

INTRODUCTION

1.1. Background

Emkhuzweni Health Centre (EHC) is a public health service owned by the Ministry of Health and Social Welfare in Swaziland. It is located in the northern Hhohho Region of the country, 55km south of the town of Pigg's Peak. This health centre was established by Christian Swedish Missionaries in 1975 to provide curative, promotive and preventive services at the primary health care level. In 2002, the centre was transferred to the Ministry of Health and Social Welfare.

The health centre's catchment area covers 14 chiefdoms and five Tinkhundla (administrative councils) centers. According to the 1995 census, there were more than 45 000 people in the catchment area of the Emkhuzweni Health Centre, the majority of whom are Swazi speaking Siswati. Others include migrants from Asia, Pakistan and India, as well as from neighbouring Southern African countries.

Emkhuzweni Health Centre has both in-patient and out-patient departments. The Public Health Unit (PHU) in the out-patient department provides basic antenatal care to pregnant mothers, postnatal care, immunization services (EPI), family planning, child welfare, nutritional assessment of children under five and control of common communicable diseases.

The services provided at the antenatal care unit include screening for high risk pregnancy, routine care of pregnant women such as counselling services, basic laboratory investigations, HIV counselling and testing services, and health education for mothers-to-be.

Routine care provided on a first visit includes: taking a detailed history of the current pregnancy, personal history and past obstetric history, calculation of last menstrual period (LMP) and expected date of delivery, weight and blood pressure measurement, fundal height measurement, baseline hematology investigations, blood group and Rh, haemoglobin levels, urine tests, serologic tests, HIV tests, RPR tests, supplementation of iron and folate, referral of high risk mothers to the doctor, referral of HIV-positive pregnant mothers to the VCT Department and setting up of appointments for subsequent follow-ups.

Subsequent follow-ups take place monthly until the end of the second trimester. From this point on visits are made every fortnight until delivery in the case of low-risk pregnant women. The routine care on subsequent follow-ups includes history of the current pregnancy, counseling services, measurement of weight, blood pressure and fundal height, foetal heartbeat assessment and supplementation of iron and folate.

Pregnant women who are high-risk are referred to a doctor for further evaluation and care.

Once seen by the doctor, they are either referred to a better equipped hospital or sent back to the antenatal clinic for frequent follow-ups every two weeks until the end of the second trimester; this is followed by weekly follow-ups until delivery.

The antenatal care unit provides these services two days a week, on Tuesdays and Thursdays. On Thursdays, the unit is assisted by the PMTCT PLUS (PORACO), a humanitarian organization in Swaziland that cares for pregnant HIV positive women and their families. The organization has its own doctors, a nurse and a data clerk, all of whom work together providing not only care to HIV positive pregnant women, but also assistance to the PHU, such as care and nutritional assessment of children under five and screening of children exposed to HIV.

The maternity ward of Emkhuzweni Health Centre has eight beds for post-delivery mothers, and four beds to be used during the second stage of labour. There are also maternal waiting huts built by the former stakeholders, the Christian Swedish Missionaries. High-risk pregnant women were accommodated in this waiting area until they are about to deliver. The community has drawn great benefit from these waiting huts, without which the lives of high-risk patients would have been compromised by poor infrastructure, unfavorable road conditions and inadequate transportation in the catchment areas. However, these huts ceased to function after the transfer of the health centre to the public service under the Ministry of Health in 2002.

The main operation theatre was constructed by the former stakeholders of Emkhuzweni Health Centre, who conducted major surgical procedures such as Caesarian sections and other surgical emergencies. The theatre has, however, also ceased to be operational, making it impossible for doctors to undertake any major operations or operative delivery services. Doctors have, as a result, been forced to refer such operations to the nearest hospital, which is in Pigg's Peak, some 55km from the centre.

1.2. Statement of the problem

The number of maternal clients at Emkhuzweni Health Centre has increased over time. According to the Emkhuzweni Health Centre maternity ward annual report, five years ago (2003-2004) the health centre provided maternity services to an average of one mother in labour a day. At the time, an average 300 deliveries were attended to each year. In 2006, the number of women in labour who were assisted at Emkhuzweni Health Centre increased and averaged two deliveries per day (Emkhuzweni Health Centre Annual report, 2005-2006).

Likewise, it has been observed that the number of poor foetal outcomes, such as neonatal sepsis and stillbirths, has increased (Emkhuzweni Health Centre Annual report, 2005-2006). Unfavorable maternal obstetric outcomes, such as obstructed labour, postpartum haemorrhage and puerperal sepsis, are becoming one of the main concerns.

The researcher believes that ongoing evaluation of the effectiveness of the health service is vital if an assessment of its delivery is to be made. This would provide information on the strengths and weaknesses of the service, and the outcome of this assessment would assist future planning at the centre

This study is intended to generate data and comprehensive information on the outcomes of deliveries carried out at the health centre and to determine the factors that contribute to adverse obstetric outcomes. This will lay the foundation for further studies, planning and interventions that are aimed at improving the quality of life of women in labour and their newborns.

1.3. Research questions

This study has made an attempt to address the following questions:

- What were the maternal obstetric outcomes of the women in labour who were assisted at Emkhuzweni Health Centre in 2007?
- What were the foetal outcomes of newborns delivered at Emkhuzweni Health Centre in 2007?
- What were the factors associated with poor foetal and maternal outcomes at Emkhuzweni Health Centre?

1.4. Scope and limitations of the study

The focus of this study is limited to the maternal and foetal outcomes of deliveries assisted at Emkhuzweni Health Centre in 2007. This study may not apply to other health facilities in Swaziland, nor does it apply to the national study. The study is limited to the year 2007.

While every effort was made to gather appropriate data, some of the records were incomplete or lacks technical terms. This is one of the drawbacks of retrospective study

The second limitation of the study is that, owing to the limitation of diagnostic facilities at the health centre, maternal and foetal conditions were diagnosed based on

clinical evaluations that were not supported by other diagnostic tools. For example, gestational age was estimated based on last menstrual period by date, unsupported by ultrasonography; neonatal sepsis was diagnosed based on clinical presentation and CBC count, unsupported by blood culture; while puerperal sepsis was diagnosed based on clinical presentation.

1.5. Significance of the study

The study will provide valuable data and comprehensive information on the maternal and foetal outcomes of deliveries at Emkhuzweni Health Centre for the period under review. Inferences made from this data will hopefully prove useful to policy-makers whose future planning is aimed at improving the quality of the maternity service provided by this health centre.

Chapter 2

LITERATURE REVIEW

2.1. Search criteria and search methods

Internet searches for maternal and foetal outcomes were made on MEDSCAPE, World Health Organization (WHO) websites, EMBASE and MEDLINE. The following key words and phrases were used: obstetrics, foetal outcomes, maternal outcomes and risk factors for poor obstetric outcomes. Google and Yahoo search engines were used to link to sites where reference materials on the research topic were sought.

2.2. Screening of pregnant women for risk factors

The antenatal period presents important opportunities for reaching pregnant women via a number of interventions that may be vital to their health and wellbeing and that of their infants.

Regular contact with a doctor, nurse or midwife allows health personnel to manage the pregnancy and to provide a variety of services, which might include treatment of hypertension to prevent eclampsia, tetanus immunization, intermittent preventive treatment for malaria and prevention of mother-to-child transmission of HIV, micronutrient supplementation, and risk assessment and birth preparedness, including information about danger signs during pregnancy and childbirth. The antenatal period is also offers an opportunity to provide information on birth spacing, which is recognized as an important factor in improving infant survival and maternal wellbeing.

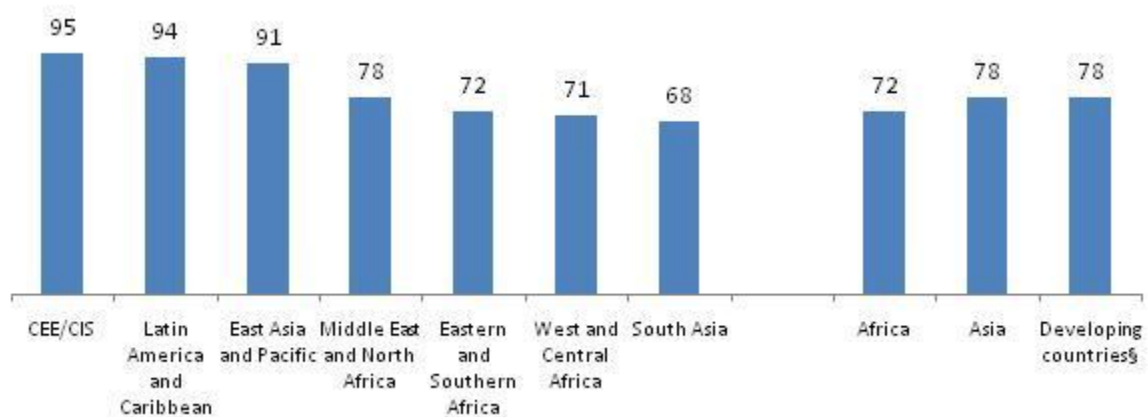
The World Health Organization (WHO) recommends a minimum of four antenatal visits by pregnant women to a clinic or doctor (WHO, 2005). According to WHO guidelines, antenatal care visits should include, at the very least, the measurement of blood pressure, the testing of urine for bacteriuria and proteinuria, and blood tests to detect syphilis and severe anaemia.

2.2.1. Antenatal care coverage across the developing world

According to the latest estimates, 78% of women in the developing world receive antenatal care (ANC) from a skilled health provider at least once during pregnancy (WHO Annual Report, 2005). Regional averages range from a low of 68% in South Asia to a high of 95% in Central and Eastern Europe/Commonwealth of Independent States (CEE/CIS) (WHO report, 2005). In addition to CEE/CIS, more than nine in 10 pregnant women are attended to at least once in Latin America and the Caribbean, and in East Asia and the Pacific. According to the 2005 WHO report, 94% of pregnant mothers in South

Africa received antenatal care between 1990 and 2001. In all developing regions, at least two thirds of pregnant women receive antenatal care from a skilled health professional (WHO Report, 2005).

Figure I. Percentage of women attended to at least once during pregnancy by a doctor, nurse, midwife or auxiliary midwife (WHO Report, 2005).



Source: MICS, DHS and other national surveys, 2003-2008.

Overall, levels of ANC remain high, regardless of place of residence. For example, two thirds of women living in rural areas receive ANC at least once from a skilled health professional. Nonetheless, there is a substantial differential: whereas 67% of rural women receive ANC from a skilled professional, the percentage of urban women benefiting from this care is much higher, at 89% (WHO Annual Report, 2005).

Fewer than half of all pregnant women in developing countries benefit from the minimum recommended four antenatal visits. In South Asia, just one third of women receive care at least four times during their pregnancy. Most importantly, these antenatal care data do not reflect the quality of care, which is difficult to measure. Nonetheless, it is essential to ensure that the quality of antenatal care is such that the services provided contribute to improved maternal health. Although ANC coverage is high, fewer than half of women in the developing world receive the recommended minimum of four visits.

The new WHO module divides pregnant mothers into two groups: those likely to need routine antenatal care (75% of the entire pregnant population), and those with specific risk factors who need special care (25% of pregnant mothers). For the first group, the standard routine of at least four antenatal care visits is recommended; with an additional visit should new health problems emerge. The WHO guideline is specific regarding the timing and content of each visit according to the gestational age. The guideline recommends that only tests and examinations that serve the immediate purpose and that have been proven to be beneficial should be performed. These examinations include

measurement of blood pressure, weight and height, testing of blood for haemoglobin, blood group and Rh, tests for syphilis, and urine tests for bacteriuria and protein.

2.2.2. Antenatal care coverage in Swaziland

According to the Swaziland Demographic and Health Survey Report (2006-2007), almost all Swazi pregnant women (97%) received some antenatal care from a medical professional, most commonly a nurse or midwife. Only 76% of women, however, had had an antenatal care visit by their fourth month of pregnancy, as recommended (UNDP Swaziland, 2006).

Although almost all Swazi women receive some antenatal care, they may not be receiving all the recommended components of this care. According to the Swaziland Demographic and Health Survey Report (2006-07), only a little over half (54%) of women were informed of signs of pregnancy complications during antenatal care, and 78% were physically examined.

Of women who received antenatal care, almost all received iron tablets, were weighed and had their blood pressure measured. Urine and blood samples were taken from over 90% of pregnant women receiving antenatal care. Three-quarters of these women's most recent births were protected against neonatal tetanus (Swaziland Demographic and Health Survey Report 2006-2007).

2.3. Factors that affect maternal and foetal outcomes

Risk equates to factors that increase the likelihood of harm to mother or baby. There is no universally accepted definition of a 'high-risk' pregnancy, nor can antenatal 'risk' screening identify every pregnancy or labour that will run into difficulties. Usually, risk factors are combined and weighed up in order to match an appropriate level of medical care and intervention to a risky pregnancy, in an attempt to reduce the chances of a poor outcome (Tamara L.Callahan, Aaron B.Caughey, and Linda J.Heiffnen 2002).

A pregnancy may be labeled 'high risk' if there is a higher than average chance of the woman or her unborn baby developing complications. Some pregnancies are considered high risk from the start due to a pre-existing medical condition. In other cases, things may start out normally, but risk areas may develop as the pregnancy progresses (Tamara L.Callahan, Aaron B.Caughey, and Linda J.Heiffnen 2002).

Risk factors that affect maternal and foetal outcomes are classified as maternal obstetric factors, maternal medical factors or foetal factors (Tamara L.Callahan, Aaron B.Caughey, and Linda J.Heiffnen 2002).

2.3.1. Maternal risk factors

Maternal risk factors include poor socioeconomic status (Jasper Chiwuzie, Chika Okolocha and Obehi Okojie 1997); teenage pregnancy; late age pregnancy (where the mother is over 35 years of age (McWhinney 1997)); primigravida; grand multiparous women; prolonged inter pregnancy time (where the last pregnancy is more than six years ago); previous stillbirth; a history of bad obstetric outcomes; multiple pregnancies; polyhydramino, olligohydramino and Rh Iso-immunization; antepartum haemorrhage and postpartum haemorrhage (Pattinson R.C. 2000); (Tamara L.Callahan, Aaron B.Caughey and Linda J.Heiffnen, 2002); premature rupture of the membrane; malpresentation and malpositions.

2.3.1.1. Poor socioeconomic status as an obstetric risk factor

A study in northern Nigeria over a decade ago revealed a death rate in childbirth of 29 per 1000 deliveries among women who had received no formal education and no perinatal care, whereas in women not thus disadvantaged the figure was much lower (Jasper Chiwuzie, Chika Okolocha and Obehi Okojie, 1997). Studies in this area revealed that:

- There was a lack of knowledge of the warning signs and risk factors of haemorrhage during pregnancy and delivery, as well as the potential danger of bleeding after delivery (Jasper Chiwuzie, Chika Okolocha and Obehi Okojie, (1997Jasper).
- Lack of proper diet and hygiene were potentially dangerous for pregnant women (Jasper Chiwuzie, Chika Okolocha and Obehi Okojie 1997).
- A belief existed that supernatural forces caused some cases of haemorrhage during pregnancy and delivery.
- Women continued to obtain care from traditional birth attendants and traditional healers even when hemorrhage occurred.

2.3.1.2. Effects of teenage pregnancy on maternal outcomes

Teenage pregnancy occurs when an under-aged girl (usually between the ages of 13 and 19) becomes pregnant (Lachance, L.L, 2005). The average age of the first menstrual period in the United States is 12 years, though this figure varies by ethnicity (Lachance, L.L, 2005) and weight. First ovulation occurs only irregularly at this age. The average age of menarche has been declining and continues to do so. Whether fertility leads to early pregnancy depends on a number of factors, both societal and personal. Worldwide,

rates of teenage pregnancy range from 143 per 1000 in some sub-Saharan countries to 2.9 per 1000 in South Korea.

In Swaziland, women tend to marry at a relatively late age. Relatively few women (26%) are married by their twentieth birthday. The median age of first marriage is 24.3 (Swaziland Demographic and Health Survey, 2007). Women in urban areas tend to marry later, at an average age of 27.9, than their counterparts in rural areas (where the average age at marriage is 22.8). Almost a quarter of young women aged between 15 and 19 have already borne children (Swaziland Demographic and Health Survey 2007). Motherhood at a young age is more common in rural areas than in urban areas.

Pregnant teenagers face many of the same obstetric issues as women in their twenties and thirties. However, there are additional medical concerns for younger mothers, particularly those under the age 15 and those living in developing countries. For mothers between 15 and 19, age in itself is not a risk factor, but additional risks may be associated with socioeconomic and other obstetric risk factors (Lachance, L.L, 2005)..

2.3.1.3 Relationship of gravidity and parity to risk behavior during pregnancy

Obstetric histories should always include parity, gravidity and outcomes of all previous pregnancies as:

- Outcomes of previous pregnancies give some indication of the likely outcome and degree of risk of the current pregnancy.
- The number of previous pregnancies and deliveries will influence the risks associated with the current pregnancy (Crwinin and Simhan, 2009).
- What is considered normal labour varies according to parity.

Normal labour in a primigravida is significantly different to normal labour in multiparous women, as the uterus is physiologically a less efficient organ; contractions may be dyscoordinate or hypotonic. The average first stage in a primigravida is significantly slower than in a multiup (primarily due to the rate of cervical dilation) (Vahratian, Hoffman, Troendle, 2006). Progress is therefore expected to be slower, but delays that are longer than expected require prompt augmentation and appropriate management of labour.

Interestingly, grand multiups have a longer latent phase during labour than both nulliparous and lower-parity multiparous women, but they then begin to dilate more rapidly after 3cm dilatation; partogram curves for multiparous and grand multiparous mothers are indistinguishable, and progress of labour does not appear to improve with additional childbearing (Gurewitsch, E.D., Diament, P. and Fong, J, 2002).

Women in Swaziland have an average of 3.8 children. Fertility varies by residence and by region. Women in urban areas have three (3) children on average, compared with 4.2 children per woman in rural areas (Swaziland Demographic and Health Survey, 2007). In the United Kingdom (UK), the current total fertility rate (the average number of children a woman would have if she experienced the fertility rate of a particular year for her entire childbearing years) stands at 1.96 (Crwinin and Simhan, 2009).

2.3.1.4. Effects of primigravidity on maternal outcomes

Primigravida is the term given to a first-time pregnancy primigravida (Crwinin and Simhan, 2009). Primigravida is considered to be one of the obstetric factors associated with an increased risk of maternal morbidity and mortality (Tamara L.Callahan, Aaron B.Caughey and Linda J.Heiffnen, 2002). These risks are to the result of poor psychological preparation and anatomical disproportions, including cephalo pelvic disproportion.

According to a study conducted in a rural hospital in Malaysia, 12% of all pregnant mothers who attended the hospital for perinatal care were primigravida (Creinin and Simhan, 2009). The rest were pregnant for at least the second time.

Risks associated with nulliparity/primigravidae include the following (Duckitt K.and Harrington, 2005).

- Higher risk of developing pre-eclampsia (relative risk 2.91 with confidence interval 1.28-6.61) (Duckitt K.and Harrington, 2005).
- Delayed first stage of labour, although this could be considered normal in a primigravida (Duckitt K.and Harrington, 2005).
- Dystocia, or difficult labour, was diagnosed in 37% of primigravida in one Danish study (Kjaergaard, Olsen and Ottesen L, 2009) (Duckitt K.and Harrington, 2005).

2.3.1.5. Grand multiparus as an obstetric risk factor

Grand multipara is the term given to a woman who has experienced more than four live births (Tamara L. Callahan, Aaron B.Caughey and Linda J.Heiffnen, 2002). Grand multipara is associated with an increased risk of maternal morbidity and mortality. Grand multiparus mothers are associated with a lax uterus and an increased risk of uterine rupture, pendulous abdomen, malpresentation and malposition. Grand multipara is also associated with depletion in the maternal store of nutrients and minerals, and with anaemia.

Other risks associated with grand multiparity (Merck, 2005) include:

- Abnormal foetal presentation
- Precipitate delivery
- Uterine atony
- Placenta previa
- Uterine rupture
- Amniotic fluid embolism
- Obstetric haemorrhage
- Stress incontinence and urinary urgency symptoms (Handa, V.L., Harvey, L. and Fox, H.E, 2004).
- Levator Ani dysfunction (Kisli, E., Kisli, M. and Agargun, H, 2006).

2.3.1.6. Multiple pregnancies as an obstetric risk factor

If a fertilized ovum is divided into two separate ova, monozygotic or identical twins result. If ovulation produces two ova and both are fertilized, diazygotic twins result. Without assisted fertility, the possibility of twinning is approximately 1 in 7000-8000 pregnancies in the USA (Tamara L., Aaron B.and Linda J, 2002). However, with the increased use of ovulation-enhancing drugs and in-vitro fertilization, the incidence of multiple gestations is increasing (Tamara L., Aaron B.and Linda J, 2002).

Multiple pregnancy results in an increase in a variety of obstetric complications, including pre-term labour, placenta previa, cord prolapse, postpartum haemorrhage, cervical incompetence, gestational diabetes and pre-eclampsia (Tamara L., Aaron B.and Linda J, 2002) . In a multiple pregnancy, the foetuses are subject to an increased risk of pre-term delivery, congenital malformation, undersize for gestational age and malpresentation. The average gestational age of delivery for twins is between 33 and 34 weeks (Tamara L., Aaron B. and Linda J, 2002).

The expected frequency of multiple pregnancies in Zimbabwe is 28 per 1000 deliveries (The International Journal of Public Health, 2002). The expected complications rates are obtained from published data on populations with similar ethnic background, this provides a simple approach for assessing the need for obstetric care (The International Journal of Public Health, 2002).

Pregnant mothers with multiple gestations are managed as high risk, usually in conjunction with a perinatologist. Apart from the antenatal management of the complications, the principal issue in multiple gestations is mode of delivery.

2.3.1.7. Preterm labour as an obstetric risk factor

Preterm labour is defined as labour that occurs before 37 weeks gestation (Elmer, Peter, Sakala, 2002), (Tamara L., Aaron B.and Linda J, 2002). Many patients present with pre-

term contractions, but only those with changes in the cervix are diagnosed with preterm labour. Preterm labour differs from an incompetent cervix, which is the silent, painless dilation of the cervix.

Preterm labour precedes almost half of preterm births and preterm birth occurs in approximately 12% of all pregnancies and is the leading cause of neonatal mortality in the United States (American College of Obstetricians and Gynecologists, 2001). In addition, preterm birth accounts for 70% of neonatal morbidity and mortality, resulting in the health care system incurring huge expense for neonatal care, largely due to the fact that 2% of American women deliver very premature infants (<32 wk) (ACOG Practice Bulletin, 2003).

In 1993 the incidence of pre-term delivery increased to over 10% of all births (Michael, David and Robert, 2009). In 2005, 9.6% of all births worldwide were preterm babies. The incidence of pre-term births in industrialized countries is currently at 7%. A high rate of preterm deliveries has been reported from Africa (11.6%) (Stacky Beck, Daniel Wajdyla and Lale Say, 2005). In a study conducted in Malawi, 20.3% of women delivered before completing 37 weeks of pregnancy (Chikondi Ntonya, Edith Kayina and White L, 2005).

2.3.1.7.1. Risks associated with per-term labour

Although prediction of preterm delivery remains inexact, Risk factors for preterm birth include demographic characteristics, maternal factors, and foetal factors (ACOG Practice Bulletin, May 2003).

Demographic factors for preterm labour include non-white race, extremes of maternal age (<17 y or >35 y), low socioeconomic status and low pre-pregnancy weight (ACOG Practice Bulletin, 2003). Preterm labour and birth can be associated with stressful life situations (e.g. domestic violence; death of close family member; insecurity about food, home or partner; work and home environment) either indirectly by associated risk behaviours or directly by mechanisms not completely understood (ACOG Practice Bulletin, May 2003). Many risk factors may manifest in the same gravida.

A number of maternal factors have been linked to a higher risk of a preterm birth. These include low socioeconomic or educational status and single motherhood (Goldenberg, R.L., Culhane ,J.F. and Iams, J.D, 2008), as well as age at the upper and lower end of the reproductive years over 35 or under 18 years of age (Goldenberg, R.L., Culhane ,J.F. and Iams, J.D, 2008), (Simhan, H. and Canavan, T, 2005) . Further, in the US and the UK, Afro-American and Afro-Caribbean women have preterm birth rates of 15–18%, more than double that of the white population. This discrepancy is not seen in Asian or Hispanic immigrants and remains unexplained (Goldenberg, R.L., Culhane ,J.F. and Iams, J.D, 2008).

Pregnancy intervals also make a difference as women with a six-month span or less between pregnancies show a two-fold increase in preterm birth (Smith, Pell and Dobbie, 2003). Studies of type of work and physical activity have produced conflicting results,

but it does seem that stressful conditions, hard labour and long hours are probably linked to preterm birth (Goldenberg, R.L., Culhane, J.F. and Iams, J.D, 2008).

Patients who have undergone previous induced abortions have been shown to have a higher risk of preterm birth, but only if the termination was performed surgically and not medically (Virk Zhang and Olsen, 2007). Adequate maternal nutrition is important. Women with a low BMI are at increased risk of preterm birth (Hendler, I., Goldenberg, R.L. and Mercer and B.M, 2005).

Furthermore, women with poor nutritional status may also be deficient in vitamins and minerals. Adequate nutrition is critical for foetal development, and a diet low in saturated fat and cholesterol may help reduce the risk of a preterm delivery. Obesity does not lead directly to preterm birth; however, it is associated with diabetes and hypertension, which are risk factors in themselves (Goldenberg, R.L., Culhane, J.F. and Iams, J.D., 2008).

Women with a previous preterm birth are at higher risk of a recurrence, at a rate of 15–50%, depending on the number of previous events and their timing (Mercer, B.M., Goldenberg, R.L. and Moawad, A.H, 1999). To some degree those individuals may have underlying conditions (such as uterine malformation, hypertension or diabetes) that persist.

Marital status is associated with risk of preterm birth. A study of 25 373 pregnancies in Finland revealed that unmarried mothers had more preterm deliveries than married mothers ($P=0.001$) (Raatikainen, Heiskanen and Heinonen, 2005). Pregnancy outside marriage was associated overall with a 20% increase in total adverse outcomes. A study in Quebec of 720 586 births from 1990-97 revealed less risk of preterm birth among infants with legally married mothers, compared to those with common law-wed or unwed parents (Luo Z.C., Wilkins, R. and Kramer, M.S, 2004).

Genetic make-up is also a factor in the causality of preterm birth. An intra- and trans-generational increase in the risk of preterm delivery has been demonstrated in genetic make-up (Winkvist, A., Mogren, I. and Hogberg, U, 1998). No single gene has been identified, but it appears from the complexity of the labour initiation that numerous polymorphic genetic interactions are possible.

Multiple pregnancies (twins, triplets, etc.) are a significant factor in preterm births. The March of Dimes Multicenter Prematurity and Prevention Study found that 54% of twins were delivered preterm as opposed to 9.6% of singleton births (Gardner, M.O., Goldenberg, R.L. and Cliver, S.P, 1995).

Triplets and larger multiple births are more at risk. Fertility medication that stimulates the ovaries to release multiple eggs, and IVF with embryo transfer of multiple embryos have been implicated as important factors in preterm birth. Maternal medical conditions also increase the risk of preterm birth, and labour often has to be induced for medical reasons. Such instances include high blood pressure (Goldenberg, R.L., Iams, J.D. and Mercer, B.M, 1998) , pre-eclampsia (Bánhidý, F., Acs, N., Puhó, E.H. and Czeizel, A.E, 2007) ,

maternal diabetes (Rosenberg, T.J., Garbers, S., Lipkind, H. and Chiasson, M.A, 2005) , asthma, thyroid disease and heart disease. In addition, a number of women have anatomical features that prevent the baby from being carried to term, such as a weak or a short cervix (Goldenberg, R.L., Iams, J.D. and Mercer, B.M, 1998).

The cervix may also have been compromised by previous cervical conization or loop excision. In women with uterine malformations, the capacity of the uterus to hold the growing pregnancy may be limited and preterm labour ensues (Acien P, 1993). Women with vaginal bleeding during pregnancy are more at risk of preterm birth, while bleeding in the third trimester may be a sign of placenta previa or placental abruption, conditions that occur frequently preterm. Even earlier bleeding that is not caused by these two conditions is linked to a higher pre-term birth rate (Krupa, F.G., Faltin, D., Cecatti, J.G., Surita, F.G. and Souza, J.P, 2006).

Women with abnormal amounts of amniotic fluid, either too much (polyhydramnios) or too little (oligohydramnios) are also at risk. The mental status of pregnant women is also of significance. Anxiety (Dola, S.M., Gross, S.J. and Merkatz, I.R., 2007) and depression have been linked to preterm births.

The use of tobacco, cocaine and the excessive consumption of alcohol during pregnancy also increase the chance of a pre-term delivery. Tobacco is the most commonly abused drug during pregnancy and also contributes significantly to low birth weight delivery (Shiono, P.H., Klebanoff, M.A. and Nugent, R.P., 1995). In addition, babies with birth defects are at greater risk of being born preterm (Parazzini, F., Chatenoud, L. and Surace, M., 2003).

In 2004, a systematic review of 30 studies on the association between intimate partner violence and birth outcomes concluded that preterm birth and other adverse outcomes, including death, were higher among abused pregnant women than among women who had not been abused (Saurel-Cubizolles, M.J., Zeitlin, J. and Lelong, N., 2004).

Finally, the foetus plays a role in the initiation of labour. In a simplistic sense, the foetus recognizes a hostile intra-uterine environment and precipitates labour by premature activation of a foetal-placental parturition pathway.

2.3.1.7.2. Goals of management

Goals of obstetric patient management of preterm labour should include (ACOG Practice Bulletin, May 2003).

- ❖ Early identification of risk factors associated with pre-term birth.
- ❖ Timely diagnosis of preterm labour.
- ❖ Identification of the aetiology of preterm labour.
- ❖ Evaluation of foetal wellbeing.

- ❖ Provision of prophylactic pharmacologic therapy to prolong gestation and reduce the incidence of Respiratory Distress Syndrome (RDS) and Intra-Amniotic Infection (IAI).
- ❖ Initiation of tocolytic therapy when indicated.
- ❖ Establishment of a plan for maternal and foetal surveillance with patient/provider education to improve neonatal outcomes.

2.3.1.7.3. Prevention of preterm labour

Historically, efforts have been aimed primarily at improving chances of survival and health of preterm infants (tertiary intervention). Such efforts, however, have not reduced the incidence of preterm births. Increasingly, primary interventions that are directed at all women, and secondary interventions that reduce existing risks are looked upon as measures that need to be developed and implemented to prevent the health problems of premature infants and children (Iams, J.D., Romero, R. and Goldenberg, R.L., 2008).

Interventions that should have been initiated prior to pregnancy can still be instituted during pregnancy, including nutritional adjustments, the use of vitamin supplements, and the cessation of smoking. Calcium supplementation, as well as the supplementary intake of vitamins C and E, could not be shown to reduce preterm birth rates (Hofmeyr, G.J. and Gülmezoglu, A.M., 2000). Various strategies are used in the administration of prenatal care, but future studies need to determine whether the focus should be on screening for high risk women, on wider support for low-risk women, or on determining the degree to which these approaches should be merged(Iams, J.D., Romero, R. and Goldenberg, R.L., 2008).

2.3.1.7.3.1 Screening for preterm labour in low risk women

Screening for asymptomatic bacteriuria, followed by appropriate treatment, reduces pyelonephritis and the risk of preterm birth (Ross, M.G., Geffen, D. and Eden, R.D. ,2009) . Extensive studies have been conducted to determine the benefit of other forms of screening in low-risk women followed by appropriate intervention. These include screening for and treatment of *Ureaplasma urealyticum*, group B streptococcus, *Trichomonas vaginalis*, and bacterial vaginosis. None of these reduced the rate of preterm birth (Iams J.D. Romero R. and Goldberg R.L., 2008). Routine ultrasound examination of the length of the cervix identifies patients at risk, but circlage has not proved useful, and the application of progesterone is under study (Iams J.D., Romero R. and Goldberg R.L., 2008). Screening for the presence of fibronectin in vaginal secretions is not recommended at this time in women at low risk.

Self care methods of reducing the risk of preterm birth include proper nutrition, avoiding stress, seeking appropriate medical care, avoiding infections, and the control of preterm birth risk factors (e.g. working long hours on one's feet, exposure to carbon monoxide, domestic abuse, and other factors). Self monitoring vaginal pH followed by yoghurt treatment or clindamycin treatment, if the pH is too high, all appear to be effective in reducing the risk of preterm birth (Lale, A., Metin, A. and Monica. 2007).

2.3.1.7.3.2. Pre-conceptual evaluation of mothers for prevention of preterm labour

Raising public and professional awareness of the scope of the problem and its significance as the major contributor to infant mortality is a start in the drive to reduce avoidable risk factors. Among these factors is the reduction of repeated uterine instrumentation (i.e. repeated surgical abortions) (Ancel P.Y., Lelong, N. and Papiernik, E., 2004) and the avoidance of risky choices of infertility treatments. Adoption of specific professional policies can immediately reduce the risk of preterm birth as experience in assisted reproduction has shown when the number of embryos during embryo transfer were limited (Iams, J.D., Romero, R. and Goldenberg, R.L., 2008).

Several countries have established specific programmes to protect pregnant women from hazardous night shift work, and to provide them with time for prenatal visits and paid maternity leave. The EUROPOP study showed that preterm birth is not related to type of employment, but rather to prolonged work (>42 h per week) or extended periods spent standing (>6 h per day) (Saurel-Cubizolles, M.J. Zeitlin and Lelong N., 2004). Also, night shift has been linked to preterm birth. Health policies that take these findings into account can be expected to reduce the rate of preterm birth. Avoidance of weight extremes and good nutritional support are also important, although a study failed to show that a multivitamin preparation taken prior to conception reduced the risk of preterm birth (Czeizel, A.E., Dudas, I. and Metnecki, J., 1994). Preconception intake of folic acid is recommended to reduce birth defects. There is significant evidence that long term (> one year) use of a folic acid supplement preconception may reduce premature birth. Limiting smoking is also expected to benefit both pregnant women and their offspring (Czeizel, A.E., Dudas, I. and Metnecki, J., 1994).

2.3.1.7.3.3. The presence of the following risk factors should be addressed prior to pregnancy

- ❖ Cervical trauma is one of the causes of preterm labour (ACOG Practice Bulletin, May 2003). The most common aetiologies for cervical injury are elective abortion, surgeries to treat cervical dysplasia, and injury occurring at delivery. A single uncomplicated elective abortion at less than 10 weeks' gestation does not increase the risk of mid-trimester loss or preterm birth, unless the cervix has been forcibly dilated to more than 10mm at the time of the abortion (ACOG Practice Bulletin, May 2003) . However, patients with a history of multiple first-trimester elective terminations or one or more second-

trimester elective abortions may be at increased risk of preterm delivery. Cervical dilation with laminaria or cervical ripening agents, such as misoprostol, appears to be less traumatizing to the cervix than mechanical dilation.

- ❖ Cervical dysplasia should be treated appropriately whenever diagnosed (ACOG Practice Bulletin, May 2003). However, the incidence of preterm birth and cervical incompetence may be increased 200-300% after preconceptual surgical treatment (cold knife cone, cryoconization, laser cone, LEEP) of cervical intra-epithelial neoplasia (CIN) (ACOG Practice Bulletin, May 2003). The risk of subsequent preterm deliveries may be proportional to the amount of cervical tissue removed during surgery. Surprisingly, the ease of performing LEEP for relatively minor abnormalities may have paradoxically led to more cervical injury than was observed with the relatively more invasive cone biopsy (ACOG Practice Bulletin, May 2003).
- ❖ Obstetric trauma may be underestimated as a risk for mid-trimester loss or preterm birth. While women may relate a history of cervical laceration, often they are unaware of the injury and the obstetric records of the previous delivery may be misleading as to the extent of the cervical injury. Therefore, visual inspection of the cervix is important to assess the degree of injury and risk.
- ❖ Defects that involve more than 50% of the length of the cervix may indicate a higher risk for mid-trimester loss (ACOG Practice Bulletin, May 2003). The accuracy of trans-vaginal ultrasonic measurements to determine risk of cervical incompetence, specifically in the presence of a history of cervical trauma, has yet to be determined. Infections play a major role in the genesis of preterm birth and may account for 25–40% of events (Goldenberg R.L., Iams J.D. and Mercer B.M., 1998). The frequency of infection in preterm births is inversely related to the gestational age. Endotoxins released by micro-organisms and cytokines stimulate decidual responses, including the release of prostaglandins, which may stimulate uterine contractions. Furthermore, the decidual response may include the release of matrix-degrading enzymes that weaken foetal membranes, leading to premature rupture ((Goldenberg R.L., Iams J.D. and Mercer B.M., 1998). Intra-uterine infection appears to be a chronic process ((Goldenberg R.L., Iams J.D. and Mercer B.M., 1998). Typical organisms identified in the uterus before rupture of the membranes are genital *Mycoplasma* spp and, specifically, *Ureaplasma urealyticum*.
- ❖ Micro-organisms may reach the decidua in a number of ways: ascending, hematogenous, iatrogenic by a procedure, or retrograde through the fallopian tubes. From the deciduas, they may reach the space between the amnion and chorion, the amniotic fluid, and finally the foetus. A chorio-amnionitis can lead to sepsis in the mother. Foetal infection is linked not only to preterm birth, but also to significant long-term handicaps such as cerebral palsy.
- ❖ It has been reported that, using a DNA probe, asymptomatic colonization of the decidua occurs in up to 70% of women at term, suggesting that the presence of micro-organisms alone may be insufficient to initiate an infectious response. Bacterial vaginosis has been linked to pre-term birth, raising the risk by a factor of 1.5 – 3 (Hillier S.L., Nugent, R.P. and Eschenbach, D.A. (1995).

- ❖ As the condition is more prevalent in black women in the US and the UK, it has been suggested as an explanation for the higher rate of preterm birth in this population. Researchers are of the opinion that bacterial vaginosis before or during pregnancy may affect the decidual inflammatory response that leads to preterm birth. A number of maternal bacterial infections are associated with preterm birth, including pyelonephritis, asymptomatic bacteriuria, pneumonia and appendicitis. In addition, periodontal disease has been shown repeatedly to be linked to preterm birth (Jeffcoat M.K., Geurs, N.C. and Reddy, M.S., 2001). In contrast, viral infections, unless accompanied by a significant febrile response, are not considered to be a major factor in preterm births.
- ❖ A history of prior pre-term deliveries places the patient in the high risk category (ACOG Practice Bulletin, May 2003). Of the predictors of preterm birth, past obstetric history may be one of the strongest. Given a baseline risk of 10-12%, the risk of recurrent preterm birth after one, two and three consecutive preterm births may be increased to approximately 15%, 30% and 45% respectively (ACOG Practice Bulletin, May 2003).
- ❖ Preconceptual counseling could encourage patients to make informed decisions concerning future pregnancies in the light of the risk of prematurity in the presence of previous preterm deliveries. Often the best time to counsel the patient is at her four- to six-week postpartum check-up after a preterm delivery.

2.3.1.7.3.4. Physical assessment guidelines to establish risk

Previous preterm deliveries, including autopsy reports and medical records if appropriate and available, should be reviewed (ACOG Practice Bulletin, May 2003). Social stressors (including housing and food availability), social support in the family, financial stability, domestic violence, drug abuse involving the patient or her family, and death or serious illness of a close family member should also be assessed.

The integrity of the cervix and the extent of any prior injury to it may be assessed by speculum and digital examination. The presence of asymptomatic bacteriuria, STD and symptomatic BV may be investigated. In some patients, formal cervical length assessment may be of use in risk assessment.

Cervical length during prenatal care, particularly at 24-28 weeks' gestation, has been demonstrated to be the most sensitive prenatal predictor of preterm birth in both high and low-risk women. In a mixed high and low-risk population of singleton pregnancies, there was a high correlation between transvaginal ultrasound-measured cervical length at 24 weeks and a risk of spontaneous pre-term delivery before 35 weeks (Iams J.D., Goldenberg R.L. and Meis, P.J., 1996).

The relative risk of preterm delivery among women with a cervix of 25mm or shorter at 24 weeks was 6.2. Furthermore, at 28 weeks, a short cervix (≤ 25 mm) was associated with a 9.6 relative risk of preterm delivery (Iams J.D., Goldenberg R.L. and Meis, P.J., 1996). A cervical length of 25mm or shorter at 28 weeks had a 49% sensitivity for prediction of preterm delivery at less than 35 weeks, a value markedly greater than that of cervical funneling.

Among high-risk women with a history of one or more spontaneous preterm births (excluding those with multiple gestation, uterine anomalies or prior cervical surgeries), 20% of patients demonstrated a cervical length shorter than 25mm, measured by transvaginal ultrasonography at 22-25 weeks (Durnwald C.P., Lundy, J.C. and Iams, J.D., 2005). Among these patients with a short cervix and one previous preterm birth, 37.5% delivered at less than 35 weeks. By contrast, patients with a cervical length greater than 25mm had a preterm rate (< 35 wk) of only 10.6%. Cervical length has similarly been demonstrated as the optimal predictor of preterm delivery in low-risk women.

In an assessment of low-risk women, short cervical length at 24-28 weeks was detected in 8.5% of these women (Goldenberg, R.L., Iams, J.D. and Mercer, B.M., 1998). These patients demonstrated a relative risk of 6.9 for preterm delivery at less than 35 weeks. Compared to foetal fibronectin or Bishop Score, cervical length demonstrated the greatest sensitivity (39%), with a specificity of 92.5% and a negative predictive value of 98%.

While cervical length assessment by digital examination is a semi-subjective measurement, a recent study has demonstrated the value of an objective cervico- portio length measurement using Cerivlenz, an intra-vaginal measuring device (Ross, M.G., Cousins, L. and Baxter-Jones, R., 2007). These manually obtained cervical length measurements appear to be reproducible, accurate and predictive of a short cervical length by trans-vaginal ultrasonography. Cerivlenz may thus represent a low-cost, objective screening tool to identify at risk patients for preterm delivery.

In addition to the 24 to 28-week assessment, evidence indicates the value of early mid-trimester cervical length measurement. Studies by Owen *et al.* from the Maternal Fetal Medicine Units Network (Owen, J., Swain, M. and Dildy, G.A., 2001) demonstrate the value of cervical length measurements between 16 and 23 weeks. Serial trans-vaginal ultrasonographic cervical length measurements in a high-risk population demonstrated that a cervix shorter than 25mm resulted in a relative risk of 4.5 for spontaneous preterm birth at less than 35 weeks, with a 69% sensitivity, 80% specificity, 55% positive predictive value, and 88% negative predictive value. As the NIH Maternal Fetal Medicine Units Network is initiating a study of progesterone treatment for patients with a short cervix in the early mid-trimester, a program of routine cervical length screening may soon be justified.

Education should be provided to patients with a short cervix, alerting them to the signs and symptoms of preterm labour, especially as the pregnancy approaches potential viability. Prenatal visits or contacts may be scheduled at more frequent intervals to increase patient interaction with the care provider, especially between 20 and 34 weeks' gestation, and this may decrease the rate of extreme pre-term birth (Owen, J., Swain, M. and Dildy, G.A., 2001).

2.3.1.7.3.5. Management of specific problems in preterm labour

Randomized clinical trials of cerclage for sonographically suspected cervical incompetence (shortened cervical length and/or funneling) have been inconclusive with respect to prevention of preterm delivery. However, a history of mid-trimester losses combined with a loss of cervical integrity often results in recommendations for cerclage placement between 13 and 17 weeks' gestation (Ross, M.G., Cousins, L. and Baxter-Jones, R., 2007).

When the patient has a history of mid-trimester loss after cone or LEEP biopsy therapy, prophylactic cerclage may be considered, but consulting with a maternal foetal medicine specialist may be beneficial because of the potential risks and the as yet contentious benefits.

2.4. Mode of delivery

The common modes of delivery are vaginal delivery, Caesarean section and instrumental delivery. In the absence of any contra-indication, vaginal delivery is more favourable for maternal wellbeing, as it avoids the risk of anaesthesia and other post operative complication²⁰⁰⁴ (American College of Obstetricians and Gynecologists, 2006).

A Caesarean section (or Cesarean section in American English), also known as a C-section or a Caesar, is a surgical procedure in which incisions are made through a mother's abdomen (laparotomy) and uterus (hysterotomy) to deliver one or more babies²⁰⁰⁴ (American College of Obstetricians and Gynecologists, 2006). It is usually performed when a vaginal delivery would put the baby's or the mother's life or health at risk, although in recent times it has also been performed upon request for childbirths that could otherwise have been natural.

Population based estimates of the Caesarean section rate may reflect, at least partially, the extent to which pregnant women accesses life saving obstetric care (The International Journal of Public Health, 2002). WHO, UNICEF and UNFPA promotes a minimum Caesarean section rate of 5% without specifying the reasons for the procedure (The International Journal of Public Health, 2002) and the World Health Organization (WHO) recommends that the rate of Caesarean sections should not exceed 15% in any country. However, in recent years, the rate has risen to a record level of 46% in China and to

levels of 25% and above in many Asian countries, Latin America and the USA²⁰⁰⁴ (American College of Obstetricians and Gynecologists, 2006).

Previous Caesarean section and trial of vaginal birth after Caesarean (VBAC) are not uncommon today (American College of Obstetricians and Gynecologists, 2006). The medical practice until the late 1970s was 'once a Caesarean, always a Caesarean', but a consumer-driven movement supporting VBAC has changed this practice. Rates of VBAC in the '80s and early '90s soared, but more recently the rates have dropped dramatically owing to medico-legal restrictions.

2.5. Postpartum haemorrhage as an adverse maternal outcome

Postpartum haemorrhage is defined as the loss of more than 500ml of blood after delivery. It occurs in up to 18% of births in the USA and 23% in developing countries (Duncan, J., 2007). Blood loss exceeding 1 000 ml is considered physiologically significant and can result in haemodynamic instability. Even with appropriate management, approximately 3% of vaginal deliveries will result in severe post-partum haemorrhage. It is the most common cause of maternal morbidity in developed countries and a major cause of death worldwide (Eiboume prendiville and Carroli P., 2001).

Risk factors for postpartum haemorrhage include a prolonged third stage of labour, multiple delivery, episiotomy, fetal macrosomia, and a history of postpartum haemorrhage (Duncan, J., 2007) . However, postpartum haemorrhage also occurs in women with no risk factors, so physicians must be prepared to manage this condition at every delivery. Strategies for minimizing the effects of postpartum haemorrhage include identifying and correcting anaemia before delivery, being aware of the mother's beliefs about blood transfusions, and eliminating routine episiotomy (Duncan J., 2007). Re-examination of the patient's vital signs and vaginal flow before leaving the delivery area may help detect slow, steady bleeding.

2.6. Puerperal sepsis as an adverse maternal outcome

Puerperal fever is a temperature rise above 100.0 °F maintained over 24 hours or recurring during the period from the end of the first to the end of the tenth day after childbirth or abortion, or an oral temperature of 100.0 °F or more on any two of the first 10 days postpartum (Carter, Codell and Barbara, 2005).

Published literature indicates wide variations in the incidence of puerperal sepsis. This may be related to different definitions, recording etc. (Carter, Codell and Barbara, 2005).

Today in the United States of America, puerperal infection is believed to occur in between 1 and 8% of all deliveries. In developing countries, the incidence of puerperal

sepsis ranges from 18 to 20% of all deliveries. About three mothers die from puerperal sepsis for every 100 000 deliveries in the USA. The single most important risk factor is Caesarean sections (Carter, Codell and Barbara, 2005).

In the United Kingdom, between 1985 and 2005, the number of direct deaths associated with genital tract sepsis per 100 000 maternities was 0.40-0.85 (Carter, Codell and Barbara, 2005). Puerperal fever (from the Latin *puer*, male child), also called childbed fever, can develop into puerperal sepsis, which is a serious form of septicaemia contracted by women during or shortly after childbirth, miscarriage or abortion. If untreated, it is life-threatening.

In the 18th and 19th centuries, puerperal fever or childbed fever affected, on average, six (6) to nine (9) women in every 1 000 deliveries, killing two (2) to three (3) of them with peritonitis or septicaemia. It was the single most common cause of maternal mortality, accounting for about half of all deaths related to childbirth, and was second only to tuberculosis in killing women of childbearing age. A rough estimate is that about 250 000–500 000 women died from puerperal fever in the 1700s and 1800s in England and Wales alone (Lewis, G. and Drife J., 2001).

The Confidential Enquiry into Maternal and Child Health (UK) reported that, between 2003 and 2005, genital tract sepsis accounted for 14% of direct causes of maternal death (CEMACH, 2003), making puerperal fever still a significant factor in maternal death.

The most common infection causing puerperal fever is genital tract sepsis. Other types of infection that can lead to sepsis after childbirth include urinary tract infection, breast infection (mastitis) and respiratory tract infection (more common after anaesthesia due to lesions in the windpipe).

Puerperal fever is now rare in the West due to improved hygiene during delivery, and deaths have been reduced by antibiotics. It is no longer favored as a diagnostic category. Instead, contemporary terminology specifies:

1. The specific target of infection: endometritis (inflammation of the inner lining of the uterus), metrophlebitis (inflammation of the veins of the uterus), and peritonitis (inflammation of the membrane lining of the abdomen).
2. The severity of the infection: (relatively) uncomplicated infection (excessive multiplication of microbes), and possibly life-threatening sepsis (destruction of tissue by microbes).

2.6.1. Causal organisms of puerperal sepsis

The most common causative agents in inflammation of the inner lining of the uterus (endometritis) are *Staphylococcus aureus* and *Streptococcus* (Schrag S., Gorwitz, R., Fults-Butts et.al., 2002).

Group A Streptococcus (abbreviated to GAS, or more specifically the Streptococcus pyogenes) is a form of Streptococcus bacteria responsible for most cases of severe haemolytic streptococcal illness. Other types (B, C, D, and G) may also cause infection. Group B Streptococcus (abbreviated to GBS, or more specifically Streptococcus agalactiae) usually causes less severe maternal disease (Schrag S., Gorwitz, Fultz-Butts, K. et.al., 2002).

Other causal organisms, in order of prevalence, include staphylococci, coliform bacteria, anaerobe bacteria, chlamydia bacteria, mycoplasma and very rarely, Clostridium welchii.

There are several strains of GAS (Group A Streptococcus). Some strains cause skin infections; these are more common in warm climates, and they usually have local rather than systemic effects. Other strains, in particular Streptococcus pyogenes, attack the throat and cause severe infections.

The human nasopharynx is the main reservoir of Streptococcus pyogenes and infection is more common during winter. It is rarely found in the normal vaginal flora. It is likely that most puerperal haemolytic infections arise from this reservoir in the patient or attendants (Schrag S., Gorwitz R., Fultz-Butts et.al., 2002).

Group B Streptococcus (Streptococcus agalactiae) causes pneumonia and meningitis in neonates and the elderly, with occasional systemic bacteremia. These organisms can also colonize the intestines and the female reproductive tract, increasing the risk of transmission to the infant. The American College of Obstetricians and Gynecologists, American Academy of Pediatrics and the Centers for Disease Control recommend that all pregnant women between 35 and 37 weeks' gestation be tested for GBS (Carter, Codell and Barbara P., 2005).

2.7. Maternal Mortality

According to the WHO, a maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (Min Chou, 2006). The maternal mortality ratio is defined as the number of maternal deaths per 100 000 live births (UNDP, 2000).

The major causes of maternal death are bacterial infections, variants of gestational hypertension including pre-eclampsia, obstetrical haemorrhage, puerperal sepsis, and complications from abortions (Stephenson P., Chalmers, B. and Valentina, F., 1997). Lesser known causes of maternal death include renal failure, cardiac failure and brain damage caused by hyperemesis gravidarum.

2.7.1. Maternal mortality global figures

In the WHO Report 'Make Every Mother and Child Count' (2005), the main causes of maternal mortality were stated as: severe bleeding/haemorrhage (25%) (this includes antepartum haemorrhage due to placenta previa and abruption of placenta); postpartum haemorrhage and abortion; infections (13%); unsafe abortions (13%); eclampsia (12%); obstructed labour (8%); other direct causes (8%); and indirect causes (20%). Indirect causes include malaria, anaemia, HIV/AIDS, cardiovascular disease and complicated pregnancy (Chou, 2006), (UNDP Report, 2000).

Sierra Leone has the highest maternal death rate at 2 000, with Afghanistan the second highest at 1 900 maternal deaths per 100 000 live births, as reported by the UN based on figures in the year 2000. Lowest rates included Iceland at 0 per 100 000 and Austria at four per 100 000. In the United States, the maternal death rate was 17 maternal deaths per 100 000 live births in 2000. Lifetime risk of maternal death accounts for number of pregnancies risk. In sub-Saharan Africa, the lifetime risk of maternal death is 1 in 16; for developed nations it is only 1 in 2 800 (Chou, 2006), (UNDP report, 2000).

2.7.2. Maternal mortality in developing countries

Each year, more than 500 000 women in the developing world die during pregnancy or childbirth. One in 16 women in Africa and one in 43 women in Asia will die of maternal causes this year (Chou, 2006), (UNDP Report, 2000). The maternal mortality rate for sub-Saharan Africa in 2000 was 920 per 100 000 live births (UNDP Report, 2000) and 130 per 100 000 live births in North Africa (UNDP Report, 2000).

2.7.3. Maternal mortality report in Swaziland

The Swaziland Demographic and Health Survey conducted in 2006/2007 asked women about the death of their sisters in order to determine maternal mortalities associated with pregnancy and childbearing. The survey revealed that the 2006/2007 maternal mortality rate in Swaziland was 482 per 100000 (Swaziland Demographic and Health Survey, 2007).

2.7.4. Prevention of maternal mortality

The strategy for reducing maternal mortality mainly focuses on:

- ❖ Provision of health education in sexuality and awareness of family planning (Stephenson P, Chalmers B. and Valentina F., 1997).
- ❖ Increased family planning availability and provision (Stephenson P., Chalmers B. and Valentina F., 1997).
- ❖ Antenatal care services.

- ❖ Training health workers to provide improved reproductive health care for women (Stephenson P., Chalmers B. and Valentina F., 1997).

2.8. Factors associated with adverse foetal outcomes

A pre-term delivery and pre-term baby, low birth weight (The World Health Report, 2005), foetal distress, congenital malformations, stillbirth, intra-uterine growth retardation, intra-uterine foetal death, macrosomia, oligohydramnio, polyhydramnio, Rh iso immunization, post-term pregnancy and twin pregnancy with twin-twin transfusion syndrome are all adverse foetal outcomes.

2.8.1. Pre-term baby as an adverse foetal outcome

It is estimated that spontaneous pre-term birth is responsible for 21.8% of perinatal deaths or 6 346 babies per year in South Africa (Michael, David and Robert, 2009).

Pre-term birth is less common in first world countries ($\pm 12\%$ of deliveries), but in spite of intensive research, the figures continue to increase. A disproportionate amount of the costs incurred in managing neonates is caused by pre-term deliveries.

Prematurity puts infants at a greater risk of hyaline membrane disease with respiratory distress syndrome, intra-ventricular haemorrhage, susceptibility to developing infection and sepsis,

Poorly developed gastro-intestinal system with necrotic enterocolitis and jaundice, poor thermoregulatory system and hypothermia, poorly developed endocrine system and hypoglycaemia.

Babies born before 37 weeks are more likely to die within 24 hours than those born at term (21.7% versus 53.4%) (Chikondi Ntonya, Edith Kayina and S. White, 2005).

Infants born on the cusp of viability at 24 weeks of gestational age have a greater than 50% mortality rate, whereas infants born after 36 weeks have a mortality rate similar to full term infants.

The causes of pre-term labour are unknown. However, various risk factors can be correlated with pre-term labour (Goldenberg R.L., Culhane J.F. and Iams, J.D., 2008). These include pre-term rupture of the membrane, chorioamionitis, multiple gestation, uterine anomalies such as a bicornuate uterus, previous pre-term labour, maternal weight less than 50kg, placenta abruption, maternal disease, including pre-clampsia, infection, intra-abdominal disease, and low socioeconomic class.

In humans, pre-term birth refers to the birth of a baby of less than 37 weeks' gestational age (Goldenberg R.L., Culhane J.F. and Iams, J.D., 2008). Premature birth, commonly

used as a synonym for pre-term birth, refers to the birth of a premature infant. The child may commonly be referred to throughout its life as having been born a 'preemie' or as a 'preemie baby'. Because it is by far the most common cause of prematurity, pre-term birth is the major cause of neonatal mortality in developed countries.

Premature infants are at greater risk of short and long term complications, including disabilities and impediments in growth and mental development. Significant progress has been made in the care of premature infants, but not in reducing the prevalence of pre-term birth (Goldenberg R.L., Culhane J.F. and Iams, J.D., 2008).

The cause of pre-term birth is in many instances elusive and unknown; many factors appear to be associated with the development of pre-term birth, making its reduction a challenging proposition. In that they continue developing after birth, most animals are not born mature. At birth, a normal human infant is less mature than infants of some other primate species, possibly to allow the disproportionately large head to fit through a pelvis adapted for walking on two legs in humans, whereas the usual definition of pre-term birth is birth before 37 weeks' gestation (Goldenberg R.L., Culhane J.F. and Iams, J.D., 2008). A 'premature' infant is one that has not yet reached the level of foetal development that generally allows life outside the womb. In the normal human foetus, several organ systems mature between 34 and 37 weeks, and the foetus only reaches adequate maturity at the end of this period (Chikondi Ntonya, Edith Kayina and S. White, 2005).

The organs most affected by premature birth are the lungs. The lungs are among the last organs to develop in the womb; because of this, premature babies typically spend the first days or weeks of their life on a ventilator. Therefore, a significant overlap exists between pre-term birth and prematurity: generally, pre-term babies are premature and term babies are mature. Prematurity can be reduced to a lesser extent by using drugs to accelerate maturation of the foetus and to a greater extent by preventing pre-term birth altogether.

The shorter the duration of the pregnancy, the greater the risks of mortality rate, morbidity for the baby primarily and due to the related prematurity. Pre-term-premature babies ('preemies' or 'premmies') have an increased risk of death in the first year of life (infant mortality), with the greatest risk occurring in the first month of life (neonatal mortality). Worldwide prematurity accounts for 10% of neonatal mortality, or around 500 000 deaths per year (Chikondi Ntonya, Edith Kayina and S. White, 2005).

In the U.S., where many infections and other causes of neonatal death have been markedly reduced, prematurity is the leading cause of neonatal mortality at 25% (Kaempff J.W., Tomlinson, M. and Arduza, C., 2006). Prematurely born infants are also at greater risk of having subsequent serious chronic health problems, as discussed below.

The earliest gestational age at which the infant has at least a 50% chance of survival is referred to as the limit of viability. As NICU care has improved over the last 40 years, the age of viability has fallen to approximately 24 weeks (Kaempff J.W., Tomlinson, M. and Arduza, C., 2006). Although rare survivors have been documented as early as 21 weeks (Goldenberg R.L., Culhane J.F. and Iams J.D., 2008), this date is controversial as

gestation in this case was measured from the date of conception rather than the date of the mother's last menstrual period.

Gestation appears two weeks shorter than if calculated by the more common method (James S. D., 2007). As risk of brain damage and developmental delay are significant at that threshold even if the infant survives, there are ethical questions over the aggressiveness of the care rendered to such infants. The limit of viability has also become a factor in the abortion debate.

2.8.1.1. Specific risks for the pre-term neonate

Pre-term infants usually show physical signs of prematurity in reverse proportion to the gestational age. As a result, they are at risk of numerous medical problems affecting different organ systems (Simhan H. and Caritis T., 2005)

- ❖ Neurological problems include apnea of prematurity, hypoxic-ischemic encephalopathy (HIE), retinopathy of prematurity (ROP), developmental disability, cerebral palsy and intra-ventricular haemorrhage, the latter affecting 25 percent of babies born pre-term, usually before 32 weeks of pregnancy. Mild brain bleeds usually leave no or few lasting complications, but severe bleeds often result in brain damage or even death.
- ❖ Cardiovascular complications may arise from the failure of the ductus arteriosus to close after birth: patent ductus arteriosus (PDA).
- ❖ Respiratory problems are common, specifically the respiratory distress syndrome (RDS or IRDS) (previously called hyaline membrane disease). Another problem can be chronic lung disease (previously called bronchopulmonary dysplasia or BPD).
- ❖ Gastrointestinal and metabolic issues can arise from hypoglycemia, feeding difficulties, rickets of prematurity, hypocalcemia, inguinal hernia, and necrotizing enterocolitis (NEC).
- ❖ Haematologic complications include anaemia of prematurity, thrombocytopenia, and hyperbilirubinemia (jaundice) that can lead to kernicterus.
- ❖ Infections include sepsis, pneumonia and urinary tract infection.

As the cause of labour still remains elusive, the exact cause of pre-term birth is also unsolved. Labour is a complex process involving many factors. Four different pathways have been identified that may result in pre-term birth and have provided considerable evidence: precocious foetal endocrine activation, uterine overdistension, decidual bleeding and intra-uterine inflammation/infection (Simhan H. and Caritis T., 2005). Activation of one or more of these pathways may happen gradually over weeks, even months (Simhan H. and Caritis T., 2005). From a practical point of view, a number of factors have been identified that are associated with pre-term birth; however, an association does not establish causality.

2.8.2. Disorders of foetal growth as a factor associated with adverse foetal outcomes

Ultrasound can be used to estimate foetal weight. Foetuses whose estimated weight is less than the 10th percentile are termed small for gestational age. Those estimated weight (EFW) is greater than the 90th percentile are termed large for gestational age. Small for gestational age foetuses are further described as either symmetric or asymmetric (Fenn B., Kirkwood B.R. and Popatia, Z. et.al., 2007), (Tamara, Callahan and Aaron, 2001). Symmetric implies that the foetus is proportionately small. Asymmetric implies that certain organs of the foetus are disproportionately small. Classically, an asymmetric infant will have wasting of the torso and extremities, while preserving the brain. Thus the skull will be at a greater percentile than the rest of the body. Screening for disorders in foetal growth is done during routine prenatal care. Once the foetus is at or greater than 20 weeks' gestational age, the uterine fundal height in centimetres should be approximately equal to the gestational age (Fenn B., Kirkwood B.R. and Popatia, Z. et.al.2007). Thus foetal growth can be followed by serial examinations of the fundal height.

2.8.3. Small for gestational age as a factor associated with adverse foetal outcomes

Foetuses which are small for gestational age (SGA) are associated with higher rates of mortality and morbidity than normal sized foetuses. The overall incidence of low birth weight was 15.4% in South Africa. Factors associated with small for gestational age can be divided into those that lead to decreased growth potential and those that lead to intra-uterine growth restriction (IUGR) (Tamara L.Callahan, Aaron B.Caughey and Linda J., 2002).

Factors associated with growth restriction are:

❖ **Maternal factors:**

- Hypertension, anaemia, chronic renal disease, malnutrition, diabetes mellitus
- Hypothyroidism

❖ **Placental factors:**

- Placenta praevia, chronic abruption, placenta infraction and multiple gestations

Decreased growth potential: Congenital abnormality accounts for approximately 10-15% of small for gestational age infants. Trisomy 21 (Down syndrome), Trisomy 18 (Edwards Syndrome) and Trisomy 13(Patau Syndrome) all lead to small for gestational age babies.

Intra-uterine infections of all varieties, particularly the cytomegalus virus and rubella, lead to small for gestational age infants. These infections probably account for 10 -15% of all small for gestational age babies (Trevor, Michael and Joyce, 2002).

Exposure to teratogens: Most chemotherapeutic agents and other drugs taken during pregnancy can lead to decreased potential. The two most common teratogens are alcohol and cigarettes. Up to 10% of small for gestational age foetuses are constitutionally small based purely on parental stature.

2.8.4. Large for gestational age as adverse foetal outcome

Large for gestational age (LFGA) is defined as having an expected foetal weight greater than the 90th percentile. Although definitions of macrosema vary, a birth weight heavier than 4kg is considered as macrosema (Farial , F.F., Syed Iqubai Amazon and Heinze W. Berendes, 2002), (Tamara L.Callahan, Aaron B.Caughey and Linda J., 2002). Macrosemic foetuses have a higher risk of shoulder dystocia and birth trauma with resultant brachial plexus injuries in vaginal deliveries. Other neonatal risks include low APGAR score, hypoglycemia, polycythemia, hypocalcemia and jaundice. Large for gestational age foetuses are at a higher risk of childhood leukemia, Wilms tumour and osteosarcoma. Mothers with large for gestational age macrosemic foetuses are at increased risk of Caesarean section, perineal trauma and postpartum haemorrhage.

2.8.5. Neonatal sepsis as adverse foetal outcome

Neonatal sepsis may be defined both clinically and/or microbiologically, by positive blood and/or cerebrospinal fluid cultures. In this review, only microbiologically-proven cases are included (Verganano, Shorland and Pkazembe, 2004).

Neonatal sepsis may be classified according to the time of onset of the disease: early onset (EOS) and late onset (LOS). The distinction has clinical relevance, as EOS disease is caused mainly by bacteria acquired before and during delivery, while LOS disease can be attributed to bacteria acquired after delivery (nosocomial or community sources) (Barlett, Bocaletti and Bocaletti, 1991).

EOS occurs from 48 hours to six (6) days after delivery. This makes it difficult to compare studies where cases are grouped into EOS and LOS without further details. Those studies using more detailed definitions will incorporate a larger proportion of cases where the organism is acquired horizontally, from nosocomial or community sources, rather than as a result of vertical transmission. Different practices of care can, therefore, have an impact on these rates. For example, hospitals with early discharge policies may expose infants to community infections and those with late discharge policies to nosocomial infections. Studies based on hospitals with early discharge will probably report lower rates of late-early or LOS infections, especially if infants presenting from the community are not incorporated in the analyses. A few papers distinguish between very early onset (within 24 hours), EOS (24 hours to six days), and LOS (after more than six days) sepsis (Barlett, Bocaletti and Bocaletti, 1991).

The reported incidence of neonatal sepsis varies from 7.1 to 38 per 1 000 live births in Asia, from 6.5 to 23 per 1 000 live births in Africa, and from 3.5 to 8.9 per 1 000 live births in South America and the Caribbean. By comparison, rates reported in the United States and Australasia range from 1.5 to 3.5 per 1 000 for EOS sepsis and up to 6 per 1 000 live births for LOS sepsis, a total of 6 to 9 per 1 000 for neonatal sepsis (Barlett, Bocaletti and Bocaletti, 1991).

In 2005, the incidence of early onset neonatal sepsis was 0.4 percent of all live births delivered at Johannesburg Hospital (Matora, Deballot and Peravic, 2005).

Several Authors have defined risk factors that could help to predict early onset of neonatal sepsis including premature rupture of membrane, preterm labour, maternal infections such as chorioamnionitis and Urinary tract infection.

2.9. Perinatal mortality

The perinatal mortality rate (PNMR) is the number of prenatal deaths per 1 000 births (Pattinson R.C., 2000). The perinatal period starts at the beginning of foetal viability (28 weeks' gestation or 1 000g) and ends at the end of the seventh day after delivery. Perinatal deaths are the sum of stillbirths and early neonatal deaths.

2.9.1. Global perinatal mortality

The PNMR is the most sensitive indicator of obstetric care. In developed countries, the PNMR for babies over 1 000g is usually less than 6/1 000 births. The highest neonatal mortality rates and rates of stillbirth occur in sub-Saharan Africa, followed by Asia and Latin America (Pattinson R.C., 2000). In countries where the mortality is highest, almost 10 percent of babies do not survive more than a month.

2.9.2. Perinatal mortality in developing countries

Each year, 10.7 million children under the age of five years die: 4 million during the first four weeks of life. Another 3.3 million are stillborn. And these are only the official reports. In less developed countries, which account for 98 percent of reported neonatal deaths and 97 percent of reported stillbirths, these births and deaths are not always registered (Central Statistical Office (CSO) of Swaziland, 2006-2007), (Pattinson R.C. 2000). In developing countries, PNMR ranges from 30-200 (Central Statistical Office (CSO) of Swaziland, 2006-2007).

2.9.3. Perinatal mortality in Swaziland

In Swaziland, the infant mortality rate is 85 per 1 000 live births, while the under five mortality rate is 120 per 1 000 live births (Swaziland Demographic and Health Survey, 2007). The average birth interval in this country is 36 months (Swaziland Demographic and Health Survey, 2007).

Since 2000, when the United Nations Millennium Declaration was signed, efforts to reduce mortality among children under five years of age have been accelerating. It will be difficult to reach the stated goal (cutting the rate by two thirds by 2015) without reducing the number of neonatal deaths. Many useful interventions can be implemented in resource-poor settings, but weak health care delivery systems remain a significant barrier. Research on alternative approaches is ongoing, including the training and deployment of traditional birth attendants. But the problems involved are so many, and the resources so limited, that the task remain a daunting one.

2.10. Summary of literature review

In summary, adverse foetal and maternal outcomes are some of the main challenges in developing countries. The causes of poor foetal outcomes and maternal outcomes are:

- ❖ Socioeconomic factors, such as inadequate health service delivery and antenatal care provision, poor infrastructure and the distance of the health facility from the home state, a low income society, lack of proper health education and cultural influences (Kagee, 2004).
- ❖ Maternal obstetric factors such as teenage and early age pregnancy, late age primi, grand multipara, and multiple pregnancies, premature rupture of membrane.
- ❖ Abortion, antepartum haemorrhage, pregnancy-induced hypertension, polyhydramino and oligohydramino (Juli, Abdulrrazaq and Mizanur, 2004).
- ❖ Maternal medical conditions: diabetes mellitus, chronic hypertension, heart disease, urinary tract infection and pelvic inflammatory disease (Wilkinson, 1997).
- ❖ Maternal lifestyle: alcohol intake and abuse, smoking and drug abuse.
- ❖ Foetal factors: pre-term baby, low birth weight, Rh isoimmunisation, twin-twin transfusion and macrosemia (Tamara, Callahan and Aaron, 2002).
- ❖ Some adverse maternal outcomes are: postpartum haemorrhage, puerperal sepsis, pregnancy-induced hypertension and obstetric related maternal death.
- ❖ Poor foetal outcomes include pre-term babies, very low birth weight, neonatal sepsis, congenital malformations and perinatal death.

Chapter 3

METHODOLOGY

3.1 AIM

The aim of the study was to measure the maternal and foetal outcomes of the deliveries attended to at Emkhuzweni Health Centre, Swaziland.

3.2. OBJECTIVES

The objectives of the study were:

- ❖ To determine maternal outcomes of the deliveries attended to at Emkhuzweni Health Centre.
- ❖ To determine foetal outcomes of the deliveries attended to at Emkhuzweni Health Centre.
- ❖ To identify risk factors that affect maternal and foetal outcomes at Emkhuzweni Health Centre.

3.3. METHODS

3.3.1. Study design

The study design was a retrospective quantitative study.

3.3.2. Study population

The study population was all deliveries at Emkhuzweni Health Centre between 1 January and 31 December, 31 2007, a total of 520 deliveries.

3.3.3. Sample

The sample was the records of entire study population: records of all the deliveries attended to at Emkhuzweni Health Centre in 2007.

3.3.4. Inclusion criteria

All deliveries at Emkhuzweni Health Centre from 1 January 2007 to 31 December 2007 were included in the study.

3.3.5. Exclusion criteria

- ❖ Home deliveries not admitted at the maternity ward for delivery service were not included in the study.
- ❖ Mothers who were admitted at Emkhuzweni Health Centre for delivery service, but who opted out of the service against medical advice were not included in the study.

3.3.6. Data collection

A retrospective chart review was performed for the records of all deliveries that took place at Emkhuzweni Health Centre from 1 January 2007 to 31 December 31 2007. Records of the labouring mothers were eligible for the study if they met the inclusion criteria.

Data comprised demographic information, risk factors, maternal outcomes and foetal outcomes for each participant. This information included age, address, parity, gravidity, gestation age, mode of delivery, any obstetric problems, foetal condition after delivery and maternal condition after delivery, including APGAR score at first and fifth minute and birth weight.

Addresses of labouring mothers were written in terms of name of a village, as all the catchments areas of Emkhuzweni Health Centre are rural areas. In rural area of Swaziland name of a village is considered as an address.

The risk grading was classified based on the assumption that the presence of at least one risk factor was considered as high risk, the absence of any risk factor from the maternal records as low risk and those who are lacking information as unknown.

The data was collected by a nurse who was trained in the collection of data by the researcher. She collected the data in her own time when she was off duty in order to avoid any conflict with her duties at the health centre.

Once the data had been collected, it was captured on computer by the nurse, using Microsoft Excel. The researcher supervised this process very carefully and verified the data.

3.3.7. Data analysis

The results were analyzed using statistical software SPSS 17.0. The information was presented in descriptive statistics for all variables in order to determine the distribution of variables and simple univariate analysis of data, i.e. rate, ratios etc were conducted in order to determine the frequency of the variables on the data collection form. Tables were used to illustrate the results. Categorical variables were analyzed by chi-square or Mann Whitney test for continuous variables. Odds ratio (OR) and 95% confidence intervals (95%CI) were calculated by logistic regression model and used as a measure of the strength of the association between the outcome variables and their predictors. The relationship between variables were analyzed by the Pearson's correlation. The threshold for statistical significance was considered as p value < .05 for all statistical analyses.

3.4. Validity and Reliability

3.4.1. Validity

Validity is the extent to which measurement truly reflects the phenomenon under scrutiny (Pop and Mays 1995). In this study, validity was ensured by:

- Large sample size has a good representative of the study population and increases the power of the study
- Consultation of highly skilled and reputable professionals on relevant topics
- Leveling similar risk factors into one group.
- Appropriate training of data collector.

3.4.2. Reliability

Reliability is the extent to which a measurement yields the same answer (result) each time it is used (Pope and Mays 1995). In this study, the following measures were taken to ensure reliability:

- The same data collector was used throughout the study.
- The same data collection form was used for all the participants in the study.
- The data collector was trained before she started the data collection process.

3.5. Bias

Bias is a process that, in a systematic manner, introduces into a research study some elements that lead to outcomes and deductions that differ from the true situation (Katzenellenbogen 1999).

As much as possible efforts were done to minimize bias in this study; however, due to the fact that the study is based on existing data, loss of information due to non documentation could cause some information bias.

The measures taken to minimize bias were as follow.

3.5.1. Sampling bias

The whole study population, i.e. all the deliveries at Emkhuzweni Health Centre in 2007, were taken as the study sample in order to minimize sampling bias.

3.5.2. Observer bias

The data was collected by one data collector to minimize observer bias.

3.5.3. Data analysis bias

The data analysis bias was minimized by using a standard data collection form and the same data collection form was used for the entire study sample.

3.6. Ethical considerations

Permission to carry out the study was obtained from the following bodies:

1. Medunsa Research Ethics Committee (MREC), University of Limpopo, Medunsa campus.
2. Ministry of Health and Social Welfare's Scientific and Ethics Committee.
3. Emkhuzweni Health Centre Management Committee.

Chapter 4

RESULTS

4.1 Introduction

In this chapter the study population (520 labouring mothers) who were assisted at Emkhuzweni Health Centre in 2007 and eligible were entered in to the SPSS for statistical analysis. The 520 data occupied one row per each data on the SPSS data spread sheet. The complete data for every labouring mother included maternal outcomes, foetal outcomes and maternal risk factors.

The twin neonates occupied one row for every neonate on the SPSS data spread sheet and the total number of SPSS rows occupied was 532. However, this doesn't mean that the study population was 532. The 12 extra from the 520 study population were due to twin neonates.

The following variables on the questionnaire were amended during data collection.

Age group was amended in to <20, 20- 25, 26-30, 31- 35 and > 35

Addresses were written by the name of the villages where they used to stay at the time when they were admitted for delivery service.

The variables for the Post delivery maternal condition as mentioned on the questionnaire were normal, sick and death. Furthermore, during data collection, mothers who were sick after delivery were further analyzed in to the type of illness that they had after they delivered.

APGAR score were grouped in to < 4, 4-6 and >6 both at the first and fifth minute. This is similar to the grouping on the questionnaire ≤ 3 , 4-6 and ≥ 7 .

Data for the whole sample size (520), was available for the following variables: age, address, health facilities where antenatal care was received by the pregnant mothers, gravidity, parity, gestational age, risk grading and mode of deliver

When you look at the mode of delivery, you will see that the number of referred pregnant mothers in 2007 to Piggs Peak hospital for further obstetric care was 58 and these 58 mothers were excluded from the post delivery maternal hospital stay and post delivery maternal condition analysis. Hence, the data for the post delivery maternal hospital stay and post delivery maternal condition was reduced to 462.

The data for the APGAR score at the first minute and APGAR score at the fifth minute was 445. This is because the 58 referred mothers were excluded from the analysis and another 31 were excluded from the analysis as they didn't have proper data on the APGAR grading.

The number of data available for the newborn baby birth weight, sex of the newborn baby and neonatal condition after birth was 476 this excludes the 58 referrals. And the 12 twin neonates raise the figures of the newborn baby's data by 12.

4.2. Demographic characteristics

4.2.1. Maternal age

Information about the maternal age was available for the 520 labouring mothers who were assisted at Emkhuzweni Health Centre in 2007. Out of the 520, 112 (21.5%) were aged between below 20 years. This age group is the third common in the frequency of the age distribution, next to age group 20-25 years and age group 26-30 years. The mean age for this age group was 17.5 and the median was 18 years.

The majority of the labouring mothers 228 (43.8%) were between age 20 and 25. The median age for this age group was 22 and mean age was 22. Followed by the age 26-30

years, which accounts for 116 (22.8%) of the total number of the mothers. The mean and median for this age group were 27.8 and 28 respectively. Forty (40) (7.7%) were aged between 31 and 35 years, with mean and median of 33. The rest - 34 (6.5%) were of an age greater than 36 years. The mean age for this age group was 38.2 and median age was 38.

Table I. Distribution of maternal age in years

Age of labouring mothers	Frequency (f)	Percent (%)	mean	median
<20 years	112	21.5	17.5	18
20-25	228	43.8	22	22
26-30years	116	20.5	27.8	28
31-35years	40	7.7	27.8	28
>35years	34	6.5	38.2	38
Total	520	100.0		

The distribution of labouring mothers by their age category and the frequency of each age group is tallied in Table 1 above. Ages in months were approximated to the nearest age in years.

4.2.2. Addresses of the labouring mothers

Addresses were available for all 520 labouring women who were assisted at Emkhuzweni Health Centre in 2007. Out of the 520 labouring mothers who were assisted at Emkhuzweni Health Centre in 2007, 130 (24.4%) lived in Mayiwane village. Mayiwane is the nearest area to the health centre, and surrounds it in three directions: East, North and South. Fifty-three (53) (10%) came from Nyakatfo area. This village is located to the West, half-way between Dvokolwako Health Centre and Emkhuzweni Health Centre. These communities have two options when it comes to accessing health services; they can go either to Dvokolwako or to Emkhuzweni Health Centre. Both health centers offer similar health service.

Fourty nine (49) (9.2%) were from Ndlalambi village, 65 (12.2%) were from Mhlangatane; 57 (18.7%) were from Sihhoye village; 47 (8.8%) were from Mpofu village; 21 (3.9%) were from Fontotshe; 66 (12.4%) were from Herefords village; 30 (5.6%) were from Nhlangyavuka. Eleven (11) (2.1%) were from others including Bulandzeni, Timpisini, Matfuntini, Tingonini, Malibeni and Zway'bani villages.

Some 48.15% of women who were assisted at Emkhuzweni Health Centre were found to live within 6-31km far from the Health Centre; 42.25% were within a 6km distance, while the rest (9.6%) lived more than 31 kilometers away from Emkhuzweni Health Centre.

Table II. Distribution of addresses of the labouring mothers assisted at Emkhuzweni Health Centre in 2007

Address	Frequency (f)	Percent (%)
Mhlangatane	65	12.2
Mayiwane	130	24.4
Nyakatfo	53	10.0
Sihhoye	57	10.7
Nhlang'yavuka	30	5.6
Fontotshe	21	3.9
Ndlalambi	49	9.2
Mpofu	47	8.8
Others	11	2.1
Herefords	66	12.4
Total	520	100.0

The addresses of the labouring mothers where used to stay at the time of admission to the maternity ward for delivery service are listed in table II. Others are Bulandzeni, Malibeni and Zewy bani villages; however, they are not listed in this table.

4.2.3. Health facilities where antenatal care was received by the pregnant mothers

Information on the frequency of antenatal visit to health facilities by these women during pregnancy was available for 520 of them. Out of the 520 women in the study, 190 (36.5%) received antenatal care service at Emkhuzweni Health Centre. Eighty one (15.6%) had attended antenatal care follow-ups at Manguweni clinic; 81 (15.6%) at Herefords clinic; 42 (8.1%) at Ndwabangeni clinic; 22 (4.2) at Bulandzeni clinic; 14 (2.7%) at Horo clinic; 9(1.7%) at Mhlangatane clinic; and 27 (5.2%) attended antenatal care follow-ups at other health service centers. These included Pigg’s Peak Hospital, Mhlangatane clinic, Vuvulane clinic and Jeppe Hospital in South Africa. The rest 54(10.4%) didn’t have antenatal care attendance.

Table III. List of health services where antenatal care was provided to the pregnant Mothers

ANC attended	<i>Frequency (f)</i>	Percent (%)
EHC	190	36.5
Herefords	81	15.6
Manguweni clinic	81	15.6
Horo clinic	14	2.7
Ndwabangeni clinic	42	8.1
Bulandzeni clinic	22	4.2
Mhlangatane	9	1.7
Others	27	5.2
NoANC attendance	54	10.4
Total	520	100%

The frequency with which health facilities providing antenatal care were attended by the women in the study population was plotted in this table. The majority received antenatal

care at Emkhuzweni Health Centre. Herefords clinic, Horo clinic, Ndwabangeni clinic and Manguweni clinic are constant clinics found in the catchments area of Emkhuzweni Health Centre, Bulandzeni and Mhlangatane clinic are mobile clinics.

4.3. Maternal factors

4.3.1. Gravidity

Information about the number of pregnancies that each woman had experienced was available for all the 520 women. The highest frequency was observed among the gravida two-to-four (2-4), which accounted for 340 (65.4%) of all women in the sample. This was followed by primigravida, which accounted for 92 (17.7%) of the sample and 88 (16.7%) were pregnant more than four times.

Table IV. Number of gravidity of women at the time of admission

Gravidity	Frequency (<i>f</i>)	Percent (%)
gravida 1	92	17.7
gravida2-4	340	65.4
Gravid> 4	88	16.7
Total	520	100

The frequencies of pregnancies experienced by the women in labour assisted at Emkhuzweni health centre were categorized in to gravida 1, gravida 2-4 and gravida ≥ 5 in table IV.

4.3.2. Parity of the labouring women

Information was available for all the labouring mothers who were assisted at Emkhuzweni Health Centre in 2007. Of the 520 women, the majority 390 (75%) had one-to-five (1-5) live births. Eighty four (16.1%) were nulliparous, and 46 (8.9%) had more than five live births.

Table V. The distribution of the total number of live births experienced by the labouring mothers who were assisted at Emkhuzweni Health Centre in 2007

Parity of the Labouring Mothers	Frequency (<i>f</i>)	Percent (%)
para 0	84	16.1
para1-5	390	75
>5 parity	46	8.9
Total	520	100

Distribution of total number of live births experienced by women in labour assisted at Emkhuzweni Health Centre in 2007. The frequencies of parity were categorized into nulliparous (mothers who had no live births at all); multiparous (mothers who had 1-5 live births and grand multiparous (those who had more than five live births).

4.3.3. Gestational age

Information about the gestational age was available for 520 of the aborting mothers who were admitted at Emkhuzweni Health Centre in 2007. Highest frequency 402 (77.3%) was observed among 38-42 weeks of gestational age, statistically significant at $p=0.001$ and 99% confidence interval; 104 (20%) of the aborting mothers delivered at gestational age of between 20 and 37 weeks by date and 11 (2.1%) were post date.

Table VI. Gestational age by date at the time of deliver

Gestational age	Frequency (<i>f</i>)	Percent (%)
20- 37 weeks of G. Age	104	20
38-42 weeks G. Age	402	77.3
>42 Weeks G. Age	11	2.1
Not known	3	.6
Total	520	100

The gestational age at the time of delivery was plotted for all the 43 laboring mothers who were assisted at Emkhuzweni Health Centre in 2007. Term pregnancy (gestational age 38-42 weeks); preterm pregnancy (gestational age 20-37 weeks); and post date (gestational age greater than 42 weeks by date).

4.3.4. Risk grading of pregnancy

Information about the presence or absence of risk factors was available for 520 mothers. The majority 300 (57.7%) were low risk pregnant mothers and 198 (38%) were high risk mothers and the rest 22 (4.2%) had unknown risk grading.

Table VII. Risk grading of the pregnant mothers

Risky grading	<i>Frequency</i> (<i>f</i>)	Percent (%)
low risk	300	57.7%
High risk	198	38 %
unknown	22	4.2%
Total	520	100

Based on the overall risk assessment, the labouring mothers who were assisted at Emkhuzweni Health Centre in this study were categorized a slow risk and high risk in table VII. The presence of at least one obstetric risk factor is defines a woman as 'high

risk mother' and absence of any obstetric risk factor is defines a woman as low risk in table VII.

4.3.5. Mode of delivery

Information about the mode of delivery was available for all the labouring mothers assisted at Emkhuzweni Health Centre in 2007. The highest frequency was observed among the mothers who had normal vaginal delivery. These accounted for 457 (87.9%) of all the women who were assisted, statistically significant at $p=0.012$. Fifty eight (11.1%) were transferred to Pigg's Peak Hospital for Caesarean section or other operative delivery; while five (0.96%) were assisted by instrument delivery.

The decisions for the referral in each case were made by the attending physician at Emkhuzweni Health Centre, based on the maternal and foetal conditions at the time of admission and course of the labour.

Table VIII. Mode of delivery of the labouring mothers assisted at Emkhuzweni Health Centre

Mode of delivery	Frequency (f)	Percent (%)	Mean	SD	<i>P-Value</i>
NVD	457	87.9	1.58	0.516	P=0.012 ***
Assisted	5	.96	1.60	0.548	
Transferred	58	11.1	1.50	0.516	
Total	520	100			

***significant at $p=0.012$

P-values are calculated by Mann Whitney test for continuous variables and Chi-square test for dichotomous variables.

4.4. Maternal outcomes

4.4.1. Maternal condition after delivery

Information concerning maternal condition after delivery was available for the 462 mothers who delivered at Emkhuzweni Health Centre. The majority 415 (89.8%) who were assisted here had uneventful deliveries. This was statistically significant at $p=0.030$; 25 (5.4%) developed puerperal infection; 16 (3.4%) experienced postpartum haemorrhage; five (1%) suffered pregnancy-induced hypertension and there was one case (0.2%) of maternal death.

The diagnosis for the maternal postpartum sepsis, postpartum haemorrhage and maternal death was made and treated accordingly by the treating physician. However, mothers who had normal deliveries and were well after delivery were attended to by midwifery.

Table IX. Maternal condition after delivery

Maternal condition	Frequency (<i>f</i>)	Percent (%)	Mean	SD	<i>P=Value</i>
normal	415	89.8	1.58	0.495	P=0.030
PPH	16	3.4	1.43	0.535	***
Purpural sepsis	25	5.4	1.71	0.488	
PIH	5	1	1.00		
maternal death	1	.2			
Total	462	100			

SD: Standard Deviation

*** Statistically significant at $p=0.030$

4.4.2. Post delivery maternal hospital stay

Information on the postpartum maternal ward stay was available for all the 462 labouring mothers who delivered at Emkhuzweni Health Centre excluding those who were referred to Pigg's Peak Hospital. Of all the deliveries, 285 (61.7%) labouring mothers who were assisted at Emkhuzweni Health Centre were discharged from the maternity ward in less than 24 hours after delivery. This was statistically significant at $p=0.000$; 149 (32.2%) stayed in the maternity ward for between one and three days post delivery; 27 (5.8%) were discharged after three to seven days stay in the maternity ward; the remaining 1 (0.2%) were discharged from the maternity ward after seven days after delivery.

In the case of mothers who were discharged in under 24 hours after delivery, the decision was made by the attending midwife. Decisions to keep postpartum mothers at the ward for more than 24 hours were made by the treating physician, based on the presence of post delivery maternal or foetal abnormality.

Table X. Duration of post delivery maternal stay at the hospital

Hospital stay	<i>Frequency</i> (<i>f</i>)	Percent (%)	Chi-square	Mean	SD	p. value
<24 hrs	285	61.7	437.16	1.75	0.500	0.000
24hrs- 3 days	149	32.2		1.67	0.500	***
4-7 days	27	5.8		1.67	0.516	
> 7 days	1	.2		2.00	0.00	
Total	462	100				

*** Statistically significant

Post delivery maternal hospital stay of labouring mothers who were assisted at Emkhuzweni health centre was plotted in table X. The duration of stay were categorized in to <24hrs, 24hrs-3days, 4-7 days and >7 days.

4.5. Foetal outcomes

4.5.1. New-born baby APGAR score

Information on the first minute APGAR score was available from the neonatal record book for 476 of the neonates. APGAR scores were not recorded for 31 neonates and the midwifery who assisted the delivery used instead terms such as ‘the baby cried after birth’, ‘the baby didn’t cry after birth’, and ‘condition of the baby is satisfactory’.

The APGAR score of the first minute and fifth minute for the 445 new-born baby’s are shown in Table XI and XII. The first minute scores were grouped into APGAR score less than four; score of 4-6; and APGAR scores greater than six.

The fifth minute APGAR score was divided into score less than 4; score of 4-6 and APGAR score of greater than seven. The highest frequency was observed among the babies who had APGAR score of greater than six, these accounted for 317 (71.3%) of all the neonates who were delivered at Emkhuzweni Health Centre in 2007, and are statistically significant at $p=0.000$. Eighty five (19%) had APGAR score of 4-6 at their first minute post delivery; 43 (9.7%) had APGAR score of less than four at the first minute post delivery.

Some 393 (88.3%) of neonates delivered at Emkhuzweni Health Centre had APGAR score greater than 6 in the fifth minute post delivery. This was statistically significant at $p=0.001$. Forty four (9.9%) of the neonates had APGAR score of 4-6 in their fifth minute post delivery; and 8 (1.8%) had APGAR score of less than 4 in the fifth minute post delivery.

The APGAR score for each new-born was filled by the attending midwifery and by the attending physician, based on the grading system.

Table XI. APGAR score at the first minute

APGAR Score	Frequency (<i>f</i>)	Percent (%)	Chi-square	P. value
< 4	43	9.7	684.09	0.001
4-6	85	19		***
>6	317	71.3		
Total	445	100		

**Statistically significant at p=0.001

The first minute APGAR score was categorized into APGAR score less than 4; APGAR score 4-6, and APGAR score greater than 6.

Table XII. APGAR Score in the fifth minute

APGAR Score	Frequency (<i>f</i>)	Percent (%)	Chi-square	P. value
<4	8	1.8	724.000	0.001
4-6	44	9.9		***
>6	393	88.3		
Total	445			

*** Statistically significant at p=0.001

Fifth minute APGAR score was grouped into APGAR score less than 4; APGAR score 4-6, and APGAR score greater than 6.

4.5.2. New-born baby birth weight

Information about the birth weight of each new-born was available for all the 476 live births delivered at Emkhuzweni Health Centre in 2007. Of these 476 new-born, 368 (77.3%) had a birth weight between 2.6 and 4kg, statistically significant at p=0.001 and 99% confidence interval; 60 (12.6 %) had birth weight between 2 and 2.5kg; 21 (4.4%) had birth weight of less than 2kg; and 26 (5.5%) had birth weight greater than 4kg.

three (33) of the low birth weight babies were pre-term; 25 were term and born to mothers with low risk; eight (8) of the low birth weight babies were twins; two (2) were born to mothers who had pregnancy-induced hypertension and another two were born to mothers who had chronic maternal illnesses.

Table XIII. Neonatal birth weight

Birth weight of babies	Frequency (f)	Percent (%)	Mean	SD
<2 kg	21	4.4	1.75	0.500
2-2.5kg	60	12.6	1.45	0.45
2.6-3.9kg	368	77.3	1.54	0.500
>4 kg	26	5.5	1.93	0.267
Total	476	100		

Birth weight of the neonates delivered at Emkhuzweni Health Centre in 2007. The birth weights were categorized into over weight, normal birth weight, low birth weight, and very low birth weight.

4.5.3. Sex distribution of new-born babies

The new-born babies were categorized into two groups, male and female, based on their external sexual organs.

Information about the sex of each new-born was available for the 476 newborns delivered at Emkhuzweni Health Centre in 2007. The majority, 265 (55.7%), of these neonates who were delivered at the health centre were females. The proportion of female to male was 1.25% and the Chi square test was 264.796.

Table XIV. The sex distribution of the newborn babies who were delivered at Emkhuzweni Health Centre in 2007

Gender of the new born babies	Frequency (f)	Percent (%)	Cumulative Percent	Chi- square test
male	211	44.3	44.3	264.796
female	265	55.7	100	
Total	476	100		

The sex distribution of the newborns delivered at Emkhuzweni Health Centre in 2007. The sex distribution was grouped into male and female based on the presence of male or female external genitalia and there was no ambiguous sex.

4.5.4. Newborn babies' conditions after birth

Foetal outcomes were grouped into normal, low birth weight, neonatal sepsis, pre-term, congenital mal formation neonatal death and still birth.

Information on the outcomes of 476 newborns was gathered from the neonatal registration book. 284 (59.7%) of all the neonates who were delivered at the health centre were term and normal after delivery. This was statistically significant at $p=0.000$. There were seven (1.5%) stillbirth; while 81 neonates (17%) had low and very low birth weight; 90 (18.9%) were pre-term, nine (1.9%) developed early onset neonatal sepsis; two (0.4) neonatal death and three (0.4%) had congenital malformations.

The diagnosis of early onset neonatal sepsis was made by the treating physician, based on the neonatal clinical condition and laboratory investigations. These cases were treated by the treating physician at Emkhuzweni Health Centre. However, the labelling of pre-term and term neonate was made partly by the midwifery and partly by the treating physician. The two congenital malformations were seen by the treating physician.

Table XV. Foetal condition after birth

Fetal condition	Frequency (f)	Percent (%)	Mean	SD	p. value
normal	284	59.7	1.58	0.495	0.000
Pre-term	90	18.9	1.58	0.499	***
neonatal sepsis	9	1.9	1.80	0.447	
congenital malformation	3	0.6			
neonatal death	2	0.4	1.50	0.577	
stillbirth	7	1.5	1.25	0.707	
low birth weight	81	17	1.56	0.500	
Total	476				

*** Statistically significant at p=0.000

Outcomes of the neonates delivered at Emkhuzweni Health Centre in 2007

New-born baby were grouped based on their health outcomes into six categories: Normal; low birth weight; congenital malformation; neonatal sepsis; pre-term and stillbirth

4.6. Maternal and foetal outcomes among the high risk mothers

The odds ratios and 95% confidence interval for the maternal risk factors that affect maternal and foetal outcomes was analyzed in table VI

The odds ratio for the PPH was 2.09 and the 95% confidence interval was 1.99- 2.81, the OR for the puerperal sepsis was 2.91 and the 95% CI was 1.88- 3.05, the OR for the PIH was 2.56 with 95% confidence interval of 1.67- 2.98.

The OR for the mothers who stayed post delivery for more than 7 days at the maternity ward was 3.09 with 95% confidence interval of 1.81- 2.80, OR for mothers who stayed 4-7 days post delivery was 2.85 with 95% confidence interval of 1.54- 2.98.

The odds ratio new born babies with birth weight < 2kg was 4.33 with 95% CI of 2.39- 5.62 and the OR for new born babies with birth weight of 2-2.5 kg was 1.91 with 95% CI of 1.93- 2.55.

The odds ratio for the neonates who developed neonatal sepsis was 3.05 with 95% confidence interval of 0.98-3.82, the OR for preterm new born babies was 2.01 with 95% CI of 1.94-2.66,

The OR for the neonates with congenital malformations was 4.12 with 95% confidence interval of 2.50- 7.84 and the OR for the stillbirths was 1.56 with 95% CI of 0.97- 1.89.

Table XVI. Risk factors that affects maternal and foetal outcomes

Variables	Odds ratio (OR)	95% Confidence interval	
Maternal condition			
normal	1.00	-	-
PPH	2.09	1.99	2.81
Puerperal sepsis	2.91	1.88	3.05
PIH	2.56	1.67	2.98
maternal death	-	-	-
Duration of post delivery maternal stay at the hospital			
<24 hrs	1.00	-	-
24hrs- 3 days	2.41	2.13	2.45
4-7 days	2.85	1.54	2.98
> 7 days	3.09	1.81	2.80
Birth weight of babies			
<2 kg	4.33	2.39	5.62
2-2.5kg	1.91	1.93	2.55
2.6-3.9kg	1		
>4 kg	-	2.03	3.95
normal	1.00	-	-
Pre-term	2.01	1.94	2.66
neonatal sepsis	3.05	0.98	3.82
congenital malformation	4.12	2.50	7.84
neonatal death	-	-	-
Stillbirth	1.56	0.97	1.89

Table 15 above shows the odds ratios and the 95% confidence intervals for each level of the risk factors considered at Emkhuzweni health centre.

4.7. Pearson's correlation for the maternal age, maternal geststional age, mode of delivery, weight of the baby, maternal and foetal outcome

The relationship between the maternal age, gestational age, mode of delivery, weight of the baby, post delivery maternal condition and post delivery neonatal condition was done

with the Pearson's correlation. The Pearson's correlation for the maternal age against the post delivery condition of the baby was 0.014, maternal gestational age was 0.22, 0.095 for the mode of delivery, 0.034 for the weight of the newborn baby, 0.007 post delivery maternal condition and .014 for the post delivery condition of the newborn baby.

The Pearson correlation between the G.A. verses mode of delivery, weight of the newborn baby, post delivery maternal and foetal condition were -.127, .081, -.191, -.155 respectively.

The Pearson correlation between the mode of delivery verses neonatal birth weight, post delivery maternal and foetal condition were -.014, .046 and -.009 respectively

Table XVII Pearson's correlation for the age, maternal gestational age, mode of delivery, weight of the baby, post delivery maternal and foetal condition.

		age	G.A	mode of delivery	Weight of baby	post delivery condition of baby	post delivery maternal condition
age	Pearson Correlation	1.000	.022	-.095	.034	.014	.007
	Sig. (2-tailed)	.	.612	.030	.465	.760	.883
	N	520	519	518	464	464	466
G.A	Pearson Correlation	.022	1.000	-.127	.081	-.191	-.155
	Sig. (2-tailed)	.612	.	.004	.082	.000	.001
	N	519	519	517	463	463	465
mode of delivery	Pearson Correlation	-.095	-.127	1.000	-.014	.046	-.009
	Sig. (2-tailed)	.030	.004	.	.761	.317	.841
	N	518	517	520	465	465	465
Weight of baby	Pearson Correlation	.034	.081	-.014	1.000	-.271	-.115
	Sig. (2-tailed)	.465	.082	.761	.	.000	.013
	N	464	463	465	476	474	465
post delivery condition of baby	Pearson Correlation	.014	-.191	.046	-.271	1.000	.223
	Sig. (2-tailed)	.760	.000	.317	.000	.	.000
	N	464	463	465	474	476	465
post delivery maternal condition	Pearson Correlation	.007	-.155	-.009	-.115	.223	1.000
	Sig. (2-tailed)	.883	.001	.841	.013	.000	.
	N	466	465	465	465	465	467

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Chapter 5

DISCUSSION OF FINDINGS

5.1. Demographic characteristics

The Swaziland Demographic and Health Survey (2007) revealed that almost one quarter (25%) of young women aged between 15 and 19 had already borne children. It appears that young motherhood is more common in rural areas than in urban areas.

The study indicated that women marry at a relatively late age in Swaziland. Only one quarter of women (26%) are married by their twentieth birthday. The median age at first marriage is 24.3. Women in urban areas tend to marry later, at a median age of 27.9, than their counterparts in rural areas (22.8) (Swaziland Demographic and Health Survey). Similar to the above report, in this study, 112 (21.5%) of the 520 women in labour who were assisted at Emkhuzweni Health Centre in 2007 were aged between 15 and 20 years. This figure is similar to the Swaziland Demographic and Health Survey's (2007) report. In the present study, the incidence of teenage pregnancy among the women in the sample was higher than the worldwide rates of teenage pregnancy, which range from 143 per 1000 in some sub-Saharan African countries to 2.9 per 1 000 in South Korea (Ross, Geffen and Eden 2009).

The World Health Organization (WHO Annual report 2003) showed that 78% of women in the developing countries receive antenatal care from skilled health provider at least once during pregnancy, while central and Eastern Europe had antenatal care attendance rate(95%)(WHO report, 2003). The WHO annual report (2003) also reported that 94% of pregnant mothers in South Africa received antenatal care between 1990- 2001. The study showed that the antenatal care service attended by the pregnant mothers at Emkhuzweni Health Centre in 2007 (89.7%), this figure is less than the South Africa, Central and Eastern Europe antenatal care attendance rate, however better than the antenatal care attendance in developing countries.

The Swaziland Demographic and Health Survey (2006) report revealed that almost all (97%) Swazi women received some antenatal care from a medical professional, most commonly from a nurse or midwife. Again in contrast to the above report, this study found that only 89.7% of pregnant women assisted at Emkhuzweni Health Centre had received some antenatal care service from medical professionals. The remainder (10.3%) had had no antenatal care during the entire duration of their pregnancy. A lower number of antenatal care attendants were also observed in this study.

Socioeconomic conditions such as poverty, ignorance and poor infrastructure are some of the factors that affect maternal and foetal outcomes (Chiwuzie, Okolocha and Okojie 1997).

In this study most of the laboring mothers were living in an area where the average distance from the health centre was between six and 31 kilometers which means many of these pregnant women lived in areas which are a long distance, from the Health Centre due to this the cost of transport might be also another contributory factor for the lower rate of antenatal care attendance.

Other factors such as inadequate health education about the antenatal care provision could affect the attendance rate of the perinatal care. The way health education provided at Emkhuzweni Health Centre is mainly through verbal teaching, there is scarcity of teaching aids, the verbal health education unsupported by teaching aid might not be attractive for the attendants this could eventually have a negative impact on the health education and the perinatal care service.

A shortage of manpower is yet another issue at Emkhuzweni Health Centre; the fact that it is a rural health facility, there is a high turnover of health workers such as nurses and midwives. After serving at Emkhuzweni Health Centre for some time, these health workers tend to move to towns, leaving a gap at the centre. This manpower shortage could affect health service delivery, including the antenatal care service.

The parity of the laboring mothers is one of the factors that affect obstetric outcomes; a first pregnancy can have a negative impact on the morbidity and mortality of pregnant women, as reported by Callahan, Caughey and Heiffnen (2001).

Women in the rural areas of Swaziland have on average 4.2 children each (Swaziland Demographic and Health Survey 2007). This is consistent with the present study, which found that 45% of the study population had on average 2-4 children each.

A study conducted by Creinin and Simhan (2009) in a rural hospital in Malaysia found that only 12% of all the pregnant women who attended the rural hospital for perinatal care were primigravida. In this study of the pregnant women who were assisted at Emkhuzweni Health Centre in 2007, (16.1%) were primigravida; the other 83.9% had had at least one prior pregnancy.

This shows that the rate of primigravida was higher at Emkhuzweni Health Centre as compared to Creinin and Simhan's (2009) report in Malaysia.

The higher rate of primigravida could affect the maternal and foetal outcomes at Emkhuzweni Health Centre, as primigravida is considered as one of the risk factors associated with poor maternal and foetal outcomes (Callahan, Caughey and Heiffnen, 2001).

In this study, the rate of pre-term labour at Emkhuzweni Health Centre was 20%, which is significantly higher by 8% than the rate USA (Sakala and Penalver 2002). The rate of pre-term labour for all births worldwide in 2005 was 9.6% (Beck, Wajdyia and Say 2005).

The incidence of pre-term labour at Emkhuzweni Health Centre was also higher, at 7%, than in industrialized countries, and than the report on all Africa (11.6%) (Beck, Wajdyia and say 2005). The incidence of pre-term labour at Emkhuzweni Health Centre was, however, similar to that of Malawi: 20.3% of women delivered before the 37th completed week of pregnancy (Ntonya, Kayiva and White 2005).

The higher rate of preterm delivery at Emkhuzweni Health Centre could be attributed to the poor antenatal care attendance as it is revealed in this study. Through proper antenatal care service high risk pregnant mothers could have been screened as early as possible and those who were higher risk for preterm deliveries such as multiple pregnancy, incompetent cervix, polyhydramnios, mothers who are in substance abuse and mothers engaged in stressful condition etc, could have been managed properly, eventually the rate of preterm delivery would have been reduced.

Jasper Chiwuzie, Chika Okolocha and Obehi Okojie (1997) have indicated that poor socioeconomic status could jeopardize maternal outcomes, similarly Emkhuzweni Health Centre catchment areas have undeveloped infrastructure, low socioeconomic status and the communities are scattered and live far from Emkhuzweni Health Centre. Those factors could contribute to the higher rate of preterm deliveries.

The Caesarean section rate may reflect, at least partially, the extent to which pregnant women access life saving obstetric care (The International Journal of Public Health, 2002).

WHO, UNICEF and UNFPA promote a minimum Caesarean section rate of 5% without specifying the reasons for the procedure (The International Journal of Public Health, 2002) and the World Health Organization (WHO) recommends that the rate of Caesarean sections should not exceed 15% in any country. However, in recent years, the rate has risen to a record level of 46% in China and to levels of 25% and above in many Asian countries, Latin America and the USA 2004 (American College of Obstetricians and Gynecologists, 2006).

In this study 11.1% of pregnant mothers at Emkhuzweni Health Centre were transferred to Piggs Speak hospital for Caesarean section in 2007. This rate is in the recommended range by the WHO. And less than the China and other Asia countries, Latin America and the USA (American College of Obstetricians and Gynecologists, 2006) Caesarean section rate.

5.2. Maternal outcomes

The incidence of maternal postpartum haemorrhage (3.4%) among women in labour who were assisted at Emkhuzeni Health Centre was lower than in the USA (18%) and in developing countries (23%) (Duncan 2007).

The incidence of maternal puerperal infection among all these women assisted at Emkhuzweni Health Centre (5.4%) was similar to the rate in the USA (1-8%) (Carter, Codell and Barbara 2005) but lower than the incidence of puerperal sepsis in developing countries (5.4% vis 10%) (Carter, Codell and Barbara 2005).

One maternal death was recorded in this study, the cause of which was multifactorial. The mother's immune system was compromised, and she was receiving antiretroviral treatment. She suffered from moderate anaemia, puerperal sepsis and haemorrhage.

The rate of maternal deaths at Emkhuzweni Health Centre (0.2%) was lower than the rate of maternal mortality in developing countries (6.2%) (Chou 2006; UNDP Report, 2000). Maternal mortality rates at Emkhuzweni Health Centre were, however, higher than rates in the USA and other developed countries such as Iceland (Chou 2006; UNDP Report 2000). The rate of 0.2% was, however, similar to that of Swaziland as a whole (0.48%) (Swaziland Demographic and Health Survey, 2007).

The average post delivery hospital stay at Emkhuzweni Health Centre was less than 24 hours. This length of stay for post delivery mothers is less than that reflected in the report by Veron (2007). He found that the average hospital stay in the western world was one to two days for spontaneous vaginal deliveries and three to four days for post Caesarian sections. Such short stays at Emkuzweni Health Centre could be due to a shortage of rooms and beds for post delivery mothers, forcing them to be discharged in under than 24 hours.

Short hospital stays for post delivery mothers could compromise maternal and foetal observations by trained health workers at the Health Centre, and this might eventually contribute to postpartum maternal and foetal complications.

To address the shorter post delivery hospital stay at Emkhuzweni Health Centre, the health centre has to find a means to extend the maternity ward. The existing maternity ward has no post delivery maternal waiting room; it is therefore recommendable that the health centre needs to have a post delivery maternal waiting room in order to address the short post delivery maternal hospital stay as shown in this study.

5.3. Foetal outcomes

The rate of neonatal sepsis (1.9%) was higher among neonates delivered at Emkhuzweni Health Centre in 2007 than in the USA for the same period (1.5%). At present, the rate of neonatal sepsis is higher at Emkhuzweni Health Centre than in other developing countries (Michael, David and Robert 2009). When compared to the incidence of early onset neonatal sepsis among newborns delivered at Johannesburg Hospital in 2005 (0.4%) (Motora, De Ballot and Perovic, 2005), in 2007 the rate of early onset neonatal sepsis among newborns was higher at Emkhuzweni Health Centre.

The higher rate of neonatal sepsis could be attributed to the higher rate of preterm deliveries as it was revealed in this study. Preterm babies are vulnerable to develop infection and sepsis because of undeveloped immunity system (Motora, De Ballot and Perovic, 2005).

Factors such as shortage of medical equipments and manpower at Emkhuzweni Health Centre could contribute to the higher rate of neonatal sepsis at Emkhuzweni Health Centre.

In order to alleviate the higher neonatal sepsis at Emkhuzweni Health Centre, emphasis need to be given to deploy adequate health workers such as nurses and midwifery, procurement of medical equipments such as incubators and a program aimed at improving the preterm delivery need to be encouraged.

The perinatal mortality rate at Emkhuzweni Health Centre (19 per 1000 live births) was higher than in developed countries (1%) but lower than the rate in developing countries (30-200 per 1000 live births) (Lale, Allan and Metin 2006) and Swaziland (85 per 1000 live births) (Swaziland Demographic and Health Survey 2007).

The rate of pre-term babies at Emkhuzweni Health Centre was higher than the rate for developed countries (Sakala and Penalver 2002) and the rate worldwide, which is 9.6% of all births (Beck, Wajdyia and Say 2005). The rate of pre-term babies at Emkhuzweni Health Centre was higher than the rate in the whole of Africa (11.6%) (Beck, Wajdyia and Say 2005).

5.4. Maternal and foetal outcomes among the high risk mothers

Pregnant mothers who have at least one of the factors that affect maternal and foetal outcomes adversely are considered as high risk mothers (Pattinson 2000; Tamara, Callahan, Linda *et al.* 2001). The risk factors were maternal obstetric risk factors, maternal medical illnesses and low socio economic status (Pattinson 2000; Tamara, Callahan, Linda *et al.* 2001), (Davanzo, Abdulrazaq and Mizanur 2004).

In this study, the odds of Puerperal sepsis was three times higher among mothers with a riskfactor as compared to the low risk mothers (OR= 2.91 & 95% CI = 1.88-3.05). This is consistent with the review notes of Sakala P. and Manuel P. (2002) where high risk

factors such as PROM, prolonged labour and multiple pregnancies are associated with puerperal sepsis.

Post partum hemorrhage is associated with maternal risk factors such as prolonged labour, multiple pregnancies, APH, fetal macrosomia, and a history of postpartum haemorrhage (Duncan, J. 2007). This applies to the mothers who were assisted at Emkhuzweni Health Centre where the odds of PPH was 2.09 higher among the high risk mothers (95% CI= 1.99- 2.81).

The odds of PIH was 2.56 higher among the high risk mothers than the low risk mothers (95% CI= 1.67- 2.98) . This is similar to the study conducted by Duckitt K. and Harrington (2005). Where the risk of developing PIH among primigravida mothers was three times higher than the low risk mothers with 95% confidence interval of 1.28- 6.61.

The odds of new born babies with birth weight < 2kg was 4.33 higher among babies born to high risk mothers (95% CI = 2.39- 5.62) and the odds of new born babies with birth weight of 2-2.5 kg was 1.91 higher among babies born to high risk mothers (95% CI = 1.93- 2.55).

Neonatal sepsis is associated with maternal risk factors including premature rupture of membrane, preterm labour, maternal infections such as chorioamnionitis and Urinary tract infection.(R. Leheur, L.Leitich and S. Jirecek et al (2001). This is similar to the labouring mothers assisted at Emkhuzweni Health Centre where the odds of neonatal sepsis was 3.05 higher among babies born to high risk mothers with (95% = 0.98-3.82).

Preterm labour is associated with a number of maternal, demographic and socioeconomic risk factors (Simhan, H. and Canavan, T. (2005); (Goldenberg, R.L., Culhane ,J.F. and Iams, J.D. (2008). This is similar to this study where the odds of preterm new born babies was 2.01 higher among babies born to high risk mothers (95% CI= 1.94-2.66).

The odds of the neonates with congenital malformations was 4.12 higher among babies born to high risk mothers (95% CI= 2.50- 7.84) and the odds of stillbirths was 1.56 higher among the babies born to high risk mothers (95% CI = 0.97- 1.89).

From the Pearson correlation among the maternal age, gestational age, mode of delivery, weight of the baby, post delivery maternal condition and post delivery neonatal condition, showed that there was a significant relationship between the maternal age versus gestational age and mode of delivery, however; there was poor relationship between the maternal age versus the neonatal birth weight, post delivery maternal and neonatal condition.

There was significant relationship between the maternal gestational age verses mode of delivery, neonatal birth weight, post delivery maternal and neonatal condition.

There was no significant relationship between the mode of delivery verses neonatal birth weight, post delivery maternal and foetal condition.

Chapter 6

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This study found that the maternal outcomes at Emkhuzweni Health Centre in 2007 were similar to those in Swaziland as a whole and in other developing countries, except that there was a higher rate of pre-term delivery among pregnant women assisted at the centre.

The foetal outcomes of Emkhuzweni Health Centre in 2007 were similar to the data from developing countries. Additionally, however; significant numbers of pre-term babies and a high number of neonatal sepsis were observed at the centre.

Some of the risk factors for poor maternal and foetal outcomes were poor antenatal care attendance, distance of the Health Centre from the home state of the pregnant woman, preterm labour and under age and teenage pregnancies.

6.2. Recommendations

6.2.1. Recommendation for community based study

This study was a facility based study and the study population was laboring mothers who were attended at Emkhuzweni Health Centre in 2007. Home deliveries and deliveries attended in other Health Services were not included in the study. This study therefore may not fully represent the maternal and foetal outcome of the communities in the catchments area of Emkhuzweni Health Centre.

The other reason is that even though extensive efforts were made to access similar facility based studies conducted in other part of the world, especially in the developing world, for comparison with this study, however; very few facility based studies were discovered through extensive internet search and from other reference sources, most of the studies were community based studies.

It is therefore recommendable that a community based study on maternal and foetal outcomes to be conducted at the Catchments areas of Emkhuzweni Health Centre. in order to compare and contrast with other community based studies.

6.2.2 Recommendation to the staffs of Emkhuzweni Health Centre

This study has revealed that the antenatal care attendance at Emkhuzweni Health Centre were lower than the Swaziland national rate of antenatal care attendance and other countries attendance rate.

Health education should therefore be strengthened and made sustainable without interruptions. Health education can be provided both at group and individual level. Nurses in the PHU department should provide group health education in the waiting area to all pregnant women who come for their antenatal care visits. As the Health Centre has a television and video recorder, this education could be supported by films on video which deal with the care of pregnant women, a healthy lifestyle for these women and family planning services. Posters, pamphlets and pictures that display messages about these topics in Siswati language could be used as teaching aids in order to provide health education in an attractive way. These materials are available from the Reproductive Health Department at the Ministry of Health.

Individual health education should be provided by the nurse attending the pregnant woman at the antenatal care clinic, and also by the attending doctor.

6.2.3. Recommendations for Ministry of Health

The structure of the maternity ward needs to be upgraded as we can see from this study, most of the pregnant women lived at least six kilometers away from the Health Centre. Infrastructure in these communities is poor, and costly transportation jeopardizes the maternal and foetal outcomes. In an effort to overcome these challenges, the Health Centre should have a waiting area for high risk women who need to be admitted for close observation before onset of labour.

6.2.4. Recommendations for community health representatives

Community health representatives should work more closely with the community administrative councils in order to improve conditions of the roads in the area and to ensure the availability of vehicles to transfer women in labour to the Health Centre.

The community health representatives should work hand in hand with traditional birth attendants in order to improve the latter's quality of service. These representatives are expected to bridge the gap between the Health Centre and the community.

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APPENDIX-I

ENGLISH DATA COLLECTION SHEET(FORM)

Research title

Foetal and maternal out comes of deliveries at Emkhuzweni Health Centre in 2007

NB. Fill the questionnaire for each deliveries assisted at Emkhuzweni Health Centre in 2007 and referral made for delivery service

Labouring mother identification

Maternity code number. -----

1. Age in years

15-20 21-25 26-30 31-35 >36

2. Address -----

3. Name of Health Service where Antenatal care service attended. -----

Obstetric condition of the labour in mother

4. Gravidity (No. of pregnancy)

1 2 3 4 ≥ 5

5. Parity

0 1 2 3 4 ≥ 5

6. Gestational age at the time of delivery in weeks

28-37 38-42 ≥ 43

7. Risk condition of the pregnancy

High risk low risk

Maternal out come

8. Mode of delivery

Normal vaginal Instrumental Referral for CS

9. Condition of mother after delivery

Normal sick Death

10. Duration of stay of the labouring mother at the maternity ward due to maternal condition

24hrs 24-72hrs 3-7days
>7days

Foetal out comes

11. Sex of the Newborn

Male Female

12. Weight of the newborn at birth

<1.5kg 1.6-1.99kg 2-2.5kg 2.6-3.99kg >4kg

13. APGAR score at the first minute. ≤ 3 4-6 ≥ 7

14. APGAR score at the fifth minute. ≤ 3 4-6 ≥ 7

15. Duration of Neonate stay in the hospital after delivery

<24hrs 24hrs-72hrs 3 days- 7days >
7days

16. General condition of the newborn before discharge

Normal Congenital malformation Neonatal sepsis
Others

APPENDIX- II

SISWATI DATA COLLECTION FORM

SIHLOKO SELUCWANINGO

Simo samake nemutswana emvakwekubeleka lowabelekela Emkhuzweni Health Centre ngemnyaka na 2007

NB. Phendvula umbuto ngamunye wabomake lababelekela Emkhuzweni ngemnyaka wa 2007 nabobonkhe bomake labandluselna esibhedlela lesikhlulu ngetinkinga labahlangana nato naba beleka

Wonkhe make utawehlukaniswa ngenombolo yakhe lanikwa yona esibhedlela nakato belela

1. Iminyaka yakhe

15-20yrs 21-25yrs 26-30yrs 31-35yrs
> 56yrs

2. Likhli-----

3. Ligama lemtfolamphilo lapho apopola khonasisusimo samake nakahelwa-

4. Make bekatetfwele kangaki

1 2 3 4 ≥ 5

5. Bantswana labatalwa baphila bangaki

0 1 2 3 4 ≥ 5

6. Wabeleka sekamangaki emaviki atetfwele

28-37 38-42 ≥ 43

7. Yayinganani ingoti ekutetfwaleni kwakhe

Yayisetulu yayiphansi

Simo samake emvakweku beleka

8. Indlela leka bekeka ngayo

Wabeleka

Umntfwana wakhokhwa ngetinsimbi

Wendluliselwa esibhedlela lesikhulu kuyohlindvwa

9. Simo samake emva kwekubeleka

Sabasihle Wagula Wafa

10. Sikhatsi make lekasihlela ewadini lekobeleka ngesizatfu sesimo sakhe

< 24hrs 24- 72 hrs 3-7 days > 7 days

11. Bulili bentfanana

Bekamdvana Bekayintfombane

12. Sisindvo semntfwana

< 1.5kg 1.6- 1.99kg 2- 2.5kg 2.6- 3.99kg ≥ 4kg

13. Simo semntfwana ngemzuzu wekucala abelekiwe

≤ 3 4- 6 ≥ 7

14. Simo semntfwana ngemizuzu lesihlanu abelekiwe

≤ 3 4- 6 ≥ 7

15. Sikhatsi umntfwana lekasihlala esibhedlela asabelekiwe

< 24 hrs 24 – 72 hrs 3- 7 days

16. Simo sentfwana angakakhokhwa esibhedlela

Besikahle

Abekhubatekile

Umntfwana bekagula

Lokunye lokungakabalwa ngenhla

APPENDIX 3

STATISTICAL ANALYSES

The Chairperson,
Medunsa Campus Research and Ethics Committee (MCREC),
Box _____
UNIVERSITY OF LIMPOPO
Medunsa Campus

Dear Sir/Madam

STATISTICAL ANALYSES

I have studied the research protocol of Dr. W Fikadu

titled:

and I agree to assist with the statistical analyses.

Yours sincerely,

Signature: Statistician

Ms Annah Managa Department of Statistics UNISA, Tel: +27 12 429 4877, Cell: +21 79 492 4078

Name in block letters

__8/ 9/2010_____
Date

* Please delete which is not applicable. If you do not agree to assist with the statistical analyses, please provide reasons on a separate sheet.

UNIVERSITY OF LIMPOPO

Medunsa Campus



MEDUNSA RESEARCH & ETHICS COMMITTEE

CLEARANCE CERTIFICATE

P O Medunsa
Medunsa
0204
SOUTH AFRICA

MEETING: 05/2009

Tel: 012 - 521 4000

PROJECT NUMBER: MREC/M/53/2009: PG.

Fax: 012 - 560 0086

PROJECT :

Title: Maternal and foetal outcomes of deliveries attended at Emkhuzweni Health Centre in Swaziland

Researcher: Dr F Woreta
Supervisor: Prof GA Ogunbanjo
Hospital Superintendent: Dr I Mopfeka (Emkhuzweni Health Centre)
Department: Family Medicine
School: Medicine
Degree: MMED

DECISION OF THE COMMITTEE:

MREC approved the project.

DATE: 09 June 2009



Nbrahim
PROF N EBRAHIM
DEPUTY CHAIRPERSON MREC

Note:

- i) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
- ii) The budget for the research will be considered separately from the protocol. PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Telegrams:
Telex:
Telephone: (+268 404
2431)
Fax: (+268 404 2092



MINISTRY OF HEALTH
&
SOCIAL WELFARE
P.O. BOX 5
MBABANE
SWAZILAND

THE KINGDOM OF SWAZILAND

TO: Fikadu Woreta
Medical Officer
Mkhuzweni Health Centre

DATE: 21st September, 2009

REF: MH /701

**RE: MATERNAL AND FOETAL OUTCOMES OF DELIVERIES ATTENDED AT
EMKHUZWENI HEALTH CENTRE IN SWAZILAND**

The Scientific and Ethics committee would like to appreciate your response to the comments raised in our last meeting.

In view of the fact that you have addressed all the issues that were of concern to the committee, you are therefore granted authority to conduct the study in Emkhuzweni health centre. You are kindly requested to adhere to the processes outlined in the protocol and if there are any changes, you are advised to notify the chairman of the committee before you effect any changes.

The committee is looking forward to the findings of the study to inform decision making in this area.


DR S.V MAGAGULA
CHAIRMAN OF SEC

Cc: SEC members