DESCRIPTION AND OUTCOMES OF OBSTETRIC PATIENTS ADMITTED TO THE HIGH CARE AREA (HCA) AT CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Medicine in Obstetrics and Gynaecology MMed (O&G)

Johannesburg, 23 October 2019

DECLARATION

I, Siyanda Mlungisi Joshua Zulu declare that the work I am submitting for assessment is my own work contains no sections copied in whole or in part from any other source unless explicitly identified in quotation marks and with detailed, complete and accurate referencing. It is being submitted for the degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at any other university or institution for the purpose of post graduate degree.

Dr S.M.J Zulu

Signed at Johannesburg on the 23rd day of October 2019

DEDICATION

This research report is dedicated to:

To the love of my life, my wife, my beautiful daughter, my mother and my late father:

Thank you for the love and support you have given me throughout my life and career.

POSTER PRESENTATION

38th National Congress of the South African Society of Obstetricians and Gynaecologists, 06 March 2018

ACKNOWLEDGEMENTS

I would like to gratefully acknowledge and express my sincere gratitude to my supervisors, Dr Coceka Mnyani and Prof Lawrence Chauke for the support, patience and guidance throughout this project.

A special thank you to the nursing staff at the Obstetric High Care Area and staff at the records department at Charlotte Maxeke Johannesburg Academic Hospital.

Last but not least, a special dedication to all the families that have lost their loved ones through the experience and process of pregnancy and childbirth.

ABSTRACT

Background

Critical obstetric care in the developed world has been shown to be a useful tool in reducing maternal morbidity and mortality. Despite this there has been few studies in the developing world and in particular South Africa which looked into the incidence, risk factors and characteristics of patients requiring such a specialised service. This information could assist in improving patient care and clinical outcomes. Hence the aim of the study was to describe the characteristics and outcomes of patients admitted to the obstetrics high care area (HCA) at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

Methods

This was a retrospective record review of patients admitted to the obstetrics HCA at CMJAH during the period 1 January to 30 June 2016. Labour ward, theatre, HCA and intensive care unit (ICU) registers were used to identify patients included in the study. Patient records were retrieved from the hospital's records area. A standardised data collection tool was used to extract the following information from patients' files: demographics, indications for admission to HCA, management and outcomes. Descriptive statistics were used to analyse the data.

Results

A total of 114 patients were admitted to the HCA during the study period. The most common obstetric reason for HCA admissions was pre-eclampsia (58.8%, n=67/114) and its associated complications which included HELLP syndrome (12.3%, n=14/114) and eclampsia (7.0%, n=8/114), followed by obstetric haemorrhage (28.1%, n=32/114). Cardiac diseases (12.3%, n=14/114), followed by pneumonia (5.3%, n=6/114) were the most common non-obstetrics reasons for HCA admissions. The majority of these patients had a short HCA stay, 1 to 2 days. Most of the patients were discharged alive (86.8%, n=99/114) and 11 (9.6%) were transferred to ICU. Out of the 11 patients who went to ICU, seven were transferred back to HCA well and four were maternal deaths. Two of the maternal deaths were due to complications of eclampsia, one had jaundice with hepatosplenomegaly of unknown cause, and the fourth patient had metastatic breast cancer.

Conclusion

Pre-eclampsia, and its complications which included HELLP syndrome and eclampsia, obstetric haemorrhage, cardiac diseases and pneumonia were the most common reasons why obstetric patients required HCA and ICU admission. Most of the obstetric patients with complications were managed successfully in HCA and only a small percentage required ICU admission. From the study, a conclusion can be made that most of the common obstetric complications that the study cohort presented with could be successfully managed in a high care setting, hence reducing the need for ICU which is more expensive.

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LIST OF ABBREVIATIONS

ART:	Antiretroviral therapy
CMJAH:	Charlotte Maxeke Johannesburg Academic Hospital
CS:	Caesarean Section
ESMOE:	Essential Steps in Management of Obstetric Emergencies
ESOT:	Emergency Obstetric Simulation Training
EUA:	Examination Under Anaesthesia
HCA:	High Care Area
HELLP:	Haemolysis Elevated Liver enzymes Low Platelet
HIV:	Human Immunodeficiency Virus
ICU:	Intensive Care Unit
IQR:	Interquartile range
MDGs:	Millennium Development Goals
NVD:	Normal Vaginal Delivery
PPROM:	Preterm Prelabour Rupture of Membranes
SDGs:	Sustainable Development Goals
SVT:	Supra Ventricular Tachycardia
TB:	Tuberculosis
TOP:	Termination of Pregnancy
UK:	United Kingdom
WHO:	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1. Background

In the majority of cases, pregnancy usually proceeds until the delivery of the foetus and the peri-partum period with no complications. However, there are instances where complications do occur requiring admission to either an intensive care unit (ICU) or high care area (HCA). Studies reporting on admission of critically ill obstetric patients to ICU have been extensively reported and in these studies ICU admission has been shown to lead to better outcomes for both the mother and the foetus[1–3]. Critically ill obstetric patients present a unique challenge because of the altered physiology of pregnancy and also that the attending clinician should take into consideration the interest of the developing foetus[1]. The intensive care management of critical obstetric patients is complex and requires multidisciplinary care team which includes intensivists, anaesthesiologists, physicians and obstetricians[4]. The proportion of these critically ill patients admitted to ICU varies between developed and developing countries[1–3]. In developed countries, only a small proportion of pregnant women gets admitted to ICU, less than 2%[1], while this figure can reach up to 10% or more in developing countries[1]. Another notable difference is that maternal mortality among patients admitted to ICU is lower (0 to 4.9%) in developed when compared to developing countries (0 to 38%) [1–3]. This is despite the fact that the obstetric indications for admission to either an ICU or HCA are similar in developed and developing countries. Hypertensive disorders and obstetric haemorrhage are the leading indications for admission[1–3].

1.2. Aim and objectives the study

There is evidence in the literature, mainly from resource-rich settings, that availability of HCA and early transfer of critically ill obstetric patients to ICU leads to better outcomes[1,3,5]. Therefore, the aim of the study was to describe the characteristics and outcomes of patients admitted to the obstetrics HCA at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

The specific objectives were therefore:

1. To determine the demographic and clinical characteristics of patients admitted to HCA at CMJAH

2. The outcomes of patients admitted to the HCA

CHAPTER TWO: LITERATURE REVIEW

The need for ICU admission in a pregnant woman is a relatively rare event because most pregnant women entering pregnancy are young with no comorbid conditions[6,7]. However, complications requiring critical care do arise during pregnancy hence management and outcomes of such complications is one of the key indicators of quality of maternal and neonatal care.

In a study done in the United Kingdom (UK), Wheatley et al found that hypertensive diseases of pregnancy and obstetric haemorrhage were the main reasons for transfer to ICU[8]. In the hypertension group severe pre-eclampsia, eclampsia and HELLP syndrome were the common indications of admission as not all patients with hypertension required ICU. Severe pre-eclampsia is diagnosed when a pregnant patient has a systolic blood pressure of 160 mm Hg and diastolic of 110 mmHg or above in the presence of significant proteinuria, or evidence of organ damage[9]. Obstetric haemorrhage was the second most common indication and the majority followed caesarean section. The interventions which were provided in ICU included early circulatory and respiratory support and these have been shown to prevent multiorgan failure and reduce mortality[8].

Similarly, a study by Ntuli et al, done in South Africa, showed that the common indications for obstetric ICU admissions included pre-eclampsia and eclampsia and obstetric haemorrhage[3]. Pulmonary oedema was also common as a complication of preeclampsia. There was a mortality rate of 34.8% amongst the obstetrics patients admitted to ICU[3]. The indications for HCA and ICU admission have changed over time with changing severity and new diseases (HIV). A study by Saravanakumar et al[5], done in the UK, showed that the availability of an obstetric HCA reduces the number of pregnant women that are admitted to ICU[5]. HCA is appropriate for patients who are conscious and with single organ dysfunction and who do not need invasive monitoring[8]. Most centres in the developed world have a dedicated obstetric ICU[7,10], in addition

to an obstetric HCA, whilst in the developing world a general ICU is used to manage critically ill obstetric patients[3]. Existing evidence highlight the advantages of a dedicated obstetric ICU which include foetal monitoring, availability of midwives and obstetricians, and critical care specialists, which can offer continued antenatal and postnatal care in addition to close monitoring required for the patients[5,11].

While there are no formal cost analyses to show that care in a HCA is cheaper than in ICU, it is assumed that care in HCA is cheaper because of less nurse- patient ratio required for HCA compared to ICU care (1:3 vs 1:1)[12]. Because of the fact that women who fall pregnant are relatively young and healthy, one would expect that the majority of pregnant women who develop complications during pregnancy will be successfully managed in a HCA and not require ICU transfer.

Problem statement and justification

A number of studies have reported on the profile and reasons for ICU and HCA admissions among obstetrics patients[1,3,4], however most of these studies were conducted in developed countries. Given the lack of ICU facilities in developing countries, knowledge of the characteristic of women requiring admission to HCA and also their outcomes could aid in planning maternity services, including improving maternity care and outcomes.

Definition of a high care area

ICUs are an essential component of any healthcare facility as they help reduce morbidity and mortality in critically ill patients, but providing such a service is expensive and not always available[13]. In order to reduce costs and provide close monitoring of patients HCAs are preferred instead[13]. A HCA can be generalised or specialised, catering for a specific population of patients, e.g. obstetrics patients only. HCAs are for patients who need a higher level of care than what is offered in the general ward, but who do not need the sophistication and expertise

of an ICU. As such, ICU beds can be used only for patients who really need such care[13]. The common elements included in definition of a HCA as adopted by the British National Health Service, the Association of Anaesthetists of Great Britain and Ireland, the Faculty of Intensive Care of the Australian and New Zealand College of Anaesthetists and the American College of Critical Care Medicine are summarised in Table 1[12–14]:

Table 1: Characteristics of a high care area[12,15]

1. Specifically staffed and equipped section of an intensive care complex.

2. Provides an intermediate level of clinical care between a general ward and intensive care.

3. Provides invasive monitoring and support for patients with, or at risk of developing, acute (or acute on chronic) single organ failure. (An associated co-morbidity may convert a need for high care to a need for intensive care. Multi-organ failure should be managed in the ICU.)

4. Acts as a "step-up" or "step-down" unit between the levels of care delivered in a general ward and intensive care.

5. Admits patients where the predicted risk of clinical deterioration is high or unknown.

6. Does not normally accept patients requiring mechanical ventilation.

7. Does not regularly admit patients requiring frequent non- specialist nursing interventions only, such as non-invasive clinical observations.

Availability of HCA and patients' outcomes

There are limited studies on the role of a dedicated obstetric HCA and its effectiveness in managing critically ill obstetric patients. Most of these studies are retrospective in nature[15–17]. A study by Ryan et al[18] done in Dublin, Ireland, on critically ill obstetric patients, reported on 17 patients who were admitted in ICU between 1996 to 1999. Twelve women, (12/12070; 0.08%) were transferred to ICU before establishing an on-site HCA and this number decreased to five, (5/14096; 0.04%) afterwards, supporting the view that an obstetric HCA reduces the need for ICU admissions for pregnancy-related complications. The above findings have been supported by a study conducted by Wheatley et al[8]. The authors found that 60% of obstetric

patients who were admitted to ICU between 1989 to 1993, prior to the establishment of an on-site HCA, could have been managed appropriately in a HCA and did not require ICU care[8]. In addition to providing primary critical care services, obstetric HCA plays an important role in providing stepdown critical care services for patients who are discharged from ICU[19].

A study by Wallis et al[20], conducted in the UK, looked at why patients die in general wards after discharge from ICU. Out of the 1700 admitted to ICU over a 5-year period, 341 (20%) died in ICU and a further 154 (9%) died in the general wards following discharge from ICU. Although some deaths were expected and inevitable, some patients were expected to survive, and the authors concluded that the lack of 'stepdown' HCA facilities after ICU discharge, contributed to some of the unexplained deaths[20]. As a result of the demands for ICU beds, some patients might have been discharged prematurely from ICU. The authors postulated that such deaths could have been prevented through the provision of a 'stepdown' HCA[20].

The ICU admits patients who are critically ill, and upon discharge from ICU, these patients remain at higher risk of death and readmission and as such HCAs were developed as a 'step down' facility following the observation of higher mortality in the general wards[12,18,20,21]. In countries like Brazil, HCAs are still not widely available[22]. A study done by Rosa et al[22], in Brazil, further supports the need for a dedicated obstetric HCA. The authors collected data on 3200 patients who were discharged from general ICUs, and included obstetric, medical and surgical patients from three different hospitals[22]. Their findings were that the provision of a dedicated obstetric HCA did not reduce the incidence of readmission to ICU or mortality[22]. They attributed their findings mainly to poor handover of patients, lack of patient follow-up and appropriately trained critical care personnel[22].

Whilst the availability of ICUs leads to improved patient outcomes, the provision of such a service comes at a huge financial cost[13,23]. Rudy et al[23], in the United States of America, compared the total cost of patients admitted to HCA vs ICU. Their findings were that the total cost of delivering care in HCA is $5,000 cheaper than that of a patient admitted to ICU. In addition, the cost of keeping a patient alive in HCA was $19,000 cheaper per patient compared to that of rendering care in ICU [23]. From the above evidence, HCA are not only effective in providing primary high care services for critically ill obstetric patients but also reduce

associated mortality of ICU patients that are stepped down to HCA at a much lower cost. The above highlights the lower cost of managing patients in a compared to admission to ICU.

Table 2 highlights the criteria for admission to either an ICU or a HCA[24].

Table 2: Guidelines for admission to ICU and HCA

ICU is appropriate for:	**HCA is appropriate for**:
Patient requiring or likely to require advanced respiratory support alone	Patients requiring support for a single failing organ system, but excluding those needing advanced respiratory support
Patients requiring support of two or more organ systems	Patients who can benefit from more detailed observation or monitoring than can be safely be provided on a general ward
Patients with chronic impairment of one or more organ systems sufficient to restrict daily activities and who require support for an acute reversible failure of another organ system	Patients no longer needing intensive care, but who are not yet well enough to be returned to a general ward
	Post-operative patients who need close monitoring for longer than a few hours

Categories of Organ System Monitoring and Support[24]:

Advanced Respiratory Support:

- Mechanical ventilatory support (excluding mask continuous positive airway pressure (CPAP) or non-invasive, e.g. mask ventilation
- The possibility of a sudden, precipitous deterioration in respiratory function requiring immediate endotracheal intubation and mechanical ventilation

Basic Respiratory Monitoring and Support:

- The need for more than 40% oxygen via a fixed performance mask
- The possibility of progressive deterioration to the point of needing advanced respiratory support
- Patients recently extubated after a prolonged period of intubation and mechanical ventilation
- The need for mask CPAP or non-invasive ventilation
- Patients who are intubated to protect the airway but needing no ventilatory support and otherwise stable

Circulatory Support:

- The need for vasoactive drugs to support arterial pressure or cardiac output
- Support for circulatory instability due to hypovolemia from any cause and which is unresponsive to modest volume replacement. This will include, but not limited to, post-surgical or gastro intestinal hemorrhage or haemorrhage related to a coagulopathy
- Patients resuscitated following cardiac arrest where intensive or high dependency care is considered clinically appropriate

Neurological Monitoring and Support:

- Central nervous system depression, from whatever cause, sufficient to prejudice the airway and protective reflexes
- Invasive neurological monitoring

Renal Support:

- The need for renal replacement therapy (haemodialysis, haemofiltration or haemodiafiltration)

Maternal morbidity and mortality

One of the Sustainable Development Goals (SDGs) is to reduce maternal mortality in developing countries, a goal which the Millennium Development Goals (MDGs) failed to achieve[25]. Developed countries have made considerable progress in reducing maternal mortality and some of these countries are recording even zero maternal mortality, necessitating the use of maternal morbidity instead of mortality as a measure of maternal care[6,10]. For

example, in a study by Baskett et al[10] done in Canada, there were only 64 maternal deaths out of 1 054 828 live births in the period 1997 to 2000[10]. Severe acute maternal morbidity (SAMM), also referred to as maternal near-miss, is defined as a woman who has severe organ dysfunction or failure in pregnancy, childbirth or within 42 days of termination of pregnancy that could result in maternal death, but survived. It is used to judge the quality of maternal health care in situations where maternal mortality statistics are low[4]. Worldwide, the near-miss prevalence differs and ranges from 0.015% to 8.23% between developed and developing countires[15]. It is by understanding the near-misses that the right resources can be channelled and be used to guide clinical practice in preventing maternal deaths[15]. The World Health Organization (WHO) near-miss criteria is presented in Table 3.

Table 3: The World Health Organization (WHO) near-miss criteria[25]

Clinical criteria	
Acute cyanosis	Loss of consciousness lasting >12 hours
gasping	Loss of consciousness and absence of pulse/heart beat
Respiratory rate>40 or <6/min	stroke
shock	Uncontrollable fit/ total paralysis
Oliguria non-responsive to fluids or diuretics	Jaundice in the presence of pre-eclampsia
Clotting failure	
Laboratory based criteria	
Oxygen saturation <90% for >=60min	pH< 7.1
paO2/FiO2 < 200mmHg	Lactate > 5
Creatinine>=300 mmol/l or 3.5 mg/dl	Acute thrombocytopenia< 50 000 platelets
Bilirubin>100 mmol/l or >6.0 mg/dl	Loss of consciousness and presence of glucose and ketoacids in urine
Management based criteria	

Use of continuous vasoactive drugs	Intubation and ventilation for >=60 min not related to anaesthesia
Hysterectomy following infection or haemorrhage	Dialysis for acute renal failure
Transfusion of 5 units of red cell transfusion	Cardio-pulmonary resuscitation (CPR)

Acute physiology and chronic health evaluation II score (APACHE II score) is a scoring system used to assess severity of disease and risk of death.[7] It is calculated by adding the total points for the acute physiology score (heart rate, systolic blood pressure, temperature, oxygenation, respiratory rate, arterial PH, serum sodium, potassium and creatinine, haematocrit, white blood cell count and Glasgow Coma Score, age score and chronic health score, use of mechanical ventilation. An integer score of 0 to 71 is then computed based on these measurements[7]. A higher score implies more severe disease and higher risk of death. It is used to predict mortality in ICU patients; however it is inaccurate in obstetric patients as patients are generally young and healthy[7].

Obstetric and non-obstetric indications for admission to a HCA or ICU in obstetric patients

Perspective from developed countries

The indications for HCA and ICU admissions are similar in both developed and developing countries[26–30]. The incidence of ICU admissions in developed countries for pregnant women is low and less than 2%[1,3,6]. In a study by Pollock et al[30], done in Australia on pregnant and postpartum women requiring critical care in ICU, they concluded that hypertensive disorders of pregnancy and obstetric haemorrhage were the leading causes of ICU admissions[30]. The study findings are consistent with other developed countries where similar causes of ICU admissions have been reported[6,10,30]. In Canada, Baskett et al[31], in their study of pregnant women needing critical care also found that hypertensive disorders of pregnancy and obstetric haemorrhage were the two most common reasons for admission to ICU. Increasing maternal age above 35 years, having multiple pregnancies, maternal obesity and caesarean section were all identified as risk factors for ICU admission secondary to post-partum heamorrhage[31].

A study by Wheatley et al, in the United Kingdom, where they looked at the management differences between HCA and ICU, found ICU to be appropriate for patients who require invasive monitoring, ventilatory support and circulatory support[8]. The commonest Interventions for patients in ICU include mechanical ventilation, arterial line, central venous line, pulmonary artery catheter, blood transfusion, administration of magnesium sulphate and antihypertensive drugs, inotropic support[6,8]. The day to day running and care is provided by intensive care specialist. In contrast, HCA is for patients who are conscious with single organ dysfunction and at high risk of developing life-threatening complications. Care is provided by obstetricians and nurses with a ratio of 1:3, rather than intensive care specialists[8].

In developed countries, the maternal mortality in ICU, which is defined as death of a pregnant women up to 42 days post-delivery, is between 0% to 4.9% and in developing countries it is higher and ranges between 0 to 38%[1,3]. While the profile of patients and the incidence of ICU admission show a similar pattern, it is the maternal mortality which is different between developed and developing countries, with developing countries having a higher mortality rate[30].

A developing world perspective

In the developing world, the pattern and incidence of ICU and HCA admissions is similar to developed countries, but with some notable differences[6,15,18,29,31]. A study was done by Dattaray et al[15], in India, on an obstetric population where they looked at patterns and outcomes of patients admitted to ICU. Of the total number of 57 patients admitted to ICU , puerperal sepsis (20/57; 35%) was the most common indication for admission, followed by obstetric haemorrhage (17/57; 29.8%) and hypertensive disorders of pregnancy (12/57; 21.05%)[15]. The high number of cases with puerperal sepsis was attributed to more home deliveries where sterility is not observed, no antibiotics given, and deliveries are conducted by unskilled personnel. Patients in rural India, where there are more home births, unsupervised deliveries, poor or no antenatal care, low socioeconomic status, late presentation to hospitals, advanced maternal age, failure to use uterotonics and anaemia all drive up the high number of maternal morbidity and mortality[15,32]. In the non-obstetric indication for ICU admission, cardiac disease was the most common[15].

A study done by Farzi et al[33], in Iran, on pregnant and post-partum critically ill obstetric patients needing ICU, found a similar pattern with hypertensive disorders of pregnancy

(280/1019=27.5%) and obstetric haemorrhage (138/1019=13.5%) being their leading obstetric causes of admission to ICU[33]. Cardiac disease and epilepsy were the most common non-obstetrics indications[33]. They had 1029 patients admitted to ICU during the study period from 2009 to 2014 and 753 (79.3%) were admitted in an emergency situation and 266 (26.1%) had elective admission[33].

In Benin, Filippi et al[29] also found that hypertensive disorders of pregnancy and obstetric haemorrhage were the leading causes of ICU admission. Although least reported in other studies[21] they found that anaemia was the most common underlying cause in all their near-misses[29]. The study highlights the importance of identifying near-misses which can then be used to improve maternal care as more healthcare workers will be trained in identifying these cases and know how to treat or refer them immediately to prevent morbidity and mortality[29].

In a study by Okafor et al[21], done in Nigeria, where they looked at the admission pattern and outcomes of pregnant women requiring ICU admission, their findings were that hypertensive disorders of pregnancy and obstetric haemorrhage were the leading causes of ICU admission[21]. They had 18 patients admitted to ICU and all were admitted after delivery. There were six maternal deaths which represented a mortality rate of 33%. A total of 9/18, 50%, had hypertensive complications of pregnancy and the other 4/18 patients, 22.2%, obstetric haemorrhage[21]. All the patients that died were unbooked and were admitted as emergencies and postpartum. The authors concluded that these high risks patients should be admitted to ICU pre-operatively to be optimised and assessed by anaesthetics before surgery[21].

In a study by Ashraf et al[34], in India, on pregnant and post-partum woman, 55 patients were admitted to ICU, and the main indication was obstetric haemorrhage in 15/55 patients; 55% had haemodynamic instability requiring inotropic support and ventilation[34]. Hypertensive disorders of pregnancy accounted for 11/55 patients, 18%, with six patients needing ventilatory support secondary to pulmonary oedema[34]. Seven patients died following multi-organ failure secondary to massive blood loss. They concluded that contributing to maternal deaths is that some of the hospitals still do not have blood bank services, no ICU beds, lack of transport and that patients have to travel long distances to hospitals[34].

The need for a dedicated obstetric ICU is still lacking in developing countries with obstetric patients increasingly making up a significant numbers of ICU admissions. In a study by Tobi et al[35], done in Nigeria, they had 114 obstetric patients requiring admission to ICU, making up 9.8% of all ICU admissions. The study findings were that obstetric patients are usually young

and healthy with no comorbidities except pregnancy-related complications, and are usually admitted for shorter stay, less than three days in ICU, with generally good outcomes. They concluded that a dedicated obstetric ICU will make a huge difference in maternal health[35].

The above studies highlight the fact that the pattern of obstetric admissions to ICU is similar in both developed and developing countries[15,21,29,33,34]. This is somehow surprising because of the difference in socioeconomic status, and availability of ICU beds in developed countries[15]. In developing countries, patients tend to present late in critical conditions, have difficulty accessing healthcare services and there is the burden of HIV, which all contribute to the high rates of morbidity and mortality[30,36,37].

The South African perspective

South African studies on obstetric patients admitted to ICU show a similar pattern of the indications for admission with those of developed countries, with major differences in mortality rates[1,3,30]. A study done by Ntuli et al[3], in Limpopo, which looked at the patterns and outcomes of obstetric patients admitted to ICU showed that obstetric patients make up 7% of all ICU admissions. The common obstetric indications were hypertensive disorders of pregnancy (52.9%, n=73/138) and obstetric haemorrhage (18.1%, n=25/138)[3]. A study done by Motiang et al, in Pretoria, found that cardiac disease was the most common non-obstetric cause for admission to ICU (44.3%, n=93/210), followed by pre-eclampsia-eclampsia (20%, n=42/210) and obstetric haemorrhage (16.2%, n=34/210)[1]. The maternal mortality rate in a study by Ntuli et al[3], was 34% , and in a study done at Charlotte Maxeke Johannesburg Academic Hospital by Richards et al, the maternal mortality rate was 38%[38]. Another study done in King Edward Hospital VIII, in KwaZulu-Natal, 21% of the obstetric patients admitted to ICU died[3]. In another South African study by Motiang et al[1], done at Dr George Mukhari Academic Hospital, in Pretoria, the maternal mortality rate of patients admitted to ICU was 35%[1].

The South African studies reviewed shows that although obstetric patients make up only a small number of between 7 to 14% of ICU admissions, the mortality is high[1,3]. Some of the reasons given are poor antenatal care, delayed referrals, poor transport facilities, limited specialist obstetrician and critical care specialist support, long distances to the referral hospitals and inadequate emergency obstetric care at referral centres close to patient residences[3]. These findings are also similar to other studies done in developing countries[15,16,21,39,40] .

Tygerberg and Groote Schuur Hospitals both situated in Cape Town, are the only two hospitals in South Africa with a dedicated obstetric ICU in the public sector. The obstetric ICU provides invasive monitoring and mechanical ventilation, and is run by obstetricians, anaesthetists and critical care specialists, with multidisciplinary support from other areas of medicine[1]. A study done in Tygerberg Hospital, Cape Town, showed that there were better outcomes, with reduced maternal deaths when obstetric patients were managed in a dedicated obstetric ICU[41]. A dedicated obstetric ICU was established in 2006 and reasons for reduced maternal mortality were having a dedicated ICU in the labour ward staffed by doctors and nurses with in-service training and experience in critical care. Other factors included early detection of illness, appropriate and skilled monitoring and respiratory and haemodynamic management and care[41].

Hence the results of studies reviewed have confirmed that hypertensive disorders of pregnancy and obstetric haemorrhage are the leading causes of both ICU and HCA admission in both developed and developing world.

CHAPTER THREE: METHODS

Study setting

The study was conducted at CMJAH, a tertiary hospital in Parktown, Johannesburg. CMJAH is a teaching hospital of the University of Witwatersrand's Faculty of Health Sciences. The obstetric unit at CMJAH receives referrals from district and regional hospitals, primary healthcare facilities and also self-referrals. The hospital offers a full range of secondary, tertiary and highly specialized services. A dedicated four bed obstetric HCA is present within the labour ward and is staffed by qualified midwives. Immediate medical cover includes obstetrics and anaesthetic teams and multidisciplinary care is emphasised. Specialised medical advice is readily sought from physicians, surgeons and intensivists within CMJAH.

The nurse to patient ratio in HCA is 1:3 which sometimes is more due to staff shortages and the large number of patients needing HCA which have to be out-lied to labour ward due to bed shortages. Ward round are conducted daily by a specialist obstetrician and an obstetric registrar. Patients get admitted directly to HCA from admissions, antenatal wards, labour ward or from the operating theatre if they develop complications. Interventions offered in HCA include blood pressure control, non-invasive monitoring and administration of blood products. Those with more critical complications get admitted to ICU, and in the event that no beds are available in ICU, gets admitted to the obstetric HCA, at least initially. The interventions in ICU include invasive monitoring, inotropic support and ventilation. After patients get discharged from ICU, they transit through the obstetric HCA before being sent to post-natal wards.

Study design

This was a retrospective record review of obstetric patients admitted to the obstetric HCA and general ICU at CMJAH, from January to June 2016. Patient's records were obtained from the records department at CMJAH.

Study population

The study population consisted of all pregnant and postpartum women admitted to the obstetric HCA and those transferred to ICU during the study period. All women who were admitted to HCA or ICU outside pregnancy or the postpartum period were excluded.

Data collection and data analysis

Patients included in the study were identified from the labour ward, theatre, HCA and ICU registers. Data collected comprised of antenatal, intrapartum and postpartum information, and the required information was then extracted and filled in the data collection sheet (Appendix A).

The variables collected comprised of the following:

- Patients demographics
- Indications for admission to HCA and ICU
- Management and outcomes

Data was then captured and entered onto REDCap[42] programme and exported to Microsoft Excel spreadsheet. Data was then transferred to Stata 14.1 (Statacorp, College Station, Texas) for statistical analysis. Descriptive tables were constructed, with means or medians (with respective standard deviations or inter-quartile ranges) described for continuous variables. Categorical variables were tabulated and their frequencies were recorded.

Ethical approval

Permission to perform the study was obtained from the University of the Witwatersrand's Health Sciences Research Ethics Committee (HREC) (Appendix B). Institutional permission to conduct the study was granted by the Chief Executive Officer of CMJAH (Appendix C).

Funding

All costs arising from the study were borne by the researcher.

CHAPTER FOUR: RESULTS

From 01 January to 30 June 2016 there were a total of 4 637 deliveries in the obstetrics unit at CMJAH. Of these deliveries, 2 508 (54.1%) patients delivered via normal vaginal delivery (NVD) and 2 129 (45.9%) via caesarean section (CS). A total of 114 (2.5%) pregnant and postpartum patients were admitted to the obstetrics HCA. Eleven patients (9.6%) were admitted to the main ICU at CMJAH during the study period.

Characteristics of the women admitted to HCA and ICU

Table 4 provides details of the maternal characteristics of the patients who were admitted to HCA and ICU. The age of the women ranged from 15 to 47 years, with a mean age of 29.6 years (SD±6.5). The majority of the patients, 78.9% (90/114), were younger than 35 and only 21.1% (24/114) were 35 years and older. Just over a quarter, 28.1%, of the women admitted were primigravidae, and the median gravidity overall was 2, interquartile range (IQR): 2 – 3. The majority of the patients, 92/114 (80.7%), had a gravidity of three or less. The median parity was 1, IQR 0 – 2, and most of the patients, 107/114 (93.9%), had a parity of 3 or less. A greater number had accessed antenatal care; 89.5% (102/144) had a prior antenatal clinic visit and the median gestational age at booking was 23 weeks, IQR: 19 – 26. The mean haemoglobin level at booking was 12.1g/dl (SD±1.7).

All the patients were tested for HIV, including the 12 unbooked patients who were tested on presentation at CMJAH. A total of 35 (30.7%) patients were HIV-positive and 31 (91.2%) were on antiretroviral therapy (ART). The median CD4 cell count (for 22 women) was 390 cells/mm^3 (IQR: 278 – 541). In terms of obstetric history, 63/114 (55.2%) patients had a history of a previous NVD and 32/114 (28.1%) had had a previous CS. A total of 17.5% (20/114) of the previous pregnancies ended up with miscarriages and two patients each had an ectopic and a termination, respectively.

Table 4: Maternal characteristics, n=114

Characteristic		*n*=114	Percentage
Age (years)			
	<25	29	25.4
	25-29	25	21.9
	30-34	36	31.6
	≥35	24	21.1
Gravidity			
	1 – 2	59	51.8
	3 – 4	46	40.4
	≥5	9	7.8
Parity			
	0	32	28.1
	1 – 2	65	57.0
	3 – 4	16	14.0
	≥5	1	0.9
Accessed antenatal care			
	Yes	102	89.5
	No	12	10.5
Gestational age at booking (weeks) Median (inter-quartile range)	1st trimester	2	12 (12 – 12)
	2nd trimester	73	21 (19 – 25)
	3rd trimester	10	31 (29 – 33)
HIV status			
	Negative	79	69.3
	Positive	35	30.7
Received ART			
	No	4	8.8
	Yes	31	91.2
CD4 count (units) Median (inter-quartile range)	390	278-541	
Previous pregnancy complications			
	Postpartum haemorrhage	1	0.9
	Early neonatal death	3	2.6
	Intrauterine foetal death	3	2.6
	Preterm delivery	6	5.3
	Infant death	1	0.9

Medical and surgical history

The medical and surgical history of the patients who were admitted to HCA and ICU is presented in Table 5. The majority of patients (81; 71.1%) had no significant medical and surgical history. Among those with a medical history, 18 (15.8%) had hypertension while 7 (6.1%) had cardiac disease. A total of 17/18 women (94.4%) who were diagnosed with hypertension were on anti-hypertensive treatment and 2/5 (40%) patients with diabetes were on insulin. The majority of women (68.4%) had no surgical history.

Table 5: Medical and surgical history

Characteristic	Category	*n*=114	Percentage
Medical history			
	Hypertension	18	15.8
	Cardiac	7	6.1
	Diabetes	5	4.4
	TB	5	4.4
	Asthma	3	2.6
	Epilepsy	1	0.9
	No medical history of note	81	71.1
Surgical history			
	Caesarean section	32	28.1
	Laparotomy	4	3.5
	None	78	68.4
Chronic medication			
	Anti-retroviral treatment	31	27.2
	Anti-hypertensives	17	14.9
	Inhalers	4	3.5
	Cardiac medication	4	3.5
	Insulin	2	1.8
	Anti-epileptics	1	0.9
	Oral hypoglycaemics	1	0.9

In terms of indications for HCA admission, pre-eclampsia (severe) and its complications which include HELLP syndrome and eclampsia were the most common obstetric indications, with cardiac diseases the most common in the non-obstetric group. This data is summarised in Table 6. The most common obstetric indication was pre-eclampsia and its complications (89/114; 78.1%) followed by post-partum haemorrhage (32/114; 28.1%). There was one case each of post-operative sepsis (0.9%), PPROM (0.9%) and illegal TOP (0.9%). The most common non-

obstetric indication was cardiac disease (14/114; 12.3%), followed by pneumonia (6/114; 5.3%). There were two cases of anaesthetic complications (1.8%), of which both were from a high spinal. There was one case each of epilepsy, renal failure, syncope, maternal tachycardia, post-operative observations and diabetes mellitus in labour.

Table 6: Indications for admissions to high care

Indications for admission to HCA	*n*=114	Percentage
Obstetric indications		
Pre-eclampsia	67	58.8
Post-partum haemorrhage	32	28.1
HELLP syndrome	14	12.3
Eclampsia	8	7.0
Post-operative sepsis	1	0.9
Other (PPROM and illegal TOP for observation)	2	1.8
Non-obstetric indications		
Cardiac disease	14	12.3
Pneumonia	6	5.3
Anaesthetic complications	2	1.8
Epilepsy	1	0.9
Renal failure	1	0.9
Other (syncope, maternal tachycardia, post-op observation and diabetes mellitus in labour)	4	3.5

Obstetric outcomes

Of the patients that were still pregnant at the time of admission to HCA, the median gestational age was 32.5 weeks (IQR: 29 – 36). Table 7 details the mode of delivery.

Table 7: Mode of delivery

Delivery Details	*n*=114	Percentage
Delivered	77	67.5
Undelivered	37	32.4
Born alive	62	80.5
Stillbirths	15	19.4
Mode of delivery		
Caesarean section	63	81.8
Normal vaginal delivery	14	18.2

The majority of the babies delivered (62/77; 80.5%) were born alive. Of the women who were postpartum at the time of admission, 63/77 (81.8%) delivered by CS. Nine women (11.7%) out of the 77 deliveries were stillbirths; including one woman (1.3%) who had a macerated stillborn. Among the deliveries, the most common complication recorded was a postpartum haemorrhage reported in 22 (28.6%) of the total deliveries (Table 8).

Table 8: Complications during and after delivery

Complications during and after delivery	*n*=77	Percentage
Postpartum haemorrhage	22	28.6
Visceral injury	3	3.9
Anaesthetic complications (high spinal)	2	2.6
Hysterectomy	2	2.6
Re-look laparotomy	1	1.3
Other (SVT, aspiration, maternal tachycardia)	3	3.9

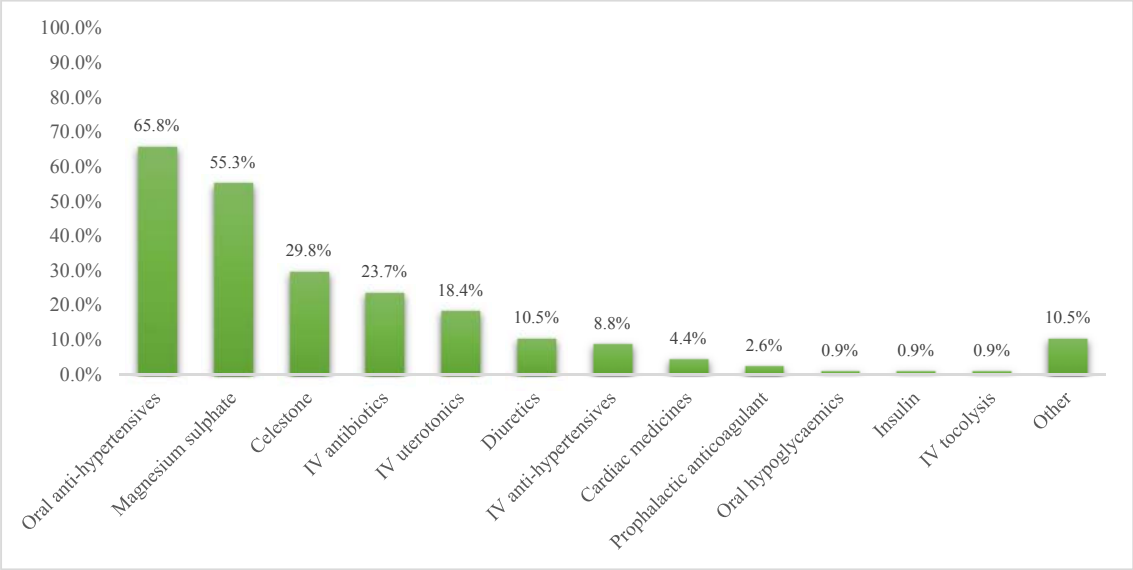
Forty-seven women (42.7%) stayed in HCA for 24-48 hours and 39 women (35.5%) needed high care for more than 48 hours (Table 9).

Table 9: Duration of stay in HCA

Duration of stay in HCA	*n*=114	Percentage
Less than 24 hours	24	21.8
24 – 48 hours	47	42.7
More than 48 hours	39	35.5
Missing information	4	3.5%

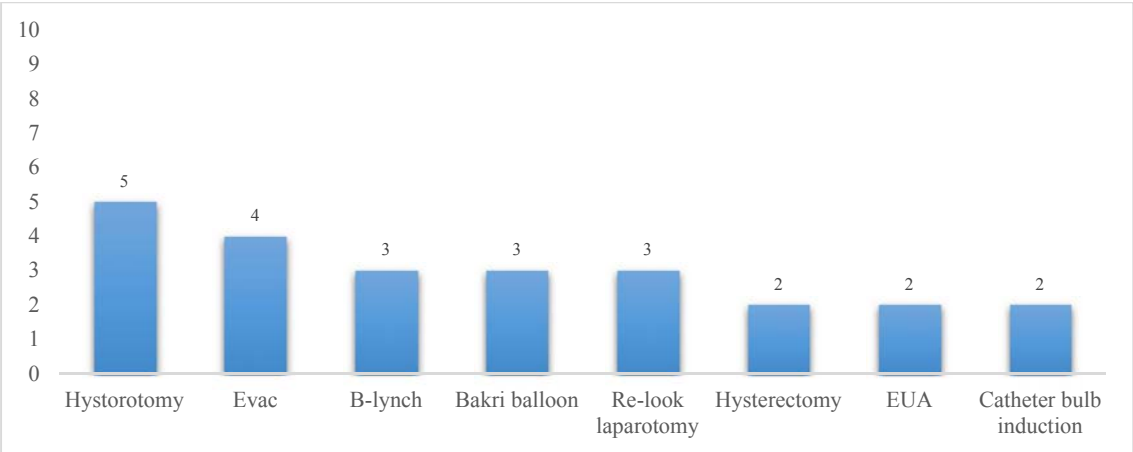
Management in HCA

Seventy-five patients (65.8%) admitted in HCA received treatment for pre-eclampsia and its complications. Figure 1 gives details on the medical management of the patients. None of the patients admitted to the HCA had invasive monitoring and ventilation. Those needing invasive monitoring and ventilation were transferred to ICU.



<u>Figure 1</u>: Medical management of patients in HCA (IV= intravenous, other=oral misoprostol, MTOP (medical termination of pregnancy) with cytotec, potassium shift, anti-epileptic, ventilated, PV cytotec, anti-D)

Figure 2 shows the surgeries performed among patients who were admitted to HCA. Five patients (4.4%) had hystorotomies and 4 women (3.5%) had evacuation of the uterus. Furthermore, 3 patients (2.6%) each had B-lynch, Bakri Balloon and re-look laparotomies. Two patients (1.8%) had hysterectomies and 2 (1.8%) patients (1.8%) had catheter bulb inductions.



<u>Figure 2: Surgery performed among patients admitted in HCA</u>

Table 10 shows the outcomes of patients admitted to HCA and Table 11 shows the reasons for ICU transfer. The majority of the patients (103/144; 86.8%) were discharged to the postnatal wards, while 11/114 (9.6%) were transferred to ICU.

Table 10: Outcomes of patients admitted in HCA

Maternal outcomes in HCA	*n*=114	Percentage
Transferred to ICU	11	9.6
Discharged to postnatal ward	99	86.8
Antenatal ward	4	3.5

Of the patients transferred to ICU, 4 (3.5%) patients were transferred because of pre-eclampsia, two patients (1.8%) because of HELLP Syndrome and one patient (0.9%) because of post-partum haemorrhage. The non-obstetric indications for transfer to ICU were cardiac disease, renal dysfunction, anaesthetic complications, post-operative respiratory diseases and venous thromboembolic disease.

Table 11: Reasons for transfer to ICU

Obstetric indications for transfer to ICU		
Pre-eclampsia	4	3.5
HELLP syndrome	2	1.8
Post-partum haemorrhage	1	0.9
Non-obstetric indications for transfer to ICU		
Cardiac disease	10	8.8
Renal dysfunction	2	1.8
Anaesthetic complications	2	1.8
Post-operative respiratory diseases	1	0.9
Venous thromboembolic disease	1	0.9

Of the 11 patients who were transferred to ICU, 4 (36.4%) died in ICU, and 7 (63.6%) were stepped down back to HCA. Two of the maternal deaths (50.0%) were due to complications of eclampsia; one death (25.0%) was due to jaundice with hepatosplenomegaly of unknown cause; and one woman (25.0%) was a patient with metastatic breast cancer.

CHAPTER FIVE: DISCUSSION

In this retrospective record review of admissions and outcomes of obstetric patients admitted to HCA and ICU at CMJAH, the admission rate was 2.5%. Most of patients were young and had no underlying medical and surgical history. A high number of the patients were of low parity. Admission to HCA and ICU occurred during the postpartum period in majority of cases. The most common indications for admission to HCA were pre-eclampsia and its complications, postpartum haemorrhage, cardiac disease and pneumonia, and the most common reasons for transfer to ICU were cardiac disease and complications related to pre-eclampsia. There was one patient with sepsis, admitted to HCA, majority of these patients get admitted to post-natal ward or gynae ward after delivery. Management consisted mainly of medical management, and drugs to treat hypertension and its complications were the commonest drugs given. The majority of patients were discharged alive and well from HCA and ICU. Of the women who died in ICU, the leading causes of death were complications secondary to eclampsia, one with jaundice secondary to hepatosplenomegaly of unknown cause, and a patient with metastatic breast cancer.

The admission rate of 2.5% is higher than that observed in the developed world where the rate of admission is less than 2%[1]. In the UK, the admission rate to HCA and ICU was reported as 0.75% for the period of 1989 to 1993, with North America at 0,9% for a similar period[8]. The rate may be higher in this study because of the referral bias and the fact that CMJAH is a tertiary hospital receiving high risk pregnancies from several facilities in the catchment area. The admission rate in this study is however lower than that reported for developing countries. In India the admission rate is reported to be around 5.4%[15], while that in Nigeria is reported to be 2.8%[21]. Data from two South African hospitals, Dr George Mukhari Academic Hospital in Pretoria reported an incidence of maternity admissions to ICU of 5.7%[1], whilst that in Pietersburg Hospital in Limpopo was 6.7%[3]. It should however be noted that the studies above in developing world were for patients admitted to ICU and not HCA[1,3].

Antenatal and intrapartum factors associated with risk of HCA and ICU admissions

More than two thirds of patients admitted to HCA and ICU were not of advanced maternal age, i.e. younger than 35 years, with no co-morbidities except pregnancy complications like pre-eclampsia and postpartum haemorrhage. Most admission were therefore not predictable from past medical history. This is in keeping with studies done in the developed and developing world which found that pregnant women are generally young and healthy[27]. The pregnancy state leads to physiological and anatomical changes and whilst beneficial, can also be the cause of major maternal morbidity and mortality[43]. The high number of multiparous patients who developed pre-eclampsia is somewhat surprising given that pre-eclampsia is generally a disease of primigravid women[8]. It could be because of the different patient population with black African race known to have a higher incidence of hypertension[27] .

The majority of the patients in this study while booked presented late for antenatal care, after the first trimester. This finding is in line with studies from the developing world where patients present late with poor or no antenatal care[1,3,44].The majority of the patients in the study had a normal haemoglobin at the first antenatal booking. The Saving Mothers Report 2014-2016, the seventh triennial report on confidential enquiries into maternal deaths in South Africa suggested that one of the measures to prevent sepsis and obstetric haemorrhage is to correct anaemia during pregnancy[45]. Despite good booking mean haemoglobin, a large proportion of women admitted to HCA and ICU suffered severe haemorrhage.

Indications for admission to HCA and ICU

Obstetric indication for HCA and ICU admission

Pre-eclampsia, and its complications, and obstetric haemorrhage were the leading indications for admission to HCA and ICU. This is in keeping with the findings from the developing and developed world. It is interesting that despite the differences in socio-economic status, access to health care and lack of resources in the developing world, the reasons for HCA/ICU are similar to that of the developed world. This is somehow surprising given the fact that in developing countries pregnant women typically present late in a critical condition, with no or poor antenatal care, coupled with a high burden of HIV and a lack of resources.

A large proportion of patients admitted to HCA had caesarean sections which complicated with obstetric haemorrhage necessitating blood transfusion, caesarean hysterectomy and re-look laparotomies. This finding is in keeping with WHO findings that caesarean section is a risk

factor for maternal morbidity and mortality. In South Africa, a country experiencing an increasing number of caesarean section deliveries, haemorrhage at caesarean section puts patinets at an increasing risk of maternal morbidity and mortality[45].In contrast to findings from this study, an Indian study by Dattaray et al found that pregnancy related sepsis accounted for the majority 35% of cases admitted to HCA and ICU, followed by obstetric haemorrhage at 31% and pre-eclampsia at 21%[15]. In Canada, Basket et al findings were that obstetric haemorrhage was the leading cause of ICU admissions, followed by pre-eclampsia and its complications[31].

Non-obstetric indications for HCA and ICU admission

Among the non-obstetric indications leading to HCA admissions, medical disorders, and chief amongst them cardiac disease, followed by respiratory infections, were the leading causes of admission. Of the women with non-obstetric indications for admission to HCA, 9.6% were transferred to ICU and majority had cardiac diseases. The relatively small proportion of patients transferred to ICU may be due to availability of HCA and the quality of care in the unit. The small number of cardiac patients may also be an indication of severity of cardiac disease. Many of these will be elective admission. Our findings are similar to those by Motiang et al, in a South African study done at Dr George Mukhari Academic hospital which showed that cardiac disease was the leading cause of ICU admission, followed by complications of eclampsia and pre-eclampsia[1]. Despite the small numbers of women with cardiac disease transferred to ICU, this group represent a very important group as the mortality is high.

Maternal outcomes in HCA and ICU

The studies that have been done in the developed world show that maternal mortality of obstetric patients admitted to ICU is low and ranges from 0 to 4.9 % whilst that in developing world is high and ranges from 2 to 44%[2,3]. Unfortunately, there are limited studies done in HCA in the developing world to make a comparison. In this study, there were no maternal deaths reported in patients admitted to the HCA. This shows that a large number of obstetric patients can be adequately managed in HCA and only a small number require ICU, but the mortality is high. Eleven patients were transferred to ICU and four (36.4%) died. Of the patients who died in ICU, two died due to complications of eclampsia and one from severe jaundice

with hepatosplenomegaly of unknown cause. The cause of death for the fourth patient is unknown. Pregnant women, despite the majority being young and generally healthy other than pregnancy complications, have a higher mortality when transferred to ICU and early referral to ICU for cardiovascular and respiratory system support is essential. We attribute the high mortality of obstetric patients admitted to ICU as multifactorial involving complexity of the obstetric and medical conditions, late referrals and poor or no prenatal care. The need for multidisciplinary care cannot be over emphasized.

Limitations

A limitation of this study is that it was a retrospective study and the sample size was small. The retrospective nature of our study could have resulted in some missing patients' files and data, but this was minimized by reviewing all files from the records department, HCA and ICU. Also, being a single centre study and a referral hospital that only sees high risk patients, our results cannot be extrapolated to a larger and diverse obstetric population. Another limitation was the poor recording of entries in the obstetric HCA admission and ICU registers making retrieval of patients' records in the records department difficult.

Recommendations

Maternal audits and near-misses analyses have consistently shown that hypertensive disorders of pregnancy and obstetric haemorrhage are the leading causes of maternal morbidity and mortality[10]. Therefore, all healthcare workers who manage pregnant women should be trained in identifying and managing such conditions, and also to refer early to higher levels of care where multidisciplinary personnel and care are available, in order to reduce mortality associated with such conditions. Such training involves training all health care workers involved in obstetrics in the essential steps in management of obstetric emergencies (ESMOE) and team training using emergency obstetric simulation training (ESOT). Doctors in all hospitals that perform caesarean sections should be trained in surgical skills to be able to safely perform caesarean sections, and to manage complications if they arise. Also, to avoid the first caesarean section if possible, by reviewing the indications if they are appropriate[45].

Conclusion

In this study, pre-eclampsia and its complications, obstetric haemorrhage and cardiac disease were the most common reasons why obstetric patients required HCA and ICU admission. This shows a similar pattern to that seen in other parts of South Africa, the developing and developed world. Most of the obstetric patients with complications can be managed successfully in a HCA and only a small percentage require ICU, but the mortality rate is higher. Our study provides some understanding of high-risk pregnancy complications and outcomes that require admission to HCA and ICU. A large prospective, multicentre study will assist us in understanding further the pattern and outcomes of obstetric population that require HCA and ICU admission.

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APPENDIX A: DATA COLLECTION SHEET

DATA COLLECTION SHEET

Study number:

AGE: PARITY: GRAVIDITY:

COUNTRY OF ORIGIN:

TABLE 1: DEMOGRAPHIC PARTICULARS OF STUDY POPULATION

ANTENATAL HISTORY

BOOKED/UNBOOKED GESTATIONAL AGE AT BOOKING:

RPR P/N/?	RH P/N/?	RVD P/N/?	HB
RX RECEIVED Y/N 1^{ST} 2^{ND} 3^{RD}	ANTIBODIES Y/N/?	ON TREATMENT Y/N CD4 VL	DATE

P=positive, N=negative,?=unknown

OBSTETRIC HISTORY

YEAR	GESTATION	DELIVERY	WEIGHT	SEX	COMPLICATIONS

MEDICAL HISTORY

Hypertension	Epilepsy	Diabetes	Cardiac	TB	Healthy

Other (specify):

If yes to any of the above, give further details:

SURGICAL HISTORY:

CHRONIC MEDICATION:

ALLERGIES:

SMOKING: Yes/No

TABLE 2: DETAILS OF ADMISSION TO HCA

GESTATIONAL AGE AT ADMISSION TO HCA:

IF POST PARTUM ON ADMISSION TO HCA/ICU

- DAYS POST PARTUM:
- TIME OF DELIVERY
- DELIVERY DETAILS:
- LEVEL OF CARE: MOU/DISTRICT HOSP/REGIONAL/TERTIARY HOSPITAL
- MODE OF DELIVERY:
- COMPLICATIONS:

INDICATIONS FOR ADMISSION TO HCA

obstetric	Non obstetric
postpartum haemorrhage	Cardiac disease
Pre-eclampsia	Diabetes Mellitus
Eclampsia	PPCMO
HELLP syndrome	Venous Thrombo Embolic disease
Postoperative sepsis	Epilepsy
	Asthma
other	Post-operative respiratory distress PCP

DURATION OF STAY IN HCA:

<24 HOURS
24-48 HOURS
>48 HOURS

VITALS AT TIME OF ADMISSION:

WORST PARAMETERS DURING STAY IN HDU

BP	P	T	RR	URINE OUTPUT	SATS	BIOCHEMISTRY/HEAMATOLOGY	INVESTIGATION	OTHER

BP= blood pressure. P=pulse, T=temperature, SATS=saturation

MANAGEMENT

MEDICAL	SURGICAL	OTHER

INTERVENTIONS

MANAGEMENT BEFORE TRANSFER TO CMJAH FROM OUSTIDE HOSPITAL/CLINIC

- WHO: CONSULTANT/MO/MIDWIFE/SISTER/COMMSERVE/INTERN
- TREATMENT GIVEN:

_____

_____

MATERNAL OUTCOMES IN OBSTETRIC HCA

TRANSFERRED TO ICU
DISCHARGED TO POSTNATES
DIED
RE LOOK LAPAROTOMY
OTHER

INDICATIONS FOR TRANSFER TO ICU

obstetric	Non obstetric
Pre-eclampsia	Cardiac disease
eclampsia	Postoperative respiratory distress

HELLP syndrome	Venous thromboembolic disease
postpartum haemorrhage	Diabetes mellitus
septicaemia	PPCMO
	Pneumonia/PCP
other	Renal failure

MATERNAL OUTCOMES IN ICU:

DISCHARGED	DIED	UNKNOWN

STEP DOWN FROM ICU TO HCA

- DURATION OF STAY:
- ADDITIONAL CARE:

APPENDIX B: ETHICAL APPROVAL

R14/49 Dr Siyanda Zulu et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170229

NAME: (Principal Investigator)	Dr Siyanda Zulu et al
DEPARTMENT:	Obstetrics and Gynaecology Charlotte Maxeke Johannesburg Academic Hospital
PROJECT TITLE:	The Need for Obstetric High Dependency Units in the Fight against Maternal Mortality: A One-Year Review of Patients Admitted to the Charlotte Maxeke Johannesburg Academic Hospital Obstetric High Dependency Unit
DATE CONSIDERED:	24/02/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Coceka Mnyani
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	07/04/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004,10th floor, Senate House/2nd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX C: PERMISSION TO CONDUCT STUDY

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Mr. J. Maepa
Office of the Clinical Director
Tell: (011) 488-3365
Email:johannes.maepa@gauteng.gov.za
22 March 2017

Dear Dr M.J. Zulu

STUDY TITLE: Description and outcomes of obstetrics patients admitted to High Care Area at Charlotte Maxeke Johannesburg Hospital.

Permission to conduct the above mentioned study is provisionally approved. Your study can only commence once Ethics approval is obtained. Please forward a copy of your ethics clearance as soon as the study is approved by the Ethics committee for the CEO's to give you the final approval to conduct the study.

Supported/not supported

pp

Dr M.I. Mofokeng
Clinical Director
DATE: 22/03/2017

Approved/not approved

Ms G. Bogoshi
Chief Executive Officer
Date: 24.03.2017