University of Malawi

College of Medicine

Audit of Maternal Near Misses at Queen Elizabeth Central Hospital, Chatinkha Maternity Unit

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By

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Bachelor of Medicine, Bachelor of Surgery (MW)

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Medicine in Obstetrics and Gynaecology

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July, 2017

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Declaration

I hereby declare that this thesis is my original work and has not been presented for any other awards at the University of Malawi or any other University.

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Signature: ……..

Date: 10th July, 2017

DEDICATION

This thesis is dedicated to my mother, my guardian angel, Mrs Shupekire Hilda Chirwa Mvula, who was always my biggest fan and my support system from the moment I started the MMED program, but did not live long enough to see me complete it. I can only pray that I have made her proud.

ACKNOWLEDGEMENTS

This body of work would not have been possible without the following:

1. Dr Luis Gadama [MMED, FCOG (SA)], my thesis supervisor, who was instrumental in the development of the proposal, fighting for the research and ethics committee approval, fighting for the funding for the project, proving guidance throughout, and providing overall moral support.
2. Dr Bonus Makanani [MMED, FCOG (SA)] for being my overall MMED supervisor, for providing moral support, listening to my concerns and being a source of encouragement throughout.
3. Dr Gladys Gadama [MMED, FCOG (SA)] for guiding and supporting me through the process, and going through my thesis, helping make the relevant changes.
4. Dr Phylos Bonongwe (FCOG), the clinical head of department, for allowing this research to take place in the wards, and his support.
5. Dr Frank Taulo [MMED, FCOG (SA)], the then academic head of department, for his support and permission to conduct this research, and providing office space in the department.
6. Dr Geoffrey Manda (MBBS), my research assistant who was vigilant in identifying near miss cases and collecting the data.
7. Mr Eddie Malunga who developed the data entry form and helped with the analysis of the data
8. Fellow registrars in the department who helped in notification of cases
9. Last, but most importantly, my family for always pushing me to do better.

ABSTRACT

Background

Maternal near miss is an event in which a pregnant or recently delivered woman comes close to maternal death but does not die, due to either timely intervention or by pure chance.

Evaluation of maternal near misses has been noted, in more developed countries, to aid in assessing the quality of obstetric care in a maternity unit and to formulate strategies to reduce the number of maternal deaths. It has been noted that up to 9 million women suffer from severe obstetric complications every year.

This audit was done to determine the frequency of maternal near misses, to determine the proportion of near misses to maternal deaths, to assess the implementation of key evidence based interventions in women experiencing severe maternal morbidity.

Methodology

This was a prospective observational folder review where data was collected on standardized forms, from all admissions to the Chatinkha Maternity Unit at Queen Elizabeth Central Hospital between the months of July and December 2016.

Data was entered into Epi Info and analyzed using Microsoft Excel and Epi Info.

Results

During this study period there were a total of 5463 deliveries in the unit, of which 5337 were live births. There were a total of 303 severe maternal complications. Using the WHO criteria, there were a total of 80(26.4%) near miss cases whilst 216(71.3%) fit the Haydom near misses criteria. There were 19 maternal deaths that occurred in the study

period making a maternal mortality ratio of 356 per 100 000 live births. The leading cause of maternal near miss was obstetric haemorrhage (33.8%) followed by hypertensive disorders in pregnancy (32.9%), whilst pregnancy related infection (26.3%) was the commonest cause of maternal mortality.

Conclusion

Maternal near misses are a common occurrence in our setting, and the main causes mirror those that cause maternal deaths. Obstetric haemorrhage and hypertensive disorders remains a big problem in our set up and there is need to be more diligent in preventing and treating these conditions.

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ABBREVIATIONS AND ACRONYMS

ANC	Antenatal clinic
CVS	Cardiovascular
C/S	Caesarean Section
CNS	Central Nervous System
COMREC	College of Medicine Research Ethics Committee
FBC	Full Blood Count
ICU	Intensive Care Unit
LFT	Liver Function tests
LTC	Life threatening condition
LBR	Live birth Rate
MD	Maternal death
MMR	Maternal Mortality Rate
MI	Mortality Index
MNM	Maternal Near miss
MNMR	Maternal Near Miss Ratio
PPH	Postpartum Hemmorhage
QECH	Queen Elizabeth Central Hospital
SAMM	Severe acute maternal morbidity
SMO	Severe Maternal Outcome
U&Es	Urea and Electrolytes

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Maternal near miss is defined as a very ill pregnant or recently delivered woman, within 42 days of delivery, who would have died had it not been that luck and good care was on her side (1). Maternal near misses are measured per 1000 live births. Previously, maternal deaths were used as a measure of quality of obstetric care but as numbers of maternal deaths have continued to be on a decline, especially in developed countries, auditing maternal near misses has started to gain popularity. The use of data collected on maternal near misses has been shown to be a mechanism for identifying health system failures or priorities in maternal health care more rapidly than maternal deaths especially in developed countries where rates of maternal deaths are now low (1). It has the advantage of events being rare thus not to overload clinicians and data capturing personnel within a facility. Its routine use as an indicator for maternal health and emergency obstetric care, however, is limited due to the lack of uniform criteria of identification of the cases (1).

The World Health Organization (WHO) established a technical working group of obstetricians, midwives, epidemiologists and public health professionals from developing and developed countries to develop a maternal death classification system (2). This technical working group recommends that the maternal near miss approach be considered in national plans for improving maternal health. By using the same classifications, reliable comparisons can be made within and between countries and regions. Applying this classification should help to identify the health system shortfalls

that countries need to address in order to reduce complications and fatal outcomes of pregnancy and childbirth (2).

This approach will serve to:

- Determine the frequency of severe maternal complications, maternal near miss cases and maternal deaths
- Evaluate a health-care facility or a health system's performance (depending on the health-care level at which the approach is implemented) in reducing severe maternal outcomes
- Determine the frequency of use of key interventions for the prevention and management of severe complications related to pregnancy and childbirth
- Raise awareness about, and promote reflection of, quality-of-care issues and foster changes towards the improvement of maternal health care.

There are a number of definitions that are used when dealing with maternal near misses and these include (2):

1. **Severe maternal complications** which are defined as potentially life-threatening conditions.
2. **Severe acute maternal morbidity** (SAMM) refers to a life-threatening disorder that can end up in near miss with or without residual morbidity or mortality.
3. **Maternal death** which is defined as death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

4. **Live Birth** refers to the birth of an offspring which breathes or shows evidence of life.
5. **Severe maternal outcomes** are maternal near miss cases and maternal deaths combined.
6. **Severe Maternal Outcome Ratio** refers to the number of women with life threatening conditions (MNM + MD) per thousand live births.
7. **Maternal Near Miss Ratio** refers to the number of maternal near miss cases per 1000 live births (MNMR = MNM/LB) which gives an estimation of the amount of care and resources that would be needed in an area or facility.
8. **Maternal Near Miss Mortality Ratio (MNM: 1 MD)** refers to the ratio between maternal near miss cases and maternal deaths. Higher rations indicate better care.
9. **Mortality index** refers to the number of maternal deaths divided by the number of women with life threatening conditions expressed as a percentage [MI – MD/(MNM+MD)].
10. **Critical interventions** are those that are required in the management of life-threatening and potentially life-threatening conditions
11. **Admission to intensive care unit** is defined as admission to a unit that provides 24-hour medical supervision and is able to provide mechanical ventilation and continuous vasoactive drug support

However, not all WHO criteria are applicable in low-resource settings, especially with regards to laboratory investigations. In a study done at Haydom Lutheran Hospital in

Tanzania, the criteria were modified to be more fitting for poor resource setting as seen in appendix B (3).

As maternal deaths are relatively rare events, in order to overcome the difficulty in their estimation and to track quality of service delivery, examining near miss events has the potential to complement the maternal death reviews. In practice, it is often impossible to determine the exact cause of death of a pregnant or recently pregnant woman particularly when deaths occur outside health facilities. To facilitate the development of precautionary measures and safer environments that minimize maternal deaths, it is essential that near miss data are recorded and analyzed.

Since surviving a near miss is mostly attributable to the care provided, reviewing near misses has the potential of highlighting deficiencies and positive elements in the obstetric care of any health system (4). As the mother survives in near misses, she can provide valuable details on what she experienced.

1.2 LITERATURE REVIEW

THE PROBLEM AT HAND – MORBIDITY AND MORTALITY

One of the key indicators used to assess maternal health is the maternal mortality ratio and, further to this, review of maternal deaths has been widely recommended. There are approximately 287,000 preventable maternal deaths annually, of which 99% occur in developing countries (5). Sustainable development goal number 5 is to ensure healthy lives and promote wellbeing for all ages. The specific target regarding maternal health is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by

2030. Globally, an estimated 289 000 women died during pregnancy and childbirth in 2013, a decline of 45% from levels in 1990 but still quite far from the target (6).

The Malawi Demographic health survey estimated the maternal mortality ration to be 620 per 100,000 in 1992 and 439 in 2016 (7,8) which shows some improvement but is nowhere near the target as is the case in most developing countries, meaning that the global decline in maternal deaths is largely occurring in developed countries.

For a long time there was a lack of standard definitions and criteria for identifying severe maternal morbidity and near miss cases. Maternal near miss refers to situations where women experience severe life-threatening obstetric complications during pregnancy, delivery or within 42 days of termination of the pregnancy which they survive either by chance or because they receive good care at a facility (4). Severe acute maternal morbidity (SAMM) refers to a life-threatening disorder that can end up in near miss with or without residual morbidity or mortality (4). It has been estimated that up to 9 million women survive obstetric complications every year, and the consequences of these may be permanent and wide-reaching (18).

Since cases of near miss occur in larger numbers than maternal deaths, it was thought that identifying cases of SAMM and consequently near miss, would provide a much better picture into the state of obstetric care in a facility or a nation. A study was carried out in Brazil that served as a pre-validation for the WHO criteria as a tool for identifying maternal near misses. Six hundred and seventy three women with SAMM were admitted over a period of 5 years, and 18 of those died. The criteria identified 194

cases of MNM and all the maternal deaths, proving that it is a useful tool in picking up these cases (9).

Causes of maternal mortality and morbidity in the developing countries differ from those in the developed countries. There are numerous contributing factors in the developing countries. Thaddeus and Maine categorized these factors into three ‘delays’ (10):

a) delays in the decision to seek care

b) delays in getting to a health facility

c) delays in the provision of adequate care

The WHO has estimated that 15% of all pregnancies develop complications which require rapid and skilled intervention if the woman is to survive, including without life-long disabilities (11).

The probability of a woman dying from a pregnancy complication depends not only on the woman’s capacity to cope with a complication, but also on the action and care she receives.

IDENTIFYING NEAR MISSES

There are several criteria used to classify patients as being near miss which include(10):

1. Clinical diagnostic criteria of morbidity from obstetric complications.

   This is when clinical signs and symptoms are used to make an obstetric diagnosis. Such criteria focus on the major causes of maternal mortality i.e. haemorrhage, hypertensive disorders and sepsis.

2. Criteria based on organ system dysfunction in the following systems: cardiac, vascular, immunological, respiratory, renal, liver, cerebral, metabolic and coagulation.
3. Criteria based on management such as :

- Admission to an intensive care unit regardless of the medical reason for the admission
- Major Interventions such as:

  i. Emergency post-partum hysterectomy

  ii. Massive blood transfusion

  iii. Hospitalization for 4 days or more

  iv. Anaesthetic accident.

PREVALENCE OF MATERNAL NEAR MISSES

In a systematic review of near misses done by the WHO in 2004, it was noted that in resource poor settings, 4–8% of pregnant women who delivered in hospitals will experience severe acute maternal morbidity (SAMM) when case-identification criteria were based on specific diseases(1). This rate is around 1% when the organ failure is considered. In more developed country settings, the rates are around 1% with disease-specific and 0.4% with organ-system based criteria, respectively (1).

In a study done in the Tanzanian hospital, Haydom Lutheran, over a two year period, 248 women with life-threatening conditions were included, 216 maternal near miss cases and 32 maternal deaths (3). In the study period 9471 deliveries and 9136 live births occurred (3). These numbers are slightly higher than the WHO estimates of 7.5 cases of near miss per 1000 deliveries (2).

In a retrospective study done in Nigeria in 2005, there were 1501 deliveries, 211 near miss cases and 44 maternal deaths, a number that is also very high compared to the WHO estimates (12). This could be attributed to the fact that the WHO figures were global, whilst the two studies cited here were done in developing countries, and therefore could be more comparable to the situation at Queen Elizabeth Central Hospital (QECH).

An audit of maternal near miss cases from January 2011 to December 2012 was undertaken in a tertiary care institution in India with six primary health centers attached to it (13). It was a referral hospital for both public and private hospitals. In addition to providing twenty-four-hour emergency obstetric services, the hospital also provides antenatal care and delivery services for both low and high risk pregnant women. The hospital has 24-hour facility for blood component therapy. High dependency unit (HDU) in labor room complex and intensive care ICU with 24-hour facility for multidisciplinary specialty also function well, which is a similar set up to QECH. During the period of audit there were a total of 7390 deliveries and 7330 live births, 131 near miss cases, and 23 maternal deaths. Hemorrhage and hypertensive disorders are the leading causes of near miss events. New-onset viral infections have emerged as the

leading cause of maternal mortality. The trend of near miss events and maternal deaths was the same in the two years (13).

In a cross sectional study performed at a tertiary hospital in Rwanda, the prevalence of severe maternal outcomes was 11 per 1000 live births (14). The maternal near miss ratio was 8 per 1000 live births. The majority of severe obstetric morbidity and mortalities resulted from: sepsis/peritonitis (30.2 %), primarily following caesarean deliveries, hypertensive disease (28.6 %), and hemorrhage (19.3 %).

A prospective study encompassing eight hospitals with maternity facilities located in the two large cities in southeast Iran (16). It was performed in 2013 over a nine month period. During the study period, there were 501 near miss cases in 19,908 live births (a near miss ratio of 25.2 per 1000 live births). The highest near miss ratio (104.8 in 1000) was observed in the only referral and teaching hospital that was involved in the study. Two maternal deaths occurred during this period making the rate of maternal death in near miss cases 0.40% with a case fatality ratio of 250:1.

A retrospective facility-based review of cases of near miss and maternal mortality took place in the years 2006-2007 at Damascus Maternity University Hospital, Syria (5). Near miss cases were defined based on disease specific criteria including: haemorrhage, hypertensive disorders in pregnancy, dystocia, infection and anaemia. In this study there were 28 025 deliveries, 15 maternal deaths and 901 near miss cases. The study showed a MNMR of 32.9/1000 live births, a MMR of 54.8/100 000 live births and a relatively low mortality index of 1.7%. Hypertensive disorders (52%) and haemorrhage (34%)

were the top causes of near misses. Late pregnancy haemorrhage was the leading cause of maternal mortality (60%) while sepsis had the highest mortality index (7.4%). Most cases (93%) were referred in critical conditions from other facilities (5).

A study to evaluate what implementation of the WHO organ based criteria would mean for the analysis of a cohort of 386 women in Thyolo District, Malawi, who sustained severe acute maternal morbidity according to disease-based criteria was done (15). Using disease-based criteria developed for the local setting, 341 (88%) of the 386 women fulfilled the WHO disease-based criteria provided by the WHO MNM Tool, 179 (46%) fulfilled the intervention-based criteria, and only 85 (22%) suggested organ-failure based criteria. It was therefore concluded that application of these organ-failure based criteria that require relatively sophisticated laboratory and clinical monitoring underestimates the occurrence of maternal near miss in low resource settings (15).

There is sufficient evidence in literature that appropriate emergency obstetric care can prevent most maternal morbidities. Audits or reviews are useful ways of finding out what factors hinder the provision of such care and can assist in finding remedial interventions.

1.3 STUDY RATIONALE

Maternal near miss refers to situations where women experience severe life-threatening obstetric complications during pregnancy, delivery or within 42 days of termination of the pregnancy which they survive either by chance or because they receive good care at a facility. Evaluating these cases can teach an institution or a nation a lot about the processes in place, or lack thereof, for the care of pregnant women. WHO has

formulated a standardized near miss approach which an institution or a nation can implement in order to gather information on these cases and therefore institute appropriate interventions where necessary. Unlike in the developed countries, there is limited experience with the use of near miss reviews as a tool for monitoring the quality of maternity services in developing countries. This is probably as a result of the persistently high levels of maternal mortality that has overshadowed other severe obstetric complications, from which lessons could equally be learned. There is no known data on near misses at QECH, or Malawi. The purpose of this audit is to determine the frequency of maternal near misses at QECH, the commonest conditions associated with maternal near misses, and to evaluate the quality of obstetric care for severe pregnancy complications.

The WHO near miss approach however does rely on a lot of laboratory based investigations in its criteria, which may be difficult to do in developing countries. Therefore in this audit, data was collected using both the WHO and Haydom criteria and a comparison will be made at the end, thereby exploring the most relevant set of criteria for use in Malawi.

CHAPTER 2 RESEARCH OBJECTIVES

2.1 PRIMARY OBJECTIVES

- To determine the frequency of maternal near misses
- To determine the commonest causes of maternal near misses
- To determine maternal near miss to mortality ratio and mortality index

2.2 SPECIFIC OBJECTIVES

- To describe the implementation of key evidence based interventions in women experiencing severe maternal morbidity
    - Describe use and administration of emergency obstetric medications
    - Availability of blood results
- To compare the WHO and Haydom criteria as tools for picking up MNMs

CHAPTER 3 STUDY METHODOLOGY

3.1 STUDY DESIGN

This audit was a prospective observational folder review that was conducted in the Chatinkha Maternity Unit at Queen Elizabeth Central Hospital

3.2 STUDY LOCATION

QECH is the largest referral hospital in the country, providing health care services to both urban and rural residents as well as specialized clinical services to district hospitals in Southern Region. It is also a teaching hospital for medical, nursing and clinical officer students. In the structure of the Malawi health system, there are 3 levels of facilities. The primary level are the health centres which offer basic obstetric care like antenatal care and delivery of uncomplicated cases. These services are normally provided by midwives. The secondary level are the district hospitals which are able to perform obstetric and basic gynaecological surgeries. There are a total of 28 districts in Malawi, with 26 district hospitals, Blantyre being one of the districts that does not have a level 2 hospital. District hospitals tend to be manned primarily by clinical officers, with at least 2 medical doctors who play more of an administrative role. The tertiary level comprises the 4 central hospitals across the country and these offer specialist care to all patients referred from the two lower levels.

The Chatinkha Maternity Wing is comprised of an antenatal ward, a postnatal ward, a gynaecology ward, a labour ward, a paying ward which accommodates both ante- and

postpartum patients and a high dependency unit (HDU). If any patient in any of these wards requires intensive care management then they are referred to a four bed ICU that is shared with the rest of the hospital.

3.3 STUDY POPULATION

The population studied included all the women admitted to Chatinkha Maternity Wing, and from those, the ones that fit the study criteria were included.

3.4 INCLUSION CRITERIA

The WHO and Haydom Near Miss criteria were used and it is outlined in Appendix A and B

3.5 IDENTIFICATION OF NEAR MISSES

The primary investigator and a study assistant paid daily visits to the wards mentioned above and went through all the new admission and all discharge files to identify those women that had any of life threatening conditions as outlined by the WHO. Those folders that fit the criteria were further looked into to determine if they were indeed a near miss, but data was only collected upon patient discharge to ensure that they actually left the hospital alive.

Weekly Maternal Mortality meetings were also used as a platform to identify those that died and the causes thereof, in order to compare them with the near miss cases.

3.6 DATA MANAGEMENT

3.6.1 Sample size

The prevalence of severe maternal outcomes may vary depending on several factors, but it is generally expected to be around 7.5 cases/1000 deliveries (2). Chatinkha maternity unit delivers approximately 700 babies a month, which translates to 4200 babies in 6 months. The sample size therefore would therefore be expected to be about 33 cases in the 6 months. QECH being a referral hospital however, the number could potentially be higher because critically ill patients delivered outside the unit but referred for management of an obstetric complication will also be included.

3.6.2 Data collection

Data was collected on standardized audit forms shown in appendix C. All patients admitted to the Chatinkha Maternity Unit between the months of July 2016 to December 2016 were screened for eligibility, and the data of the cases fitting the criteria of a maternal near miss were collected. Both the WHO and Haydom criteria were used.

3.6.3 Data entry and analysis

The data was entered into Epi-Info 7 and the exported to Microsoft Excel where it was analysed, with the aid of SPSS.

3.7 ETHICAL CONSIDERATIONS AND APPROVAL

All data was confidential. It was stored in a designated folder and office, and was only accessible to the investigator and the supervisor. As it was a folder review, there was no contact between the investigator and the patients.

Ethical approval was provided by the College of Medicine Research and Ethics Committee and data collection only commenced upon approval

CHAPTER 4: RESULTS

In the period between 1st July and 31st December 2016, there were a total of 5463 deliveries in the Chatinkha Maternity Unit, of which 5337 were live births. There were a total of 303 severe maternal complications. Using the WHO criteria, there were a total of 80 near miss cases whilst 216 fit the Haydom near misses criteria. There were 19 maternal deaths that occurred in the study period. The 80 near misses from the WHO near misses do fall in the 216 from the Haydom criteria and as such the demographic data will be presented as whole.

4.1 DEMOGRAPHICS

4.1.1 Maternal Age and Parity

Table 1: Age and Parity

AGE	**N (%)**
<20	37(17.2)
20-34	147 (68.1)
>35	31 (14.1)
Unknown	1(0.5)
PARITY	**N (%)**
0	0 (3.2)
1-4	179 (82.9)
>5	30 (13.8)

Table 1 shows the demographics of the near miss cases. The average age was 26.33 years with the minimum age being 15 years and maximum age 48 years. One case did not have the age indicated on the file and was recorded as unknown. The majority of the near misses were between para 1 and 4, with only a small percentage being nulliparas.

4.1.2 Gestational Age

Table 2: Gestational Age at Delivery or when Near Miss Occurred

Gestational Age	Numbers	%
< 28	39	18.1
28 to 34	40	18.5
>34	128	59.3
Unknown	9	4.2

Table 2 above shows that the gestational ages of the maternal near miss cases ranged from 4 to 42 weeks, with the majority occurring after 34 weeks gestation.

4.1.3 HIV Status of Maternal Near Misses

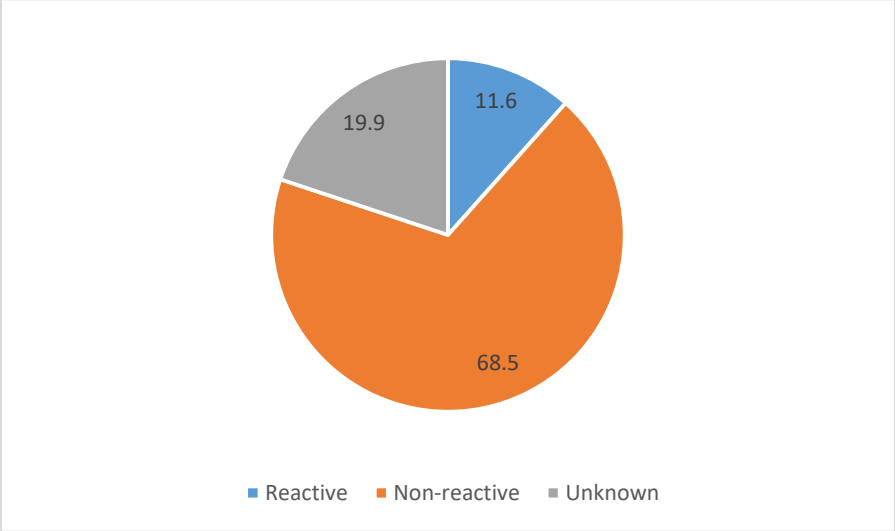

Figure 1: HIV Status

Figure 1 shows that the HIV infection rate was 11.6% amongst the cases, with 19.9% of the cases having an unknown status.

4.1.4 Antenatal Care Attendance

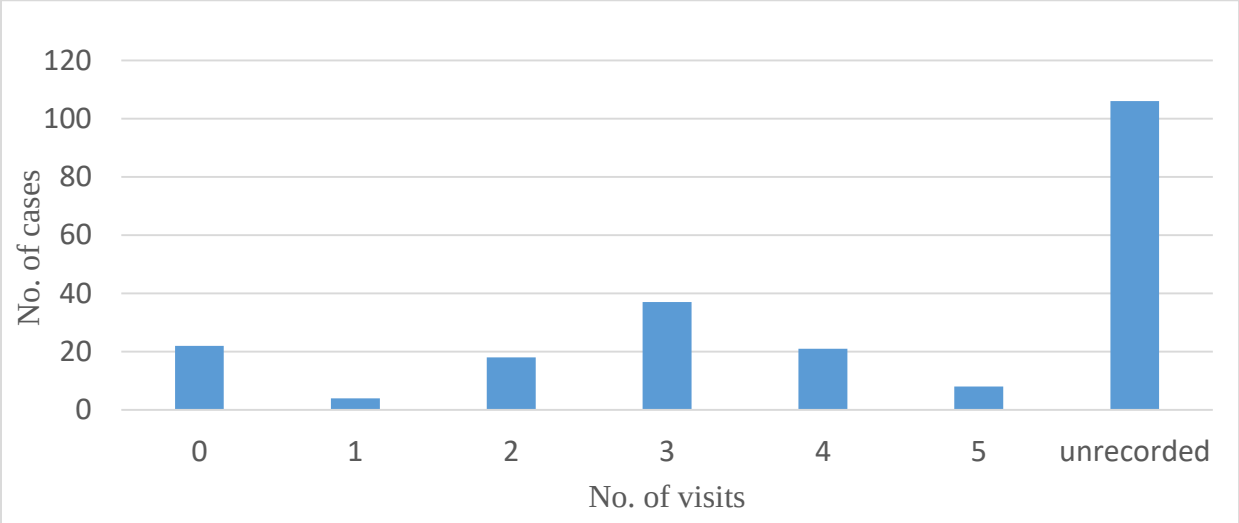

Figure 2: Antenatal Care

Figure 2 is showing the frequency of attendance of any antenatal care clinic. Most of the near miss cases did not have their antenatal clinic attendance documented on their folders, but for those that were recorded, most of them attended at least one antenatal care visit.

4.1.5 Pregnancy Outcome

Table 3: Mode of delivery and other outcomes

Mode of delivery/other outcome	N	%
Cesarean section	78	36.1
Vaginal delivery	87	40.3
Laparotomy for Ectopic pregnancy	14	6.5
Laparotomy for ruptured uterus	7	3.2
Manual Vacuum Aspiration	16	7.4
Medical abortion	2	0.9
Antenatal (Discharged undelivered)	12	5.6

Table 3 above shows the outcomes of the pregnancies in the women who ended up being a near miss. Seventy eight (36.1%) of the mothers delivered through cesarean section while 87 (40.3%) delivered vaginally. Fourteen (6.5%) of the cases were ectopic pregnancies who underwent laparotomy. Seven (3.2%) of the mother had a ruptured

uterus and laparotomies were conducted on them. Sixteen (7.4%) of the cases underwent manual vacuum aspiration (MVA) as a result of a miscarriage, whether spontaneous or induced. Twelve of the near misses occurred antenatally and the women were discharged whilst still pregnant.

4.2 NEAR MISS TOTALS AND NEAR MISS INDICATORS

Table 4: Maternal Near Miss Indicators

Indicator	**WHO**	**HAYDOM**
Near Misses	80	216
MNMR	14.9	40.4
MMR	356	356
SMOR	18.5	44.0
MNM:MR	4.2:1	11.4:1
Mortality Index	19.2	8.1

Table 4 outlines the different near miss indicators that were identified in the study period. The indicators were calculated for the figures using both the WHO and Haydom criteria. The figures are significantly lower if the WHO criteria is used. The maternal near miss ratio which indicates the number of near misses per 1000 live births, is 14.9 for the WHO and 40.4 for the Haydom criteria. For every 1 maternal death, there are 4.2 and 11.4 near misses for the WHO and Haydom criteria respectively.

4.3 SEVERE MATERNAL COMPLICATIONS

Table 5: Severe maternal complications of the near misses and maternal deaths

Complication	Near miss	Maternal Death
	N (%)	N (%)
Haemorrhage	73 (33.8)	3 (15.8)
Hypertensive disorders in pregnancy	71 (32.9)	2 (10.5)
Pregnancy with abortive outcome	30 (13.9)	3 (15.8)
Pregnancy related infection	20 (9.3)	5 (26.3)
Other	14 (6.5)	

Table 5 shows the maternal complications of the near miss cases and the maternal deaths. The leading cause of near misses was obstetrics hemorrhage with 37 cases representing 33.8%. During the same period, 3 women died from complications of severe obstetrics hemorrhage. The second commonest cause of maternal near miss was hypertensive disorder in pregnancy representing 32.9 % of all the cases. Twowomen died from complications of hypertensive disorders of pregnancy in this period.

Although near miss cases due to pregnancy related infection were few, it was the leading cause of maternal deaths during the study period accounting for 26.3% of the deaths.

Table 6: Organ dysfunction

Complication	Organ dysfunction	
	Yes N (%)	No N (%)
Obstetrics hemorrhage	22 (30.1)	51 (69.9)
Hypertensive disorder in pregnancy	9 (12.7)	62 (87.3)
Pregnancy with abortive outcome	9 (30.0)	21 (70.0)
Pregnancy related infection	11 (55.0)	9 (45.0)
Other	6 (42.9)	8 (57.1)
Total	57 (26.7)	153 (73.3)

Table 6 above shows the patients with severe maternal complications that suffered any type of organ dysfunction. All in all, 57 (26.7%) of the maternal near misses suffered some type of organ dysfunction. Patients with pregnancy related infection had the highest incidence of organ dysfunction at 55.0%. Those who had obstetrics hemorrhage were second, with about 30% of them having suffered a type of organ dysfunction. Overall, 26.7% of patients with maternal near miss suffered some form of organ dysfunction.

Table 7: Types of organ dysfunction

Complication	Type of organ dysfunction						Total
	CVS(N)	Renal (N)	Coag (N)	Resp (N)	Neuro (N)	Uterine (N)	N
Hemorrhage	3	2	4	0	1	13	23
HTN	0	2	6	0	3	0	11
Infection	0	0	0	0	0	11	11
Abortion	5	1	3	0	0	2	11
Other	1	1	2	2	1	0	7
Not indicated	0	1	1	0	0	1	3
Total	9	7	16	2	5	27	66

Table 7 above outlines the types of organ dysfunction against the severe complication the woman suffered. The commonest type of organ dysfunction was uterine, both due to PPH and endomyometritis. Coagulation was the second commonest and this cases were mostly of DIC in postpartum hemorrhage and low platelets in severe pre-eclampsia or eclampsia.

4.4 CLINICAL MANAGEMENT

Prophylaxis for PPH

- Number of deliveries - 178
- Number of patients that received oxytocin – 161 (90.4%)

Table 8: Treatment of Severe PPH

Treatment	N (%)
Oxytocin	52 (71.2)
Misoprostol	37 (50.7)
RPOC removal	18 (24.7)
Balloon tamponade	1 (1.4)
B-Lynch suture	1 (1.4)
Hysterectomy	11 (15.1)
Abdominal packing	1 (1.4)

Prophylactic oxytocin was administered to 161(90.4%) deliveries while as 17 (9.6%) were not given, or it was not recorded as shown in Table 8 above.

However during treatment of PPH 52 (71.2%) had oxytocin administered and a hysterectomy was conducted on 11 (15.1%) of the cases.

Management of hypertensive disorders of pregnancy

Hypertensive disorder in pregnancy was identified in 71 cases of the near misses. Of these, 51 (71.8%) cases had severe preeclampsia while 18 (25.4%) cases had eclampsia(see Table 9 below). Sixty eight of these women received magnesium

sulphate either a seizure prophylactic in severe preeclampsia or as a treatment in Eclampsia. The 3 that did not receive were all severe preeclamptics.

Table 9: Usage of Magnesium Sulphate

	MgSO4 (N)	(%)
Eclampsia	18	100
Severe pre-eclampsia	48	94.1

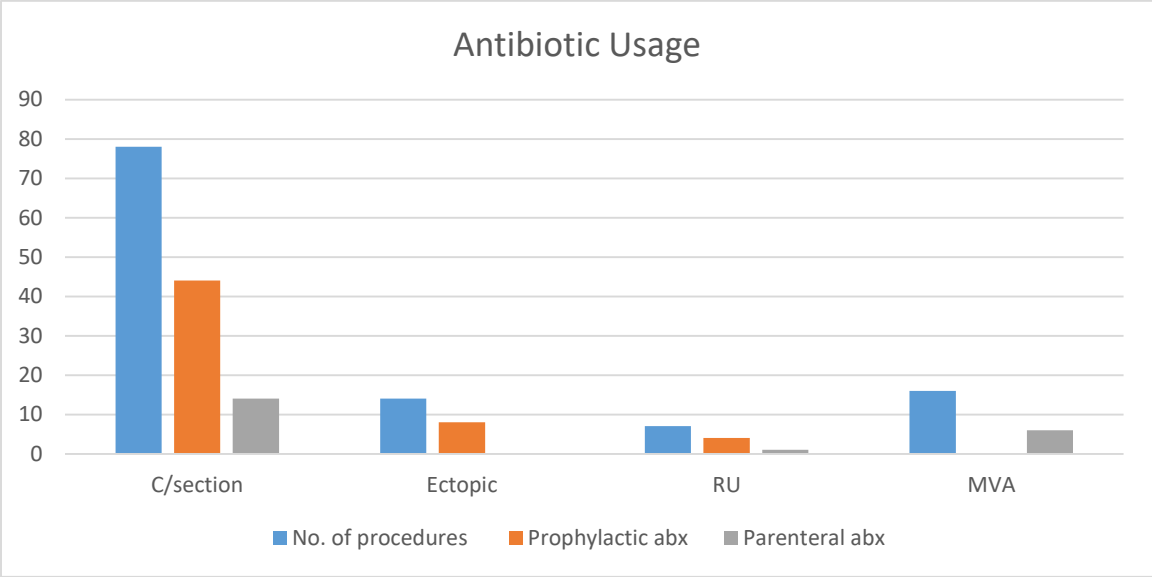

Figure 3: Antibiotic usage

Figure 3 above shows the number of procedures that were done and the number of cases that received either prophylactic or parental antibiotics. Caesarean sections were the most performed procedure, however only 47 of the 78 c/sections, 8 of the 14 ectopic pregnancies and 4 of the 7 ruptured uterus received prophylactic antibiotics.

Table 10: Critical Interventions

Complication	Type of Intervention					
	Blood products		Laparotomy		ICU admission	
	N	(%)	N	(%)	N	(%)
Hypertensive disorders	9	(8.1)	1	(2.3)	4	(50.0)
Obstetrics hemorrhage	61	(55.0)	18	(41.9)	1	(12.5)
Pregnancy related infection	8	(7.2)	10	(23.2)	2	(25.0)
Pregnancy with abortion	24	(21.6)	14	(32.6)	1	(12.5)
Other	9	(8.1)	0	0.0	0	(0.0)
Not indicated	3	(2.7)	0	0.0	0	0.0
Total	111	(100)	43	(100)	8	(100)

Table 10 above shows the types of critical interventions all of the different severe maternal complications required. The leading type of intervention conducted was blood transfusion. There were 111 cases who required blood products. Of these, 61 (55.0%) were those who had obstetric hemorrhage. Hypertensive disorders made for the most ICU admissions, whilst obstetric haemorrhage accounted for the most hysterectomies, both from ruptured uteruses and PPH.

4.5 OTHER RELATED FACTORS

Table 11: Contributory factors

Contributory condition	(%)
HIV infection	11.6
Anaemia	17.6
Previous c-section	6.9
Obstructed labour	6.9

Table 11 above shows the co-morbidities that the women with severe maternal complications had, which could potentially have affected their overall wellbeing. About 17.6% of all the cases had pre-existing anaemia according to the WHO definition.

Table 12: Availability of blood results

Test	% of patients
FBC	81.0 %
U&Es	12.5 %
Creatinine	19.9 %
LFTs	17.1 %

The majority of near miss cases had their full blood count result. Only 19.9% however had a creatinine result, which is the single most indicator for kidney function in women with severe complications as outlined in table 12 above.

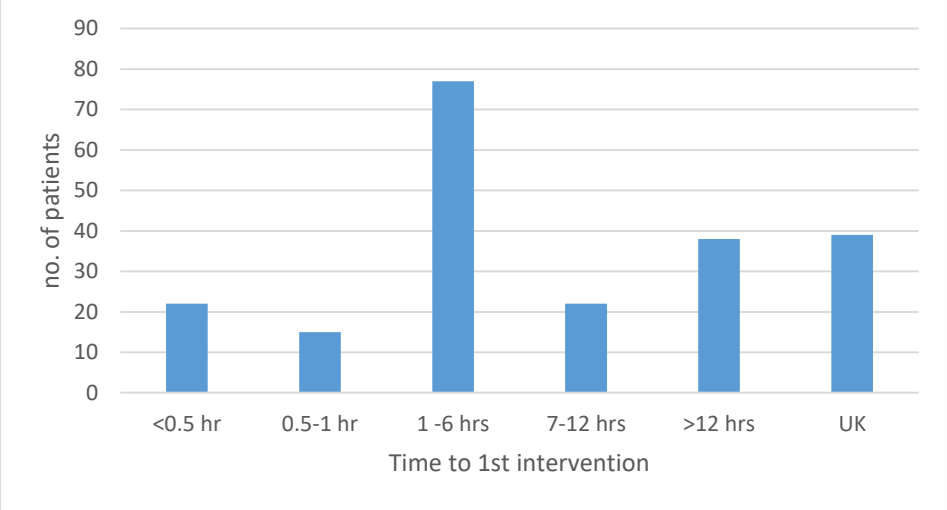

Figure 4: Timing of Intervention

As shown in figure 4, the majority of patients received the appropriate treatment for the near miss diagnosis between 1 to 6 hours of the diagnosis being made. About 22 were managed between 7 to 12 hours, and some waited more than 12 hours. The longest time it took from diagnosis to treatment was 72 hours, in 3 patients. 39 patients do to have time of arrival or time of first intervention indicated in the file, and hence are labeled as unknown**.**

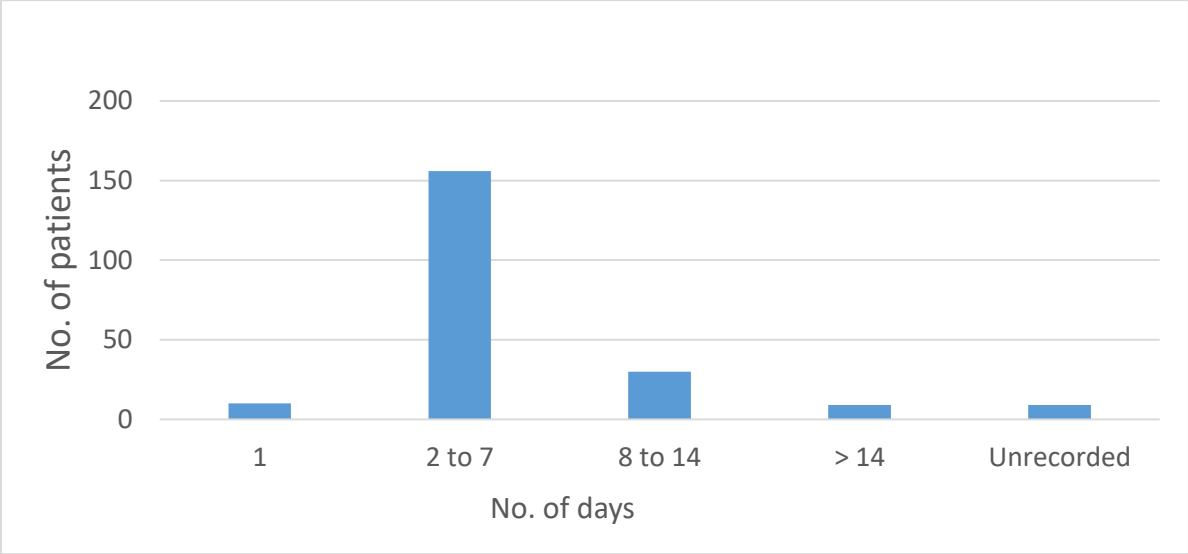

Figure 5: Duration of hospital stay

Figure 5 above shows the number of days spent in the hospital by the women who suffered severe complications. 155 patients were in the hospital for more than 24 hours but not more than a week. The patient with the longest hospital stay spent 51 days in the ward.

CHAPTER 5: DISCUSSION

This audit took place over a period of six months in the Chatinkha maternity unit. The WHO near miss criteria is commonly used for auditing maternal near misses. However, this approach is not user friendly in low resource settings because most laboratory investigations and the critical interventions cannot be carried out. This audit therefore used mainly the Haydom criteria which is more suited for poor countries, and was compared to the WHO criteria in its ability to pick up maternal near miss cases. Using the Haydom criteria there were a total of 216 near misses, whilst there were 80 cases using the WHO criteria. There were 19 maternal deaths that occurred during the period of the audit. Maternal near miss indicators were calculated for both and comparisons made, in order to fully understand the problem at QECH.

Demographics of the maternal near miss cases

Age

The average age of the near miss cases was 26.33 years with the minimum age being 15 years and maximum age 48 years. The majority of the patients were between ages 20 to 34, at 68.1%. It is difficult to comment on whether age is a risk factor for occurrence of a near miss as this audit did not look at any controls. These figures are comparable to a study on near misses done in Rwanda where 77.6% of the cases were between 20 and 35 (14).

Parity

The majority of the near misses were between para 1 and 4, with only 3.2 percentage being nulliparas and 13.8 being grandmultiparas. Just like with the age, this audit ca not comment on whether parity is a risk factor, due to the lack of controls.

Gestation age

The gestational age recorded was either at delivery or at occurrence of near miss, whichever came first. The majority of near misses occurred after 34 weeks gestation. The ones that occurred before 12 weeks were either abortions or ectopic pregnancies. This is comparable to the study done in Nigeria where 81.5% of cases happened above 28 weeks and only 12.3% occurred before 12 weeks (12).

HIV Status

The HIV infection rate was 11.6% amongst the cases, with 19.9% of the cases having an unknown status. The 2015 - 2016 Malawi Demographic and Health Survey (MDHS), the most recent national HIV survey, found a higher HIV prevalence in females aged 15-49 years (10.8%) than in their male counterparts (6.4%) (8). The prevalence rate in this audit is slightly higher but is not too different from that of the women in the rest of the country. As noted however, there were still 19.9% of women who did not know their HIV status and this is a problem that needs to be tackled as there are ways to prevent transmission to the baby if they are known to be positive. It is important to note that most of the ones who did not know their HIV status were in their first trimester and had not yet started antenatal care. HIV prevalence is an important statistic to note because of the high rates of post abortal or postpartum sepsis as immunosuppression is a very significant risk factor.

Antenatal care

37 women attended antenatal care 3 times, which was the most occurring frequency in terms of attendance. Of all the 216 folders reviewed however, 103 of them did not have attendance of ANC documented. The admission charts into Chatinkha Maternity Unit and the partographs both have a section where the admitting officer should fill in how many times their patient attended ANC but this audit has found that most health workers do not fill it in. It is well documented that incompleteness of information on a patient file can be detrimental to their wellbeing in a hospital. According the MDHS 2015-2016, 95% of women between 20 and 34 years of age receive antenatal care from a skilled attendant (8), so this statistic from our audit is likely due to lack of recording as opposed to lack of attendance. As some of the causes of near miss like hypertensive disorders in pregnancy are usually picked up antenatally, all health care providers must be prudent in documenting any information of attendance as this could help with recognizing where the problem actually started.

Mode of Delivery

This study showed that the majority of the patients, 40.3%, delivered through the vaginal route. 36.1% underwent caesarean delivery while 3.2 % had a laparotomy for a ruptured uterus. With QECH being a referral hospital, the caesarean section rate is higher than the recommended WHO rate of 15%. The rate in near miss cases is even higher, reflecting the need for expedited delivery in women who have suffered a complication. It is more likely that women deliver through caesarean sections will experience infective complications compared to those who

delivered vaginally, and these will be picked up as a near miss, making the statistic of caesarean sections higher in this audit. A 2012 Cochrane review of endometritis found a 1–3% rate of endometritis after vaginal delivery and 5–10 times higher rates following caesarean section (16).

Maternal Near Miss Indicators

These indicators were calculated for the WHO and the Haydom criteria. Using the WHO criteria, the maternal near miss ratio was 14.9, meaning that for every 1000 live births, 14.9 patients will be a near miss, whilst using the Haydom criteria, this number rises to 40.4. The differences are so vast that is paramount for a setting like Malawi to decide which of the criteria it is going to use because one is clearly a misrepresentation. The study done in Haydom had a ratio of 6.56 using the WHO criteria and 23.6 using their own criteria, which shows that the results are reproducible in other developing countries.

In a study done in Syria, the total MNMR was 32.9/1000 live births, which is similar to QECH but this study had a much lower mortality index for near miss cases which was 1.67% (5).

Severe maternal complications of the near misses and maternal deaths

The leading cause of near misses in this audit was obstetrics hemorrhage with 37 cases representing 33.8%. During the same period, 3 women died from complications of

severe obstetrics hemorrhage representing a mortality index of 7.5 for obstetric haemorrhage.

The second commonest cause of maternal near miss was hypertensive disorder in pregnancy representing 32.9 % of all the cases. 2 women died from complications of hypertensive disorders of pregnancy in this period, making the mortality index 2.7%.

Thirty of the near misses were due to pregnancies with abortive outcomes, making up 13.9% of the total. Three patients died from abortion complications in the study period and this makes the mortality index 9.1%.

Pregnancy related infections were present in 20 of the near misses, making them the lowest cause of MNM. It was however the leading cause of maternal deaths during the study period accounting for 26.3% of the deaths, creating a mortality index of 20% which is the highest amongst all the severe maternal complications.

A high mortality index represents low quality of care, therefore more women with a particular life threatening condition will die. In this audit, women who suffered pregnancy related infections, which were mainly endomyometritis, are more likely to die than those that experience a near miss due to other complications like haemorrhage. This could indicate that health workers are more conversant or more diligent with dealing with the other causes of maternal near miss. This audit shows that the best care was provided to those with hypertensive disorders in pregnancy, as they had the lowest mortality index.

In a study done in Syria, the most common types of near miss cases fell under the diagnostic categories of severe hypertensive disorders with a MNMR of 17/1000 live and severe haemorrhage with a MNMR of 11/1000 live births (5). These two were also the commonest cause of near miss at QECH.

Organ dysfunction

Organ dysfunction looks at different organ systems, and a number of parameters, mostly laboratory based are used in this criteria. This the main difference in the WHO and Haydom criteria as most developing countries are unable to carry out all the investigations required for someone that has suffered a severe maternal complication.

According to the WHO criteria, cardiovascular dysfunction includes presence of shock, cardiac arrest, use of vasoactive drugs, CPR, severe hypoperfusion indicated by lactate levels of > 5mmol/L and severe acidosis indicated by pH of <7 (2). The Haydom criteria does not include use of vasoactive drugs, lactate and pH measurements (3). In this regard, overall 9 cases were noted to have CVS dysfunction, 5 of them being those with abortive outcomes, all of whom had shock and 3 having postpartum haemorrhage also with shock. The last one had suffered a cardiac arrest due to a high spinal anaesthesia.

Respiratory dysfunction is defined by either acute cyanosis, gasping, severe tachypnea, severe bradypnoea, intubation not related to anaesthesia, oxygen saturations < 90% for > 60 minutes or PAO2/FiO2 < 200. The only thing excluded in the Haydom criteria is the PAO2/FiO2 (3). In this audit, 2 patients suffered from respiratory dysfunction and

both of these had pneumonia in pregnancy. They were both discharged from the hospital still pregnant. Those that did have any of the above clinical features in a woman with a severe complication during the study period, all ended up as maternal deaths so were not included in the analysis.

Renal dysfunction is defined by oliguria nonresponsive to fluids or diuretics, dialysis for AKI, severe acute azotemia (creatinine >3.5mg/dL), according to the WHO criteria (2). Haydom only uses the oliguria is an indication for renal dysfunction (3). In this study 7 women had a diagnosis of renal dysfunction. 1 had eclampsia, 2 had severe pre-eclampsia, 1 had postpartum haemorrhage, 1 had both severe pre-eclampsia and PPH, 1 had an abortion complication and one had endomyometritis. Although only the presence of oliguria was used in making the of these diagnoses, it is important to note that there are some patients who did have creatinine results in this study, but not all the ones that were requested came back so it was not a reliable way of screening. This will be further discussed when availability of results is discussed.

Coagulation dysfunction is defined by the WHO criteria as failure to form clots, massive transfusion of 5 or more units of blood or red cells, severe acute thrombocytopenia (2). The Haydom criteria changed the transfusion amount to two or more units as it is almost impossible to transfuse 5 units of blood in a resource poor setting even if a patient requires it (3). This is what made the biggest difference in the number of near miss using the two criteria in this study. Only 5 patients were transfused 5 or more blood products during the study period, whilst 111 were transfused at least 2, on the background of a severe maternal complication.

Hepatic dysfunction is defined as jaundice in the presence of pre-eclampsia for both the WHO and Haydom criteria (2,3), and also severe hyperbilirubinemia (bilirubin > 100micromol or > 6mg/dL) for the WHO criteria (2). There was no one that had any jaundice in the study period, and not enough liver function results to show a true picture, so there was no patient that was diagnosed as having hepatic dysfunction.

Neurological dysfunction is defined as prolonged unconsciousness (> 12 hours), coma, stroke, uncontrollable fits/status epilepticus and total paralysis. There were 5 patients diagnosed with neurological dysfunction, 3 of whom had eclampsia and were unconscious for more than 12 hours, 1 had postpartum haemorrhage and the last one was an epileptic patient who came in status epilepticus, with a background of malaria.

Uterine dysfunction was defined both by the WHO and Haydom criteria as uterine haemorrhage or infection that lead to a hysterectomy (2,3). Thirteen patients with haemorrhage, 11 with endomyometritis and 2 with post abortal infection all had hysterectomies and therefore were categorized as having uterine dysfunction.

Contributory factors to maternal near miss

These are factors that were already existent in the patient that could have potentially contributed to the severity of their condition, and these included history of a previous caesarean section, pre-exiting anaemia, HIV infection and obstructed labour. 17.6% of the near miss cases had pre-existing anaemia of varying severity but with a maximum of 10g/dL as defined by WHO for pregnant women. Anaemia can potentially contribute to the burden of disease especially in conditions like haemorrhage, infection and severe pre-eclampsia/eclampsia.

Previous caesarean delivery can put a woman at risk of obstetric haemorrhage because they are at risk of placenta praevia, morbidly adherent placenta and adhesions that could make the current caesarean delivery very tricky. This therefore also puts these women at risk of hysterectomy and blood transfusion. Obstructed labour makes for a difficult surgery, and this puts the women at risk of haemorrhage, postpartum infection and subsequently hysterectomy.

Clinical management of three major maternal complications causing near miss

There is a standard of care for certain conditions that can present as severe maternal complications. These principles of care are evidence based and are required to be carried out for each patient with said condition. Looking at whether these processes were carried out for each diagnosis helps us see if a unit is following protocol and hence interpret the quality of care in said unit.

Prophylaxis for postpartum haemorrhage

The standard of care is that all women should receive 10 international units of oxytocin just after delivery for the prevention of PPH. In this study there were 178 that delivered in this unit and of those, 161 were documented to have received their prophylactic oxytocin, making it 90.4% of all deliveries. It is unclear whether the remaining 10% did actually not receive the oxytocin because it just was not indicated in the file. This is a problem because giving oxytocin is so routine, some people don't bother indicating in the patient file, probably with the assumption that everyone will know the patient must

have gotten it. However, this can be very dangerous because if a patient develops PPH and there is no indication of them getting oxytocin, initiating their management might be difficult, in terms of decided whether they need a bolus or just commencement of an infusion.

Treatment of Postpartum Haemorrhage

The standard of care is that all women with PPH should receive oxytocin while it is being investigated what the cause of the PPH is, as uterine atony is the commonest cause. There were a total of 73 cases that had severe postpartum haemorrhage amongst the near misses.

However during treatment of PPH only 52 (71.2%) had oxytocin administered meaning that a third did not receive. As a process indicator, this is quite poor management because it has been shown that giving oxytocin right after a patient starts hemorrhaging can save a lot of lives. There were no women that were treated with tranexamic acid, which is outlined in the WHO criteria. The Woman Trial assessed the effects of early administration of tranexamic acid on death, hysterectomy, and other relevant outcomes in women with post-partum haemorrhage and found that death due to bleeding was significantly reduced in women given tranexamic acid (155 [1·5%] of 10 036 patients vs 191 [1·9%] of 9985 in the placebo group, risk ratio [RR] 0·81, 95% CI 0·65–1·00; p=0·045), especially in women given treatment within 3 h of giving birth (89 [1·2%] in the tranexamic acid group vs 127 [1·7%] in the placebo group, RR 0·69, 95% CI 0·52–0·91; p=0·008) (18). There is no documented effect this has on near misses but it could be worth looking into.

In terms of surgical management of PPH, 18 required evacuation of retained products of conception whilst 11 required a hysterectomy for uncontrolled haemorrhage.

Management of hypertensive disorders in pregnancy

The standard of care is that all women with eclampsia or severe pre-eclampsia should receive magnesium sulphate either as treatment of seizure or prophylaxis against them respectively.

Hypertensive disorder in pregnancy was identified in 71 cases of the near misses. Of these, 51 cases had severe preeclampsia and 48 of these received magnesium sulphate. MgSo4 was administered to all of the 18 that had eclampsia. It is clear therefore that most physicians and nurses are diligent in giving at least the first dose of MgSo4 to patients that have a severe form of the hypertensive disorders as 68 out of the 71 cases received it, although 100% coverage would be ideal.

Management of pregnancy related infections

1. Prophylactic antibiotics – the standard of care is that every woman going for caesarean section should receive prophylactic antibiotics, and at QECH this is usually Ampicillin 1g intravenously. In this audit however 44 of the 78 patients that went for caesarean section were indicated to have received the antibiotic. This however does not necessarily mean that the remaining 34 did not get it, it could also be a case of poor documentation because there isn't a particular place on the patient folder to record this. This in itself poses a problem because if the patient then presents with a postoperative infection, it is difficult to pinpoint

exactly where the insult occurred, and whether the lack of the prophylaxis is a contributing factor.

2. Parental antibiotics in infected patients – this audit picked up 20 cases that had a pregnancy related infection, all of which were endomyometritis, and of these, 16 were documented to have received parenteral antibiotics. The standard of care is that all women with severe infection must receive intravenous antibiotics and it is unclear whether the 4 really did not receive any antibiotics or this was also an issue of documentation.

Timing of intervention

This section looks at the time it took between making a diagnosis of a severe complication to instituting the appropriate management for that particular complication. Since these conditions are life threatening, it is paramount that treatment be started promptly if the life of the woman is to be saved. The majority of patients received the appropriate treatment for the near miss diagnosis between 1 to 6 hours of the diagnosis being made in this audit. This a considerably long time considering that the majority of these diagnoses need immediate treatment. The sepsis 6 hour bundle clearly stipulates that intravenous antibiotics must be administered within the first hour of diagnosis and yet in this audit, the 3 that took 72 hours to receive care were all cases of endomyometritis. It is important to note how that the majority of those that required MgSO4 got it with 30 minutes of being diagnosed. This again might be an indication the health care workers are more conversant with treating certain diagnoses as emergencies as compared to others.

Critical Interventions

The WHO includes admission to the ICU, transfusion of 5 or more blood products, interventional radiology and laparotomy as critical interventions that can be used to classify a woman as a near miss (2). The Haydom criteria modified this criteria by removing interventional radiology and reducing the number of blood products required to 2 units (3).

There were 43 patients who had laparotomies performed during the study period that fulfilled the near miss criteria. Seven were for ruptured uterus, 14 for ectopic pregnancies, 11 for PPH and 10 for endomyometritis.

Eight of the near misses were admitted to ICU making that 3.7% of the total. 4 of those had a hypertensive disorder as an underlying problem. Two had endomyometritis, 1 had an abortion complication and 1 had obstetric haemorrhage.

Use of blood products was the commonest intervention carried out amongst the near misses. One hundred and one patients were transfused at least 2 units of blood, which is in keeping with the Haydom criteria. According to the WHO criteria however, only 5 would be eligible as those are the ones that received 5 or more units of blood products (2).

Availability of blood results

Laboratory tests are essential for the WHO laboratory based criteria, which help in diagnosing several types of organ dysfunction. In our audit, 81% of all the cases had

their FBC results available whilst only 19.9% had their creatinine results available. Creatinine is necessary for making the diagnosis of renal dysfunction using the WHO criteria (2). Hypertensive disorders, massive haemorrhage and sepsis all can lead to renal complications and yet less than quarter of the cases in this audit had their results available. This just goes to show that using the laboratory based criteria is not very feasible in a low resource setting.

Duration of Hospital Stay

One hundred and fifty five patients were in the hospital for more than 24 hours but not more than a week. The patient with the longest hospital stay spent 51 days in the ward which shows us that burden of disease from a near miss can be quite large on the health system.

Study Limitations

The study was a folder review which meant that there was no contact with the patients that survived. Talking to the patients could have provided more insight to the events that occurred leading them to have a severe complication that were not documented in their files.

The study was done over a 6 month period which is not long enough to investigate the rarer causes of near miss or maternal mortality in our setting, for example pulmonary emboli. The number of maternal deaths in this period also made it difficult to make a good comparison of the causes of deaths with those of near misses.

As the study was a folder review, there is certain data that is not collected routinely that could be of substance in determining the risk factors for maternal near miss, for example education status.

There was no follow up of the patients once they were discharged from the hospital to determine their quality of life, any residual ailments or whether they then died at home or at another facility.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Maternal near misses are a common occurrence in our setting, and the main causes mirror those that cause maternal deaths. Obstetric haemorrhage and hypertensive disorders remains a big problem in our set up and there is need to be more diligent in preventing and treating these conditions. Paying particular attention a woman's antenatal care record and actually recording it in their file could be of great help in determining were exactly the problems begin.

The WHO and Haydom tools for assessing maternal near misses are both very good and very useful, however there is a danger of missing a lot of the near miss cases if the WHO criteria were to be used in a setting like Malawi. This is owing to the fact that the WHO criteria focus a lot on interventions and organ dysfunction that require laboratory investigations which may be difficult to come by in a low resource setting.

6.2 RECOMMENDATIONS

Queen Elizabeth Central Hospital needs to have a forum where near miss cases can be discussed and audited regularly the way maternal deaths are audited because this will provide insight in deficiencies in the unit.

There needs to be continued enforcement of documenting all the important elements of a patient's history because even though most patients will go home without incident, for

the few that do suffer a severe complication, there is need to have complete information in order to manage them properly.

A more in depth study needs to follow this one, looking at avoidable factors that contribute to occurrence of near misses.

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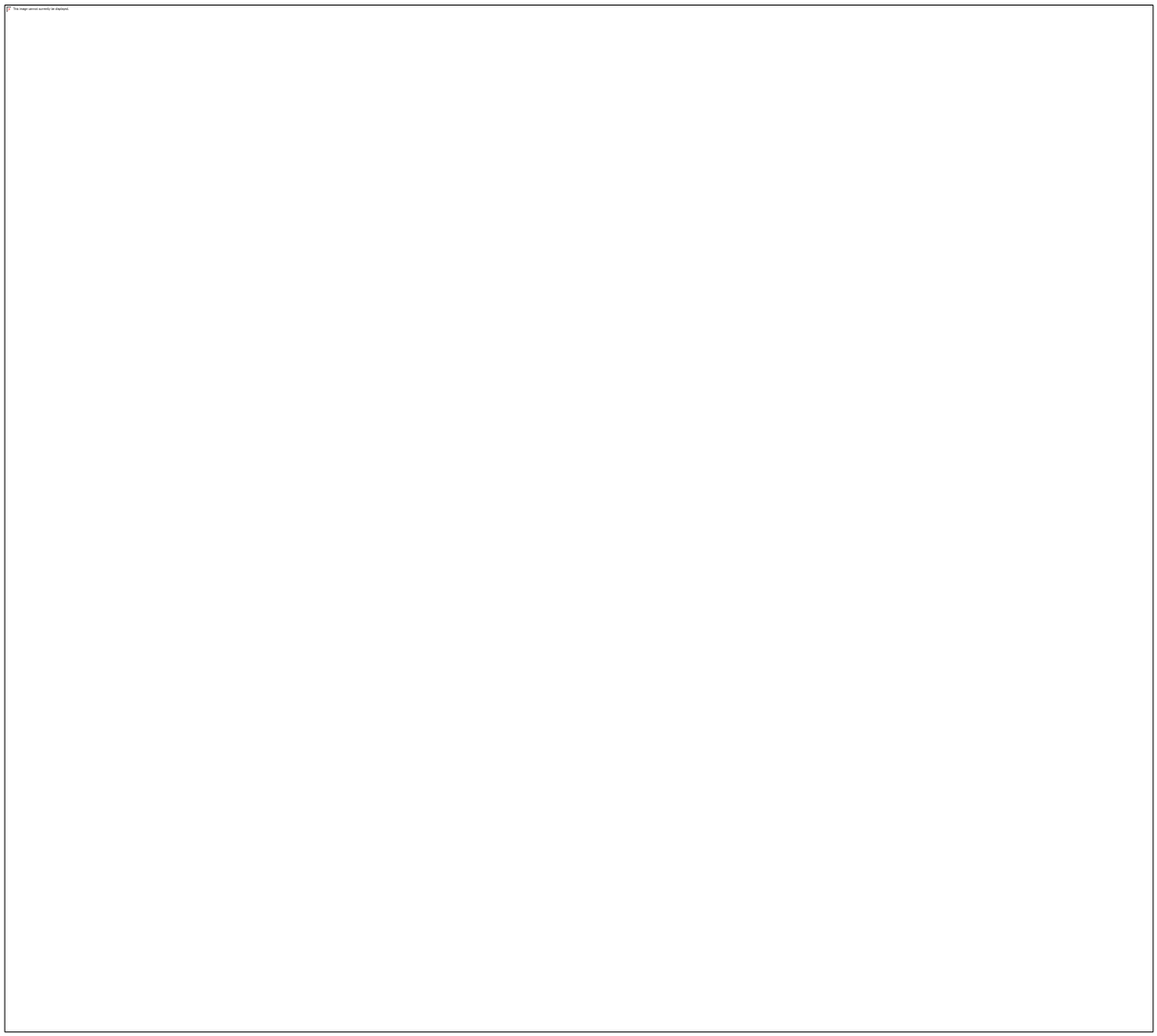
APPENDICES

Appendix A: World Health Organization Definitions for Identifying Near Miss Cases

Severe maternal complications	• Severe PPH • Severe pre-eclampsia and Eclampsia • Sepsis or severe systemic infection • Ruptured uterus • Severe complications of abortion
Critical interventions or intensive care unit use	• Admission to ICU • Interventional radiology • Laparotomy • Use of blood products
Life – Threatening Conditions (Near Miss Criteria)	
Cardiovascular dysfunction	Shock, cardiac arrest (absence of pulse/heart beat and loss of consciousness), use of continuous vasoactive drugs, CPR, severe hypoperfusion (lactate > 5mmol/l or >45mg/dL), severe acidosis (pH <7.1)
Respiratory dysfunction	Acute cyanosis, gasping, severe tachypnea (RR >40 breaths/min), severe bradypnoea (RR < 6 breaths/min), intubation not related to anaesthesia, severe hypoxemia (O2 saturations <90% for >60 minutes or PAO2/FiO2 <200
Renal Dysfunction	Oliguria non-responsive to fluids or diuretics, dialysis for acute renal failure, severe acute azotemia (creatinine >300 micromol/ml or >3.5 mg/dL
Coagulopathy	Inability to form clots, massive transfusion of blood or red cells (> 5 units), severe acute thrombocytopenia (<50,000/ml)
Hepatic Dysfunction	Jaundice in the presence of pre-eclampsia, severe acute hyperbilirubinemia (bilirubin > 100 micromol/L or > 6.0 mg/dL)
Neurological dysfunction	Prolonged unconsciousness (lasting >12 hours)/ coma (including metabolic coma), stroke, uncontrollable fits/status epilepticus, total paralysis
Uterine dysfunction	Uterine haemorrhage or infection leading to hysterectomy

Appendix B: WHO vs Haydom Criteria



Appendix C: Data Collection Form

Queen Elizabeth Central Hospital: Maternal Near Miss Data Collection Form Age: Parity: ANC:

1. Screening Questions

0= The condition was not present during the hospital stay

1= The condition was present at arrival or within 12 hours of hospital arrival

2= The condition developed after 12 hours of hospital arrival

3= Information not available / unknown or not applicable

A) Severe complications / potentially life-threatening conditions

A1. Severe postpartum haemorrhage	
A2. Severe preeclampsia	
A3. Eclampsia	
A4. Sepsis or severe systemic infection	
A5. Ruptured uterus	

B) Critical interventions or intensive care unit admission

B1. Use of blood products	
B2. Interventional radiology	
B3. Laparotomy	
B4. Admission to ICU	

2. Maternal and Perinatal Info

1. Date of admission

2. Date of delivery or uterine evacuation

3. Date of hospital discharge of death

Time of admission:

Time of intervention:

Final Mode of

C) Organ dysfunction / life-threatening conditions

C1. Cardiovascular dysfunction	
C2. Respiratory dysfunction	
C3. Renal dysfunction	
C4. Coagulation/haematologic	
C5. Hepatic	
C6. Neurologic dysfunction	
C.7 Uterine dysfunction/Hysterectomy	

If answers are 1 or 2 in any of the above categories, proceed with data collection.

Delivery/End of Pregnancy (please circle)

1. Vaginal
2. C/section
3. Complete abortion
4. MVA
5. Medical abortion
6. Laparotomy for ectopic pregnancy
7. Laparotomy for ruptured uterus
8. Woman discharged still pregnant or died still pregnant
9. Unknown

Best estimate of gestational age in completed weeks

a) At Delivery or termination
b) At Discharge or death

Vital status of the infant at discharge or up to day 7 of hospital stay if still admitted

a) Alive
b) Dead

Anticonvulsants

a) Magnesium sulphate
b) Other

Antibiotics

A. Prophylactic antibiotic during caesarean section
B. Parenteral, therapeutic antibiotics

Fetal lung maturation

Corticosteroids betamethasone or dexamethasone

A. Given
B. Not given

4. Process indicators **Conditions at arrival in the facility** a) Delivery or abortion occurred before arrival at any health facility b) Delivery within 3 hours of arrival in the health facility c) Laparotomy within 3 hours of hospital arrival or in other hospital d) Woman referred from other health facility e) Woman referred to any higher complexity hospital **Use of interventions** **Prevention of postpartum haemorrhage** a) Oxtocin b) Use of other uterotonics **Treatment of postpartum haemorrhage** a) Oxytocin b) Ergometrine c) Misoprostol d) Tranexamic acid e) Removal of retained products f) Balloon tamponade g) Artery ligation h) Hysterectomy i) Abdominal packing	**5. Underlying cause of maternal near miss** A. Pregnancy with abortive outcome B. Obstetric haemorrhage C. Hypertensive disorders D. Pregnancy related infection E. Other causes (specify) a. ……. **6. Contributory conditions** A. HIV infection B. Anaemia C. Previous c-section D. Obstructed labour E. Availability of blood results • FBC • Urea and Electrolytes • Creatinine • Liver Function Tests