death	Well	p value
Death	0 (0%)	2 (2.1%)	0 (0%)	0.1126
Discharged	34 (97.1%)	90 (95.7%)	146 (100%)	
Transferred	1 (2.9%)	2 (2.1%)	0 (0%)	

* Fischer Exact test done

3.4.1.8 Average length of stay of the mother

The length of stay of the mothers is presented in Table 3.21. The differences in the average length of stay of the mother by perinatal outcome within the two years of the study was statistically significant (p value 0.0001) as mothers who had perinates that were admitted had a length of stay double that of mothers whose perinates were discharged or died.

Table 3.21: Length of stay of the mother by perinatal outcome

Average length of stay	Mean	Std Dev	Median	Range	p value
Admission (N=35)	3.3	2.3	3.0	0 - 7	0.0001
Death (N=94)	1.5	1.3	1.0	0 - 6	
Well (N=146)	1.5	1.4	1.0	0 - 6	

* Mann-Whitney test done

3.4.2 Profile of perinates in Carolina Hospital by perinatal outcome

3.4.2.1 Birth weight

According to the perinatal outcome, a third of the perinatal deaths (37.2%) were above 2500 gram, whilst 20.4 % of those who died were between 500 grams to 999 grams. Nearly twenty percent (19.4%) of those who died were between 1000-1499 grams. The majority of the admitted neonates (54.3%) were above 2500 grams, whilst 22.9% of the admitted neonates were between 1000-1499 grams. About 90% of perinates who were discharged had a birth weight 2500 grams or more. Four of the neonates (2.7%) were discharged with a birth weight of 1000-1499 (Table 3.22). The differences in birth weight by perinatal outcome were found to be statistically significantly different (p value 0.0000).

Table 3.22: Birth weight by perinatal outcome

Birth weight	Admission (N=35)	Death (N=94)	Well (N=146)	p value
500 – 999g	0 (0%)	19 (20.4%)	0 (0%)	0.0000
1000 – 1499g	8 (22.9%)	18 (19.4%)	4 (2.7%)	
1500 – 1999g	4 (11.4%)	13 (13.8%)	0 (0%)	
2000 – 2499g	4 (11.4%)	9 (9.6%)	12 (8.2 %)	
2500+g	19 (54.3%)	34 (37.2%)	130 (89%)	

* Fischer Exact test done

3.4.2.2 Mode of delivery

The mode of delivery of the perinates is presented in Table 3.23. A third (34.3%) of the perinates who were admitted were born by caesarean section compared to 11.7% who died. The differences in the mode of delivery by perinatal outcome were found to be statistically significantly different (p value 0.0074).

Table 3.23: Mode of delivery by perinatal outcome

Mode of delivery	Admission (N=35)	Death (N=94)	Well (N=146)	p value
Breech	2 (5.7%)	6 (6.4%)	1 (0.7%)	0.0074
Caesarian section	12 (34.3%)	11 (11.7%)	22 (15.1%)	
Forceps	0 (0%)	0 (0%)	1 (0.7%)	
NVD	21 (60.0%)	77 (81.9%)	122 (83.6%)	

* Fischer Exact test done

3.4.2.3 Length of stay of the perinates

The distribution of the average length of stay of the perinates by perinatal outcome is presented in Table 3.24. As expected, the differences in the average length of stay of the perinates were found to be statistically significantly different (p value 0.0000).

Table 3.24: Average length of stay of the perinates by perinatal outcome

Average length of stay	Mean	Std Dev	Median	Range	p value
Admission (N=35)	5.4	1.3	5.0	3 - 11	0.0000
Death (N=94)	0.3	0.7	0.0	0 - 5	
Well (N=146)	1.5	1.4	1.0	0 - 6	

* Mann-Whitney test done

3.5 CAUSES OF PERINATAL MORTALITY AND MORBIDITY

3.5.1 Causes of perinatal mortality

The causes of perinatal mortality are presented in Table 3.25. Intrauterine death (40.4%) was the leading cause of perinatal mortality at Carolina Hospital for the two years of study. Hypoxia was the second cause of perinatal death (30.9%). Immaturity (19.1%) was the third cause of death during the perinatal period. Birth trauma accounted for 3.2% of the deaths, whilst infection and other causes were responsible for two percent (2.1%) of the perinatal deaths.

Table 3.25: Causes of perinatal morbidity by perinatal outcome

Cause of admission or death	Death (N=94)
Intrauterine death	38 (40.4%)
Hypoxia	29 (30.9%)
Immaturity related	18 (19.1%)
Trauma	3 (3.2%)
Infection	2 (2.1%)
Other	2 (2.1%)
Congenital abnormalities	1 (1%)
Unknown cause of death	1 (1.1%)

3.5.2 Causes of perinatal morbidity

The causes of perinatal morbidity are presented in Table 3.26. Hypoxia (34.3%) and immaturity (31.4%) were the leading causes of perinatal morbidity. Infection accounted for 17.1% of the admissions. Birth trauma accounted for 11.4% of the admissions, whilst 5.7% of the perinates were admitted due to congenital abnormalities.

Table 3.26: Causes of perinatal morbidity

Cause of admission or death	**Admission (N=35)**
Hypoxia	12 (34.3%)
Immaturity related	11 (31.4%)
Infection	6 (17.1%)
Trauma	4 (11.4%)
Congenital abnormalities	2 (5.7%)

3.5.2 Avoidable factors related to perinatal mortality and morbidity in Carolina Hospital

The avoidable factors related to perinatal mortality and morbidity are presented in Table 3.27. Over the two year study period, health care related causes occurred in 39.5% of the perinatal mortalities and morbidities. A large proportion of the perinates (72.9%) were admitted or died due to patient related causes. There was no statistically significant difference in the avoidable factors over the two years of study period. One delivery could have more than one avoidable factor; therefore the analysis had to be done as presented in Table 3.27.

Table 3.27: Avoidable factors for perinatal mortality and morbidity over the two year study period

Avoidable causes of perinatal mortality and morbidity	Total	2009/2010	2010/2011	p value
Patient related causes	94 (72.9%)	59 (74.7%)	35 (70.0%)	0.3500
Health care related causes	51 (39.5%)	34 (43.0%)	17 (34.0%)	0.2258
Administrative causes*	3 (2.3%)	3 (3.8%)	0 (0%)	0.2262

* Fischer Exact test done

3.5.3 Avoidable factors by perinatal outcome

The avoidable factors by perinatal outcome are presented in Table 3.28. Although a significant percentage of the admissions (77.1%) and deaths (73%) were patient related, there was no statistically significant difference in the avoidable causes and the perinatal outcomes within the two years of study (p value 0.3658).

Table 3.28: Avoidable factors by perinatal outcome

Avoidable causes of perinatal mortality and morbidity	Admission	Death	p value
Patient related causes	27 (77.1%)	67 (71.3%)	0.3336
Health care related causes	13 (37.1%)	38 (40.4%)	0.4483
Administrative causes*	0 (0%)	3 (3.2%)	0.3835

* Fisher exact test done

3.5.4 Specific avoidable factors related to perinatal mortality and morbidity in Carolina Hospital

The specific avoidable factors are presented in Table 3.29. Patient related factors were the highest avoidable factors given, accounting to 72.9% of the total. These included women who booked late in pregnancy (26.4%), delay in seeking medical attention during labour (17.8%), never initiating antenatal care (12.4%), infrequent

visits to antenatal clinic (8.5%) and inappropriate response to poor fetal movement (7.8%).

Health care related factors were the next commonest avoidable factors cited (39.5%). The top five health care related factors included inappropriate response to poor fetal movement (7.8%), fetal distress not detected in the intrapartum period while the fetus was monitored (6.2%), physical examination of patient in clinic incomplete (6.2%), medical personnel underestimated fetal size (4.7%) and delay in doctor responding to a call (3.1%).

Administrative causes accounted for 3.2% of the avoidable factors. Nearly two percent (1.6%) of the women were not screened for syphilis serology during the antenatal period.

Table 3.29: Specific avoidable factors

Patient related factors	**Total**	**2009/2010**	**2010/2011**
Booked late in pregnancy	34 (26.4%)	16 (20.3%)	18 (36.0%)
Delay in seeking medical attention during labour	23 (17.8%)	18 (22.8%)	5 (10%)
Never initiated antenatal care	16 (12.4%)	11 (13.9%)	5 (10.0%)
Infrequent visits to antenatal clinic	11 (8.5%)	5 (6.3%)	6 (12.0%)
Inappropriate response to poor fetal movement	10 (7.8%)	9 (11.4%)	1 (2.0%)

Health care related factors	**Total**	**2009/2010**	**2010/2011**
Poor progress in labour, partogram interpreted incorrectly	10 (7.8%)	6 (7.6%)	4 (8%)
Fetal distress not detected intrapartum, fetus monitored	8 (6.2%)	5 (6.3%)	3 (6%)
Physical examination of patient in clinic incomplete	8 (6.2%)	5 (6.3%)	3 (6%)
Medical personnel underestimate fetal size	6 (4.7%)	4 (5.1%)	2 (4%)

Delay in doctor responding to a call	4 (3.1%)	2 (2.5%)	2 (4%)
Delay in medical personnel calling for expert assistance	3 (2.3%)	2 (2.5%)	1 (2%)
Management of second stage, prolonged with no intervention	2 (1.6%)	1 (1.3%)	1 (2%)
Poor progress in labour, partogram not used correctly	2 (1.6%)	2 (2.5%)	0 (0%)
Breech presentation not diagnosed till late in labour	1 (0.8%)	1 (1.3%)	0 (0%)
Delay in referring patient for secondary/tertiary treatment	1 (0.8%)	0 (0%)	1 (2%)
Incorrect management of antepartum haemorrhage	1 (0.8%)	1 (1.3%)	0 (0%)
Multiple pregnancy not diagnosed intrapartum	1 (0.8%)	1 (1.3%)	0 (0%)
No response to history of stillbirths	1 (0.8%)	1 (1.3%)	0 (0%)
No response to maternal hypertension	1 (0.8%)	1 (1.3%)	0 (0%)
No response to positive syphilis serology	1 (0.8%)	1 (1.3%)	0 (0%)
Prolonged second stage with no intervention	1 (0.8%)	1 (1.3%)	0 (0%)

Administrative related factors	**Total**	**2009/2010**	**2010/2011**
No syphilis screening performed at the clinic	2 (1.6%)	2 (2.5%)	0 (0%)
Inappropriate trained staff	1 (0.8%)	1 (1.3%)	0 (0%)

CHAPTER 4
DISCUSSION

In this chapter, the results obtained from the analysis of the data are discussed and compared with those from other published studies.

4.1 INTRODUCTION

This study was done in order to describe the PNMR and to identify the causes and avoidable factors of perinatal mortality and morbidity at Carolina Hospital, a district hospital in Gert Sibande District in the Mpumalanga Province during a two year study period (1st April 2009 - 31st March 2011). No study had been conducted previously at the level of a district hospital in the Mpumalanga Province to look at the various factors that influence the perinatal mortality rate.

4.2 PERINATAL MORTALITY RATE

The study highlighted a high PNMR of 61.4 per 1000 live births. In the Mpumalanga Province the PNMR for the year 2010/2011 was 33.2 per 1000 live births (Day, Barron, Massyn, et al., 2012). Trends suggest a gradual decline in the PNMR from 35.4 per 1000 live births in 2003/2004 to 29.4 per 1000 per live births in 2004/2005. However, there has been a slight increase to 34.9 per 1000 live births in 2008/2009 (Day, Monticelli, Barron, et al., 2010). On comparing districts within the Mpumalanga Province, the PNMR was highest at Nkangala district at 36.2 per 1000 live births in the year 2010/2011, followed by Gert Sibande district at 33.2 per 1000 live births and Enhlanzeni district at 31.8 per 1000 live births (Day, Barron, Massyn, et al., 2012). The National PNMR for South Africa was 38.6 per 1000 live births in the year 2003/2004; with a gradual decline to 31.0 per 1000 live births in 2008/2009. However, there has been a slight increase to 32.8 per 1000 live births in 2010/2011 (Day, Barron, Massyn, et al., 2012). The World Health Organization estimated the global PNMR of 43 per 1000 live births in 2004; with a stillbirth rate of 22 per 1000 live births and an early neonatal death rate of 21 per 1000 live births (WHO, 2007).

The stillbirth rate (SBR) was 44.9 per 1000 births at Carolina Hospital. Macerated stillbirths accounted for fifty eight percent (58.3%) of the stillbirths, whilst fresh stillbirths accounted for 41.7%. In the Mpumalanga province, there has been a gradual decrease in the SBR from 24.9 per 1000 births in the year 2003/2004 to 22.8 per 1000 births in 2007/2008. There was however a slight increase to 24.5 per 1000 births in 2008/2009 with a light decrease to 24.3 per 1000 births in 2010/2011 (Day, Monticelli, Barron, et al., 2010; Day, Barron, Massyn, et al., 2012). According to the sixth report on perinatal deaths in South Africa, sixty percent of the babies born in public hospitals were macerated stillbirths, whilst 40% were fresh stillbirths. Most of the fresh stillbirths occurred in district hospitals; therefore improving the quality of intrapartum care at that level will have the biggest impact in child health (Pattinson, 2009). The high macerated stillbirth rate indicates a need for improving the antenatal care services in the primary health care setting within the Gert Sibande district.

The early neonatal death rate (ENDR) was 14.4 per 1000 live births during the time of the study. In South Africa the ENDR has increased from 16 to 35.8 per 1000 live births from 2004 to 2008/2009 (Pattinson, 2011; WHO, 2007). Globally, the ENDR for 2004 was 21 per 1000 live births (WHO, 2007). In Carolina Hospital the percentage of early neonatal deaths and fresh stillbirths declined quite a bit in the two year period. This means that the care provided at Carolina Hospital is probably good; however, this should be observed in the future to see if this is sustained. For macerated stillbirths, there is a need to improve the ANC services and education of patients.

4.3 PROFILE OF PATIENTS

4.3.1 Maternal profile

4.3.1.1 Maternal age

The age of mothers ranged from 13 years to 50 years. There was no statistically significant difference in the median maternal age by perinatal outcome. However,

Garssen (2004) is of the view that perinatal mortality and morbidity is highest amongst babies of teenage mothers and women 40 years and older. A pregnant woman aged 16 and less, or aged 40 and more are classified as high risk according to the WHO antenatal care model (2002). It was therefore surprising that this was not found in this study. This could either imply that women with high risk pregnancies due to age profile are identified early and properly managed or that all women are inadequately managed and therefore have equally poor outcomes.

4.3.1.2 Risk category

The results of this study showed that a low proportion of the women (8.7%) were classified as having a high risk pregnancy according to the Guidelines for Maternity Care in South Africa (National Department of Health, 2007). The WHO antenatal care model classifies high risk pregnant women as those women who need special care based on their risk factors (World Health Organization, 2002). Generally, 25% of pregnant women are high risk (World Health Organization, 2002), therefore, some women at risk may have been missed during antenatal care or wrongly categorized during the study period. This may be due to the fact that health care providers may have inadequate knowledge in categorizing women who are at risk during the ANC, or screening of the woman is not done in totality, hence the wrong categorizing of women. There is however a problem in the manner in which health care providers categorizes women at risk during the antenatal period. It is therefore necessary that during the first antenatal visit, health care providers implement the checklist of risk factors which will assist in identifying women at risk and institute early management to decrease avoidable factors of perinatal mortality and morbidity (National Department of Health, 2007).

4.3.1.3 Antenatal status

Antenatal care and skilled obstetric care are important strategies for improving maternal and newborn health outcomes, however many women in developing countries go through pregnancy without using these services (Iyanuwura & Yussuf, 2009). Many health problems can be prevented, detected and treated during

antenatal care with skilled health care providers (WHO, 2003a). In this study, the majority of the women (90.9%) were booked for antenatal care, and this increased significantly over the two year period, which is good. However, ensuring good quality of ANC care is important.

Amongst developing countries, just over 70% of the women attended antenatal care services in 2000-2001, with the highest in Latin America at 86% and the lowest in South Asia at 54%. In the Sub-Saharan Africa, 68% of the women attended at least one antenatal care visit in 2000-2001, with South Africa having an attendance rate of 94% (World Health Organization, 2003a). The WHO recommends a minimum of four antenatal care visits comprising of screening, risk identification and care (World Health Organization, 2003a). This will ensure that identified risks are managed earlier to minimize avoidable mortalities and morbidities for both the mother and the baby. In South Africa, after one visit to the ANC, a pregnant woman is considered to be "booked" (National Department of Health, 2007).

Despite the relatively high proportion of the women who booked for antenatal care, 9.1% of the women in this study never attended antenatal services. This accounted to 11.4% of perinatal morbidity and 17% of the mortality which occurred during the study period. The results of the study also indicated that the majority of the women who booked had well babies (96.6%).

However, 88.6% of the perinatal morbidities and 83% of the mortalities were from booked mothers. This figure is high, and makes one worry about the quality of antenatal care. In a similar study conducted in Pakistan, Nisar and Amjad (2007) concluded that the antenatal care provided in public health facilities needed improvement by increasing both material and human resources. In South Africa, the Saving Babies Report shows that the idea behind antenatal care is not only to encourage women to attend antenatal care, but to encourage them to attend early (Pattinson, 2000). During antenatal care, pregnant women are also counseled for HIV as one of the strategies to decrease perinatal mortality.

4.3.1.4 HIV status

At the end of 2010, an estimated 34 million people were living with HIV globally; however, the number of people newly infected with HIV has been declining. South Africa's HIV epidemic remains the largest in the world, with an estimate of 5.6 million people living with HIV (World Health Organization, 2011a). The HIV prevalence amongst antenatal women in South Africa however has shown some stability for the past years at 29.1% in 2006 to 29.4% in 2009 (National Department of Health, 2011a). The HIV prevalence amongst antenatal women for the year 2010 in South Africa has increased to 30.2%; however, the increase was not statistically significant. The highest HIV prevalence estimate was reported in Kwazulu-Natal at 39.5%, followed by Mpumalanga at 35.1%, with the lowest in Northern Cape at 18.4%. In Mpumalanga the highest HIV prevalence estimate among antenatal women has been noted in the Gert Sibande district at 38.8 % (National Department of Health, 2011a).

This study found that 35.6% of the pregnant women were reactive to the HIV antibody with a significant increase in the percentage of pregnant women being tested over the two years. This might be due to the efforts to improve PMTCT programmes and health care provider initiated HIV counseling and testing (HCT) campaigns occurring in the facility and the surrounding clinics. In addition, there was a significant decline of 7.2% (from 38.9% in 2009/2010 to 31.7% in 2010/2011) in the percentage of HIV amongst the women. The decline in HIV prevalence may be due to the fact that in the past only women who were suspected of having HIV were being tested, and currently as more women are being tested a better sense of the actual prevalence figures are obtained.

Over a third (34%) of the perinates who died were born from HIV positive mothers; whilst more than halve (54.3%) of those perinates who were admitted during the perinatal period were born from HIV positive mothers. The risk of transmission of HIV from mother to child (MTCT) during pregnancy is 5 - 10% (National Department of Health, 2007). "In the absence of any interventions to prevent MTCT; it is estimated that in about 30% of the cases, the HIV virus will be transmitted from mother to child"

(National Department of Health, 2007). Just over a third (34.5%) of the mothers were on the PMTCT programme. In this study, one woman in the first year, and two in the second year who were HIV positive were not on the PMTCT programme. This figure indicates that there is good utilization of the PMTCT programme by pregnant. It is however not known if the women participated late in the PMTCT programme and whether they actually took the anti-retroviral given to them. This would need to be investigated in future studies.

4.3.1.5 Gestational age

Gestational age and birth weight are important determinants of perinatal mortality (Pattinson, 2003). In most cases, birth weight is used to determine child survival instead of gestational age as in a large number of women the gestational age is not known (Pattinson, 2003). In this study the gestational age of the mothers' of perinates ranged between 28 to 40 weeks. There was a statistically significant difference in the mean gestational age and the perinatal outcome with babies who died having a lower gestational age (36.2 weeks) than those who were admitted (38.1 weeks) or discharged well (39.7 weeks). The mean gestational age of 36.2 weeks indicates that those babies were born prematurely. Trends indicate that the higher the gestational age, the better the perinatal outcome.

4.4 PERINATAL PROFILE

4.4.1 Birth weight

During the study period the birth weight of the perinates at Carolina Hospital ranged from 500g to just above 2500g. The WHO defines low birth weight as birth weight of less than 2500g on delivery (World Health Organization, 2004). In most cases, women with premature labour come to the hospital too late for health care providers to refer to the next level of care. This is mostly related to the rural nature of the Albert Luthuli sub-district, and the fact that a significant number of the women using the facility are from the farms where transport may be a challenge. The district health services should therefore explore the utilisation of maternity waiting homes

which may be located in community health centres to strengthen the accessibility of maternal services. There was a significant increase in the number of deliveries >2.5kg over the two years.

Over two thirds (63.2%) of the perinatal deaths were below 2500g while just less than half (45.7%) of admissions were below this birth weight. In South African, a large number of neonatal mortalities occur in district hospitals, with the highest mortalities occurring between 1000-2000g. In most cases, district hospitals do not have adequate equipment to manage very low weight babies. It is therefore important to strengthen the care of low birth weight babies in all levels of care (Pattinson, 2009), especially in rural areas, where it is hard to refer women and where referral facilities might be far away

About 90% of perinates who were discharged had a birth weight of 2500 grams or more. Four of the neonates (2.7%) were discharged with a birth weight of 1000-1499g. This is a concern as low birth weight is associated with perinatal mortality and morbidity, therefore those perinates discharged with a low birth weight may be at risk (WHO, 2004). The recommended discharge weight for a low birth weight baby is 1800g to 2000g (National Department of Health, 2008a). The weight at discharge depends on the baby's well being, the mother's confidence to care for the baby, socio-economic factors and access to follow up facilities (National Department of Health, 2008a). After the researcher has confirmed that some perinates have been discharged with a weight of less than 1800g, an arrangement has been made for health care providers in the maternity ward to attend an in-service training programme based on neonatal care guidelines in relations to low birth weight.

4.4.2 Mode of delivery

The majority of the deliveries (80%) were normal vertex deliveries whilst 3.3% of the deliveries were breech and 0.4% assisted deliveries; however these measures are not recorded on the DHIS nor are there norms for them. In this study, 60% of the perinates who were admitted and 82% of those who died were born by normal vaginal delivery, compared to 84% who were well and discharged. Vaginal breech

deliveries accounted for 6.4% of the mortalities and 5.7% of the morbidities. The significant proportion of the breech mortalities and morbidities may be related to the fact that the women delivered the baby vaginally, which may have led into perinatal complications. The Guidelines to Maternity Care in South Africa (National Department of Health, 2007) clearly states that an elective caesarean section is the safest method for delivering a baby with a breech presentation.

During the study period the caesarean section rate was 16.4%. This rate is above the recommended threshold of 10% - 15% by the World Health Organization (Day, Monticelli, Barron, et al., 2010). In 2008/2009 the caesarean section rate for the South African district hospitals was 16.1%; with the highest rate of 32.5% in Nelson Mandela Bay Metro district in the Eastern Cape and lowest at 3.2% in Frances Baard district in the Northern Cape. In the Mpumalanga province, the caesarean section rate for district hospitals was 14.1%; with the highest rate at the Gert Sibande district at 16.1% and the lowest rate at Nkangala district at 11.9% (Day, Monticelli, Barron, et al., 2010).

However, the rate of caesarean sections is increasing globally beyond the WHO acceptable threshold of 10 to 15%. Although unevenly distributed, 15% of the births globally occur by caesarean section. The highest rate of caesarean section deliveries is noted in Latin America and the Caribbean at 29.2%; whilst Africa shows the lowest at 3.5% (Betran, Merialdi, Lauer, et al., 2007). The increasing trend in caesarean section rate is a matter for concern; however, it is attributed to different factors. Indications such as failure to progress, cephalo-pelvic disproportion, previous caesarean section, fetal distress, etc are some of the reasons for the high caesarean rate (Shah, Fawole & M'imunya et al., 2009). There is however a growing trend to have non-medically indicated elective caesarean sections on maternal request or by recommendation of the health care provider (Naidoo & Moodley, 2009).

This is especially a problem in the South African private health sector. In a study conducted by Naidoo and Moodley (2009) on rising rates of caesarean section in the private health sector in KwaZulu-Natal, the rate of caesarean sections was found to

be 60.4%, which was considerably higher than the ideal rate of 10-15% as recommended by WHO. It is assumed that the fact that physicians in the private health sector work on a fee for service basis may be contributing to the conducting of non-essential caesarean sections. It is also assumed that because caesarean section deliveries pay more and requires less time than a vaginal delivery it may result in their over utilization. In addition there is less likelihood of perinatal complications, so in the private sector they might do more caesarean sections to avoid litigation.

Although potentially lifesaving, caesarean sections increase healthcare cost and pose other risks for both mothers and newborns (Day, Monticelli, Barron, et al., 2010). Caesarean sections should therefore be done when there is a medical indication in order to improve the health outcomes of either the mother or baby (Lumbiganon, Laopaiboon, Gülmezoglu, et al., 2010). Different strategies, for example, protocols, routine clinical audits, supervision and leadership by senior physicians, etc can be used to reduce the high caesarean section rate and improve the quality of obstetric services (WHO, 2007).

4.4.3 Length of stay

The maternity ward at Carolina Hospital provides primary maternity care services which includes antenatal care, labour and birth; and postnatal care. On admission of the mother or baby, the average length of stay (ALOS) is used to measure the duration of time in average a patient spent in the hospital (Day, Monticelli, Barron, et al., 2010). ALOS is calculated by dividing the number of inpatient days by number of separations and expressed as number of days. ALOS is a “proxy measure for the quality of care received as well as of the efficiency of the hospital” (Day, Monticelli, Barron, et al., 2010).

The mean ALOS for the mothers and perinates at Carolina hospital was 1.7 and 1.6 days respectively during the time of the study. The ALOS of the mother and her healthy perinate should be long enough to allow for early identification of problems. However, the Guidelines for Maternity Care in South Africa (National Department of

Health, 2007) encourages that for normal vaginal deliveries, women should be discharged six hours after delivery. This however depends on various factors such as the health of both the mother and baby; and the ability and confidence of the mother to care for her baby**.**

There was a statistically significant difference in the average length of stay of the mothers and perinates by perinatal outcome within the two years. Mothers who had perinates that were admitted had a length of stay that was double that of mothers whose perinates were discharged or died. A similar result was found with the perinatal length of stay. This is as expected and in line with the Guidelines for Maternity Care in South Africa (National Department of Health, 2007) as women and perinates should be discharged home when the condition of both the mother and baby are satisfactory.

4.5 CAUSES OF PERINATAL MORTALITY AND MORBIDTY

In this study, most of the perinatal mortality was due to intrauterine deaths (40%), hypoxia/asphyxia (30.9%). According to the Fourth Perinatal Care Survey in South Africa, intrauterine deaths accounted for 25.4% of the perinatal deaths in the Mpumalanga province (Pattinson, 2004). It therefore becomes important to improve the ANC services within the Chief Albert Luthuli sub district. In addition this emphasises the need for educating the mothers on the necessity of early booking for ANC, danger signs of pregnancy and when to seek medical attention.

In this study over a third of the perinatal morbidity was due to hypoxia (34.3%) and prematurity (31.4%). Hypoxia usually occurs during labour. It is an indicator that fetal distress is not being recognized or it is poorly managed (Pattinson, 2011). There is a need to develop and monitor the implementation of protocols and guidelines for management of obstetric emergencies in the facility. In developing countries, hypoxia/asphyxia contributes greatly to perinatal mortality and morbidity. Hypoxia occurring during labour and delivery within a health facility gives an opportunity for health care providers to intervene, thus preventing the death

(Pattison, 2009). Other causes included infection (17.1%), birth trauma (11.4%) and congenital abnormalities (5.7%).

Prematurity accounted for 19.1% of the mortalities. In South Africa, prematurity accounted for 21% of the perinatal deaths in 2008/2009 (Pattinson, 2011). Again, there is a need to educate pregnant women to book early or ANC as well as to seek medical attention early. There is however challenges which may be contributory to premature deaths, such as poor access to maternal and child health services, especially where primary health care services may only be accessible at specific days of the week. Lack of transport is also contributory to premature deaths as the non-availability of transport may delay a woman in reaching the health care facility where assistance may have been given. Premature labour often can be identified earlier and women referred to a higher level where the labour can be stopped to allow the baby more time to grow. The signs include contractions, abdominal cramps, pelvic pressure, etc. Furthermore, premature babies need special care, and this can be provided for in a health care facility specially designed, equipped and staffed according to the needs of the premature population (Pattinson, 2011).

Birth trauma accounted for 3.2% of the perinatal deaths, whilst 2.1% of the deaths were due to infections. The findings of the Saving Babies Report 2006-2007 show that birth trauma accounted for 0.67% of the perinatal mortality in district hospitals. Infections also contributed to the mortalities, and were shown to be highest in district hospitals (Pattinson, 2009).

4.6 AVOIDABLE FACTORS OF PERINATAL MORTALITY AND MORBIDITY

The majority of the avoidable factors (72.9%) were patient related. The findings of the Saving Babies Report show that in district hospitals, the most avoidable factors for perinatal mortality (36.5%) were also patient related. This however contributed a much smaller percentage than the findings in this study. Those patient related factors included late booking, poor attendance to the clinic, and delay in seeking help during labour (Pattinson, 2009). In this study, although a large proportion of the perinates were admitted (77.1%) or died (71.3%) due to patient related factors and

the difference was not statistically significant. The patient-related avoidable factors included late booking (26.4%), delay in seeking medical attention during labour (17.8%), never initiated antenatal care (12.4%), infrequent visits to the clinic (8.5%), and inappropriate response to poor fetal movement (7.8%).

There was a relative increase in the percentage of the women who booked late for pregnancy within the two years of study, from 20.3% to 36%. More women had infrequent antenatal clinic visits as well (from 6.3% to 12%). The percentage of women who never initiated antenatal care however decreased from 13.9% to 10%. There is a need to educate the community about the importance of early antenatal booking; as well as compliance to the given antenatal care schedule (Pattinson, 2003). Access to ANC is often linked to limited transport from home to the health facility; therefore mobile clinics should be equipped to provide ANC in areas which are far away from health care facilities (Pattinson, 2009). Women who start ANC late should however have in their initial visit all activities recommended for the previous visits, as well as those activities corresponding to the present visit (WHO, 2003b). It therefore becomes important that BANC be implemented in all antenatal clinics to strengthen standardised monitoring and early identification and management of risks (Pattinson, 2009).

However, it may be inappropriate to place the blame on the woman for the late antenatal booking because of the common practice in South African women to confirm their pregnancy early with general practitioners (National Department of Health, 2007). A general practitioner often fails to initiate formal antenatal care at the time, with the woman appearing to be unbooked or booking late. The Guidelines for Maternity Care in SA (National Department of Health, 2007) recommends that all women presenting to a health care facility and found to be pregnant should be issued an antenatal card thus initiating the first antenatal care visit. As part of strengthening PHC engineering and moving towards the National Health Insurance, the Department of Health should consider providing General Practitioners with ANC cards that they can complete these for pregnant women presenting in their facilities. This will thus ensure that there are records of the women's early ANC and continuity of care can be ensured when they access the public health facilities.

With inappropriate responses to poor fetal movement, the women presented to the hospital with intrauterine death days after they have noticed the lack of fetal movements. However, should those women have presented to the health facility earlier, there might have been an opportunity to save the baby as prompt management and care would have been initiated (Pattinson, 2003). This could be due to poor access to health care services related to lack of transport from home to the health care facilities. It can also be due to lack of awareness of pregnancy related problems and how those challenges could be managed. It therefore becomes important that mobile clinics service points be extended to reach the magnitude of women living in rural areas. In addition, health education messages will reduce avoidable perinatal mortality and morbidity.

In South Africa, avoidable mortality as a result of health-care provider related factors are highest in district hospitals (56.7%), and is related mostly to the inadequate management of intrapartum asphyxia, birth trauma and spontaneous preterm birth (Pattinson, 2009). In this study, over a third (39.5%) of the avoidable factors was health care provider related. This accounted in forty percent (40.4%) of the perinatal mortalities and thirty seven percent (37.1%) of the morbidities. The top five health care provider related factors included poor progress in labour with the partogram interpreted incorrectly (7.8%); fetal distress not detected in the intrapartum period while the fetus was monitored (6.2%), physical examination of the patient in the clinic was incomplete (6.2%); medical personnel underestimated fetal size (4.2%); and delay in the doctor responding to a call (3.1%).

According to the Guidelines for Maternity Care in South Africa (National Department of Health, 2007) poor progress in labour is one of the leading indications for caesarian section and instrumental vaginal delivery. If used correctly, the partogram is an effective means for recording the progress of labour and early identification of problems that may occur. However, incorrect interpretation of the partogram may lead to adverse outcomes for both the mother and baby. According to Pattinson (2006) all doctors and midwives who are involved in the care of women during labour should receive continuous in-service training on the correct use and interpretation of the partogram. In addition, partogram use should be audited regularly and the

findings be presented in perinatal audit meetings. This will help in improving the quality of maternal and child health care.

Fetal distress in labour is one of the leading causes of perinatal mortality and morbidity. Pattinson (2006) is of the view that doctors and midwives should also receive in-service training in the recognition and urgent management of fetal distress. Specific protocols for intrapartum care should be available in all facilities rendering intrapartum care. In addition, protocols for selected emergencies should be pasted in visible areas in the maternity wards. Greenfields as cited by Pattinson et al. (2006) recommends that for a 24 hour shift 16 midwives should be allocated for each hundred deliveries; however, this number should be increased in higher levels of care. In order to give the necessary supervision and care for women in labour, one midwife should be responsible for two women only. Labour wards in hospitals should also be equipped with essential equipment as per the level of care, such as the cardiotocograph, hand held Doppler instrument, etc. (Pattinson, 2006). Health care facilities should have referral protocols which clearly states when to refer, referral routes, modes of transport and escort requirements (Pattinson, 2006).

Physical examination of the woman during pregnancy plays an important role in ascertaining normality. During the first antenatal visit, measurement of weight, height, heart rate and blood pressure is assessed to ascertain if they are within normal ranges. An abdominal examination, symphysis fundal height measurement and fetal heart rate are also assessed. Routine tests such as syphilis serology, rhesus blood group, haemoglobin, HIV serology and urine dipstick are collected for analysis. After the first antenatal examination, a schedule of four follow up visits is given to women who are not at risk. However, the schedule of women at risk will depend on their specific problem (National Department of Health, 2007). At each subsequent visit physical examination of the woman which includes weight, blood pressure, abdominal examination, routine test is conducted. It is however a challenge if the physical examination of patient in the clinic is incomplete as this may lead to poor recognition of risk factors. Midwives and doctors should therefore be given continuous education on the components of antenatal care.

During physical examination of the pregnant woman, the fetal size is estimated. Health care providers should have adequate experience and understanding of fetal growth and development in order to estimate the fetal size. During fundal palpation, an experienced health care provider should be able to estimate the fetal size judging by the size of the head and abdominal palpation (National Department of Health, 2007). Underestimation of the fetal size may result in adverse perinatal outcomes such as birth trauma, especially if the woman is delivering a very big baby.

Doctors on call are expected to respond promptly to any emergencies, including obstetric emergencies. However 3,1% of the avoidable causes of perinatal mortality at Carolina Hospital were due to a delay in doctors responding to a call. It is assumed that if timely treatment was given, some perinates would not have died. It becomes imperative that perinatal audits be conducted regularly and results of the findings be discussed in doctors' meetings to improve quality of maternity care.

In South Africa, avoidable factors related to administrative problems are highest in district hospitals (Pattinson, 2009). In this study administrative factors were responsible for 2.3% of the mortalities and morbidities. There has however been a decrease from 3.8% to 0% within the two years of study. The administrative avoidable factors included the following: inappropriately trained staff (1.6%); and no syphilis screening performed at the clinic (1.6%).

4.7 LIMITATIONS OF THE STUDY

The study had a few limitations. Firstly, the study was based on a record review; therefore the data depended on what was collected in the maternity records. In some cases, the researcher did not have the necessary level of detail required. For example, with PMTCT, the researcher did not have the CD4 count data and did not know the level of PMTCT adherence, etc. Also, the researcher could not look at causality, just associations because the study was cross-sectional. The researcher only looked at the two-year study period and although some significant changes were identified, this would need to be monitored to look at a longer trend of changes. No sampling was done for mortalities and morbidities, however, systematic sampling

was done for the well babies, and this limits the interpretation of some of the findings. Furthermore, babies who were admitted for longer than seven days were not included in the study as this falls under the neonatal period yet their condition may have also been due to perinatal complications.

Health care providers in the antenatal clinic classified women at risk; therefore some women at risk may have been missed during antenatal care or wrongly categorized during the study period. The study was done in one district hospital; therefore the results of the study may not represent all district hospitals in South Africa. The limitation for using the PPIP is that while focusing on the mortalities, it excludes perinatal morbidities which are also important predictors of child health. Due to the fact that the PPIP is a computer based system, it can be infected with viruses which may affect the quality of the data. The strength for using the PPIP is that it allows the health care provider to analyze the data on perinatal mortalities, thus calculates different rates that can be used for planning and decision making. It also assists in identifying avoidable causes of perinatal mortality. The limitation for the hospital audit tool for morbidity is that it is an excel spreadsheet and data errors may occur, therefore the data needs to be validated on frequent basis. The strength of this tool is that it assist healthcare workers to identify avoidable causes of morbidities, thus assist them developing improvement strategies.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the results obtained from the study were assessed in relation to the aims and objectives of the study in order to draw appropriate conclusions. Appropriate recommendations were made based on the findings of the study. Finally, suggestions for future research were included.

5.2 CONCLUSIONS

The PNMR of 58.6 per 1000 live births at Carolina Hospital was higher than the national average of 32.8 per 1000 live births in 2010/2011 (Day, Barron, Massyn, et al., 2012). The stillbirth rate of 44.9 per 1000 births was also higher than the national average of 22.3 per 1000 per births in 2008/2009 (Day, Monticelli, Barron, et al., 2010). The early neonatal mortality rate was 13.7 per 1000 live births, which was lower than the national average of 35.8 per 1000 live births in 2008/2009 (Pattinson, 2011). In order to achieve the Millennium Development Goal 4, which aims to reduce by two thirds the mortality rate of under five by 2015, more attention should be given to reducing perinatal deaths. Perinatal deaths are largely avoidable with skilled care (World Health Organization, 2007).

The study had some positive findings. More pregnant women had booked for ANC over the two years of the study, more had tested for HIV, more women at low risk were managed in the hospital and birth weights were higher, implying that high risk pregnancies and those with early gestations and small estimated fetal sizes were probably referred to higher levels of care. The study however found that despite the high percentage (90.9%) of the women who attended ANC, there was still a high number of morbidities (88.6%) and mortalities (83%) of perinates born from booked mothers. This indicated a need to strengthen the quality of ANC rendered, especially in the primary health care facilities.

Although there have been good utilization of the PMTCT programme at Carolina Hospital, HIV contributed highly to perinatal mortality (34%) and morbidity (54.3%) in the facility**.** The study did not investigate compliance of the women to PMTCT, and this need to be done.

When analyzing the avoidable causes of perinatal mortality it becomes clear that there are gaps in the quality of care rendered during antenatal, intrapartum and the perinatal period. Although many factors have been identified, the following challenges were regarded as top priority: lack of knowledge of the necessity of ANC by pregnant women.

5.3 RECOMMENDATIONS

This project is the first systematic study to be done at Carolina Hospital. The study identified a high perinatal mortality rate. In view of that the following recommendations are made:

Primary health care (Community clinic)

a) Ensure that all midwives at the clinics are trained on BANC.
b) Improve ANC services. This can be done through extending access in the clinics by increasing outreach services by health care providers

Maternity Services within the hospital

a) Protocols for maternal and child care should be developed, implemented and monitored. This should include methods for early identification of risks and referral and management protocols.
b) Weekly clinical audits should be conducted
c) Continuous in-service training of midwives and doctors on clinical guidelines for maternal and child care should be provided
d) The maternity unit should be equipped with all essential equipment required for maternal and child health care.

District health services

a) Improve education on maternal and child health services including ANC. This can be done through campaigns or door to door by community health workers.
b) Strengthen HIV counseling and testing services.
c) Provide outreach on neonatal health services by specialists from the regional hospital to the districts.

6.3 FUTURE RESEARCH

Based on the results of the study, the following future research is suggested:

- A quantitative study involving interviewing of pregnant women on the determinants of antenatal care service utilization in the primary health care setting. This will provide insight as to why some women book late whilst others book early for antenatal care.
- A study on the reasons why caesarian section deliveries are conducted in district hospitals.
- A study on adherence to the PMTCT Programme by pregnant women who deliver at facilities within the district.

REFERENCES

Abushhaiwia, A.M.E., Ziyani, M.M.N. & Dekna, M. 2010. Mortality in the special are baby unit of the children's hospital in Tripoli, Libyan Arab Jahamariya. *Eastern Mediterranean Health Journal*, 16(11), pp. 1137-1142.

Betran, A.P., Merialdi, M., Lauer, J.A., et al., 2007. Rates of caesarean section: analysis of global, regional and national estimates. *Paediatric and perinatal epidemiology*, 21, pp. 98-113.

Bhutta, Z., Darmstadt, G.L., Haws, R.A., et al. 2009. Delivering interventions to reduce the global burden of stillbirths: improving service supply and community demand. *BMC Pregnancy Childbirth,* 9(Suppl1), pp. S7.

Claeson, M., Bos, R.R., Mawji, T., et al. 2000. Reducing child mortality in India in the new millennium. *Bulletin of the World Health Organization*, 78(10), pp. 1192–1199.

Day, C., Monticelli, F., Barron, P., et al. 2010. *The District Health Barometer 2008/09*. Durban: Health Systems Trust.

Day, Barron, Massyn, et al., 2012. *The District Health Barometer 2008/09*. Durban: Health Systems Trust.

de Jonge, A., van der Goes, B.Y., Ravelli, R.C.J., et al. 2009. Perinatal mortality and morbidity in a nationwide cohort of 529 688 low-risk planned home and hospital births. *BJOG: An international journal of obstetrics and gynaecology*, 116(9), pp.1177-1184.

Dott, M.M., Orakail, N., Eadi, H., et al. 2005. Implementing a facility –based maternal and perinatal health care surveillance system in Afghanistan. *Journal of midwifery & women's health*, 50(4), pp. 296-300.

Garssen, J. & van der Meulen, A. 2004. Perinatal mortality in the Netherlands. Backgrounds of a worsening international ranking. *Journal of demographic Research*, 11(13), pp. 357-394.

Gert Sibande District Municipality. 2010. Final Integrated development plan 2010/2011.

Hoque, M., Haaq, S. & Islam, R. 2011. Causes of neonatal admissions and deaths at a rural hospital in KwaZulu-Natal, South Africa. *South African Journal of epidemiology and infection*, 26(1), pp27-29.

Lumbiganon, Laopaiboon, Gülmezoglu, et al., 2010. Method of pregnancy and delivery outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-2008 [Online]. Available from www. thelancet. com

Mpumalanga Department of Health. 2008. Service transformation plan. Nelspruit: The Department of Health.

Naidoo, R.P. & Moodley, J. 2009. Rising rates of caesarean sections: an audit of caesarean Sections in a specialist private practice. *South African family practice*, 51 (3), pp. 254-258

National Department of Health. 2007. Guidelines for Maternity Care in South Africa. A manual for clinics, community health centres and district hospitals. Pretoria. Department of Health.

National Department of Health. 2008a. Guidelines for neonatal care. Pretoria. Department of Health.

National Department of Health. 2008b. Saving Mothers 2005-2007. Fourth report on confidential enquiries into maternal deaths in South Africa. Pretoria. Department of Health.

National Department of Health. 2011a. The 2010 National Antenatal HIV and syphilis prevalence survey in South Africa. Pretoria. Department of Health.

National Department of Health. 2011b. Negotiated Service Delivery Agreement. Along and healthy lifestyles for all South Africans. Pretoria. Department of Health.

Nisar, N. & Amjad, R. 2007. Pattern of antenatal care provided at a public sector hospital Hyderabab Sindh. *Journal of Ayab medical college Abbottabad*, 19(4), pp. 11-13.

Pattinson, R.C. 2000. Saving Babies: *A Perinatal Care Survey of South Africa.* Pretoria: Tshepesa Press.

Pattinson, R.C. & Tlepere, P. 2001. Introduction, methods and definitions of the survey. In Pattison R.C. (ed). *Saving Babies: 2nd Perinatal Care Survey of South Africa*. Pretoria: Tshepesa Press.

Pattinson, R.C. 2003. Saving Babies 2003*: Fourth Perinatal Care Survey of South Africa*. Pretoria: Tshepesa Press

Pattinson, R.C. 2006. Saving Babies 2003-2005*: Fifth Perinatal Care Survey of South Africa*. Pretoria: Tshepesa Press

Pattison R.C. 2009. Saving Babies 2006-2007*: Sixth perinatal care survey of South Africa.* Pretoria: Tshepesa Press.

Pattison R.C. 2011. Saving Babies 2008-2009*: Seventh report on perinatal care in South Africa.* Pretoria: Tshepesa Press.

Shah, Fawole & M'imunya et al., 2009. Caesarean delivery outcomes from the WHO global survey on maternal and perinatalhealth in Africa. International journal of gynaecology and obstetrics, 107, pp. 191-197.

Shrestha, M., Manandhar, D. S., Dhakal S., et al. 2006. Two year audit of

perinatal mortality at Kathmandu Medical College teaching hospital. *Kathmandu University medical journal,* 4(2), pp. 176-181.

Stanton, C., Lawn, J.E., Rahman, H. 2006. Stillbirth rates: delivering estimates in 190 countries. *Lancet*, 367(9521), pp. 1487-1494.

Statistics South Africa, 2008. Community Survey 2007: Statistical Release Basic Results Municipalities. Pretoria.

Tomashek, K.M., Crouse, C.J., Iyasu, S., et al. 2006. A comparison of morbidity rates attributed to conditions originating in the perinatal period amongts newborns discharged from United States hospitals, 1989-90 and 1999-2000. *Paediatric and perinatal epidemiology*, 20 (1), pp. 24-34.

World Health Organization. 2002. WHO antenatal randomized trial: manual for implementation of the new model. Geneva: WHO Press.

World Health Organization. 2003a. Antenatal care in developing countries: promises, achievements and missed opportunities. An analysis of trends, levels and differentials, 1990-2001. Switzerland: WHO Press.

World Health Organization. 2003b. Integrated Management of Pregnancy and Childbirth. Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Practice. Singapore: WHO Press.

World Health Organization. 2004. Low birth weight. Global, country and regional estimates: New York.

World Health Organization. 2006. Neonatal and perinatal mortality: country, Regional and global estimates. Switzerland: WHO Press.

World Health Organization. 2007a. Neonatal and perinatal mortality: country, Regional and global estimates 2004. Switzerland: WHO Press

World Health Organization. 2007b. Maternal mortality in 2005: estimates developed by the WHO, UNICEF, UNFPA and the World Bank. Switzerland: WHO Press

World Health Organization. 2011. Country health information systems. A review of the current situation and trends. Switzerland: WHO Press

Yu., V.Y.H. 2003. Global, regional and national perinatal and neonatal mortality. *Journal of Perinatal Medicine,* 31(5), pp. 376-379.

APPENDICES

ANNEXURE A: DATA COLLECTION TOOL 1

Year	Month	Total number of deliveries	Perinatal outcome			
			Discharge or transferred out (Alive)	Fresh stillbirth	Macerated stillbirth	Early neonatal death
2009	April					
2009	May					
2009	June					
2009	July					
2009	Aug					
2009	Sep					
2009	Oct					
2009	Nov					
2009	Dec					
2009	Jan					
2009	Feb					
2009	Mar					
2010	April					
2010	May					
2010	June					
2010	July					
2010	Aug					
2010	Sep					
2010	Oct					
2010	Nov					
2010	Dec					
2010	Jan					
2010	Feb					
2010	Mar					

ANNEXURE B: TOOL 2: TO BE COMPLETED FOR ALL SELECTED RECORDS

Study no	Admission date	Maternal							Neonate				
		Maternal age	Antenatal status (Booked/Unbooked)	HIV status	On PMTCT	Gestational age	Risk category (high/low)	Outcome (Discharged, transferred out, death)	Birth weight	Mode of delivery (NVD, CS, VAD, FAD)	Perinatal status (Alive, MSB, FSB,END, admission ≤ 7 days)*	Outcome date (maternal)	Outcome date (neonate)

*** If END, FSB or MSB, complete Tool 3 using study number. If perinatal admission, complete Tool 4 using study number.**

ANNEXURE C: TOOL 3: TO BE COMPLETED FOR ALL STILLBIRTHS (FRESH OR MACERATED) AND EARLY NEONATAL DEATHS, USING STUDY NUMBER FROM TOOL 2

Study no	Cause of death	Avoidable factors		
		Patient	Administrative	Health care provider

ANNEXURE D: TOOL 4: TO BE COMPLETED FOR ALL PERINATAL ADMISSIONS ≤ 7 DAYS AFTER BIRTH, USING STUDY NUMBER FROM TOOL 2

Study no	Cause of admission (ICD 10 diagnosis)	Any avoidable factor identified		
		Patient	Administrative	Health care provider

ANNEXURE E: PERMISSION FROM THE MPUMALANGA DEPARTMENT OF HEALTH

MPUMALANGA PROVINCIAL GOVERNMENT

Building No.3
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Department of Health

Litiko Letemphilo | Umnyango WezaMaphilo | Departement van Gesondheid

Enquiries: Molefe Machaba (013) 766 3009/3172

20 January 2012

Ms FB Nyathi
Caroline Hospital CEO
P.O. Box 2146
ERMELO
2350

MPUMALANGA PROVINCE
DEPARTMENT OF HEALTH
PLANNING & INFORMATION
2012 -01- 20
PRIVATE BAG X 11285
NELSPRUIT 1200

Dear Ms FB Nyathi

AN AUDIT OF PERINATAL MORTALITY AND MORBIDITY AT A DISTRICT HOSPITAL

The Provincial Research and Ethics Committee has approved your research proposal in the latest format that you sent. No issues of ethical consideration were identified.

Kindly ensure that you provide us with the report once your research has been completed.

Kind regards,

Molefe Machaba
Research and Epidemiology

20/01/2012
Date

Siyanakekela

MPUMALANGA

ANNEXURE F: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ms Fridah B G Nyathi

CLEARANCE CERTIFICATE	**M110733**
PROJECT	An Audit of Perinatal Mortality and Morbidity at a District Hospital
INVESTIGATORS	Ms Fridah B G Nyathi.
DEPARTMENT	School of Public Health
DATE CONSIDERED	29/07/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 29/07/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr R Jina

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...