

**CAUSES OF MATERNAL DEATHS AND SEVERE ACUTE
MATERNAL MORBIDITY IN A REGIONAL HOSPITAL IN THE
NORTHWEST PROVINCE OF SOUTH AFRICA**



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Causes of Maternal Mortality and Severe Acute Maternal Morbidity in a Regional
Hospital in the North West Province in South Africa

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KEYWORDS

Causes
Maternal Deaths
Severe Acute Maternal Morbidity
Rural Area
Regional Hospital
Avoidable Factors
Audit
Transport
Skilled Attendant
Substandard Care



ABSTRACT

Causes of maternal mortality and severe acute maternal morbidity in a regional hospital in the North West province in South Africa

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Study context: Despite all measures taken by the South African government since 1994, there is a continuous increase of maternal mortality in the country and the Northwest Province is amongst the highest. Studies to date combining the review of maternal deaths and severe acute maternal morbidity (SAMM) have been conducted primarily in urban areas. With the increase prevalence of the HIV/AIDS infection, non-pregnancy related infections have become the commonest cause of maternal deaths.

AIM: Determination of causes of death and avoidable factors for maternal mortality and severe acute maternal morbidity in a rural regional hospital from 01/01/2005 to 30/04/2006

Design: The study is a retrospective cross sectional survey in one of the regional hospital in the Northwest province of South Africa. Data was collected via hospital record review using a standardized tool from the National Committee on the Confidential Enquiry into Maternal Death (NCCEMD). All 133 cases of SAMM (survivors of intensive care unit) were compared to 16 maternal deaths with regard to demographic profile, pregnancy characteristics, obstetric causes, and avoidable factors. Categorical variables were

compared with Chi-square or Fisher exact test whilst continuous variables were compared with student T-test. A p value<0.05 was considered significant.

Results: There were 4293 deliveries during the reviewed period of which 16 were maternal deaths and 141 (3.2%) were admissions to intensive care unit. Patients had a mean age of 26.5 years (standard deviation of 7.4) and a mean parity of 1.0 (standard deviation of 1.5). 83.9% of all life-threatening patients (149 cases) were booked and 89.9% were referred from the clinics or the district hospitals. High levels of perinatal mortality (209/1000 deliveries) and maternal morbidity (13.4% had hysterectomies) were reported. Complications of hypertension (65.8%) and obstetric hemorrhage (17.4%) were the commonest causes of life-threatening events. Pregnancy related sepsis (4.7%) and non-pregnant related infections (3.4%) showed poor prognosis with mortality indices respectively of 42.8% and 60%. Delay of transfer (mean transfer time of 6.5 hours) and lack of staff were the most common avoidable factors resulting in high proportion of substandard management.

Conclusion: Maternal mortality and morbidity were high in the hospital. Hypertension in pregnancy and obstetric hemorrhage were the most common complications reported and recommendations to address mostly delay of transport and lack of skilled attendants were formulated.

November 2006

DECLARATION

I declare that **causes of maternal mortality and severe acute maternal morbidity in a regional hospital in the North West province in South Africa**, is my own work, that it has been not submitted before for any degree or examination in any other university, and that all the sources I have used and quote have been indicated and acknowledged as complete references.

Dr LITENYE LOMALISA

November 2006

Signed

DR LOMALISA



DEDICATION

This work is dedicated to my wife Gertrude Lukusu Nsafu and my children Patricia, Kevin, and Josiah Lomalisa for their support during the study period.



ACKNOWLEDGEMENTS

I would like to thank everyone who contributes to the realization of this work.

My sincere word of appreciation is definitely reserved for my supervisor Prof Debra Jackson whose advice and guidance were most valuable. I would like to thank Dr Samson Muyanga of the Postgraduate Enrolment Throughput (PET) project of the University of the Western Cape for editing the manuscript. I expressed my gratitude to the management and the staff of the Mafikeng Hospital for the permission to conduct the study and their support during the audit.



LIST OF ABBREVIATIONS

AIDS: Acquired Immunodeficiency Syndrome

HAART: Highly Active Anti Retroviral Therapy

HIV: Human Immunodeficiency Virus

ICU: Intensive Care Unit

MDG: Millennium Developmental Goals

MMR: Maternal Mortality Ratio

NCCEMD: National Committee of Confidential Enquiries into Maternal deaths

SAMM: Severe Acute Maternal Morbidity.

WHO: World Health Organization

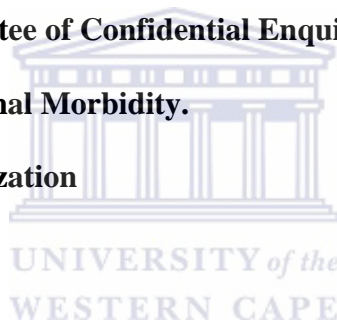
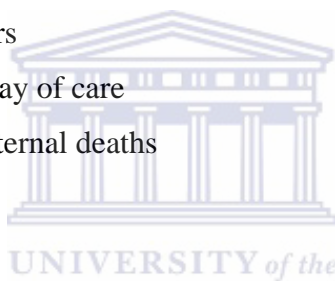


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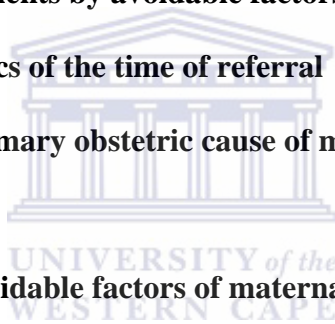
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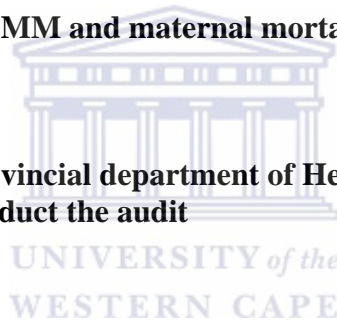
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CHAPTER 1

INTRODUCTION

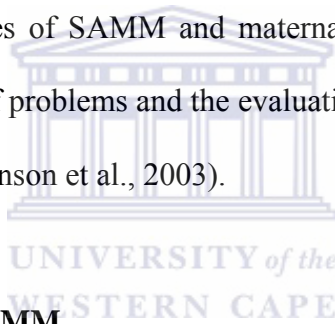
1.1 BACKGROUND

1.1.1 Definitions and worldwide prevalence of maternal mortality and morbidity

Maternal mortality is 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 (Department of Health, 1999). Severe acute maternal morbidity (SAMM) also known as near miss case, means a woman with a life-threatening obstetric condition that would have died had it not been that luck or good care was on her side (Pattinson et al., 2003). There are great disparities of maternal mortality ratios (MMR) and SAMM across countries and between groups within countries (Poole and Long, 2004). Studies published worldwide showed high MMR in developing countries and low MMR in developed countries (WHO, 2004b). Disparities also exist within countries, for example in South Africa there was high MMR in public hospitals compared to private institutions (Department of Health, 2003b). The average maternal mortality ratio in the African region raised from 870 deaths per 100,000 live births in 1990 to 1000 deaths per 100,000 live births in 2001. Of the estimated 529,000 maternal deaths that were reported globally, 99% occurred in developing countries of which 48% were in the Africa region (WHO, 2004b). The lifetime risk of maternal death in the African region was estimated at 1:16 compared to 1:3500 in North America, 1:2400 in Europe, 1:160 in Latin America and the Caribbean and 1:100 in Asia. Lifetime risk determines the

likelihood of death among women between 15 to 49 years in a defined region (WHO, 2004b). In Africa, there was one chance out of 16 for a woman in reproductive age will die due to complications of pregnancy.

Despite differences in the definition of SAMM, most studies showed that there are nearly five times as many SAMM cases as maternal deaths (Cochet et al., 2003; Pattinson et al., 2003). The prevalence of SAMM varied between 0.8 % and 8.2 % of total deliveries (Minkauskiene et al., 2004). Because maternal deaths are rare events in developed countries or with in smaller areas in developing countries, it has been suggested that the combination of review of cases of SAMM and maternal deaths in a defined area will provide for the identification of problems and the evaluation of maternal care at an earlier stage (Cochet et al., 2003; Pattinson et al., 2003).



1.1.2 Impact of MMR and SAMM

There are significant economic, social and psychological consequences of maternal mortality and SAMM. For every maternal death, it is known that thirty women will suffer short or long-term disabilities (WHO, 2006a). Death is obviously the most serious consequence of maternal ill health for the woman and the family. However, women who experienced SAMM but do not die suffer various types of disabilities such as severe anaemia, infertility, obstetric fistula and behavioral changes (e.g. postpartum depression). In addition maternal mortality impacts on the family unit. Children experience increased mortality risk; decreased nutrition and schooling due to the death of the mother. The death directly erodes the gains from the social and economic investment that has been

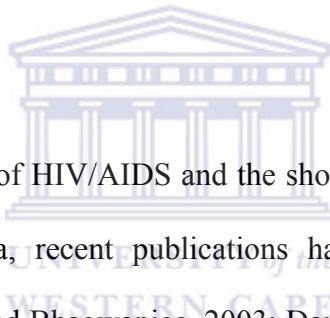
made in her life. The family is also sadly deprived of her love, her care and her productivity within and outside the home (WHO, 2006a). Maternal mortality and morbidity result in losses to the society and hindered economic development resulting in a multitude of indirect consequences and costs related to maternal mortality and morbidity.

1.1.3 Maternal Mortality in the Millennium Development Goals (MDG)

Developed countries experienced improvements of MMR and SAMM cases whilst most of the least developed countries have not shown good progress (Blaney, 1994; Abouzahr and Royston, 1993). To draw the attention of the world to this problem, the international community launched the Safe Motherhood Initiative in 1987 to make maternal health an urgent health priority and to ensure that the necessary political and financial support was dedicated to this effort (WHO, 2004b). This call was followed by many international conferences and more recently by the millennium summit that endorsed the Millennium Developmental Goals (MDG). The 5th millennium developmental goal (MDG5) deals with the improvements of maternal health by the reduction of MMR level of 1990 by 75% in 2015 (WHO, 2004b). In addition, because maternal mortality is difficult to measure, it was also suggested that by 2015, 90% of births should be assisted by skilled attendant. The proportion of births by skilled health care providers is a key process indicator for the MDG5 of improving maternal health and its target of reduction of maternal mortality.

1.1.4 MMR and SAMM in South Africa

Most of the studies performed in South Africa before the introduction of national committee for confidential enquiries into maternal deaths (NCCEMD) were facility-based reviews of maternal deaths. They reported the prevalence of MMR of more than 100 per 100,000 live births with the exception of the Western Cape where a MMR of 31.2 per 100,000 was found from 1987 to 1989 (Fawcus et al., 2005). However, comparison of the MMR in the same hospital showed the decline of the number of deaths (Cooreman et al., 1989; Spies et al., 1995; Fawcus et al., 2005). In addition, there was lack of unanimity of methodology used in facility-based review of maternal deaths (Moodley et al., 1996).



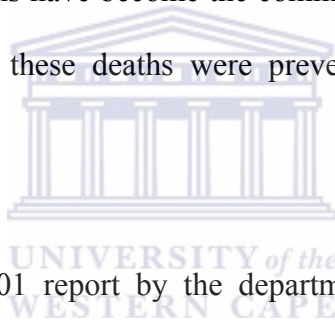
With the increased prevalence of HIV/AIDS and the shortage of health care providers in public sector in South Africa, recent publications have shown an increase in the prevalence of MMR (Kruger and Bhagwanjee, 2003; Daponte et al., 2000; Jackson et al., 2003).

In 1998, Mantel et al published the first study in South Africa combining the hospital-based review of maternal deaths with the audit of SAMM cases. Recent publications in South Africa showed 3 types of audit of maternal deaths and SAMM cases. The first group of authors reviewed separately the maternal mortality or the SAMM cases in the hospital facilities (Gandhi et al., 2004; Kruger and Bhagwanje, 2003; Daponte et al., 2000) whilst the second combined an audit of the maternal mortality and the review of SAMM in tertiary (level 3) and metropolitan hospitals (Mantel et al., 1998; Pattinson et

al., 2003; Cochet et al., 2003). The last group, the NCCEMD publishes a report on the confidential enquiries into maternal deaths every three years (Department of Health, 2006).

1.2 PROBLEM STATEMENT

Despite all measures taken by the South African government since 1994 to address inequalities inherited from the apartheid regime, there is a continuous increase of MMR in the country and the North West province is amongst the highest (Department of Health, 2003) With the high prevalence of HIV/AIDS infection reported in the country, non-pregnancy related infections have become the commonest causes of maternal deaths in South Africa and most of these deaths were preventable (Department of Health, 2003b).



The Saving Mothers 1999-2001 report by the department of health in South Africa (Department of health, 2003b) showed that maternal deaths occurred mostly in level 2 hospitals (35.6%) followed by level 3 hospitals (31.3%). There were few maternal deaths reported outside public hospitals (2% at homes and 1.5% in private hospitals).

Most of South Africa studies combining the review of SAMM and maternal deaths have been conducted in level 3 (tertiary) hospitals and metropolitan areas (Cochet et al., 2003; Vandecruys et al., 2002; Pattinson et al., 2003). The only study of SAMM cases in rural area did not include the audit of maternal deaths (Gandhi et al, 2004).

The analysis of these studies did not show the proportion of pregnant mothers who reached health facilities in critical condition (coma, shock) and the average time of transfer of patients between institutions in rural area. It is therefore important to conduct an audit of causes, avoidable factors and missed opportunities of SAMM and maternal deaths cases managed in one of the regional hospitals covering a rural area to determine the reasons of persistently high MMR, and to highlight local factors contributing to maternal mortality and morbidity.

1.3 STUDY SETTING

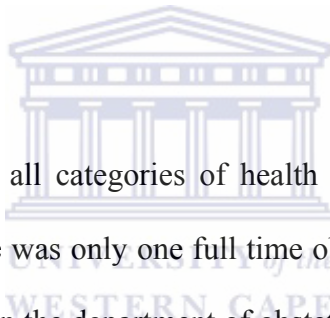
The North West province covers an area of 116320 square kilometers (9.5% total area of the country) with 65% of inhabitants resided in a rural area, 46.1% were unemployed and 89.4% are public sector dependents for health needs (Day and Gray, 2005). It was the sixth most populous province of South Africa by 2005 with an estimated population of 3791984 (2003 census). The province is divided into four districts (Bophirima, Bojanala, Central, and Southern).

The central district, the area for this study is comprised of five sub districts: Mafikeng, Tswaing (Delareyville), Zeerust, Setlakhgobi (Ratlou), and Ditsobotla (Lichtenburg) (Appendix 1). The central district has an estimated population of 790,754 (21% of the population of the province) distributed as follow: Mafikeng 33.7%, Setlakhgobi 13.5%, Ditsobotla 19.5%, Tswaing 15.5% and Zeerust 17.8% (Census, 2003).

There are 7 district hospitals, 14 community health centres, 70 clinics, and 21 mobile clinics in the central district and most facilities are situated in a distance less than 120

kilometers, and within 2 hours of driving to the Mafikeng regional hospital (Day and Gray, 2005).

The referral hospital has 390 total usable beds, 75 maternity beds, 9 ICU beds of which 4 are for a high care dependency unit. There is no separate high care unit in maternity ward and all life-threatening illnesses are admitted in ICU for intensive monitoring or mechanical ventilation. There is no problem of lack of essential drugs or equipment. The blood bank is operational 24 hours on site with all products available (red blood cells, fresh frozen plasma) except platelets products that are ordered from another town situated 180 kilometers away.



However, there is shortage of all categories of health care providers in the province. During the review period, there was only one full time obstetrician, 3 fulltime and 4 part time medical officers working in the department of obstetric and gynecology at Mafikeng regional hospital. One of the districts hospital (Gelukspan hospital), which is the first referral hospital for Tswaing and Setlakgobi sub-districts was being operated as a community health center due to lack of medical officers. There were no specialists in internal medicine, surgery, and anesthesia departments in the institution during the same period. However, since 2004 the hospital was offering free antiretroviral therapy to HIV/AIDS patients.

1.4 AIM AND OBJECTIVES

1.4.1 AIM

The purpose of the study is to identify the causes, avoidable factors, and missed opportunities of cases of SAMM and maternal deaths that occurred in the Mafikeng regional hospital in the North West province of South Africa from 01/01/2005 to 30/04/2006 inclusive.

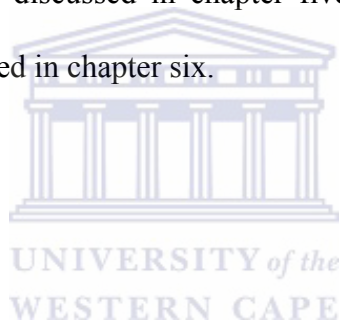
1.4.2 OBJECTIVES

The aim is further divided into the following objectives:

- 1) To describe the demographic profile and the pregnancy characteristics of maternal death and SAMM cases at Mafikeng hospital during the study period.
- 2) To identify primary obstetric causes of death or morbidity and avoidable factors found in maternal deaths and SAMM cases at Mafikeng hospital during the study period.
- 3) To determine indicators of delay of care (e.g. proportion of patients admitted in critical condition and time of referral between institutions) in maternal death and SAMM cases at Mafikeng hospital during the study period.
- 4) To formulate strategies and recommendations to the provincial health management for the reduction of maternal mortality and SAMM in the province

1.5 OUTLINE OF THE THESIS

In chapter one, the background of maternal mortality audit, the description of study area, the aim and the objectives of the study were highlighted. I reviewed the data in the literature regarding methods of audit of maternal deaths and SAMM cases, the demographic profile, the pregnancy characteristics, causes and avoidable factors in chapter two. The chapter three describes the research design and the methodology used from the sampling technique, the definition of concepts, and the data collection method and the statistical analysis. The findings of the study are presented in chapter four and the interpretation of the results is discussed in chapter five. Finally, the conclusions and recommendations are highlighted in chapter six.



CHAPTER 2

LITERATURE REVIEW

2.1 Prevalence of maternal mortality and morbidity

Maternal mortality is a major public health problem in the Africa region. However, measuring maternal mortality accurately is difficult except where there is a comprehensive registration of deaths and causes of death. Estimates by WHO for 2000 showed that of 529,000 maternal deaths reported worldwide, 251 000 of which occurred in Africa giving a maternal mortality ratio of 830/100,000 live births. The same report showed differences among different regions with an estimation of 920/100,000 live births for Sub-Saharan Africa and 130/100,000 live births for the Northern Africa (WHO, 2004b). There is no unanimity in the methods used to study maternal mortality. The majority of studies are facility-based reviews conducted in urban areas and level 3 hospitals. Verbal autopsy studies used in most Western African countries cannot determine the magnitude of the problem. Besides Egypt and South Africa, no other country to date uses the confidential enquiry into maternal deaths that gives an overview of the problem.

Although, the MDG5 aims to reduce the MMR by 75% by 2015, recent publications in the Africa region showed a continuous increase of MMR above 1000/100 000 births (WHO, 2004b; Lema et al., 2005)

Measuring severe acute maternal morbidity (SAMM) is also problematic. There is a need to set uniform criteria to identify SAMM cases. Studies in Africa primarily have used the disease specific criteria and the organ system-based dysfunction proposed by Mantel et al

(1998), whilst studies in developed countries generally have used admission to ICU as proxy for morbidity (Bewley and Creighton, 1997; Baskett and Sternadel, 1998).

Two reviews of SAMM showed that the prevalence varied between 0.01% and 8.23 % of total deliveries depending of the criteria used to identify the cases (Say et al., 2004; Minkauskene et al., 2004). Say et al. (2004) observed the prevalence's of 0.80%-8.23% for disease specific criteria, 0.01%-2.99% for the management-based criteria and 0.38%-1.09% for the organ system dysfunction based criteria.

2.1.1 Prevalence of maternal mortality and morbidity in South Africa

The Saving Mothers 1999-2001 report by the South African National Committee for the Confidential Enquiry into Maternal Deaths (NCCEMD) showed that most deaths occurred in health facilities. Most studies on maternal mortality in the country were facility-based reviews and showed the MMR to be above 100/100, 000 live births but much lower than the MMR reported in others countries in Africa. The Demographic and Health Survey of 1998 that used the verbal autopsy method estimated a MMR of 150/100 000 live births for the whole country (Department of Health, 1998).

Three reports had been released by the NCCEMD (1998; 1999-2001; 2002-2004). Although the MMR cannot be determined because the number of total births is not known in the country, the continuous increase in number of maternal deaths is a cause for concern. During 1999-2001, a total of 2777 maternal deaths were reported compared to 3406 during 2002-2004 trienniums (Department of Health, 2006).

With regard to SAMM, most studies of SAMM in South Africa have used the organ system-based dysfunction. These studies have found the prevalence of SAMM to be five times more than the prevalence of MMR (Mantel et al., 1998; Vandecruys et al., 2002).

2.2 Causes of maternal mortality and morbidity

It is known that direct causes of maternal deaths (complications of hypertension, obstetric hemorrhage, sepsis, abortion, obstructed labor) are predominant in developing countries whilst vascular accidents (pulmonary embolism) and pre-existing diseases in pregnancy are leading causes in developed countries (Kessler et al., 1979 Mantel and Moodley, 2002). There is no unanimity in the most common causes of deaths in developing countries and the differences are related to the high burden of HIV/AIDS infection, the legalization of the abortion, the budget allocated to the health department and the political will of the government to deal with health needs of the population (Sundari, 1992).

Studies in developing countries showed also that there is a difference of causes of deaths between rural and urban areas and between the different levels of care (Fawcus et al., 1996; Cooreman et al., 1989). Similar conclusions were drawn by the NCCEMD in South Africa that found postpartum hemorrhage and anesthetic deaths occurring more in level 1 hospitals whereas complications of hypertension and pregnancy related sepsis occurred at the same frequency at level 2 and 3 hospitals (Department of Health, 2003b).

The causes of maternal deaths in urban South Africa were well summarized in the study by Fawcus et al (2005) in Cape Town. They studied the trends in the peninsula maternal and neonatal services over a 50 years period. They analyzed the deaths in 3 distinct periods: 1954-1956; 1981-1983; 1999-2001. As described in many developing countries, they found a predominance of direct obstetric causes in the first two periods with high

proportion of deaths due to abortion. With the legalization of abortion since 1996 and the increase prevalence of HIV/AIDS infection reported in the country, recent studies are showing that non-pregnancy related sepsis is becoming the most common causes of deaths (Kruger and Bhagwanjee, 2003; Jackson et al., 2003; Department of Health, 2003a).

Studies of SAMM worldwide showed that complications of hypertension and obstetric hemorrhage were the most common causes (Baskett and Sternadel, 1998; Bewley and Creighton, 1997; Mantel et al., 1998). However, studies of SAMM allowed identifying other health problems that can be missed by auditing maternal deaths alone (Cochet et al. al., 2003).

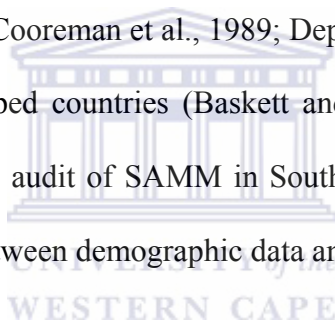
2.3 Risk factors for maternal mortality and morbidity

There is marked difference of demographic data between developed and developing countries. In the first group, there is increased mean age of first conception, less pregnancies among teenage and elderly women (more than 34 years) and high use of contraception that results in low fertility rates (Kessler et al., 1999). Studies in industrialized nations showed also that there is minimal association between demographic data and maternal mortality (Kessler et al., 1999; Baskett and Sternadel, 1998; Bewley and Creighton, 1997). However, studies in developing countries continued to show that pregnancy in extremes ages (less than 20 years and more than 34 years), in first pregnancy and grand multiparity are associated with high MMR (Fawcus et al., 1996; Lema et al., 2005). The South African NCCEMD reported similar findings regarding women of more than 34 years, nulliparity and grand multiparity (Department of Health,

2003). They reported a peak of age between 25 to 29 years of maternal deaths mothers compared to the peak of 20 to 24 years for the general population (Department of Health, 2003b). The analysis of statistics for the North West province in South Africa from the same report showed high proportion of adolescent mothers (10.2% less than 20 years) and nullipara (38%)

Studies in developing countries also showed differences in the prevalence of MMR between the rural and urban area (Fawcus et al., 1996; Lema et al., 2005). Due to poor distribution of health facilities and shortage of skilled health care providers, there is high proportion of maternal deaths in rural areas compared to the urban area (Barnes-Josiah et al., 1998; Fawcus et al., 1996; Cooreman et al., 1989; Department of Health, 2003b).

Recent publications in developed countries (Baskett and Sternadel, 1998; Bewley and Creighton, 1997) including the audit of SAMM in South Africa (Pattinson et al., 2003) did not show any difference between demographic data and maternal morbidity



2.4 Prevention of maternal morbidity and mortality

2.4.1 Antenatal care

Most studies in developing countries have reported a high proportion of unbooked and poor attendance among the maternal death mothers (Lema et al., 2005; Fawcus et al., 1996). The lack of antenatal care resulted in high prevalence of MMR. This assertion was confirmed in the study done in Johannesburg hospital in South Africa (Daponte et al., 2000) which showed that patients who attended antenatal care in the hospital had less maternal mortality (29.8/100000) compare to those who were unbooked (348.5/100000) or attended antenatal care elsewhere (304.7/100000).

Since 1994, the South African government has adopted the district health as strategy to offer comprehensive primary health care to the majority of the population (Andrews and Pillay, 2005). As a result of this intervention, an increase proportion of booked patients in recent audits of maternal mortality in the country have been observed (Fawcus et al., 2005; Daponte et al., 2000). In South Africa, majority of maternal deaths did attend antenatal care that provides the opportunity for interventions by health care providers (Pattinson et al., 2003).

The Saving Mothers 1999-2001 report by the Department of Health in South Africa showed that only 23.6% in the whole country and 22.0% in the North West province did not attend antenatal care (Department of Health, 2003b).

2.4.2 Skilled Attendance

The term skilled attendant refers to an accredited health professional –such as a midwife, doctor or nurse –who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns (WHO, 2006b). There was association seen between the proportions of births attended by skilled health personnel and maternal mortality (De Bernis et al., 2003). The proportion of births by skilled attendants is a key indicator for the MDG5 of improving maternal health and its target of reducing maternal mortality.

2.4.3. Avoidable Factors

Developing countries are struggling to provide health services for a large dispersed, mainly rural population with high fertility rate. In many poor communities, women with pregnancy related complications face delays in deciding to seek care, getting to the appropriate health facility and receiving treatment when they get there (Thaddeus and Maine, 1994; Cham et al., 2005). It is often difficult to predict instances of obstetric complications; nevertheless the majority of maternal deaths are preventable. According to the Saving Mothers 1999-2001 report by the NCCEMD, the lack of antenatal care (21.5%) and the delay in seeking help (32.6%) were the most common patient avoidable factors (Department of Health, 2003b). Fawcus et al (1996) in Zimbabwe found that 32% of patients in rural area and 28% in urban area delayed to seek care. Cham et al (2005) in Gambia found that women delay to seek care because of underestimation of the severity of the complication, cultural belief and previous experience with the health care system. A study in Uganda showed that women felt powerless due to financial barriers to seek medical care (Weeks et al., 2005). Improvements of female education, accessibility of antenatal services and legalization of abortion were among strategies to decrease high proportion of women who were delaying to seek care (Boerma, 1982; Thaddeus and Maine, 1994). Although, many Arab countries are committed to the funding of the health system, there was still high proportion of home deliveries and patient related avoidable factors (Al-Suleiman et al., 2004; Al-Meshari et al., 1996). Besides the problems of lack or delayed transportation, many countries are experiencing problems of lack of supplies and drugs, lack of blood products and lack of trained health care providers (Martey et al., 1994).

According to the last report by the South African NCCEMD, transport problems were implicated in 12.9% of deaths although no estimation of time of transfer between institutions was done (Department of Health, 2003b). Most of studies showed that lack of senior health care provider involvement were the most important avoidable factor. Most of adverse events in developing countries are related to substandard management (Bouvier-Colle et al., 2001; Fawcus et al., 1996). The report by the South African NCCEMD showed that in 40.1% of maternal deaths, there was substandard of management (Department of Health, 2003b).

2.5 Researching of Maternal Mortality and Morbidity

2.5.1 Methodologies for audit of maternal mortality and morbidity

The aim of audit of maternal mortality and morbidity is to identify problems in the maternal health care services, with an aim of improving the services and decrease in mortality. Five approaches to audit of maternal mortality and morbidity are described in the literature. They differ with regard to the level at which the review is undertaken. For maternal deaths three methods are used: these include community-based review (verbal autopsy), facility-based review and confidential enquiries into maternal deaths at the national level (WHO, 2004a). Because maternal deaths are rare events in developed countries, review of life-threatening illnesses (SAMM) is used to monitor the quality of obstetric care. Lastly, evidence based clinical audit is used in both maternal mortality and morbidity review.

- **Verbal autopsy**

The verbal autopsy identifies deaths that occur outside medical facilities and consists of interviewing people who are knowledgeable about events leading to the death such as family members, neighbors and traditional birth attendants (WHO, 2004a; Cham et al., 2005). However, this method has limitations because medical causes of deaths are not verified and assignation of avoidable factors is subjective. Also, there is under-reporting of early pregnancy deaths and those due to indirect causes (WHO, 2004a; Barnes-Josiah et al., 1998). One advantage of this method is that it enables community awareness and advocacy for change (WHO, 2004a).

- **Facility-based review**

Facility-based review provides an in-depth investigation of the causes and circumstances surrounding maternal deaths occurring in health facilities. These reviews are usually less expensive to conduct and approval and support for the review process by the health authorities are easy to obtain. However, there is little unanimity on methodology used in the facility-based review (Moodley et al., 1996; WHO, 2004a). A limitation of this method is that no information on deaths that occur in the community is provided, so there is a need to supplement information about community factors, which are generally not as rigorous as clinical audit.

- **Confidential enquiries**

Confidential enquiries into maternal deaths provide a systematic and anonymous investigation of all maternal mortality in an area, region or country and is usually published and used for advocacy for improvements in the quality of care (WHO, 2004a). Unlike the previous two methods, it allows for general recommendations and guidelines

to be made which are applicable at regional or national level (WHO, 2004a). However, it can lack value, as it does not address the underlying demographic and socioeconomic factors. Many developing countries are not adopting this method due to lack of trust in confidentiality, fears of litigation and lack of resources (De Swiet, 2000).

- **Clinical audit**

Another type of audit, not specific to mortality review is the clinical audit. Clinical audit is a systematic review of care against explicit criteria (WHO, 2004a). It provides direct feedback to the facility staff on practice and performance and the process will help them to identify realistic means for improvement. It provides a structured framework for gathering information and involves less subjective assessment of case management. However, the clinical audit is limited to the clinical care in the facility and cannot deal with community issues. It is used in both the reviews of maternal mortality and morbidity in South Africa because guidelines of management of life-threatening illnesses are published by the NCCEMD and available in all health facilities (Department of Health, 2003b).

2.5.2 Variations in use of maternal mortality audits

As described previously, three methods are used to audit the maternal mortality: the verbal autopsy, the facility-based review and the confidential enquiry into maternal deaths (WHO, 2004a). There is a difference regarding the methods used in developed and developing countries. In the first group, the number of maternal deaths is minimal which allow authors to use confidential enquiries into maternal deaths.

Most developing countries however, experienced problems with the registration of deaths and most of deaths occurred outside health facilities. For the above reasons, many authors in those countries used verbal autopsies to define the causes, avoidable factors and missed opportunities (WHO, 2004a). Some authors in least developed countries used facility- based reviews but as discuss previously, these do not reflect the magnitude of problem because most deaths continue to occur outside the health facilities and in rural area where the lack of skilled attendants is continuously reported (Fawcus et al, 1996; Daponte et al., 2000). Most of the studies in South Africa to date are facility-based reviews, which until recently had been showing a continuous decline in MMR (Spies et al., 1995; Boes, 1987). With increased prevalence of HIV/AIDS infection, the shortages of health care providers and the lack of consistent methodologies in those studies, the National Minister of Health set up in 1997 the NCCEMD to determine the causes and avoidable factors in the high proportion of MMR in the country (Department of Health, 2003b).

The confidential enquiries into maternal deaths started in 1952 in United Kingdom and reports are published every three years. Since its inception, there has been a continuous improvement of MMR and decrease proportion of avoidable factors in the United Kingdom (WHO, 2004b). However, due to lack of resources only developed countries adopt this strategy and it is difficult to introduce in developing countries (WHO, 2004a). South Africa has adopted the confidential enquiry model since 1997. Contrary to the findings of confidential enquiry in developed countries, the 3 reports by the South African NCCEMD showed a continuous deterioration of quality of obstetrical care in the country. The report is released every 3 years and the government is still struggling to

implement the 10 key recommendations proposed since the first report in 1998 (Department of Health, 2006).

2.5.3 Researching SAMM

In developed countries, maternal deaths have become rare events and it has become necessary to look for others means of assessing the quality of obstetric care. Review of SAMM cases provides strong evidence and more robust conclusions because number of SAMM occurs frequently compare to the maternal death cases (Baskett and Sternadel, 1998; Bewley and Creighton, 1997; Mantel et al., 1998; Pattinson et al., 2003).

There is no unanimity in criteria used to identify SAMM case (Say et al., 2004). Developed countries used admission to ICU as proxy for severity because most of the obstetric team in high dependency unit manages complicated cases located in the maternity ward (Baskett and Sternadel, 1998; Bewley and Creighton, 1997). Most studies in developing countries used the disease specific criteria (Olufemi et al., 2005; Filippi et al., 2005) or the organ dysfunction system (Kaye et al., 2003; Mantel et al, 1998; Cochet et al., 2003). Recently, a scoring system that included five clinical indicators (organ failure, resuscitation, admission to ICU, prolonged intubations and transfusion of more than 3 units of blood) has been proposed by Geller et al (2002) to improve identification of SAMM cases. In South Africa, most studies used the organ-based dysfunction and combined the review of SAMM with the maternal mortality. (Mantel et al, 1998; Vandecruys et al., 2002) All these studies showed that the combination of the two reviews allow identifying health problems that can be missed if you review the maternal deaths alone (Pattinson et al., 2003). Studies conducted in South Africa showed that by auditing maternal deaths alone, others health problems are missed (Vandecruys et al.,

2002; Cochet et al., 2003). The combination of audit of maternal deaths with the review of SAMM cases allow identification of trends in quality of care and the changes of causes of diseases (Cochet et al., 2003; Pattinson et al., 2003). Review of SAMM is less threatening for the staff and it is possible to speak to the woman and obtain her views about the care she received.

2.6 Conclusion

Despite all measures in place to reduce the MMR by 75% by 2015 as proposed by the WHO, there is persistent high MMR and SAMM cases with high proportions of unbooked patients, deliveries by unskilled health professionals and avoidable factors in developing countries. Although demographic data showed minimal association in developed countries, extremes ages (less than 20 years and more 34 years), first pregnancy and grand multiparity are still representing risk factors for deaths in least developed countries.

The most common causes (obstetric hemorrhage, hypertension) of maternal morbidity are the same worldwide but direct obstetric causes, however recently HIV/AIDS infection is increasing as a cause of deaths in Sub-Saharan Africa.

Confidential enquiry into maternal deaths and review of SAMM are used more frequently in developed countries whilst verbal autopsies and facility –based deaths reviews are still used more in developing countries. The combination of review of SAMM and facility death review will allow early identification of health problems.

CHAPTER 3:

RESEARCH DESIGN AND METHODOLOGY

3.1 Study design

There is no unanimity in the type of study design and the criteria used to identify SAMM case in the audit of maternal deaths and SAMM cases (Say et al., 2004)

Most studies in developed countries were retrospective in nature and used admission in ICU as proxy for severe morbidity whilst most studies in South Africa were prospective and used organ dysfunction system and management based criteria for SAMM case. (Say et al., 2004). Due to the time constraint of submitting the mini-thesis and the need of analyzing as many as possible cases of SAMM to increase the power of the study, a retrospective cross sectional survey of all cases of SAMM and maternal deaths that occurred in the Mafikeng regional hospital in the Northwest province of South Africa from 01/01/2005 to 30/04/2006 inclusive was undertaken.

3.2 Study sampling and sample size

The study is based on all cases managed during the review period in the institution and did not require any sampling technique. The audit planned to review cases over a three-year period, as done in most confidential enquiries worldwide. Due to changes in the files codification system in the hospital since December 2004, with the risk of having many missed files and the time constraint of a mini-thesis, the study period was limited from January 2005 to April 2006 inclusive. All cases fitting the definition of SAMM were identified from the ICU admission register whilst for the maternal deaths; registers from casualty, theatre, labor ward, postpartum ward, gynecologic ward and female medical ward were consulted. A maximum prevalence of 3 % of SAMM cases using the management-based criteria was expected (Say et al., 2004). With an average number of

deliveries in the institution of 250 per month and the number of SAMM expected in most studies in South Africa as five times more than maternal deaths (Mantel et al., 1998; Cochet et al., 2003), it was expected to analyze around 144 cases of which 120 for SAMM and 24 for maternal deaths. Regarding the expected precision and with the mortality index of 10+2% and the estimates obstetric causes at 90+2%, this sample size yields a 99% confidence interval. During the study period there were 149 life-threatening patients (16 maternal deaths and 133 SAMM cases) that are similar to the number of cases expected.

3.3 Variable definitions

- **Definition of SAMM**

A SAMM case is any patient during pregnancy or within 42 days of its termination who was admitted in ICU irrespective of cause (Say et al., 2004; Minkauskene et al., 2004). The management-based criteria was used to define the SAMM because the organ system dysfunction proposed by Mantel et al in 1998, while good for a prospective study, is difficult to assess in a retrospective study. All life-threatening illnesses in the hospital that were admitted in ICU were included in the audit.

- **Definition of maternal death**

Maternal death according to the tenth revision of international classification of diseases is a death that takes place during the pregnancy or within the 42 days following its termination but excluding incidental causes (Department of Health, 2003b). Maternal deaths are classified into direct and indirect causes by the NCCEMD (Department of

Health, 2003b). Direct causes are deaths resulting from obstetric complications of pregnancy state from interventions, omissions, incorrect treatment or from a chain of events resulting from any of above (hypertension, hemorrhage, pregnancy related sepsis, abortion, and ectopic pregnancy). Indirect causes of death are those from previous existing disease, or diseases that developed during pregnancy and which are not due to direct obstetric causes, but which physiologic effects of pregnancy aggravate (pre-existing maternal disease, non-pregnancy related infections) resulting in a death of the woman.

- **Defining avoidable factors**

The definitions of avoidable factors are those used by the NCCEMD in South Africa (Appendix 2). The possible avoidable factors have been grouped into three areas: patient, administrative and health care providers' problems. For the patient orientated problems, three factors most described are absence of antenatal care, self-induced abortion, and delay in seeking medical help. Regarding the administrative factors, the NCCEMD proposed to assess logistical problems (transport, communication) and problems in the facilities like lack of ICU beds, lack of drugs and equipment, lack of appropriately trained staff. The assessment of care given to the women by the health care providers follows a systematic approach based on initial assessment, problem identification, management plan and monitoring used (Department of Health, 1999; Mantel et al., 1998). If one of the above steps is deficient, substandard care is recorded and attributed as a health provider problem.

- **Delay in care**

Another alternative method of assessing the avoidable factors is the three delays model proposed by Thaddeus and Maine (1994) who argued that not getting adequate care in time is the overwhelming reason why women die in developing countries. The three delays included firstly the delay in making decision to seek care, secondly delay in reaching the medical facility that is affected by availability of transportation, road conditions or cost of transportation and thirdly delay in receiving appropriate care is influenced by lack of trained personnel and incompetence of staff. For assessing delay in care in this study, any admission to the hospital in critical condition (e.g. shock, coma, death at home) was considered to have experienced a delay in seeking care.

- **Final Cause of Death**

The organ system dysfunction proposed by Mantel was used to classify the final causes of deaths or the reasons of admission to ICU (Appendix 3). Mantel et al (1998) in South Africa described different organs affected with specific markers involved in each system. For example any patient admitted in hypovolemic shock and which required five units of blood transfusion is classified as having a vascular dysfunction. If more than one organ system is affected, the diagnosis of multiple organ failure is made (Mantel et al., 1998).

- **Mortality index**

The mortality index is the number of maternal deaths divided by the number of SAMM plus maternal deaths and is expressed as a percentage. It reflects the proportion of women who presented with life-threatening conditions and subsequently dies. It gives an indication of how successful clinicians are in treating that complication (Vandecruys et al., 2002). Studies in South Africa suggest that the value of any risk factor below or

above 20% of the overall norm in that facility should be considered as significant (Pattinson, 2004; Department of Health, 2006).

3.4 Data collection

All cases were retrieved with the assistance of the clerks in archives department and the investigator assessed notes from all cases. In case some notes were missing in the hospitals records, the investigator checked data available in the above registers and discussed other data with the medical officer on duty during the day of event. Data were collected on demographic features (age, parity, municipality of residence), pregnancy characteristics, primary obstetric cause of death and avoidable factors by using an adaptation of maternal data sheet assessment proposed by the NCEMMD (Appendix 3). The data sheet was adapted to the above model and some variables were removed e.g. resuscitation column (Appendix 4). Demographic data assessed were age, parity and sub district of residence. The patients were divided in five-year age groups (fewer 20 years, 20-24 years, 25-29 years, 30-34 years and more than 34 years) and parity is defined as number of previous pregnancy that reached viability irrespective of outcome (Department of Health, 1999). Patients were classified as nullipara (parity =0), multipara (parity 1 to 4) and grand multipara (parity >4).

The definitions of primary obstetric cause of death and avoidable factors are the same as those used by the NCEMMD in South Africa (Department of Health, 1999). If more than one organ system as proposed by Mantel et al in 1998 was affected, the diagnosis of multiple organ failure was made. Substandard care in level one was defined if it was identified in health center or district hospital and in level two if it occurred in the regional hospital. The proportion of patients who reached the first health facility in critical

condition (shock, coma, death at home) and the time of transfer if the event occurred outside the hospital from the onset of complication to the admission in Mafikeng regional hospital were determined.

3.5: Data analysis

The mortality index regarding each of the different obstetric causes was determined. If the value of mortality index found is 20% above the norm in the hospital, the difference was considered significant (Vandecruys et al., 2002; Pattinson, 2004). Data from qualitative description of events (case study at each maternal death) were post coded for quantitative analysis. Data were entered into a computer database using Microsoft Excel and analyzed in Statistical Package for Social Sciences (SPSS). Results were presented as frequencies, percentages and 95% confidence intervals for categorical data, means and standard deviation for continuous data. Categorical variables were compared with Chi-square or Fisher exact tests when appropriate whilst continuous variables were compared with student's test. Differences were considered statistically significant if p value <0.05

3.6 Validity and Reliability

The validity of assessment tools used in this study had been established by the confidential enquiries into maternal deaths in United Kingdom since 1952 and the NCEMMD in South Africa since 1998 (Department of Health, 2003b).

Medical records are known to be incomplete. All maternal deaths and a majority of SAMM records have been previously reviewed during the routine hospital mortality and morbidity meetings and consensus were reached before the maternal death notification form was completed. A copy of the summary from the mortality and morbidity meetings

is placed in the medical record. While this research was separate from the regular mortality and morbidity meetings, the availability of results from this routine review is expected to increase the quality of data in the medical record.

Although the NCCEMD in South Africa recommends assessment by two assessors, this was not possible in the context of a mini-thesis. However, the researcher who has been an obstetrician for 20 years used the skills acquired in assessing the maternal deaths in the province since 2001 for the NCCEMD to review all files. Due to the fact that it was the first audit of maternal deaths and SAMM cases in the hospital, the investigator adapted the model sheet of assessment form of the NCCEMD to accommodate local conditions (appendix 4).



3.7 Generalisability

The findings represented the population of the central district in the North West province of South Africa and would be expected to be extrapolated to similar districts within South Africa.

3.8 Ethical statement

The study used data that is freely available in medical records to the investigator as a practitioner in the hospital. However, sensitive information regarding HIV status was handled responsibly and permission was requested from the management of the hospital and the provincial Department of Health before the collection of the data (appendix 5).

Reporting was in the aggregate and no names or identifying information on the women was reported. Humans subjects approval were obtained from the University of the Western Cape Higher Degrees and research committees

3.9 Dissemination of results

The reports will be made available to the management of the hospital, all health care providers in the district, the provincial health department and the NCCEMD. Findings will be published in public health or medical journals and presented in professional meetings (e.g. perinatal congress of South Africa).



CHAPTER 4

RESULTS

4.1 General considerations

During the study period in Mafikeng regional hospital, 4293 deliveries, 16 maternal deaths, and 836 total admissions to ICU were reported. There were 149 life-threatening patients (SAMM and deaths) with 133 survivors of intensive care unit (SAMM) and eight of the 16 maternal deaths reported in this study died in ICU.

Overall, the 141 obstetric admissions in ICU represented 3.2% of total deliveries and 16.8% of total admissions to intensive care unit. The prevalence of severe morbidity (SAMM/total deliveries) was 31/1000 deliveries whilst the facility-based maternal mortality rate was 370/100,000 deliveries.

A 10.7% mortality index (deaths/SAMM+deaths) was recorded during this audit and any risk factor studied that had a mortality index below(8.6%) or above(12.8%) the 20% of the mortality index of the hospital was considered significant (Pattinson, 2004). The 16 maternal deaths, 133 SAMM cases and the 149 life-threatening events reported in the study were examined with regard to demographic profile, pregnancy characteristics, primary obstetric causes and avoidable factors. There were 7 missing files (one death and 6 SAMM) and some of the missed information was retrieved from the registers or by an interview with the medical officer on duty.

4.2 Demographic profile

The repartition of patients by age analyzed in this study is shown in Table 1.1 and Figure 1.1. The average age of life-threatening cases (Deaths +SAMM) was 26.5 with a standard deviation of 7.4, and a range of 15-44 years. The mean ages for deaths and SAMM separately was 26 years and the difference was not statistically significant (Table 1.1).

Table 1.1: Descriptive statistics of patients by age

	Death (n = 16)	SAMM (n = 133)	SAMM +Death (n = 149)
Mean	26.4	26.5	26.5
Standard deviation	7.4	7.4	7.4
Range	15-37	15-44	15-44

The analysis of deaths and SAMM cases separated into age groups suggested that deaths appeared to occur in older age groups whilst SAMM occurred more frequently in younger age groups (Figure 1.1).

It was found that 43.8% of deaths and 34.5% of SAMM were more than 30 years old whilst 43.8% of deaths and 48.9% of SAMM were less than 25 years old. However, deaths were predominant among adolescent (<20 years) and between 30 and 34 years group whilst SAMM cases were common between 20 to 24 years group.

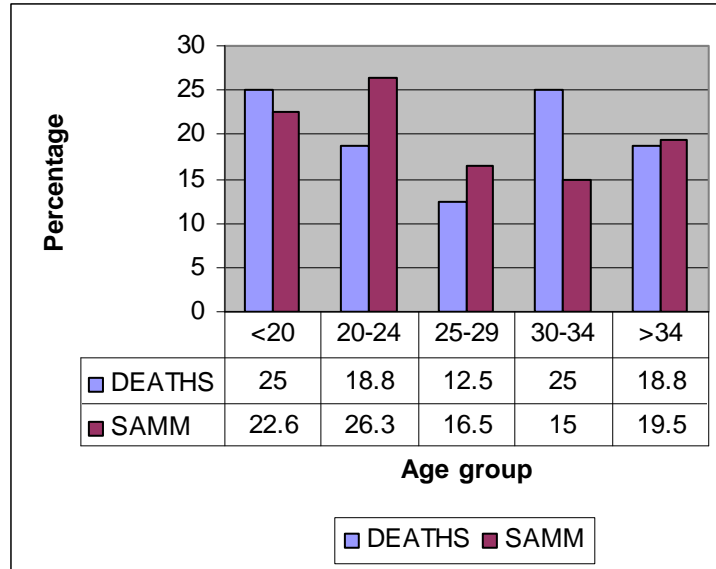


Figure 1.1: The distribution of patients by age

Table 1.2 illustrates the distribution of parity during the study. The average parity was 1.0 with a standard deviation of 1.5 and a range of 0 to 8 for all life-threatening patients seen during the study.

Table 1.2: Descriptive statistics of parity

	Death (n = 16)	SAIMM (n = 133)	SAIMM +Death (n = 149)
Mean	1.5	1.0	1.0
Standard deviation	2.0	1.4	1.5
Range	0-8	0-7	0-8

Most patients during the audit were of low parity and only 3.4% were grand multipara. Although, the comparison of deaths and SAIMM cases did not show any statistical difference ($p=0.178$), deaths occurred more in higher parity (56.2% of patients were between the parity of 1 and 4) and SAIMM cases occurred in lower parity (50.4% were nullipara).

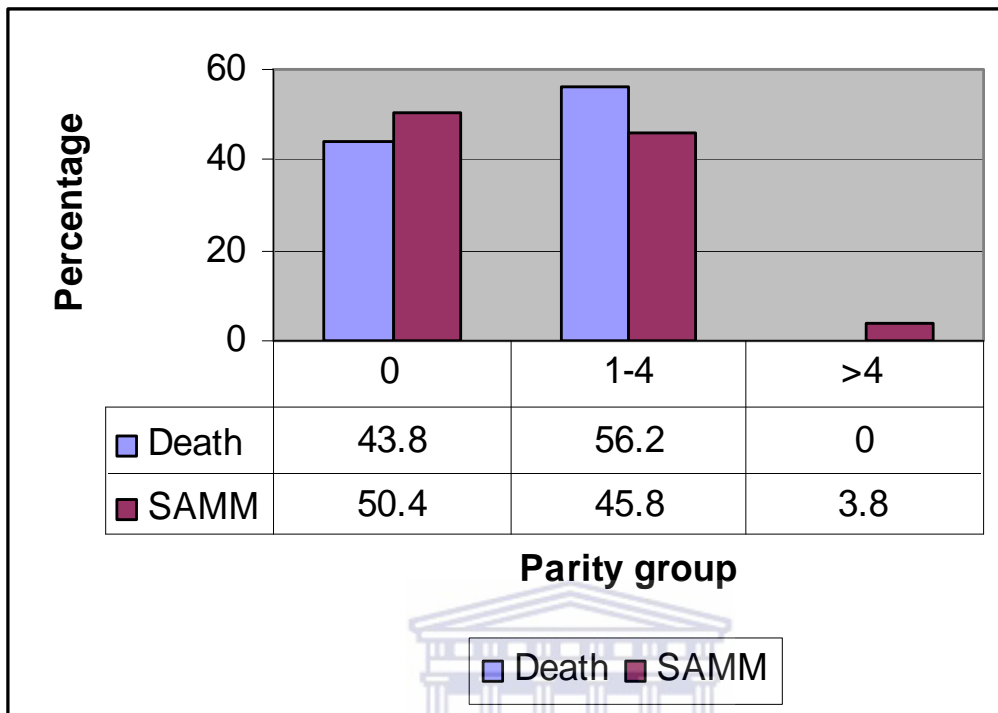


Figure 1.2: The distribution of patients by parity

Figure 1.3 describes the distribution of patients from the sub district of residence and showed that most patients were from the Mafikeng sub district. Although, the difference was not statistically significant ($p=0.677$), an increase in risk of deaths for patients was observed from Mafikeng, Delareyville, Ratlou and fewer risks for patients from Zeerust and Lichtenburg. The increased risk of deaths for patients from Mafikeng sub district which was the nearest to the regional hospital was a cause for concern. However, findings from Delareyville and Ratlou were probably due to the lack of first level hospital during the study.

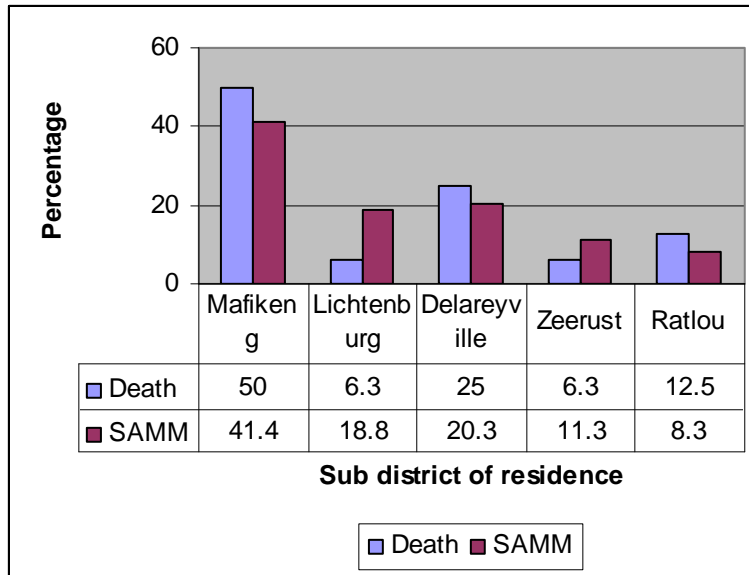
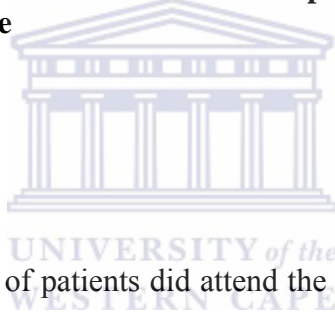


Figure 1.3: The distribution of patients by sub district of residence



4.3 Pregnancy characteristics

During this study, the majority of patients did attend the antenatal care and only 6.3% of deaths were not booked. It was observed that 93.7% of deaths and 82.7% of SAMP cases were booked and the difference was not statistically significant ($p=0.471$). Figure 2.1 describes the referral patterns during the review period. The majority of patients (89.9%) were referred within the district health system. There were few patients from private institutions (2.0%) or self referred (8.0%). There was only one case of self-referral that died and no death was reported among patients referred from private practitioners.

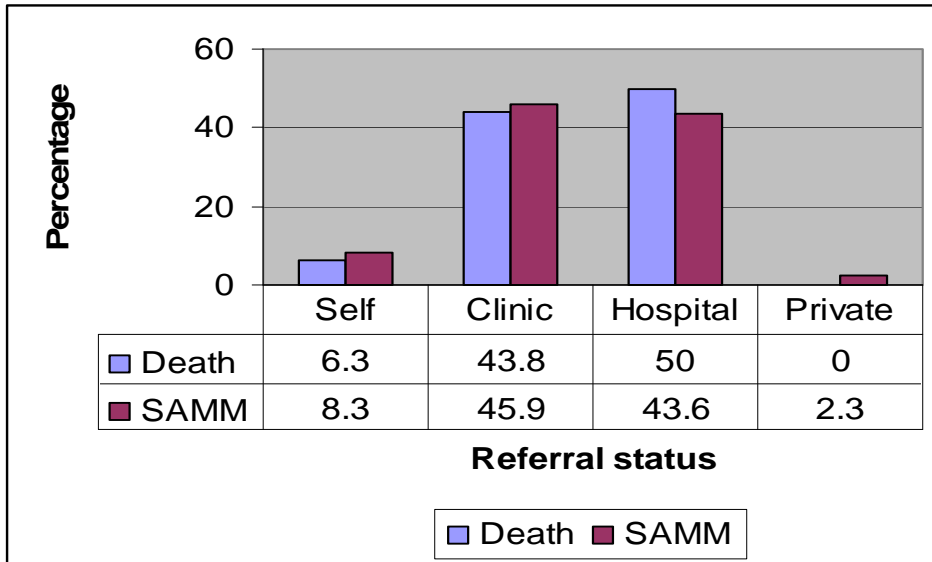


Figure 2.1: The distribution of patients by referral status.

The repartition of patients with regard to the time of emergency is illustrated in Figure2.

2. The analysis showed that most SAIMM cases occurred during the antenatal period (20 weeks to the delivery) whilst deaths occurred during the postpartum period but the difference was not statistically significant ($p=0.167$).

It was also reported that in 62.5% of deaths and 83.5% of SAIMM respectively, the emergency event (e. g convulsions or excessive vaginal bleeding) started outside the regional hospital. and the difference was statistically significant ($p=0.04$).

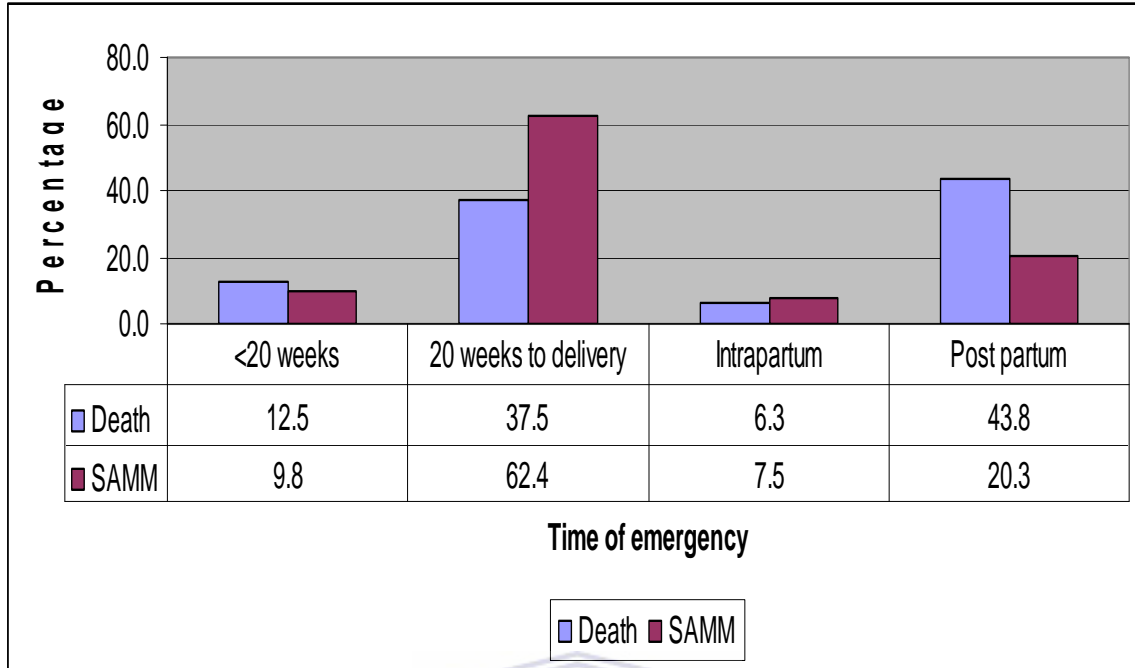


Figure 2.2: The distribution of patients by time of emergency

The mode of delivery during this study is represented in Figure 2.3. The analysis showed no difference concerning the caesarean section and the normal vaginal birth. In contrast, 68.4% of all life threatening events delivered by caesarean, 25% of deaths did not deliver and 5.9% of SAMM cases had laparotomy for rupture of uterus or an ectopic pregnancy and the difference was statistically significant ($p=0.000$), suggesting that the risk of death was higher in those women who were undelivered.

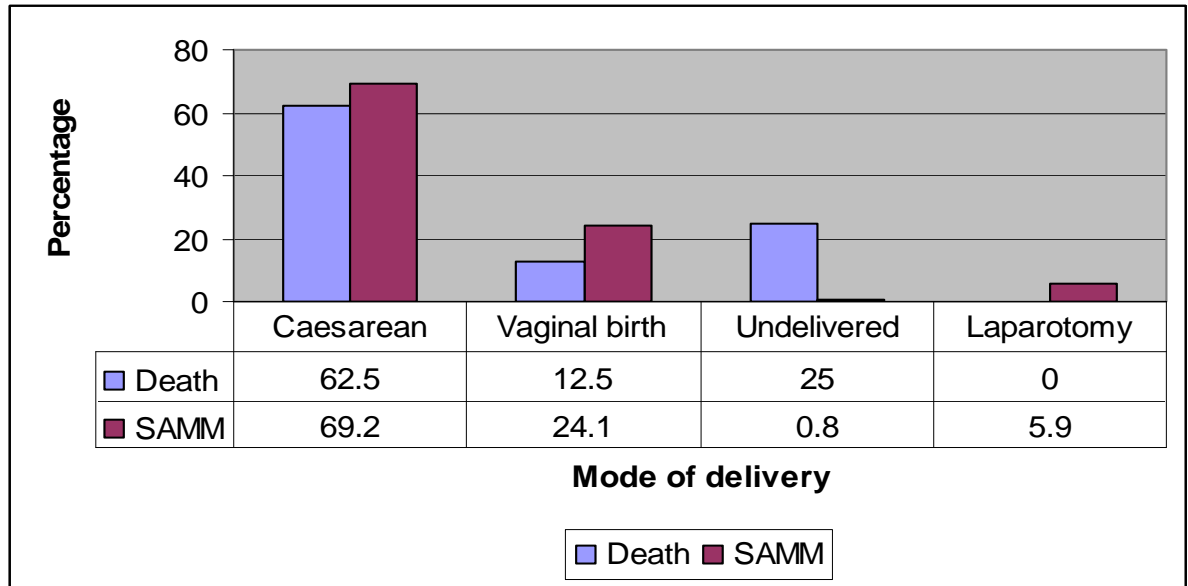


Figure 2.3: The distribution of patients by mode of delivery

All life threatening illnesses resulted in poor fetal and mother outcomes. Although, there was no difference regarding the proportion of live births as shown in Figure 2.4, 12.6% of deaths and 21.8% of SMM had a perinatal death (still birth or neonatal death) and the difference was statistically significant ($p=0.00$). It was reported that 12.5% of deaths and

13.5% of SAMM underwent hysterectomies but the difference was not significant.

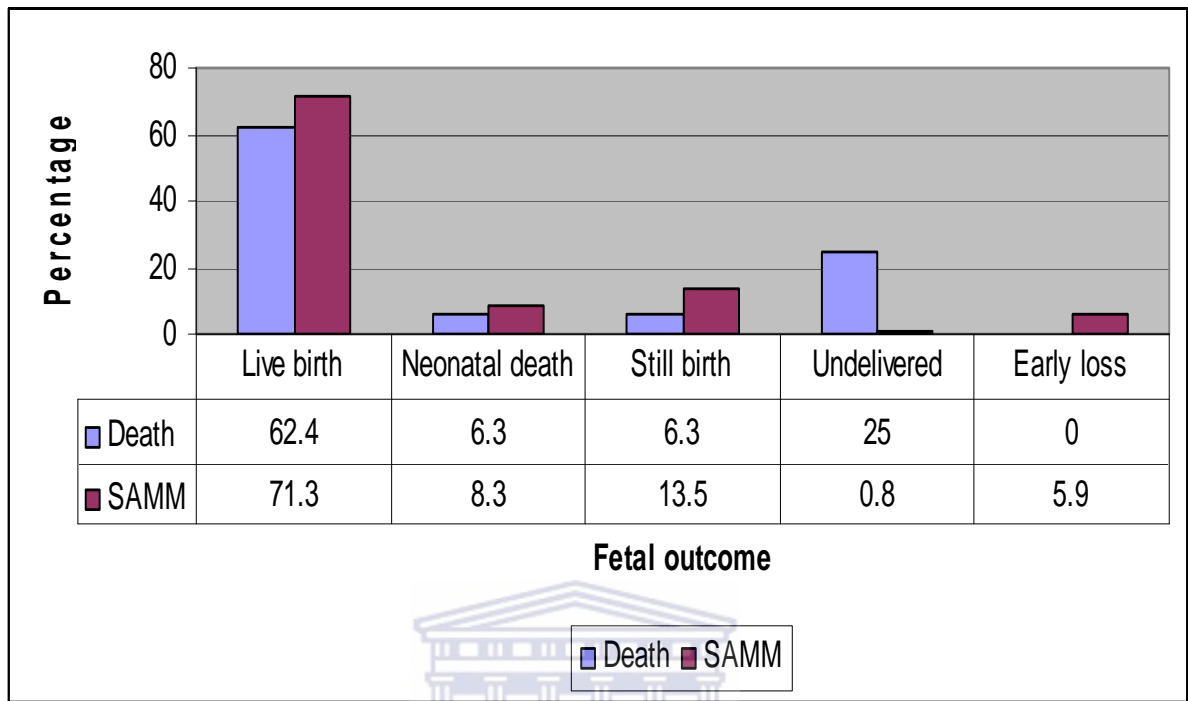


Figure 2.4: The distribution of patients by fetal outcome

The average duration of stay for all cases was 1.8 days with a standard deviation of 1.6 days and a range of 0 to 10 days. Although the mean duration for deaths was shorter, the difference was not statistically significant ($p=0.128$).

Table 2.1: Descriptive statistics of duration of stay

	Death (n = 16)	SAMM (n = 133)	SAMM +Death (n = 149)
Mean	1.3	1.9	1.8
Standard deviation	0.4	1.6	1.6
Range	0-8	1-10	0-10

Figure 2.5 describes the length of stay in the hospital from the onset of event till the death or the discharge from ICU. Deaths cases stayed less in the hospital (37.5% died the same day of admission) compared to SAMM cases that stayed longer (97% stayed between 1 and 6 days) and the difference was significant ($p=0.000$)

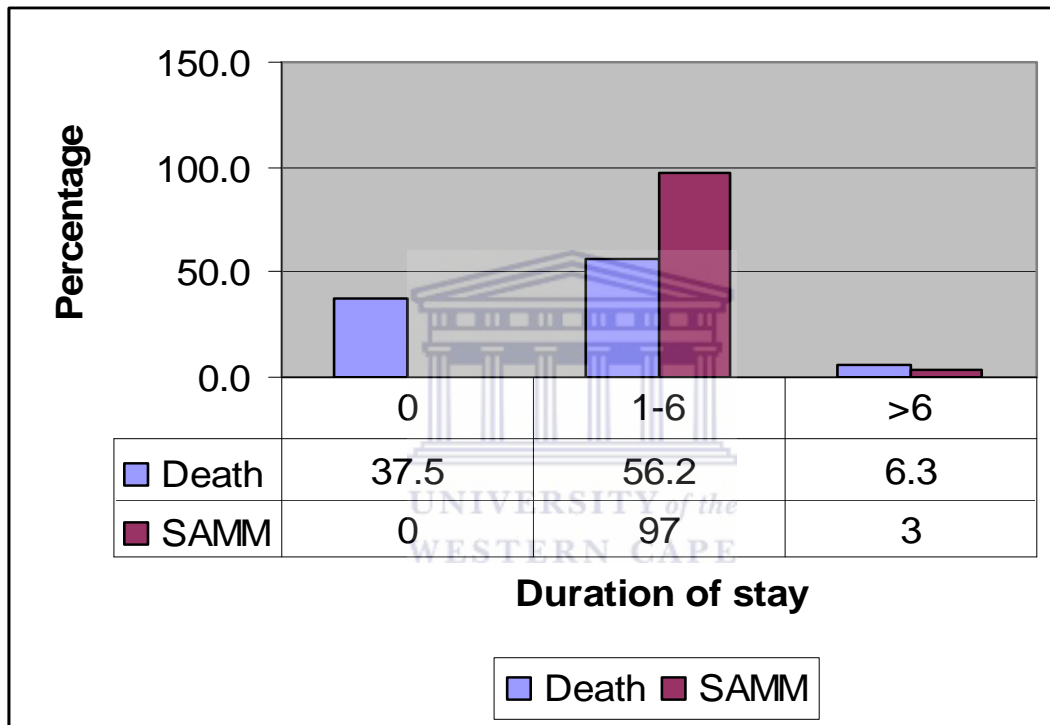


Figure 2.5: The distribution of patients by duration of stay

4.4 Obstetrical causes of deaths and SAMM

The primary obstetric causes of maternal deaths and SAMM cases reported in this study are illustrated in Table 3.1 and Figure 3.1. There were predominance of direct obstetric causes of which 65.8% were due to complications of hypertension, 17.4% were caused by obstetric hemorrhage, 5.4% by early pregnancy loss and 4.7% due to pregnancy related sepsis. Indirect causes represented 4.7% of all life threatening illnesses of which 3.4% were due to non-pregnancy related infections and 1.3% was due to pre-existing maternal diseases.

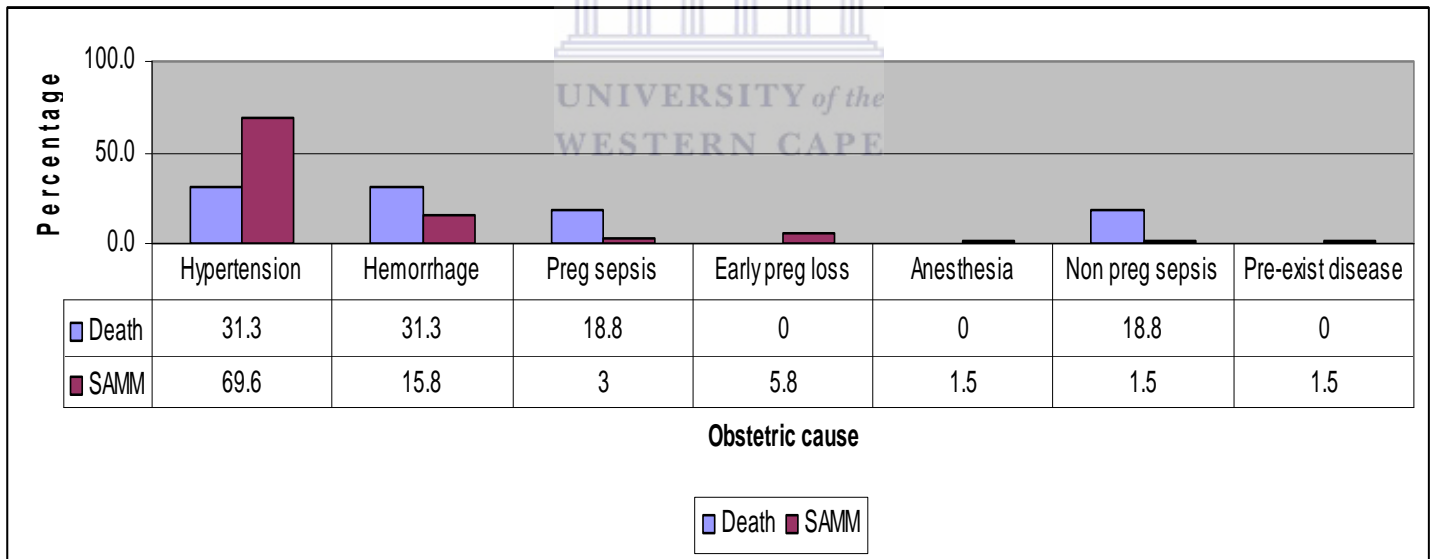


Figure 3.1: Distribution of patients by primary obstetric cause

During this study, cases due to complications of hypertension, early pregnancy losses, anesthetic complications and pre-existing diseases revealed a good prognosis whilst non-pregnancy related sepsis; pregnancy related sepsis and obstetric hemorrhage showed a poor prognosis according to the mortality index (Table 3.1).

The comparison of deaths and SAMM showed that complications of hypertension, obstetric hemorrhage and sepsis were most common causes of maternal mortality. In addition, hypertension, obstetric hemorrhage, early pregnancy losses, were the most common causes for the maternal morbidity. Cases of obstetric hemorrhage, pregnancy-related sepsis and non-pregnancy related sepsis were higher amongst deaths, but only pregnancy related sepsis ($p=0.002$) and non-pregnancy related sepsis ($p=0.009$) were statistically significant. SAMM cases on the other hand were significantly more likely to have hypertension ($p=0.003$) (Table 3.1).

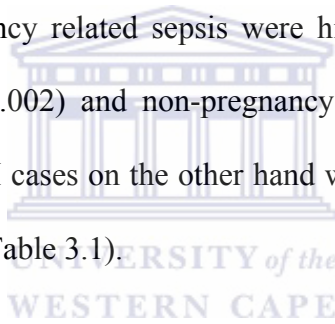


Table 3.1: Comparison of SAMM and maternal mortality by primary obstetrical causes

	DEATH (n=16)	SAMM (n=133)	SAMM+Death (n=149)	p-value	Mortality index (%)
A. Direct					
Hypertension	5(31.3)	93(69.6)	98(65.8)	0.003	5.2
Obstetric hemorrhage	5(31.3)	21(15.8)	26(17.4)		19.2
APH	1(6.3)	6(4.5)	7(4.7)	NS	14.2
PPH	3(18.8)	13(9.8)	16(10.7)	NS	18.7
Rupture uterus	1(6.3)	2(1.5)	3(2.0)	NS	33.3
Preg sepsis	3(18.8)	4(3.0)	7(4.7)	0.02	42.8
Early preg loss	0(0.0)	8(5.8)	8(5.4)		0.0
Ectopic	0(0.0)	6(4.3)	6(4.0)		
Abortion	0(0.0)	2(1.5)	2(1.3)		
Anesthesia complications	0(0.0)	2(1.5)	2(1.3)		0.0
B. Indirect					
Non preg sepsis	3(18.8)	2(1.5)	5(3.4)	0.009	60
Pre-existing maternal disease	0(0.0)	2(1.5)	2(1.3)		0.0

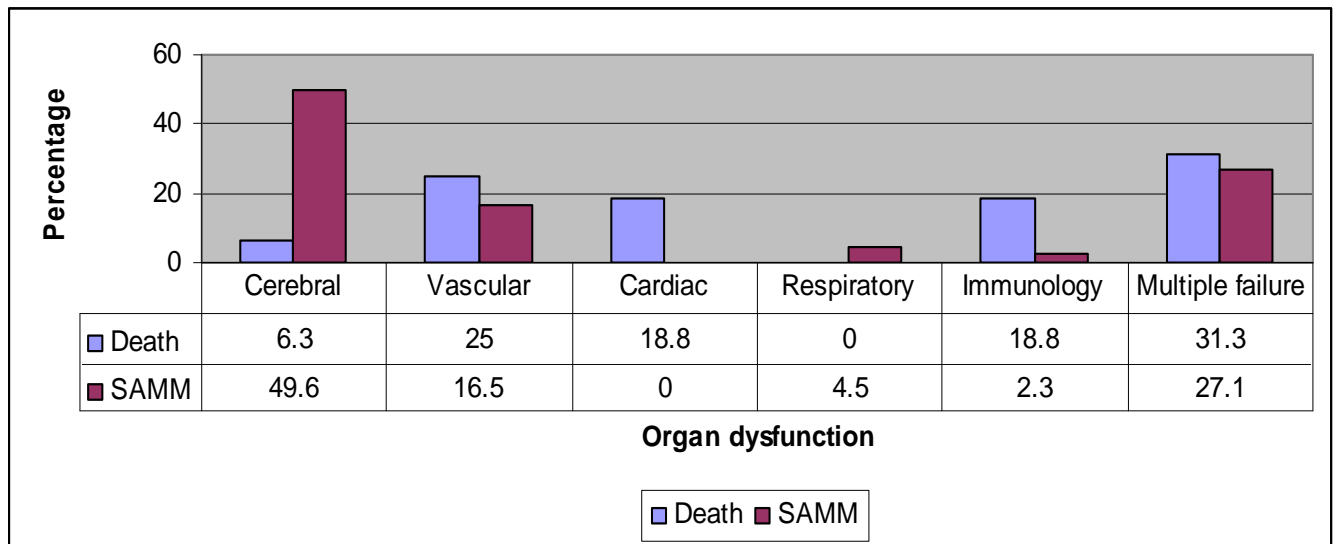


Figure 3.2: The distribution of patients by organ system dysfunction

The type of organ dysfunction affected is described in Figure 3. 2. There was no case of respiratory dysfunction amongst the deaths, while no case of cardiac dysfunction survived.

The analysis of the two groups separately showed that cerebral dysfunction and multiple organ failure were predominant for SAMP. In contrast, vascular, immunology and cardiac dysfunctions were the commonest for the deaths and the difference was statistically significant (p=0.00)

4.5 Avoidable factors

Table 4.1 describes the avoidable factors observed during this study and the analysis revealed that in 57.0% of life threatening events, there were presence of avoidable factors of which 22.8% were patient related, 14.1% due to the administrative factor and 41.6% related to the health care providers.

Examining SAMP and the deaths separately, more avoidable factors were reported among the deaths regarding the health care provider related factors ($p=0.008$) and the administrative related factors ($p=0.000$).

Table 4.1: Comparison of Deaths and SAMP by avoidable factors

Avoidable factor	DEATH (n=16)	SAMP (n=133)	SAMP+ DEATH(n=149)	P VALUE
Avoidable Factor present	15(93.7)	70(52.6)	85(57.0)	0.001
Patient related	4(25.0)	30(22.5)	34(22.8)	NS
Administrative related	8(50.0)	13(9.8)	21(14.1)	0.000
Health care related	12(75.0)	50(37.6)	62(41.6)	0.008

Although, the difference was not statistically significant with regard to the patient related factor, the distribution of patients by patient avoidable factor revealed that SAMM cases were more unbooked whilst deaths delayed to seek medical care (Figure 4.1).

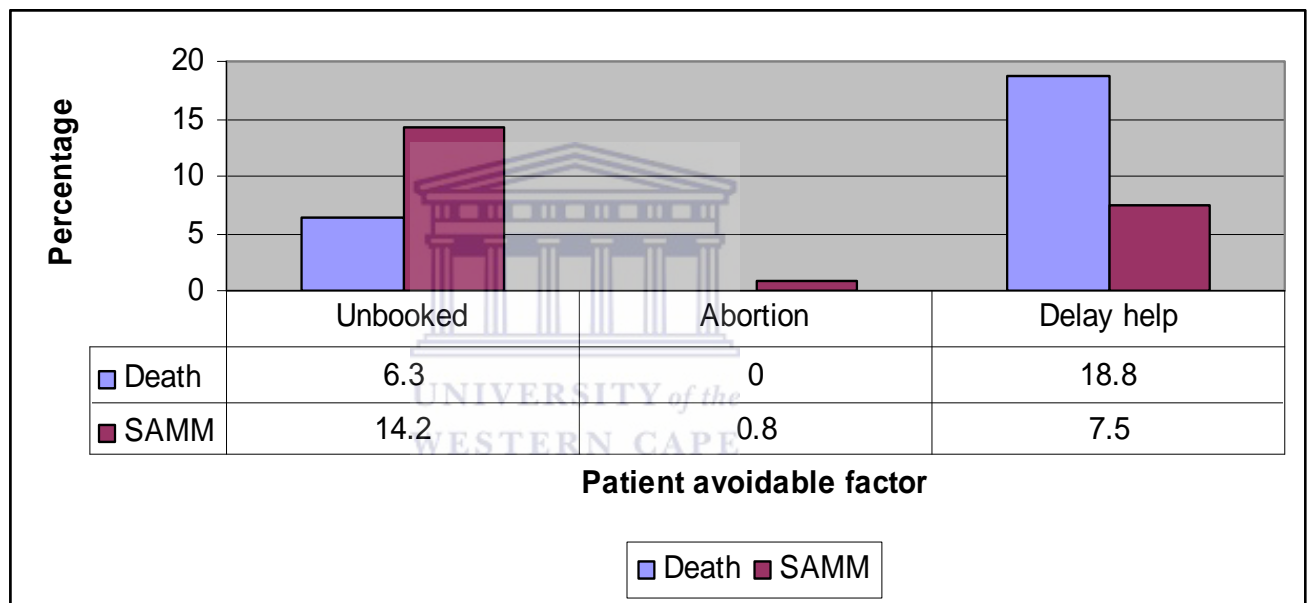


Figure 4.1: The distributions by patient avoidable factor

Delay of transportation and lack of drugs were less incriminated, while lack of appropriate trained staff was the most avoidable administrative factor reported (Figure 4.

2)

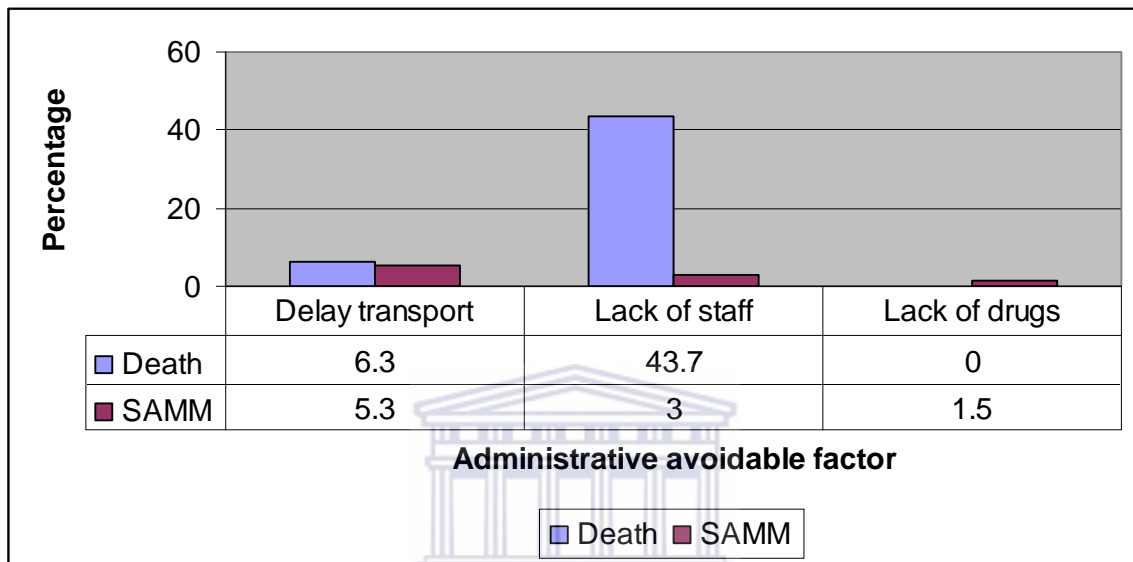


Figure 4.2: The distribution of patients by administrative avoidable factor

It was striking to observe a high proportion of substandard management amongst the deaths in the level 2 hospital followed by the level 1. A high proportion of health care avoidable factor was reported in the SAMM group in both levels of care.

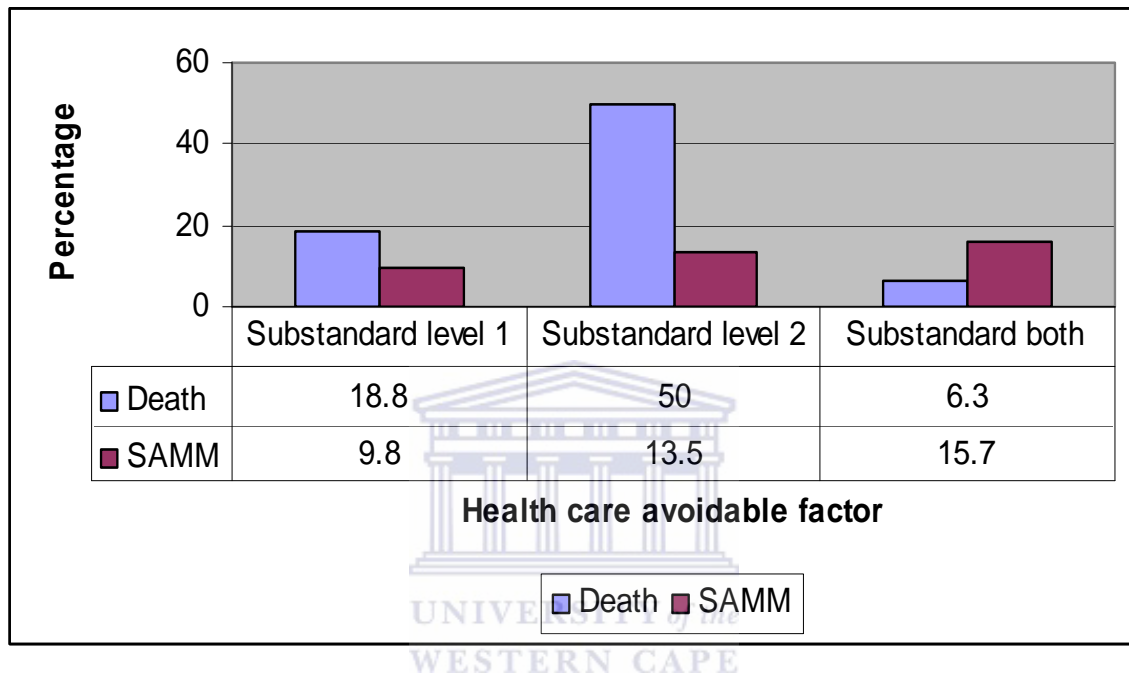


Figure 4.3: The distribution of patients by Health care avoidable factor

4.6 Indicators of delay of care

The status of patients on admission in the regional hospital is represented in Figure 5.1. The analysis showed that 50% of deaths cases were critically ill of which 12.5% were in hypovolemic shock, 18.8% in septic shock and 12.5% in coma. The prognosis was poor if the patient was in septic shock or coma and it was good if patient was stable or in hypovolemic shock.

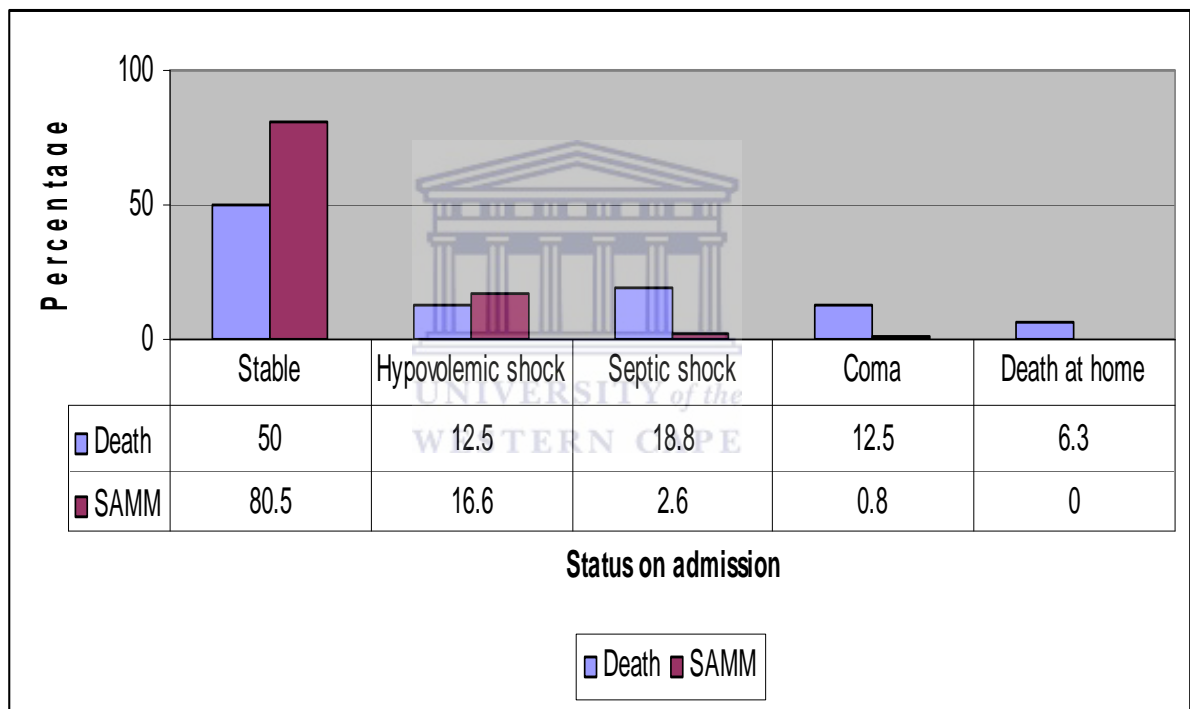


Figure 5.1: The distribution of patients by status on admission

The comparison between deaths and SAMP cases showed that 50% of deaths were critically ill on admission to the regional hospital whilst 80.5% of SAMP cases were stable and the difference was statistically significant ($p=0.011$).

Table 5.1: Descriptive statistics of the time of referral from the onset of event outside the hospital

	Death (n = 10)	SAMM (n = 111)	SAMM +Death (n = 121)
Mean	4.1	6.5	6.4
Standard deviation	2.8	11.9	10.7
Range	1-8	1-72	1-72

The analysis of the time of referral from the onset of event outside the hospital is shown in Table 5.1. The average time for all life-threatening events was 6.4 hours with a standard deviation of 10.7 and a range of 1 to 72 hours. Although, the difference was not statistically significant, 55.9% of SAMM cases arrived to the hospital between 1 to 4 hours whilst 50% of deaths reached the hospital after 4 hours.

4. Summary of maternal deaths

For each maternal death reported during the study, the description of events leading to the death allowed us to obtain an overview of the case regarding the primary obstetric condition, the final cause of death and different missed opportunities encountered.

Case 1: Eclampsia that died 3 hours after admission in the hospital for acute collapse. There was problem of communication between the nurse and the doctor in charge. Emergency case sent home without consultation of medical officer in charge. There was also substandard management due to the fact that patient was not seen by the doctor because he was busy in theatre.

Case 2: Postpartum hemorrhage and hypovolemic shock after caesarean section. There was poor monitoring in postpartum ward due to shortage of nurses and the medical officer on call delayed to assess the emergency because he was busy in theatre

Case 3: Pregnancy related sepsis that died of acute collapse in theatre after hysterectomy for septic shock. There was substandard management in postpartum ward (patient seen only by junior doctor who delayed calling for assistance.)

Case 4: Postpartum hemorrhage and hypovolaemic shock after caesarean section. The doctor on duty managed patient without requesting the consultant to perform an exploratory laparotomy.

Case 5: Case of tuberculosis infection and septic miscarriage. Patient delayed to seek for help and was admitted in septic shock. There was substandard care and patient had evacuation of the uterus before the stabilization.

Case 6: Rupture of uterus in the district hospital due to poor monitoring of previous Caesarean section patient in labor. There was delay of transportation and patient died 30 minutes after reaching the regional hospital.

CASE 7: Eclampsia delivered at the clinic with no magnesium sulfate available. There was delaying of transportation and the patient was admitted in a coma and died 24 hours after admission to ICU.

Case 8: Eclampsia in postpartum ward after a caesarean section for severe hypertension in pregnancy. There was poor monitoring in postpartum ward and delayed by the medical officer on duty to assess an emergency event. She died of pulmonary edema and brain death 12 days after observation in ICU.

Case 9: HIV/AIDS infection in pregnancy that was not on antiretroviral therapy. There was delay from the patient to seek for medical help .She was undelivered and died the same day of admission of septic shock.

Case 10: Meningitis patient who died of multiple organ failure 24 hours after caesarean section. There was a delay from the district hospital to refer the patient in appropriate level.

Case 11: Postpartum hemorrhage and coagulopathy who died of acute collapse 48 hours after caesarean section, hysterectomy and laparotomy performed the day of delivery. There was poor technique during caesarean section and lack of trained specialist in ICU.

Case 12: Antepartum hemorrhage due to rupture of liver capsule. There was substandard management due to lack of trained obstetrician and surgeon in the institution during the emergency event that occurred in the weekend.

Case 13: Pregnancy related sepsis after caesarean section that died at home 6 days later. There was a delay from the patient to seek for help and substandard management (postpartum complication managed by junior medical who did not admit the patient).

Case 14: Eclampsia that died of multiple organ failure in ICU 5 days after termination of pregnancy. There was delay of referral of patient from the clinic to the hospital because the emergency transport services required the approval of receiving hospital. The patient reached the hospital in coma 6 hours after the onset of the event.

Case 15: Pregnancy related sepsis after caesarean section in district hospital. There was substandard management in level one hospital (laparotomy for peritonitis post caesarean section in peripheral hospital with no trained specialist available) and delay in referring to appropriate level (patient died the same day of referral 10 days after the delivery).

Case 16: Eclampsia: Patient died 3 days after observation in ICU. There was delay in referring to level two and patient was admitted in coma and never recovered.

In summary, the analysis of 16 maternal deaths that occurred in the regional hospital showed the predominance of substandard management in the majority of cases. There was delay attributable to the patients only in two cases (death at home, admission in septic shock). The mean referral time of 6 hours from the event till the admission in the combined group is unacceptable. Regarding the substandard management, the following was observed:

- 1) No respect of guidelines and protocols of management of life-threatening illnesses with poor referral system between the different levels of care.
- 2) Poor training of health care providers in level one that resulted in poor monitoring of patients and delay in referring complicated cases.
- 3) Shortage of health care providers in regional hospital (poor monitoring in postpartum ward, complicated cases managed by junior doctors, delay of assessment of complicated by the doctor on call because they are attending to other emergencies).
- 4) Lack of trained specialists covering 24 hours in the hospital and delay in calling for senior assistance in some complicated cases.

4.8 Conclusion

Although, the complications of hypertension and obstetric hemorrhage were the most common obstetric conditions in both groups, the audit of maternal mortality gave a different disease pattern than the audit of SAMM cases. Deaths cases were older, of higher parity and attended antenatal clinic more than SAMM group. Furthermore, the emergency event started inside the hospital and there were less perinatal deaths and few cases of hysterectomies performed amongst the deaths. Deaths also showed more administrative avoidable and health care providers related factors. They were more

admitted in critically ill condition and majority arrived at the hospital after 4 hours of the onset of the event. In conclusion, cases of maternal deaths presented with different patterns than those of SAMM and it is suggested that cases of maternal morbidity needed to be included in audit of maternal deaths to determine deficiencies in maternal care at the earlier stage



CHAPTER 5

DISCUSSION

The purpose of the study was to determine the reasons of persistently high MMR in a regional hospital in the North West province of South Africa by examining cases of SAMM and maternal mortality. The analysis of different variables showed that cases of maternal deaths presented with different patterns than those of SAMM and it was suggested that cases of maternal morbidity needed to be included in audit of maternal deaths to determine deficiencies in maternal care at the earlier stage. In this chapter, issues which emerged from the results and that explained the persistence of high maternal mortality reported in the region will be discuss. The prevalence of maternal mortality and morbidity, the demographic profile, the referral patterns, the primary obstetric causes and the avoidable factors of all life-threatening obstetric conditions reported in the hospital will also be discuss. Findings of this audit were compared mainly to the results from the province and the country reported by the NCCEMD.

5.1 Prevalence of maternal mortality and morbidity

This study conducted in a regional hospital in one of the provinces in South Africa showed a high prevalence of maternal mortality and morbidity compared to studies conducted in urban areas in South Africa. There is no unanimity in criteria used to determine the prevalence of maternal mortality. Although, most studies used the maternal mortality ratio by dividing the number of maternal deaths to 100 000 live births it was difficult to use this ratio because the number of live births and other maternal deaths which occurred in other health facilities were not known. The facility-based maternal

mortality rate (deaths/total deliveries) was used to compare the prevalence of maternal mortality with other health facilities. The ratio of SAMM cases divided by total deliveries was used for the prevalence of maternal morbidity. The maternal mortality rate of 370/100,000 deliveries reported in this study is much lower than the rates of 1720/100,000 deliveries and 2930/100,000 deliveries respectively found by Kaye et al (2003) in Uganda and by Olufemi et al in Nigeria (2005). The rates reported in this study were much higher than those of 30/100,000 deliveries and 2/100,000 deliveries found by Bewley and Creighton (1997) and Baskett and Sternadel (1998) respectively in developed countries. The difference of prevalence reported was probably due to the fact that determinants of maternal mortality (skilled personnel, national economic wealth and health expenditure per capita) proposed by Buor and Bream (2004) were different between countries.

The rate of SAMM of 31/1000 deliveries reported in the Mafikeng hospital is higher than the rates respectively of 10/1000 deliveries by Mantel et al (1998), 11.6/1000 deliveries by Vandecruys et al (2002) and 8.2/1000 deliveries by Cochet et al (2003) in Pretoria in South Africa. The rates reported in South Africa are much higher than the rates of less than 1/1000 delivery in industrialized nations (Bewley and Creighton, 1997; Baskett and Sternadel, 1998). Some of the variations in prevalence may be due to the lack of uniformity in definitions of SAMM cases. Most Studies in South Africa used the organ-based system dysfunction or the management-based criteria whilst studies in developed countries generally used admission to ICU as proxy for maternal morbidities cases. Studies in other African countries use specific disease criteria and reported higher rates than the prevalence in South Africa (Olufemi et al., 2005; Filippi et al., 2005). In addition

to the lack of unanimity in the criteria used to identify the SAMM cases, differences can also be explained by lack of intensive care beds in general or the lack of high dependency unit in the maternity ward, which would reduce the number of women identified when ICU admission is used as the definition for SAMM. Recently, Geller et al. (2002) proposed a scoring system that included the previous markers to increase the identification of SAMM cases. Future research should attempt to use uniform definitions to allow for better comparisons across studies.

5.2 Demographic Profile

This study showed no statistical difference between demographic profile and maternal mortality and morbidity. Similar findings were reported from studies in developed countries (Kessler et al., 1979; Baskett et al., 1998) and from Pretoria, South Africa (Pattinson et al in 2003). The mean age of 26 years reported in this study is lower than the means of 29 years and 28 years respectively found by Pattinson et al (2003) in Pretoria and Olufemi et al (2005) in Nigeria. These findings confirmed the assertion by the South Africa Demographic Health Survey in 1998 that urban women are older than the rural counterpart at the first birth (Department of Health, 1998). Our study showed that 22.8% of patients were less than 20 years with increased risk of maternal mortality among adolescent. Similar conclusions were reported in other studies in developing countries (Lema et al, 2005; Kaye et al, 2003). However, variation in the mean age of the obstetrical population was the result of the most obstetric conditions that prevailed. In this study 65% of life-threatening events were due to complications of hypertension, which explained the high proportion of adolescent reported. The peak age between 20-24 years of all life-threatening patients during this study is similar to the general black

obstetrical population of South Africa (Department of Health, 2003b). The peak age of maternal deaths mothers was lower than the peak of age between 25 to 29 years found in the two Saving Mothers reports (1999-2001; 2002-2004). These findings regarding the age of the patients were similar to the parity where few grand multipara were reported contrary to other studies in Africa that reported high prevalence of grand multiparity (Martey et al, 1974;Olufemi et al, 2005). The mean parity of 1.0 reported was similar to that found by Pattinson et al (2003) in Pretoria and was lower than the mean of 3 reported by Olufemi et al (2005) in Nigeria. The low parity coupled with the high proportion of nulliparity (49.6%) in this study explains the low fertility rate reported in the region (Department of Health, 1998).



5.3 Referral system

The presence of effective referral system and a good communication between all levels of care allowed the management of women at the most appropriate level of care (Department of Health, 2003b). This study showed that 89.9% of life-threatening obstetric patients were referred from the lower level of care of which 45.6% were from the community health centers or the clinics and 44.3% from the district hospitals. They were only 10.0% of patients that were referred outside the district health system (2% from the private sector) and it was observed also that in 81.2% of cases the emergency event started outside the regional hospital. However, the equal numbers of patients referred from the lower levels of care showed the lack of clear guidelines regarding the route of referral in the district. The South African government has adopted the district health as strategy to offer comprehensive primary health care to the population. This

study found that equal numbers of life-threatening patients were referred from the clinics and the district hospitals. The lack of operational district hospital (Gelukspan) during the review period resulted in increase mortality and morbidity in the sub districts (Ratlou, Delareyville). Studies conducted in developing countries showed that majority of patients were self-referred and arriving in the hospital in critical condition due to lack of referral system (Olufemi, et al. 2005; Lema et al., 2005).

Studies by Penn-Kekana and Blaauw in 2002 showed that South Africa had more emergencies obstetrical facilities than the proposed norms by the WHO and agreed with Alihonou (1998) that maternal mortality is more closely linked to poor organization of services than to a lack of national resources as reported in many developing countries.

5.4 Primary obstetric causes of maternal mortality and morbidity

This research showed that direct causes of maternal death (complications of hypertension, obstetrical hemorrhage and pregnancy-related sepsis) were the most common causes of life-threatening illnesses and maternal deaths in the studied period. The study revealed also that there were no deaths due to abortion, pre-existing maternal diseases and the complications of anesthesia.

The study showed that obstetrical hemorrhage and sepsis were difficult to manage in this context and high mortality indices were reported for those conditions. Although, these conditions were similar as studies of SAMM in developed countries (Baskett and Sternadel, 1998; Bewley and Creighton, 1997), the outcome of these varied between the different areas. Good prognosis was observed for the complications of hypertension

whilst obstetrical hemorrhage cases resulted in high proportion of deaths. There are protocols of management of life-threatening obstetric conditions set up by the South Africa NCCEMD and available in all health facilities of the country. The good results reported regarding complications of hypertension is explained by respect of adherence to the protocols (Department of Health, 2003b; Mantel and Moodley, 2002). However, regardless of availability of the protocol of management of obstetrical hemorrhage, the poor outcome found in this study was the result of combination of other factors (delay of transport and lack of skilled attendant). These findings were similar to studies reported in the Africa region where obstetrical hemorrhage remained the most common cause of maternal mortality (Olufemi, 2005; Lema, 2005; Martey, 1994; Khan et al, 2006). Studies conducted in South Africa before the epidemic of HIV/AIDS infection (Boes, 1987; Cooreman et al., 1989; Spies et al., 1995, Fawcus et al., 2005) including audits of maternal deaths in other African countries (Lema et al., 2005; Martey et al., 1994; Fawcus et al., 1996) showed the same diseases patterns in the present study.

Although, non-pregnancy related infections were the common causes of deaths in the last two Saving Mothers reports by the Department of Health in 2003 and 2006 in South Africa and the North West province, it did not contribute as the common cause in this study (Table 6.1). Since 2003, the Department of Health in South Africa introduced the comprehensive HIV/AIDS care, management and treatment plan for South Africa and as a result of this decision most of regional hospitals are now offering highly active anti retroviral therapy (HAART) to the HIV infected pregnant mothers (Department of Health, 2003a). It is known from the studies conducted worldwide that the introduction of

HAART resulted in the reduction of opportunistic infections and mortality (Colebunders, 2002; Bradi, 2002). Mafikeng regional hospital began offering the HAART a year before this study. The introduction of HAART might have contributed to this variation of causes of maternal deaths as compared to the causes reported previously in the national and provincial data (Table 6.1). These results are potentially very encouraging due to the fact that the introduction of the HAART may have an impact in the reduction of MMR in South Africa. Further research is needed to confirm the changes of diseases patterns observed since the implementation of the HAART in public sector hospitals in South Africa.

Studies conducted in developing countries and in South Africa before the legalization of the abortion in 1996 showed high proportion of deaths related to complications of miscarriage (Boes, 1987, Spiess et al., 1995, Martey et al., 1994). Although, termination of pregnancy is legalized, the lack of availability of services resulted to the persistence of high proportion of SAMM cases due to complications of abortion (Vandecruys, 2002). Even though 3.5% of maternal deaths were due to complications of abortion in the triennium 2002-2004 in South Africa (Department of Health, 2006), our findings were similar to those reported by Fawcus in 2005 and contrary to others developing countries, abortion is no longer a major public health problem in South Africa.

Table 6.1: Comparison of primary obstetric cause of maternal deaths in South Africa

Primary Obstetric Cause	North West Province NCCEMD 1999-2001	North West Province NCCEMD 2002-2004	South Africa NCCEMD 1999-2001	South Africa NCCEMD 2002-2004	Mafikeng Hospital This study 2005-2006o
Direct cause	54.0	46.0	59.4	53.6	82.2
Hypertension	18.8	16.4	21.0	19.1	31.3
Obstetric hemorrhage	13.4	11.7	14.0	13.4	31.3
Abortion	3.5	3.7	5.0	3.5	0.0
Preg related sepsis	7.9	7.7	8.2	8.3	18.8
Anesthetic related	1.5	2.5	2.6	2.8	0.0
Indirect cause	45.0	51.2	38.8	43.4	18.8
Non-preg related infections	40.6	47.2	31.7	37.8	18.8
Pre-exist disease	4.5	4.0	7.1	5.6	0.0

The last report by the South Africa NCCEMD showed that 2.8% were anesthetic related (Department of Health, 2006). This study showed that there was no case of death due to anesthesia complications. Although, there was no trained specialist in anesthesia in the hospital, most of the medical officers working in the department had more experience in the field. Kruger and Bhagwanjee drew similar conclusions in 2003 at the Johannesburg hospital (South Africa). They found no death due to anesthesia during a four years review period and this confirmed the relation between senior skilled attendant and maternal mortality.

5.5 Avoidable Factors

The study showed that 93.7% of deaths were preventable. In contrast to industrialized nations, studies performed in developing countries continue to report high proportion of avoidable factors and most deaths due to direct obstetric causes are avoidable (Bouvier-Colle et al., 2001; Fawcus et al., 1996; Department of Health, 2003).

Reports by the NCCEMD revealed a decreasing trend in avoidable factors from the 1999-2001 to the 2002-2004 triennium (Table 6.2). This research showed that in 25% of deaths, there was a patient related factor. According to the 2002-2004 Saving Mothers report, delay in seeking medical help and lack of antenatal care represented respectively 26.8% and 18.1% of patient related avoidable factor (Department of Health, 2006). Similar findings were reported in other African countries (Fawcus et al., 1996; Martey et al., 1974) and in Arab countries where majority of deliveries took place at home (Al-

Meshari et al., 1996; Al-Suleiman et al., 2004). Although, delay to seek medical help was reported in 18.8% of deaths in this study, it is difficult to differentiate in a retrospective audit if the delay was due to patient or because of a delay to refer to appropriate level of care. Further research is needed to determine the proportion of patients admitted in level one of care (clinic or district hospital) in critical condition.

Table 6.2: Comparison of avoidable factors of maternal deaths in South Africa

Avoidable Factor	North West Province NCCEMD 1999-2001	North West Province NCCEMD 2002-2004	South Africa NCCEMD 1999-2001	South Africa NCCEMD 2002-2004	Mafikeng Hospital This study 2005-2006
Patient related	54.3	41.1	54.1	43.9	25.0
Administrative related	40.8	34.6	41.5	32.1	50.0
Health care provider in level 2 related	62.1	48.9	67.0	48.3	75.0

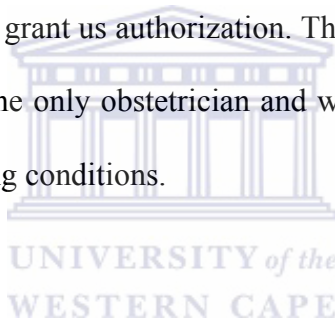
Since 1994, the South African government has been offering free antenatal services to pregnant women including free transportation of life-threatening conditions (Andrews and Pillay, 2005). However, according to the last published report by the NCCEMD, transport problems between institutions were implicated in 9.7% of deaths (Department of Health, 2006). The distance, the cost and the unavailability of public transportation were incriminated as obstacles that prevent women for reaching hospital in most developing countries (Blaney, 1994; Fawcus et al., 1996; Lema et al., 2005). Even though, delay of transportation was reported in 5.4% of life-threatening conditions, the mean time of transfer of 6.5 hours from the onset of the event to the admission to the

regional hospital is a cause for concern. A further study is needed to look at means of reducing the time of transfer.

Most studies showed that the lack of senior health care provider's involvement is the most avoidable factor (Bouvier-Colle et al., 2001; Fawcus et al., 1996). Avoidable factors within the health sector were identifiable in 67% by Fawcus et al in 1996 in rural area of Zimbabwe. The last Saving Mothers report in South Africa showed that in 48.3%, there was health care related management problem in level 2 hospitals (Department of Health, 2006). The rate of 75% of health care related reported in this audit is a cause of concern. However, as reported in many developing countries, shortage of skilled attendant is more pronounced in rural area (Fawcus et al., 1996; Barnes-Josiah et al., 1998; Cooreman et al., 1989). Since the first report in 1998, the NCCEMD has advocated that staffing norms according to the level of care need to be established. However, as described in this audit, there is persistence of shortage of skilled attendants in the hospital and in the country as a whole (Day and GRAY, 2005; Couper et al., 2005). The provision of skilled attendance requires that human resources with appropriate skills are in place, that they have the necessary drugs, equipment and supplies, and that they are able to function in a supportive environment (WHO, 2004b).

5.6 Limitations of study

The retrieval of all medical records for a retrospective study was difficult. By using admission to ICU as criteria for identification of SAMM cases, they were under-estimation of the prevalence of maternal morbidity. The lack of high care unit resulted in over estimation of cases due to the fact that more patients who were stable would be admitted outside ICU. They were under-estimation of maternal deaths because it was difficult to follow the patients after discharge from the hospital. The study planned to review cases in other regional hospitals in the province but due to the confidentiality issue, the NCCEMD refused to grant us authorization. There was a natural bias due to the fact that the investigator was the only obstetrician and was involved in the management of many cases of life-threatening conditions.



CHAPTER 6:

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

An audit of maternal deaths and severe maternal morbidity was conducted in the Mafikeng regional in the Northwest province of South Africa from 01/01/2005 to 30/04/2006

There was no specific demographic profile but patients were younger (mean age of 26 years) and of lower parity (mean of 1.0). The majority of patients were booked and 90% of them were referred within district health system. Most of deaths occurred in post partum period and high perinatal mortality (209/1000 deliveries) and maternal morbidity (13.5% had hysterectomies) were reported. Complications of hypertension in pregnancy and obstetric hemorrhage were the most common causes and non-pregnancy related infections represented only 3.4% of life-threatening events. However, cases of obstetrical hemorrhage and sepsis were difficult to manage in the institution. Delay of transportation (mean transfer time of 6 hours) and lack of trained staff were the most avoidable factors found resulting in high proportion of preventable deaths

6.2 Recommendations

Despite all measures taken by the Department of Health, there is persistence of high proportion of maternal mortality and this had been confirmed by the present research.

There is lack of implementation of 10 key recommendations proposed by the NCCEMD since the first report in 1998 (Department of health, 2006). We found that delay in seeking for medical help from the patient, lack of emergencies drugs and delayed

transportation between institutions and lack of trained staff were the most avoidable factors reported in this audit. Practical recommendations to all stakeholders (communities, health care providers, Department of Health, medical and nursing schools) are formulated to improve the quality of maternity care in the district.

A) Community

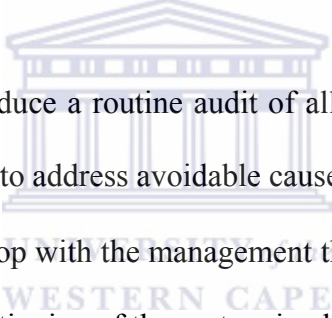
There is a need for an active participation of the community for the sustainability of key interventions. The provincial authority in the Department of Health needs to establish community emergency committees to ensure the importance of antenatal care and to help in birth preparedness planning.

B) Department of Health

- The Department of Health needs to ensure that at each level of care, management staff should be trained, administrative procedures simplified and decision making decentralized (Mavalankar, 2002).
- The Department of Health needs to define the minimum package of obstetric services at each level of care including the human resources, supplies, equipment, infrastructure and financial resources.
- The Department of Health needs to strengthen the referral system by improving the communication and restructuring the current transport system. Each district hospital needs to have a permanent ambulance available in the premises. The Department of Health needs to assess and update the training of health care providers in all levels to ensure that they maintain appropriate competencies and skills.

- The Department needs to appoint an obstetrician and an anesthetist in each district to supervise the training of medical practitioners and to ensure the distribution and the correct usage of guidelines and protocols of management of life-threatening conditions established by the NCCEMD.
- The Department needs to establish strategic partnerships with the private sector and requests for the specialists in private sector to cover for emergencies in public sector.
- The Department needs to strengthen the health information system to improve the decision making process.

C) Health care providers

- 
- There is a need to introduce a routine audit of all life-threatening illnesses in all health facilities in order to address avoidable causes.
 - There is a need to develop with the management the minimum staff establishment required for a good functioning of the system in all levels of care.
 - The regional hospital needs to supervise the training of all doctors working in maternity section in the district hospitals and introduces a system of certification.
 - The regional hospital needs to organize regular workshops involving all doctors in maternity section, health managers and nursing managers to update the management of life-threatening conditions and discuss all problems encountered in the district. The regional obstetrician needs to organize regular outreach programs in the district hospitals
 - The regional hospital needs to ensure that all life-threatening conditions are managed in consultation with the specialist on duty.

- The regional hospital needs to ensure that there is a 24 hours specialist cover and if there is no one available in public sector, there is a need to request the specialist in private practice for help.
- There is a need of good communication and harmonization of working environment between the nurse, the medical officer on duty and the specialist.

D) Nursing and Medical Schools

They need to strengthen the training by adapting the new curricula of formation and put more emphasis on the common life-threatening conditions.

6.3: Contribution of the study and further research

Although, the audit of causes and avoidable factors of maternal mortality and morbidity was limited in one regional hospital in the North West province in South Africa, it highlighted the changes of patterns of causes of diseases of maternal mortality where a lesser involvement of HIV/AIDS infection was noted as compared to other national and provincial data. This is the first study in South Africa to show the reduction in non-pregnancy related infections as the commonest cause of maternal death. This finding warrants further study to determine the likely contributors to this difference. The study showed also that delay in reaching the referral hospital in time (mean transfer time of 6 hours) and lack of skilled attendants were the most avoidable factors reported which has significance locally for programmed development to address avoidable factors. There is a need to conduct a prospective multi-centre audit of all 3 regional hospitals in the province by using the clinical indicators proposed by Geller et al (2002) to highlight the local factors that contribute to the persistent high MMR in the province.

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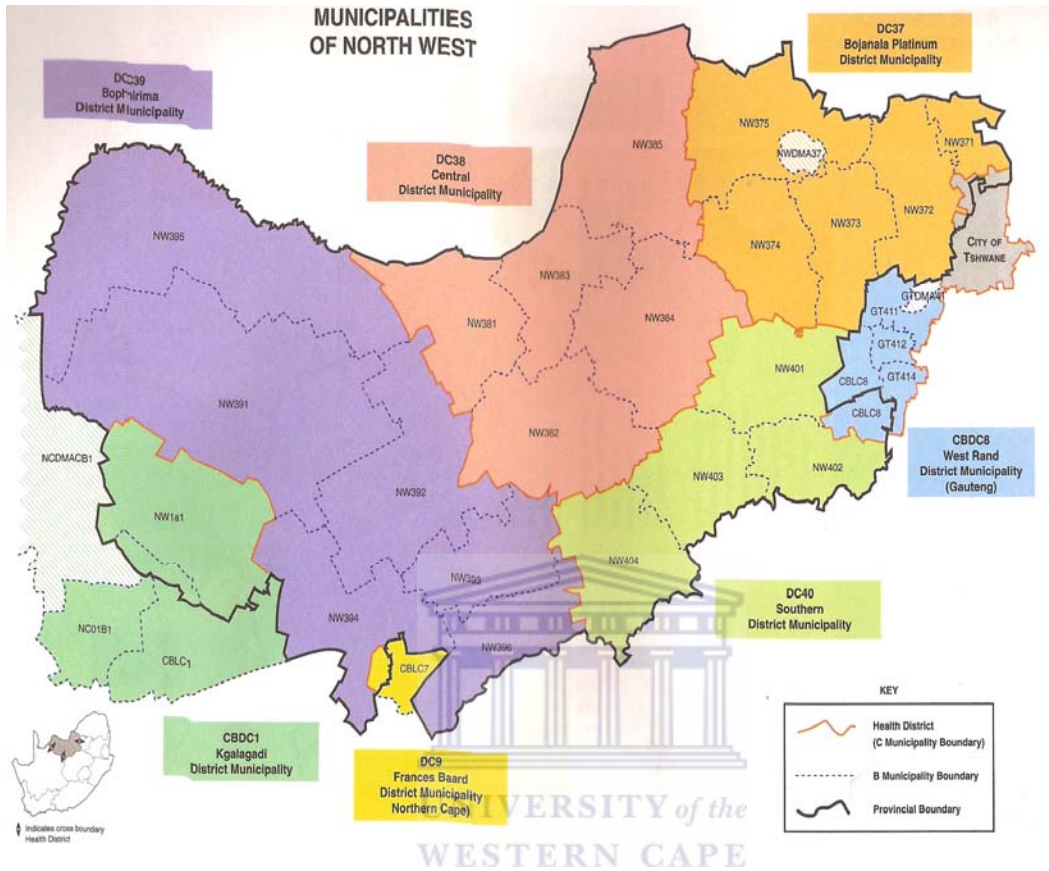
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Appendix 1 Map of NORTH WEST province



Source: Health System Trust, South Africa Health review, 2005

APPENDIX 2

Maternal Mortality- Assessors Control Sheet (NCCEMD)

DEMOGRAPHICS:

- 1) Unique Number 2) Date death
 3) Province 4) Region/District 5) Hospital
 6) Age 7) Parity before delivery
 8) Antenatal care (Yes/No/Unknown)
 9) HIV status (positive/negative/unknown)
 10) Present pregnancy outcome (live born MSB, FSB, NND, and abortion, ectopic, undelivered):

- 11) Route of delivery: (vaginal, assisted, caesarean section, undelivered):
 12) Referral (Yes/No) 12) if referred from where:
 13) Did she have an anesthesia (Yes/No) if yes at what level
 14) Did she have a hysterectomy (Yes/no) did she have a postmortem? (Yes/no)

PRIMARY OBSTETRIC PROBLEM (Tick 1 main primary obstetric problem and circle the complication and delete where applicable)	(Tick appropriate columns):	Final Cause	Contributory cause
No obstetrical cause:	1. Hypovolaemic shock		
Pre-existing maternal disease:	2. Septic shock 3. Respiratory failure		
Non-pregnancy-related infections:	4. Cardiac Failure		
Ectopic pregnancy:	5. Acute cardiopulmonary collapse due to embolism		
Abortion:			
Pregnancy-related sepsis:	6. Renal Failure		
	7. Liver Failure		
APH:			
PPH	8. Cerebral complications		
	9. Metabolic dysfunction		
	Hematological dysfunction (DIC)		
Hypertension:	11. Multiorgan failure		
	12. Immune system failure		
Anesthetic complications:	13. Unknown		
Embolism			
Acute collapse – cause unknown:	14. Other – specify		
Unknown:			

AVOIDABLE FACTORS (Tick appropriate problem areas – each column must have at least 1 tick)

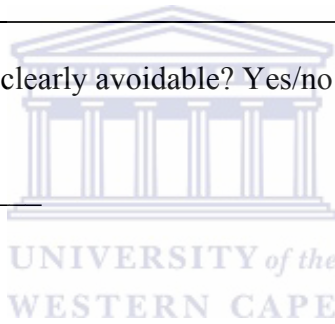
PATIENT ORIENTATED PROBLEMS:		ADMINISTRATIVE PROBLEMS	

EMEGENCY CARE PROBLEMS (TICK TYPE & LEVEL WHERE PROBLEM OCCURRED):

TIMING OF EMEGENCY	Medical CARE	1°	2°	3°	RESUSCITATION	
Give a short summary of the case						

In your opinion, was this death clearly avoidable? Yes/no

Date: _____



Signed: _____

APPENDIX 3

The criteria for a near-miss case for each specific organ system according to Mantel.

Organ system-based	Markers
Cardiac dysfunction	pulmonary edema Cardiac arrest
Vascular dysfunction	Hypovolaemia requiring ≥ 5 units of blood products
Immunology Dysfunction	ICU admission for sepsis emergency hysterectomy for sepsis
Respiratory dysfunction	intubation and ventilation for any reason other than general anesthesia Oxygen saturation of less than 90% for more than 60 min the ratio of the partial pressure of oxygen in arterial blood to the percentage oxygen in inspired air is ≤ 3 ($p_{aO_2}/f_{iO_2} \leq 3$)
Renal dysfunction	Oliguria, ≤ 400 ml/24 hr that does not respond to careful fluid replacement of attempts at inducing with dopamine or infusion acute deterioration in urea > 15 mmol/l or of creatinine to > 400 mmol/l
Liver dysfunction	jaundice in the presence of pre-eclampsia
Metabolic dysfunction	diabetic keto-acidosis
Coagulation dysfunction	acute thrombocytopenia requiring a platelet transfusion
Cerebral dysfunction	coma lasting > 12 hours Subarachnoid or intracerebral hemorrhage

APPENDIX 4

DATA SHEET OF SAMM AND MATERNAL DEATH AUDIT IN MAFIKENG REGIONAL HOSPITAL

- 1) Number
- 2) Date of event
- 3) General outcome (Death or near Miss)
- 4) Age (Years)
- 5) Parity
- 6) Sub-district of residence (Mafikeng, ratlou, zeerust, delareyville ,lichtenburg)
- 7) Pregnancy Outcome (Live Born, still Born, Neonatal Death, Abortion, Ectopic, Undelivered)
- 8) Route of Delivery (Vaginal, assisted, Caesarean, Undelivered)
- 9) Antenatal Care (Yes or No).
- 10) Hysterectomy (Yes or No).
- 11) Referral (Yes Or No). If Yes (Health Centre, District Hospital, Private Hospital, Unknown).
- 12) Time of Emergency (Before 20 Weeks, Antenatal, intrapartum, Postnatal, Anesthesia).
- 13) Obstetric and Medical Conditions (Hypertension, pregnancy related sepsis, hemorrhage (anteartum+postpartum), abortion, ectopic pregnancy, anesthetic complications, pre-existing medical diseases
- 14) Avoidable Factor (Yes Or No) If Yes (Patient, Administrative, Heath Care Provided Related; Other).

- ◆ Patient: No antenatal care, delay in seeking medical help
- ◆ Administrative: delay transport, poor communication, lack equipment, lack trained staff, lack blood/drugs, others
- ◆ Health care provider: substandard care (initial assessment, diagnosis, incorrect management, poor monitoring and delay in referring patient. level one (health center or district hospital) and level two (regional hospital)

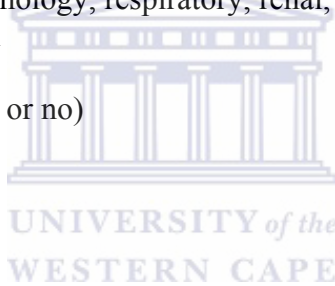
15) Status of patient on admission (stable, shock, coma death at home).

16) Time (Minutes): Onset of event- admission Mafikeng Hospital. Only if event starts outside

17) Duration Hospitalization (Days) Event- Discharge in ICU or Death.

18) Cause of death or admission ICU
(Cardiac, vascular, immunology, respiratory, renal, liver, metabolic, coagulation, multiple organ failure, Cerebral

. 19) Admission to ICU (yes or no)



APPENDIX 5

To: Director Policy, Planning and Research
Department of Health

North West Province/ South Africa

15/04/2006

DR L.LOMALISA
P.O BOX 24381

Mafikeng 2745

Subject: Permission to audit the causes and avoidable factors of maternal mortality and morbidity in the Mafikeng regional hospital

Dear Sir,

I am a gynecologist working in the province since 1994. I am completing my Master of public Health with the University of the Western Cape this year. I need to submit a mini-thesis as require by the course. As a provincial assessor of maternal deaths since 2001,I decided to look for the causes and avoidable factors of high maternal mortality ratio reported in the province. It is a retrospective audit of all cases of maternal deaths and severe acute maternal morbidity cases managed in the Mafikeng regional hospital from 01/01/2005 to 30/04/2006 (Annexure: research proposal approved by the ethics committee of the University of the Western Cape).Names and identifying information will not be abstracted and confidential study numbers will be used. I will like to state that all the funding to this audit will be on my own responsibility. The results and recommendations will be made available to the hospital management, the health care providers in the central district and the provincial department of Health.

I will appreciate your cooperation in this regard and hope that permission will be granted.

Signed

DR L.LOMALISA