Describing the causes of Near-Miss Maternal Morbidity and Mortality at Kenyatta National Hospital, Nairobi

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Purpose: Partial fulfilment for the award of Master of Medicine in Obstetrics and Gynaecology of the University of Nairobi

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DEDICATION

This book is dedicated to the most significant people in my life:

To my dear husband William, for your love, strength and encouragement and to our loving son Michael for being the light of my life.

To my wonderful parents Martin and Macrine for your motivation and support and all that you have done for me and given me throughout the years. To Max and Marilyn for just being you and helping out in your own little ways

Last but definitely not least my aunty Jennifer for being an inspiration in my life.

ACKNOWLEDGEMENTS

I convey great gratitude and appreciation to my Supervisors Dr M'Imunya Machoki and Dr Nelly Mugo for their guidance and availability while supervising the conception, implementation of the study and writing of this thesis.

I am also grateful to the University of Nairobi for providing an enabling learning environment and the Ministry of health for facilitating and supporting my training.

I am especially thankful to all the consultants, lecturers and senior registrars in the Department of Obstetrics and Gynaecology both at the University of Nairobi and Kenyatta National Hospital for sharing their knowledge and experience with us during the MMed course.

Special mention to Dr Aywak, Mr Ndaguatha, Prof Stones and Dr Obura, Dr Othigo and Dr Kombo and their teams for sharing their experience with me during my elective term.

I acknowledge Alice Lakati, Francs Njiri and Frankline Onchiri for their technical expertise in writing this dissertation.

My most sincere thanks and appreciation to my fellow registrars, nurses and all other staff of KNH, for their assistance cooperation and teamwork.

Thank you to the Marketing Africa Team for all the administrative assistance in terms of internet facilities, printing materials and arranging and numbering questionnaires.

DECLARATION

This dissertation for MMed is my original work and has not been presented for a degree course in any other University

Signed _____ Date: 7th January 2009

Dr Maureen J Owiti

CERTIFICATION OF SUPERVISION

This dissertation was researched upon by Dr Maureen Owiti under our guidance and has been submitted with our approval as University supervisors:

Signed _____ Date: 9th January 2009

Dr M'Imunya J. Machoki

Signed _____ Date: 7th January 2009

Dr Nelly Mugo

DEFINITIONS

Near-miss morbidity: is defined as an obstetric complication that immediately threatens a woman's survival but does not result in her death either by chance or because of hospital care she receives during pregnancy, labour or within 6 weeks after delivery or termination of pregnancy.

Maternal death: The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any causes related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Primary determinants of near miss morbidity: these are the immediate cause of the morbidity or mortality and include haemorrhage, hypertensive disorders of pregnancy, dystocia, infection, anaemia and non-obstetric complications.

Haemorrhage: any bleeding leading to shock, coagulation defects or some intervention e.g. blood transfusion of ≥ 3 units of blood, hysterectomy and or surgical procedure to stop bleeding.

Hypertensive disorders of pregnancy: eclampsia or severe pre-eclampsia with clinical/ laboratory indications for termination of pregnancy to save the woman's life.

Dystocia: Uterine rupture and impending rupture e.g. prolonged obstructed labour with a previous caesarean section whether diagnosed pre- or intra-operatively.

Infection: Hyperthermia or hypothermia or a clear source of infection such as purulent per vaginal discharge, peritonitis and clinical signs of septic shock.

***Anaemia:** Haemoglobin < 6g/dl or clinical signs of severe anaemia in women without severe haemorrhage for instance dizziness, palpitations, headache, difficulty in breathing and oedema.

Complications of abortion: any complication arising from abortions for instance post-abortal sepsis, uterine perforation.

Non-obstetric complications: Any medical or surgical complication occurring during pregnancy or six weeks post-partum but not accidental or incidental causes for instance diabetic keto-acidosis and thyrotoxicosis.

Secondary determinants of near miss morbidities and maternal mortality: these are factors influencing or affecting the primary determinant of morbidity and mortality and include socio-economic status, age, gender ante-natal, intra-partum and post-natal care.

Antenatal care: This is the care a pregnant woman receives from onset of pregnancy till onset of labour.

Intra-partum care: This is the care a woman receives while in labour, during delivery and in the immediate post-partum period i.e. first one hour after delivery.

Post-natal care: This is defined as the care a woman receives during the pueperium approximately 6 weeks or 42 days following delivery.

Maternal mortality ratio (MMR): this is the number or maternal deaths per 100,000 live births.

Near miss to mortality ratio this is the ratio of women with near miss morbidities to the number of maternal mortalities.

* - criteria for anaemia in near miss morbidity

Mortality index is defined as the ratio of maternal deaths among the near miss cases to the sum of maternal deaths and near miss cases. It represents the proportion of women who presents with a near miss morbidity and subsequently dies.

Neonatal death: death of a live born infant occurring up to 28 completed days of life.

ABBREVIATIONS:

A&E:	Accident & Emergency
CIS:	Commonwealth of Independent States
D&C:	Dilatation and Curettage
DKA:	Diabetic Keto-acidosis
FBC:	Full blood count
HDU:	High Dependency Unit
ICU:	Intensive Care Unit
KDHS:	Kenya Demographic & Health Survey
KMTC:	Kenya Medical Training College
KNH:	Kenyatta National Hospital
MMR:	Maternal Mortality ratio
MVA:	Manual vacuum aspiration
NBU:	New Born Unit
PCV:	Packed cell volume
SHO:	Senior House Officer
SVD:	Spontaneous vertex delivery
UNFPA:	United Nations Population Fund
UNICEF:	United Nations Children's Fund
USA:	United States of America
WHO:	World Health Organization

ABSTRACT

Background: Over half a million women die every year from pregnancy related complications. Maternal mortality ratios (MMR) vary by institution, country and continent with Africa experiencing the greatest burden: 1,100 per 100,000 live births.

Characterizing near miss morbidity is an objective, realistic and cost effective tool for monitoring the quality of obstetric care and for assessing the incidence of life threatening obstetric complications.

Objective: Determine causes of near miss maternal morbidity and mortality at Kenyatta National Hospital, describe the maternal and foetal morbidity and mortality associated with near-miss morbidities and maternal mortalities and identify gaps in management of cases of near miss morbidities and maternal mortalities.

Study design: This is a cross-sectional descriptive study. Near miss cases were identified from daily rounds and followed up prospectively until discharge or death.

Study site: Labour ward, ward 1D, ante-natal/post-natal wards; renal unit, ICU and HDU of Kenyatta National Hospital. This hospital is the national referral hospital and largest hospital in East and Central Africa with a bed capacity of 2,000 beds.

Study population: We enrolled a total of 142 pregnant women and women within six weeks after delivery or termination of pregnancy with near miss morbidity or maternal mortality.

Methods: A descriptive review of all near miss and maternal mortality cases between June and October 2008 until sample size was reached. Patients

were recruited using disease specific criteria (majority), management specific criteria and organ system dysfunction criteria. Once recruited the women were followed up until discharge or death with data recorded on the daily follow-up form and questionnaire.

Results: 142 women with near miss morbidity and maternal mortality were recruited giving a prevalence of 4.7%. The near miss to mortality ratio was 4.7 with a mortality index on 0.176. Hypertension and HIV/AIDS were the leading causes of death (32.0%), though haemorrhage was the leading cause of near miss morbidity (36.8%). Only 2.8% of cases were KNH clinic attendees and none of them died. Babies of women with near miss morbidity and of women who died had poor neonatal outcomes- still births 30%; admission to New Born Unit (MBU) 30% and neonatal deaths 15%.

Conclusions: Hypertension and HIV/AIDS are the leading causes of maternal mortality, whereas haemorrhage was the primary cause of morbidity. Women presenting in the postpartum period and women who delivered vaginally had a 3 fold risk of death.

INTRODUCTION

Every minute of every day at least one woman dies in childbirth....more than half a million each year. As many as 300 million women living in developing countries are currently suffering short or long term illness related to pregnancy and childbirth. The national MMR is 414 per 100,000 live births.[3] In Uganda and Tanzania the MMR is 505 and 529 per 100,000 live births respectively. In 2005 the MMR for developing nations was 450 per 100,000 live births while Sub Saharan Africa had a MMR of 1,100 per 100,000 live births, which is in stark contrast to 9 in developed regions; 8 in USA and 51 in CIS.[2]

For every maternal death there are several life threatening complications. Maternal deaths are just but the final step in a sequence of events that occur ranging from normal/ healthy pregnancy to death.[4] Severe maternal morbidity can be implicated as the trigger to this tragic continuum. Near-miss morbidity reviews can be used to monitor and evaluate the quality of maternity services and is more rapid than maternal death reviews.

The obstetric and gynaecological department of Kenyatta National Hospital had 6844 deliveries, with 177 maternal deaths and a MMR of 2787 per 100,000 live births in 2006 and 7604 deliveries with 134 maternal deaths and a MMR of 1899 per 100,000 live births in 2007 according to statistics from the Medical Records Department of the hospital. This hospital is the biggest referral hospital in the region. Isolated enquiry into maternal deaths is unlikely to yield adequate information when the focus of investigation is the standard of hospital care. Concurrent mortality and near miss morbidity reviews may be useful to this end hence the purpose of this study.

LITERATURE REVIEW

Maternal health is an important aspect of the measure of development as can be seen by the millennium development goals. Millennium development goal number 5 is to improve maternal health and target six geared towards this goal is to reduce by three quarters the maternal mortality ratio by 2015. [1] Maternal mortality ratios are lowest in the developed world with an average of about 20/100,000 according to WHO, UNICEF and UNFPA statistics in 2000 the lowest in Austria at 4 per 100,000. In developing countries in the same period it was 440 per 100,000 with the highest in Sierra Leone 2,000 per 100,000.[2] In Kenya the maternal mortality ratio was 414 per 100,000 according to KDHS 2003.[3] Comparing figures from the developed and developing nations and Kenya in particular, it is clear that many if not most of maternal deaths in developing countries are most probably preventable.

Maternal deaths are just but the final step in a sequence of events that occur. This continuum ranges from **Normal/healthy pregnancy->morbidity -> severe morbidity -> near-miss -> death.** [4] Severe Acute Maternal Morbidity or Near-miss events are defined as acute obstetric complications that immediately threaten a woman's survival but do not result in her death either by chance or because of hospital care she receives during pregnancy, labour or within 6 weeks after termination of pregnancy or delivery. [4, 5, 6, 7] This term was first used by Stones et al to define a group of life threatening conditions. [4]

Near Miss Maternal Morbidity is a relatively new concept in maternal care, but is increasingly becoming important in areas with low maternal mortality ratios or where the geographic area is small. [6, 7]

Near miss morbidity reviews are rarely used in developing countries as a tool for monitoring and evaluating the quality of maternity services and to present day evaluation of obstetric care provision in Kenyan hospitals is limited to maternal mortality reviews. [8]

Several studies have been carried out worldwide, in Africa and in Kenya but one cannot compare results of these studies because of differences in the identification of cases. The criteria used to classify patients as near-miss fall into 3 categories namely:

- **Disease specific**: specified criteria for common conditions e.g. pre-eclampsia, haemorrhage
- **Management specific**: specified criteria related to response to disease e.g. hysterectomy or admission to ICU
- **Organ-system dysfunction/failure based**: specified criteria for dysfunction or failure related to each organ system. [5, 7]

Anaesthetic accidents also qualify as near miss morbidities.

Depending on the criteria used for definition of near miss morbidity, the rates will vary. The prevalence of near miss morbidity is between 0.80% – 8.23% in studies that use disease-specific criteria. The range is 0.38% – 1.09% in the group of reports that use organ-system dysfunction based criteria and includes unselected women. Rates are lower (0.01% – 2.99%) and variation is lesser in the category of studies using management-based criteria. [7]

Disease specific criteria: Filippi et al used the following criteria when carrying out a study on the incidence of near-miss events in African hospitals:

- **Haemorrhage**: (leading to shock, emergency hysterectomy, coagulation defects and/or requiring blood transfusion of ≥ 3 units);
- **hypertensive disorders in pregnancy** (eclampsia and severe pre-eclampsia with clinical/laboratory indications for termination of pregnancy to save the woman's life);
- **dystocia** (uterine rupture and impending rupture e.g. prolonged obstructed labour with a previous caesarean section);
- **infection** (hyperthermia or hypothermia or a clear source of infection and clinical signs of septic shock)
- **anaemia** (low haemoglobin level: haematocrit < 6 g/dl) or clinical signs of severe anaemia in women without severe haemorrhage[9]

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- **infection** (hyperthermia or hypothermia or a clear source of infection and clinical signs of septic shock)
- **anaemia** (low haemoglobin level: haematocrit < 6 g/dl) or clinical signs of severe anaemia in women without severe haemorrhage.[9]

Management specific criteria and criteria for anaesthetic accidents are listed in table 1 below:

Table 1: Management specific criteria and criteria for anaesthetic accident [5]

Management specific criteria:	**Anaesthetic accident:**
• Admission to ICU for whatever reason • Emergency hysterectomy for any reason • Intubation and ventilation other than for general anaesthesia	• Severe hypotension associated with epidural or spinal anaesthesia – hypotension defined as systolic pressure <90mmHg for more than 60 min • Failure in endotracheal intubation requiring anaesthetic reversion

Organ system dysfunction is also another method of classifying near miss cases. Table 2 lists the criteria for organ-system dysfunction.

Table 2: Organ system dysfunction criteria [5]

Pulmonary:	**Cardiovascular:**
• Pulmonary oedema • Peripheral O2 saturation <90% for more than 60 minutes • Ratio PaO2/FiO2 <300mmHg **Renal:** • Oliguria, defined as diuresis <400ml/24h refractory to careful hydration or to furosemide or dopamine • Acute urea deterioration to 15mmol/l or creatinine >400mmol/l	• Cardio-respiratory arrest • Hypovolemia requiring 5 or more units of packed blood cells **Other:** • Coma • Sub-arachnoid or intra-parenchymatous haemorrhage • Jaundice with preeclampsia • Diabetic ketoacidosis • Thyrotoxic crisis • Acute thrombocytopaenia requiring transfusion of platelets

The management specific criteria, criteria for anaesthetic accidents and organ system dysfunction listed on tables 1 and 2 comprise ***Mantel's criteria*** for identification of near miss maternal morbidity. [5]

WHO conducted a systematic review of studies on near miss and their conclusion was that considering all complexities in definition and case-identification of near miss morbidities, it is necessary that studies clearly describe their identification criteria for the cases. There is a clear need to set criteria to identify near-miss cases. Use of organ-system dysfunction based criteria seems to be a more useful approach in identifying cases as variation in defining criteria can be avoided, particularly for similar settings. It would then be easier to establish summary estimates for near-miss prevalence which could serve as a measure of maternal health and quality of care indicator. [7]

Another study by Geller et al in Chicago Illinois who were trying to come up with a "gold standard" for the definition and identification of near-miss maternal morbidities concluded that further work needed to be done to this end and that a scoring system seemed promising in identification of cases.[4] Souza et al in their study on appropriate criteria for identification of near-miss maternal morbidity however concluded that the adoption of a two level screening strategy may be appropriate with the first level based on comprehensive criteria of severe maternal morbidity followed by use of restrictive criteria such as organ-system dysfunction. [5]

Two approaches are used as potential methods of assessing the care near-miss cases receive. "Mortality Index-MI" is defined as the ratio of maternal deaths among the near-miss cases to the sum of maternal deaths and SAMM cases. It represents the proportion of women who presents with severe maternal morbidity and subsequently dies. Another approach is to calculate the ratio of near-miss to mortality. [7]

Murage et al studied Near Miss Morbidity at KNH in 2001. In their prospective study of near miss morbidities more than 7 years ago found a ratio of approximately 7:1 near-miss to mortality. Haemorrhage and

hypertension accounted for 67.5% and 22.5% of near miss maternal morbidities respectively.[10]

Obstetrics is "bloody business." Skilled birth attendants and availability of blood transfusions have dramatically reduced maternal mortality from hemorrhage, though it still remains a leading cause of maternal death and morbidity. [11] In countries with fewer resources, the contribution of hemorrhage to maternal mortality is even more striking. Indeed, hemorrhage has been identified as the single most important cause of maternal death worldwide, accounting for almost half of all postpartum deaths in developing countries. [12]

Annually, hypertensive disorders account for 50,000 maternal deaths worldwide. [13] Eclampsia occurs in 0.2-0.5% of all deliveries worldwide and in 2004 at KNH 0.3% of deliveries were complicated by it. [14]

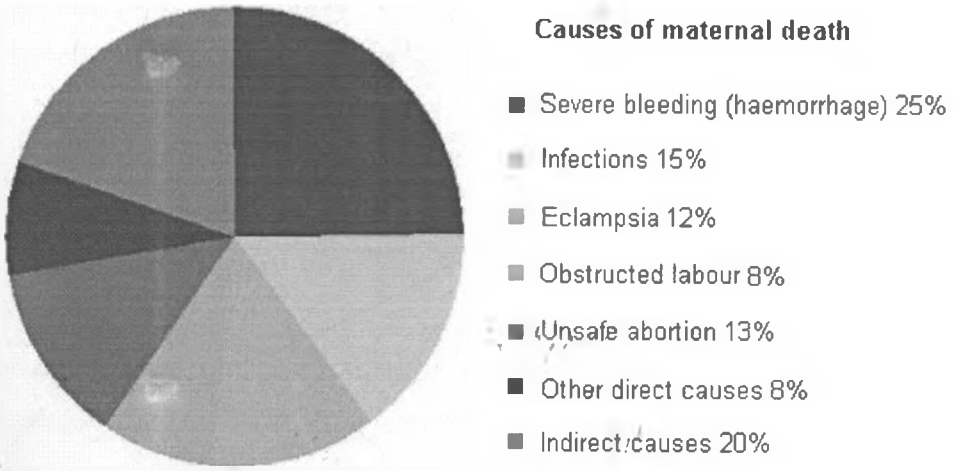
Rupture of the uterus is one of the worst catastrophes in obstetric practice leading to maternal mortality or morbidity and a dismal perinatal outcome. Its incidence at a particular institution reflects the level of obstetric care in that area. At Kenyatta National Hospital, ruptured uterus was responsible for 3% of maternal deaths in the period 1995-1999. [15]

According to the World Health Organization, anemia contributes up to 40 percent of post-natal maternal deaths third world countries. [16]

Review of near-miss cases has the potential to highlight the deficiencies as well as the positive elements in provision of obstetric services in any health system, more rapidly than maternal deaths.[6,7] It has the advantage of events still being rare enough not to overload clinicians and data capturing personnel within a facility. Its routine use as an indicator, however, is limited due to the lack of uniform criteria for identification of the cases. [7]

Figure 1 summarizes the causes of maternal death

Figure 1: Causes of maternal death



Source: The World Health Report 2005. Make every mother and child count. Geneva, World Health Organization, 2005.

RATIONALE

The burden of maternal mortality at Kenyatta National Hospital, the referral unit for the region is very high i.e. in 2006 and 2007 data from the Medical Records department indicate that there were 6844 and 7604 deliveries; 177 and 134 maternal deaths and a mortality ration of 2787 and 1899 respectively. At present the MMR for the country according to KDHS 2003 is 414 per 100,000 live births.

The study of near miss morbidities can be used to evaluate further the leading causes of maternal death (haemorrhage, infection, complications of abortion, hypertension, and obstructed labour) the quality of obstetrical care,

leading to improved understanding of the determinants of maternal mortality and identify possible areas of intervention.

Over time, improvements have occurred in the practise of obstetrics and gynaecology, for instance use of magnesium sulphate for prevention of eclampsia; development and introduction of Focused ante-natal care (FANC); implementation of Active Management of Third Stage of labour and widespread use of manual vacuum aspiration (MVA) in management of incomplete abortions, since the last study at KNH about 8 years ago.

Only women above 28 weeks gestation were included in previous national research hence some cases of near miss morbidities and maternal mortality could have been missed out.[8,10]

Many studies recommend further evaluation of near miss morbidities and specifically Koba et al in their retrospective study recommended the inclusion of near miss morbidity reviews as part of clinical audits.[8]

RESEARCH QUESTION

What are the causes of near miss maternal morbidity and mortality at Kenyatta National Hospital?

OBJECTIVES

Broad Objective

Determine causes of near miss maternal morbidity and mortality at Kenyatta National Hospital, Nairobi.

Specific objectives

1. Describe the maternal and foetal morbidity and mortality associated with near-miss morbidities and maternal mortalities.

2. Establish the primary determinants of near–miss morbidities and maternal deaths at KNH.
3. Identify gaps in management of cases of near miss morbidities and maternal mortalities.

METHODOLOGY

Study design:

This was a prospective descriptive study. Near miss cases were identified from daily rounds and followed up until discharge (max 42 days post-partum or termination of pregnancy for patients not discharged home) or death. This was done to minimise loss of reporting on maternal deaths. The investigator or assistant conducted daily rounds in labour ward, 1A, GFA, GFB, 1D, ICU, HDU and renal unit.

Study area:

Labour ward; ward 1D, all ante-natal/post-natal wards, renal unit, ICU and HDU of Kenyatta National Hospital. Kenyatta National Hospital located in Upper Hill, Nairobi - the capital of Kenya is the major referral hospital for the whole country with a bed capacity of 2000. It is the largest hospital in East and Central Africa and serves as the national referral hospital as well as a teaching hospital for the University of Nairobi medical school and the Kenya Medical Training College (KMTC).

In 2006 and 2007 data from the Medical Records department indicate that there were 6844 and 7604 deliveries and 177 and 134 maternal deaths respectively. Labour ward has an acute room where severely ill ante-natal and post-natal patients are managed and it is adequately equipped to handle obstetric emergencies i.e. resuscitation tray, cardiac monitor and defibrillator. Adjacent to labour ward are two maternity theatres, where most emergency and elective obstetric operations take place. In dire emergencies when maternity theatres are in use emergency operations are

carried out in main theatre. Ante-natal and post-natal admissions are handled in wards GFA, GFB and 1A.

The labour ward is staffed by a Resident Senior House Officer (SHO) enrolled in post-graduate training in Obstetrics and Gynaecology 24 hours a day, medical officer interns, clinical officer interns, clinical officers undergoing a post-graduate diploma course in obstetrics and gynaecology, highly trained midwives. Twelve hourly ward rounds are conducted by Senior Registrars and on-call Consultants. Acutely ill patients are reviewed on a need to basis with consultations with other specialities as required.

Ward ID covers acute gynaecological emergencies including but not limited to ectopic pregnancies, incomplete miscarriages which are also included in both maternal mortality reviews and near miss reviews. Acute gynaecological patients are reviewed by the registrar on call (available 24 hours a day) in A&E department.

Patients needing intensive care can be transferred to the ICU or HDU as their condition demands after consultation with the very active ICU team. Patients transferred to ICU are managed by both the ICU and obstetric teams.

There is also a renal unit in the hospital with capacity to undertake dialysis. Any patient with renal complications is reviewed by the renal team and those needing dialysis are worked up and dialysed by the renal team.

The obstetric and gynaecological department conducts bi-monthly mortality audits.

Study population:

Our study population was any maternal death and pregnant women or women within six weeks after delivery or termination of pregnancy managed in the study area with near miss morbidities.

Inclusion criteria:

Pregnant women at any gestation or women within 42 days of delivery or termination of pregnancy ***who consented*** to the study with:

- disease specific criteria namely haemorrhage, hypertensive disease of pregnancy, dystocia, infection and anaemia as defined for the study.
- management specific criteria (refer to table 1)
- anaesthetic accident (refer to table 1)
- organ-system dysfunction (refer to table 2)
- admission to acute room in labour ward ICU or HDU for any other reason
- Maternal deaths, whose relatives consented.

Exclusion criteria:

- Pregnant women at any gestation or women within 6 weeks of delivery who have the above inclusion criteria but did not consent to the study.
- Women with normal or uncomplicated pregnancies, deliveries or puerperium.
- Non pregnant women or women beyond 42 days of delivery with any of the above conditions.

Sample size:

A study done in KNH in 2001 by Murage et al (Near miss maternal morbidity at KNH), showed that 5.8% of patients who were managed in the maternity unit suffered from near miss morbidities, which is consistent with world wide statistics that show a prevalence of 0.8-8.23.

Samples size was calculated using the following formula:

$$n=\frac{p(100-p)}{e^2}$$

Where:

n= minimum desired sample size

p= proportion of target population estimated to have a particular characteristic = 5.8% (Murage et al 2001)

e= standard error = 2%

Therefore: $n=\frac{5.8(100-5.8)}{2^2}$ = **137**

(Ref: Betty Kirkwood. Essentials of Medical Statistics. 1998)

Recruitment and follow up:

Near miss cases and maternal mortalities were identified from admission registers daily; in labour ward, ward 1D, GFA, GFB, 1A, renal unit, ICU and HDU by the investigator and/or assistant. SHO in labour ward, ward 1D and post-natal wards were also asked about severely ill patients in their care to minimise risk of missing out those not registered in admission books. Once consent was obtained mothers were recruited and information entered in the questionnaire. Information was entered into the hospital stay and follow-up form on a daily basis till discharge or death. To minimise double recruitment of patients, a small mark was made on the inside front cover of patient's files.

Data was collected both prospectively and retrospectively. For maternal outcome, recruited mothers were followed up to discharge (max 42 days post-partum or termination of pregnancy) or death, while those who had not been recruited prior to death, data was collected retrospectively. Women still in-patient beyond 42 days post-partum or termination of pregnancy were not followed-up by the study for data collection, as they cannot be considered as a near miss morbidity or maternal mortality. Follow up was limited to in-patients only and they were followed up daily by the investigator and/or assistant during identification, recruitment and follow up rounds. There was no follow up after the hospital discharge.

There was no loss to follow-up due to the daily follow-up rounds, however a few patients may not have been recruited as it was noticed in a few instances among patients recruited due to post-partum haemorrhage that they were

recorded in admission and discharge registers as Spontaneous Vertex Delivery but were picked up during routine ward work.

Neonates with complications were followed-up until discharge from NBU up to a maximum of 28 days post delivery (time-frame for neonatal mortality).

Data management and analysis:

The data collection instruments were a questionnaire and a hospital stay and follow-up form, which had been prepared by the principal investigator. The questionnaire and hospital stay and follow-up forms were pre-tested on 10 patients at the study site and refined accordingly before commencement of the study.

The study was approved by the KNH Ethics and Research Committee, daily data collection occurred between July-October 2008. The principal investigator and research assistant, a trained medical officer intern collected data. One medical officer intern at the beginning of their rotation in the department was trained on job for two days by the principle investigator. Three medical officer interns were trained consecutively. Data was recorded into pre-coded questionnaires that included socio-demographic characteristics, diagnosis, investigations and interventions carried out on the patient up to point of discharge or death.

All data was collected and stored only by members of the study team. Data entry and data cleaning was conducted on a daily basis. Data entry was performed using SPSS version 12. Data analysis was done using SPSS version 12 and the significance of differences between variables was analysed using univariate and multivariate analysis. P values of <0.05 were considered significant.

Quality control:

There was an eligibility checklist at enrolment to ensure only participants who fit the inclusion criteria are selected for the study. The questionnaire also had similar questions asked in different ways to ensure good quality data. The questionnaire and follow-up forms were pre-tested. Data cleaning was performed by the principal investigator.

Ethical considerations:

The study proposal was submitted to the ethics and research committee of KNH for approval before commencement of the study.

Information obtained from patients' files was kept confidential and was used for purposes of the study.

Due to condition of study population informed consent was initially sought from relatives and patients who recovered gave consent once they were stable enough to do so. All patients with near miss morbidities and all maternal mortalities were included into the study and informed consent was sought from participants once stable enough to do so. Consent was sought from relatives for maternal mortalities.

No names or data identifying particular patients was written on data collection tools.

Limitations:

- Long term complications for participants with near miss morbidities not determined as follow up was limited to 42 days post-partum and was done for in-patient participants only.

- Post-partum mothers who have normal vaginal deliveries and no complications are usually discharged home the following day and we may have missed out those who experienced complications later and sought healthcare in other facilities.
- Very ill patients were not able to provide full information in such instances relatives were asked to provide any information that could assist.
- Delays in accessing services such as investigations, blood transfusion, consultations could not be adequately addressed. It was not possible to follow one patient or all of the patients for twenty four hours.

RESULTS:

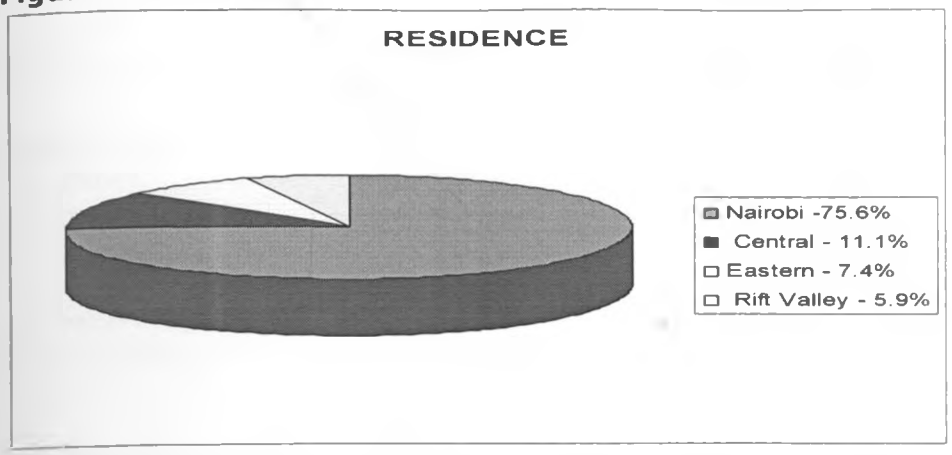
This study was carried out from 15th June 2008 – 10th October 2008 and established that 142 women experienced near miss events or maternal mortality. Over the same period 3013 deliveries occurred giving a ratio of 47 per thousand deliveries.

Table 3: Characteristics of Study Participants

	ALL	Near miss(N=117)	Death(N=25)
Age; mean(SD)		27.1(6.3)	26.5(6.7)
Year of Education; mean(SD)		9.4(2.9)	7.8(2.2)
Income; mean(SD)		3,622.2(18,619)	780(2,062)
		N (%)	N (%)
Marital status:			
Married		82(70.1)	15(60.0)
Separated		8(6.8)	2(8.0)
Single		24(20.5)	6(24)
Widowed		1(0.9)	2(8.0)
Other(Cohabiting)		2(1.7)	0 (0.0)
Occupation:			
Professional		8(6.8)	0(0.0)
Semi-skilled		23(19.6)	3(12)
Skilled		6(5.1)	0(0.0)
Unemployed/housewife		67(57.3)	20(80)
Other(unskilled)		13(11.1)	2(8.0)
Spouse occupation:			
Professional		20(23.5)	1(7.7)
Semi-skilled		27(31.8)	1(7.7)
Skilled		16(18.8)	6(46.2)
Unemployed		8(9.4)	1(7.7)
Other		14(16.5)	4(30.8)
Material of residence:			
Concrete		69(60.0)	12(50)
metallic sheets		27(23.5)	4(16.7)
Mud		11(9.6)	4(16.7)
Wood		6(5.2)	4(16.7)
Other		2(1.7)	0(0.0)
Plumbing:			
Piped water		40(34.2)	4(16.0)
Inside toilet		25(21.4)	3(12.0)

The mean age of study participants was 27; they had approximately 8 years of education and were of low socio-economic status. Majority of women who died were unemployed. (Table 3)

Figure 2: Residence



The majority of patients reside in Nairobi -75.6%. Nearly all of enrolled Nairobi residents came from Kayole, Dandora, Kibera, Kawangware, Kangemi and Eastleigh, which are low socio-economic zones. (Figure 2)

Table 4: Obstetric/Gynaecology details and maternal outcomes

	Near miss n=117	Death n=25	Total
	n (%)	n (%)	n (%)
Mode of delivery			
SVD	32(27.4%)	14(56.0%)	46(32.4%)
Caesarean Section	32(27.4%)	4(16.0%)	36(25.3%)
Vacuum	3(2.6%)	0(0.0%)	3(2.1%)
Hysterotomy	3(2.6%)	0(0.0%)	3(2.1%)
Other pregnancy outcomes			
Discharged before delivery	1(0.8%)	0(0.0%)	1(0.7%)
Died before delivery	0(0.0%)	5(20.0%)	5(3.5%)
Termination of pregnancy	1(0.8%)	0(0.0%)	1(0.7%)
Ectopic	19(16.2%)	0(0.0%)	19(13.4%)
Ruptured uterus	13(11.21%)	0(0.0%)	13(9.2%)
Abortion	11(9.4%)	2(8.0%0	13(9.2%)
Abdominal pregnancy	2(1.7%)	0(0.0%)	2(1.4%)
Total	117	25	142(100%)

The majority of deaths occurred in women who had delivered SVD (56%) and no women with ruptured ectopic gestations or ruptured uterus died. (Table 4)

Table 5: Comparison of clinical details in near miss morbidity and mortality

Clinical details	Near miss=117	Death=-25	p-value
	N (%)	N (%)	
Pregnancy state at admission			
Antepartum	61(52.1)	11(44)	0.271
Postpartum	24(20.5)	12(48)	0.009
Postabortal	11(9.4)	2(8)	0.692
Ectopic	19(16.2)	0(0)	0.197
Abdominal Pregnancy	2(1.7)	0(0)	0.999
Delivery Mode & other pregnancy outcomes			
SVD	32(27.4)	14(56)	
CS	32(27.4)	4(16)	0.021
Other (ectopic, abortion, vacuum, uterine rupture)	53(45.3)	7(28)	
Parity			
Primigravida	38(32.5)	9(36)	0.816
Multigravida	79(67.52)	16(64)	
HIV+	3(7.9)	3(42.9)	0.036
DIAGNOSIS			
Abortion	11(9.4)	2(8)	0.999
Haemorrhage	43(36.8)	4(16)	0.060
Hypertension	39(33.3)	8(32.0)	0.999
Indirect	7(6.0)	9(36.0)	<0.0001
Infection	5(4.3)	1(4)	0.999
Obstructed labour	10(8.6)	1(4)	0.689
Other direct	2(1.7)	0(0)	-
Attended ANC	75(64.10)	19(76.0)	0.352
GOK	18(24.0)	3(15.8)	0.754
KNH	4(5.3)	0(0.0)	-
City council	31(41.3)	11(57.9)	0.342
Private clinic	17(22.7)	4(21.1)	0.945
Private doctor	1(1.3)	0	-
Private hospital	4(5.3)	1(5.3)	0.999
Referred from elsewhere	65(55.6)	13(52)	0.812

Women who presented with near miss morbidity in the postpartum period had the highest chance of dying. City council clinic attendees had the highest morbidity (41.3%) and mortality rates (57.9%). Only 4 of the study population attended clinic at KNH and none died. HIV/AIDS and hypertension was the leading cause of death. (Table 5)

Table 6: Past medical history and causes of maternal morbidity and mortality among study participants

N=142	N (%)
Past medical history	
Previous admissions	18(12.7%)
previous surgery	8(5.7%)
HIV	13(9.2%)
Asthma	5(3.5%)
Hypertension	5(3.5%)
Cardiac disease	2(1.4%)
Cause of near miss morbidity & maternal mortality	
Eclampsia	34 (23.9%)
Ectopic	20 (14.1%)
PPH	17 (12.0%)
Severe pre-eclampsia	13 (9.2%)
APH	10 (7.0%)
Uterine rupture	10 (7.0%)
HIV/AIDS	9 (6.3%)
septic abortion	6 (4.2%)
Puerperal sepsis	5 (3.5%)
septic abortion + uterine perforation	5 (3.5%)
Cardiac disease IV	4 (2.8%)
Guillain Barre Syndrome	2 (1.4%)
Abortion- haemorrhage	1 (0.7%)
Allergic drug reaction	1 (0.7%)
Anaemia + abd preg + ARF	1 (0.7%)
Obstructed labour + anaemia + ARF	1 (0.7%)
Sepsis	1 (0.7%)
SOL - glioma + hydrocephalus	1 (0.7%)
uterine perforation – abdominal pregnancy	1 (0.7%)

Thirteen percent of cases had a previous admission for any illness

Table 7: Causes of near miss morbidity and maternal mortality

Cause	Near miss n (%) n=117	Death n (%) n=25
Haemorrhage	43(36.7%)	4(16.0%)
Hypertension	39(33.3%)	8(32.0%)
Abortion	11(9.4%)	2(8.0%)
Obstructed labour	10(8.5%)	1(4.0%)
Sepsis	5(4.3%)	1(4.0%)
Cardiac disease IV	3(2.6%)	0(0.0%)
Gullain Barre Syndrome	2(1.7%)	0(0.0%)
Abdominal pregnancy	2(1.7%)	0(0.0%)
Allergic drug reaction	1(0.9%)	0(0.0%)
HIV/AIDS	1(0.9%)	8(32.0%)
Space occupying lesion - glioma + hydrocephalus	0(0.0%)	1(4.0%)

HIV/AIDS and hypertension are the leading cause of maternal deaths followed by haemorrhage, though haemorrhage is the leading cause of near miss morbidity. (Table 7)

Table 8: Complications and hospital stay (days) of study participants

Complications of patients with near miss	**26(18.3%)**
Hysterectomy	16(11.3%)
Other (fistulae,	4(2.8%)
Brain damage	3(2.1%)
Chronic renal failure	2(1.4%)
Admissions	
ICU/HDU	10
Renal unit	9
Antenatal, postnatal, gynae wards	129
Duration of stay in days; mean (SD)	**Mean(SD) (days)**
ICU/HDU	8.67(11.05)
Renal unit	13.63(9.27)
Antenatal, postnatal, gynae wards	8.83(12.89)
Hospital stay for all patients n=142	10.11(12.85)

Hysterectomy was the commonest complication and as expected mean hospital stay was long 10.11(±12.85). (Table 8)

Table 9: Neonatal outcomes & diagnosis at admission to NBU or death

Neonatal outcome N=101	**N (%)**
Female	50(49.5%)
Male	51(50.5%)
Fresh Still Births	16(16.7%)
Live birth	66(66.7%)
Macerated Still Births	14(13.5%)
Missing	5(5.0%)
Twins	3(3.1%)
Discharged to mother	21(20.7%)
neonatal death prior to admission to NBU	12(11.9%)
Admitted NBU	31(30.7%)
Diagnosis at admission to NBU	
Birth asphyxia	4(4.0%)
Prematurity	18(17.8%)
Respiratory distress	2(2.0%)
Mother's condition	16(15.8%)
Other	1(1.0%)
Diagnosis at death	
Sepsis	2(2.0%)
Birth asphyxia	4(4.0%)
Prematurity	14(13.9%)
respiratory distress	4(4.0%)
Other	1(1.0%)
Gestation at birth, mean(SD)	34(5)
Weight 1st Twin	2340(1023)
Weight 2nd Twin	1950(636)
Days admitted NBU	1(0)

There were 98 deliveries with 3 twin gestations. 49.5% were females and 51.5% were males. Still births formed 30% of deliveries and another 30% of live births were admitted to nursery, out of which 50% succumbed. The average gestation at birth was 34 (± 5) weeks. (Table 9)

Table 10: Parameters checked on ANC card

Parameters on ANC card		
No of ANC visits: mean (SD)		3(1.8)
N=43		**N(%)**
Hb Checked		24(55.8)
Hb >10g/dl (n=24)		17(70.8)
Hb<10g/dl (n=24)		7(29.2)
Blood group checked		23(53.5)
VDRL:	Checked	18(41.9)
	Positive	0(0.0)
HIV:	Checked	35(81.4)
	Positive	6(14.0)
Weight checked		37(86.0)
BP checked		39(90.7)
FH checked		37(86.0)
Pallor checked		17(39.5)

Table 10 represents the population of women with near miss morbidities and maternal mortality with ANC cards in their files. Only 55.8% had Heamoglobin level recorded on their cards, Blood pressure was recorded in 90% and more than 50% had no blood group recorded on the ANC card.

Table 11: Comparison of management among obstetric & gynaecological patients

	Gyn n=35	Obs n=107
	N (%)	N (%)
ANC ATTENDANCE	4(11.4%)	90(84.1%)
CONSULTATIONS:		
Obstetrician	6(17.1%)	41(38.3%)
Renal	3(8.6%)	20(18.7%)
ICU	2(5.7%)	18(16.8%)
Surgical	5(14.3%)	5(4.7%)
Cardiology	0(0.0%)	3(2.8%)
Haematology	0(0.0%)	8(7.5%)
Medical	1(2.9%)	12(11.2%)
Neurosurgical	0(0.0%)	2(1.9%)
Other consultations	0(0.0%)	12(11.2%)
Blood Transfusion	23(65.7%)	49(45.8%)
FBC_PCV	27(77.1%)	104(97.2%)
INTERVENTIONS:		
MVA/D&C	7(20.0%)	7(6.5%)
Exploratory laparotomy	26(74.3%)	19(17.8%
Removal of placenta	1(2.9%)	3(2.8%)
Emergency hysterectomy	1(2.9%)	11(10.3%)
Uterine artery ligation	0(0.0%)	0(0.0%)
Dialysis	2(5.7%)	7(6.5%)
CVP monitoring	3(8.6%)	12(11.2%)
Intubation other than for GA	0(0.0%)	5(4.7%)
Induction of labour or termination of pregnancy	1(2.9%)	12(11.2%)
ADMISSIONS:		
ICU/HDU	2(5.7%)	8(7.5%)
Renal unit	2(5.7%)	7(6.5%)
General wards	35(100%)	94(87.9%)

The most frequent consultations made were to senior obstetricians. Routine ward rounds or handing over rounds were not counted as consultations though invariably several occurred during such sessions. Most consultations were honored (86.3%) meaning about 13.7% of consultations were not honored. The most common investigation done was a full blood count or Haemoglobin estimation that was performed on 91.9% of patients. (Table 11)

BLOOD TRANSFUSION AND MATERNAL OUTCOMES

Table 12: Percentage of blood received vs. blood ordered:

Received Blood	Got Correct Quantity of blood Required		Blood ordered
	Yes	No	
No	0(0)	9(100)	9
Yes	37(55.2)	30(44.78)	67
Total	37(48.68)	39(51.32)	76

Table 13: Percentage of Deaths vs. Quantity of Blood Received.

Received Correct Qty of Blood	Maternal outcome		Total
	Near miss	Death	
Yes	35(94.6%)	2(5.4)	37
No	32(82.1%)	7(18.0%)	39
Total	67(88.2%)	9(11.8)	76

In total 76 women needed blood of whom 37(48.7%) got the total amount of blood required and 39 got less blood than they required. Of those who got the correct quantity of blood they required, only 2(5.4%) died compared to 7 (18%) who died out of the 39 who got sub-optimal amounts. This difference in the proportion of the death between the two groups was not statistically significant based on a two-sample test of proportion p=0.0896. (Tables 12 & 13)

Table 14: Univariate analysis (logistic regression) for associations of maternal outcome

Correlate		Near miss n (%) or mean	Death n (%) or mean	OR (95%CI of OR)	p value
Mode of delivery & other pregnancy outcomes	Vaginal	31 (70.5%)	13 (29.5%)	3.2 (1.1 - 8.8)	0.026
	CS	30 (88.2%)	4 (11.8%)	1 (0.3 - 3.7)	0.989
	Other	53 (88.3%)	7 (11.7%)	1	
Pregnancy state at admission	Antenatal	59 (85.5%)	10 (14.5%)	1	
	Postnatal	23 (65.7%)	12 (34.3%)	3.1 (1.2 - 8.1)	0.023
	Postabortal	11 (84.6%)	2 (15.4%)	1.1 (0.2 - 5.6)	0.933

In a univariate analysis of the independent correlates of maternal outcomes (death or near miss events), respective odds/ (risk) of maternal death for those who had vaginal and CS deliveries are 3.2 (95% CI: 1.1-8.8) and 1 (95% CI: 0.3-3.7) times higher than the odds (risk) of death for those who had other pregnancy outcomes namely: complications of abortion and laparotomy for ectopic pregnancy, abdominal pregnancy, ruptured uterus and those discharged prior to delivery. Further; respective odds (risk) of death for women who present postnatally or who were post-abortal at admission are 3.1 (95% CI: 1.2-8.1) and 1.1 (95% CI: 0.2-5.6) times higher than the odds (risk) of dying for women who are antenatal at admission. (Table 14)

Table 15: Multivariate Logistic regression analysis

Variables	OR	p	95% CI
Age	0.998	0.763	[0.916-1.066]
Attended ANC	1.390	0.599	[0.408-4.734]
Other(ectopic ruptured uterus)	1[Reference]		
SVD	1.868	0.349	[0.506-6.901]
CS	0.671	0.604	[0.149-3.028]
Antepartum	1[Reference]		
Postpartum	2.87	0.061	[0.954-8.630]
Postabortal	1.638	0.599	[0.260-10.297]

In a multivariate logistic model including age, ANC attendance, mode of delivery and pregnancy state at delivery, none of the variables was statistically significantly associated with death based on the p-values. However, there was a suggestion of increased risk of worse maternal outcomes associated with pregnancy state at admission. Adjusting for age, ANC attendance and mode of delivery, the risk of death for those who presented in the postnatal period was 2.87 and for postabortal women was 1.638 higher than that of women who presented in the antenatal period. (Table 15)

DISCUSSION

The key findings in this study are:

The prevalence of near miss morbidity was 3.9% and jointly the prevalence of near miss morbidity and maternal mortality was 4.7%. This is in keeping with other studies done - Koba et al – 3.7%; Say L et al - 0.8-8.23%.[7,8]

The maternal mortality ratio was 829.7 per 100,000 live births during the study in this referral unit that receives very sick patients from anywhere in the region. This is lower than that found in the same unit over the period 1995-1999 by Oyieke et al 921.5 per 100,000 live births.

The near miss to mortality ratio was 4.7:1 this is much higher than that found by Murage et al of 7:1[9] and Koba et al in Nyeri 15:1. The mortality index was 1.8.

Women who presented postpartum had a 3 fold risk of mortality as compared to other presentations. This is in keeping with other studies which show that death occurs more during the pueperium.[18]

18% of participants who required blood and did not get the required amounts died

No KNH clinic attendee died and out of those who attended clinic and died 57.0% of them attended city council clinics.

Parameters checked at antenatal care are sub-optimal as not all patients (90%) had BP monitoring done and 50% of clinic attendees did not have HB or blood group recordings.

Disease specific criteria was the most common criteria used to recruit patients though some were recruited based on management specific criteria (emergency hysterectomy, admission to ICU/renal unit) and organ system dysfunction criteria (SPO2 < 90% for more than 60 minutes). It was very difficult to recruit based on organ system dysfunction as it required availability of certain results and forms of monitoring, which were not easily accessed. One of the advantages of using disease specific criteria was that it reflects the commonest causes of maternal mortality and therefore allowed a direct comparison of the two.

There were 5 times as many cases of near miss morbidities than maternal mortality in the study. This is similar to findings in Pretoria, South Africa [17] and Sagamu, Nigeria [6] but lower than what was identified by Murage et al in their study of near miss morbidity at KNH which was 7 [10], and much lower than 15 in the study of the same by Koba et al. in Nyeri. Reasons for this could be that only women beyond 28 weeks post-partum, managed only in labour ward and ICU were recruited in the two Kenyan studies as compared to our study which encompassed all pregnant women and women within 6 weeks post-partum. A similar study done in Brazil had 64 times as many cases of near miss morbidities than maternal mortality [5] but the institution had 2,929 deliveries over a one year span as compared to 3013 deliveries during the four months of the study in our hospital.

Haemorrhage and hypertensive disorders of pregnancy accounted for most of near miss morbidity jointly - 66.2%; respectively both 33% and this is similar to findings in many previous studies [5, 6, 8, 9 & 10]. Complications of abortion, obstructed labour (uterine rupture, prolonged labour), HIV/AIDS, sepsis, cardiac disease grade IV and other conditions comprised 9.2%, 7.7%, 6.3%, 4.2%, 2.8% and 3.5% respectively. The other conditions were Gullain Barre Syndrome – 2, abdominal pregnancy - 2, allergic drug reaction - 1 and patient with a glioma with hydrocephalus – 1.

During the Study there were 25 maternal deaths with the largest contributors being hypertensive disease in pregnancy and HIV/AIDS each with 8 (32%) casualties. Haemorrhage was a distant number three at 16%. A similar study in Pretoria, South Africa concluded that the increase in non-pregnancy related sepsis could be explained by the increase in the prevalence of HIV and that pregnant women with AIDS who develop severe acute morbidity have a very high chance of subsequently dying. A similar study in Nyeri had comparable findings - HIV/AIDS contributed to only 3% of near miss events but 50% to maternal mortality [8]. Murage et al did not have any cases with HIV/AIDS in their sample. A study on maternal mortality at KNH between 1995 and 1999 found that complications of abortion (post-abortal sepsis) were the leading cause of mortality haemorrhage (including ectopics) accounted for 13.3%; hypertension 9.4% HIV/AIDS 3.8%. [15]
In terms of near miss morbidity however haemorrhage was the leading cause - 36.8% of all near miss cases. It was closely followed by hypertensive disorders of pregnancy (33.3%) and complications of abortion.
Our study found that eclampsia complicated 1.1% of deliveries during the study period. By comparison eclampsia occurs in 0.2-0.5% of all deliveries; in 2004 at KNH 0.03% of deliveries were complicated by it. [14] Hypertensive disorders account for 50,000 maternal deaths worldwide. [13]

There were 9 cases of ruptured uterus – one of the worst catastrophes in pregnancy giving 7.6% of near miss morbidity, but none of these mothers died however they had very poor perinatal outcomes: only 1 neonate survived with the rest being fresh/macerated still births. At Kenyatta National Hospital, ruptured uterus was responsible for 3% of maternal deaths in the period 1995-1999. [15]

Of great interest is that none of the patients with ruptured ectopic gestations died. This is most probably due to the fact that there are specific guidelines, a high alert and quick response for this condition at Kenyatta National Hospital (KNH). This sort of awareness should be replicated for the other

causes of near miss and maternal mortality.

Sepsis was the major cause of mortality contributing to 42.8% of maternal mortality in the study done by Oyieke et al. [15], while in our study it was only responsible for 4% of mortality. Recent advances in antibiotic therapy may be responsible for this drastic change in disease patterns. There was not much difference in sepsis between our study and that of Murage et al 4.3% versus 3.8%, but this could be partly due to inclusion of complications of abortion as a separate entity and when combined with sepsis the two combined constitute 13.5% of near miss morbidity and mortality.

Vaginal delivery gives a 3-fold risk of mortality as compared to other pregnancy outcomes and Caesarean section. Also deaths occur more frequently in the pueperium or in women who present in this period. This is similar to findings in studies on maternal death in Dhaka, Bangladesh and Panama City, Panama. [18, 19]

It is very commendable that only 2.8% of identified cases were booked KNH clinic attendees. Though the study did not prove that ANC attendance had an impact on morbidity/mortality the small numbers of KNH clinic attendees shows that good ante-natal care reduces the chance of a woman experiencing a near miss morbidity or mortality.

Only 7% of the study population was admitted to ICU. This is similar to studies done around the region 9% Nyeri PGH [8], but considerably lower than that found by Murage et al in the same sitting 37.5% in 2001 [10]. This is probably due to fact that the population in the catchment area has markedly increased while public institutions with ICU/HDU facilities have remained stagnant. There is great pressure on these services and even the HDU and acute room in casualty are operating as ICU. A similar study in Sagamu Nigeria had only 4.3% of their study population admitted to ICU [6]. Of note is the fact that admission to ICU (management based criteria) cannot be

used in our set-up and similar settings, as it would lead to great under-reporting of near miss morbidities. It is dependant on availability, capacity and location of ICU and institutional guidelines for ICU admission.

Live births comprised 68.8% of births with 16.7% Fresh still births (FSB) and 13.5% Macerated still births (MSB). 30.7% were admitted to NBU while neonatal deaths accounted for 11.9% of neonatal outcomes. These are very poor perinatal outcomes and is in keeping with results from other studies.[5,8,10]

The duration of hospital stay in patients with near miss episodes has generally been found to be long and in our study the mean hospital stay was 10.1 (±12.85) days which is comparable to other studies 10.3 (±13.24) days (Brazil) [5] and 13.6 days (Nyeri) [8]. Oladapo et al in their study found duration of hospital stay to be between 2 and 74 days (median 11 days, interquatile range: 8-15 days). These long stays are not in tandem with trends of modern medicine that promote shorter hospital stays through innovation of new surgical techniques and in investment in preventive strategies.

The most common investigation done was a full blood count or Haemoglobin estimation that was performed on 91.9% of patients. Seeing as majority of patients had hypertensive disorders of pregnancy and haemorrhage a full blood count would be the most appropriate investigation for this group but this service is only available during the day. Packed cell volume, urea electrolytes and creatinine are available on a 24 hour basis. Ultrasound was the most common imaging technique and is available 24 hours but there are few ultrasound machines and radiologists and very high demand for this service resulting in delays in booking especially urgent ultrasounds.

Blood was received by majority of requiring transfusion (88%) but 44.8% of them did not get all the blood they needed. It was noted that blood

transfusion services experienced occasional shortages and probably explain this poor access to blood, though further studies done to evaluate the impact of not receiving adequate amounts of b

The most frequent consultations made were to senior obstetricians. ward rounds or handing over rounds were not counted as cons though invariably several occurred during such sessions. Most cons were honored (86.3%) meaning about 13.7% of consultations honored. Delays in some consultations were noted but this could addressed by the study because times of requests made and times consultations not recorded and it was not feasible for study team to s monitor all patients throughout their hospital stay.

CONCLUSIONS

Near miss maternal morbidity and mortality are common events at Ke National Hospital, which is the referral hospital for the country prevalence of near miss maternal morbidity at KNH is 3.9% with a mo index of 1.8 and near miss to mortality ratio of 5 as compared to 8 in and 117-223 in Europe. The maternal mortality ratio during the study 829.7 per 100,000 deliveries.

Hypertensive disorders of pregnancy, HIV/AIDS are the number 1 cau maternal deaths, while haemorrhage is the leading cause of near morbidities unlike previous studies that show haemorrhage to be the cause of death.

Women who present with near miss morbidities in the post-partum have a 3 fold risk of dying than women who present at other pregnancy.

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CONCLUSIONS

Near miss maternal morbidity and mortality are common events at Kenyatta National Hospital, which is the referral hospital for the country. The prevalence of near miss maternal morbidity at KNH is 3.9% with a mortality index of 1.8 and near miss to mortality ratio of 5 as compared to 64 in Brazil and 117-223 in Europe. The maternal mortality ratio during the study was 829.7 per 100,000 deliveries.

Hypertensive disorders of pregnancy, HIV/AIDS are the number 1 cause of maternal deaths, while haemorrhage is the leading cause of near miss morbidities unlike previous studies that show haemorrhage to be the primary cause of death.

Women who present with near miss morbidities in the post-partum period have a 3 fold risk of dying than women who present at other periods of pregnancy.

Women with near miss morbidity had long hospital stays 10.1(±12.85) days with a range of 3-97 days.

Babies born to women with near miss morbidity or to women who die have poor perinatal outcomes - stillbirths 30%; admission to NBU 30% and neonatal deaths 15%.

Consultations and blood giving services are available at the hospital, but in certain instances patients have died or suffered morbidity due to lack or limited access to these services.

RECOMMENDATIONS:

1. Further studies on the aetiology and other determinants of mortality in patients with hypertensive disorders in pregnancy, HIV/AIDS in the era of magnesium sulphate and Highly Active Anti-retroviral Therapy (HAART) and haemorrhage as they were the common cause of maternal death and morbidity.
2. KNH to consider working closely with other facilities and stake holders especially city council to optimize antenatal care and these could be in the form of Continuous Medical Education (CME), workshops, exchange programmes or outreaches.
3. Improve blood bank and blood transfusion capacity of KNH and possibly network hospital to facilitate faster and more economical procurement of consultations and results.

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INFORMED CONSENT FORM

NEAR MISS MORBIDITY AND MATERNAL MORTALITY AT KENYATTA NATIONAL HOSPITAL NAIROBI

INVESTIGATORS CONTACT:
Dr. Maureen Owiti Tel: 0722-236522; P.O. Box 58882-00200 Nairobi

PURPOSE OF STUDY
Every minute of every day at least one woman dies in childbirth..... more than half a million each year. The purpose of this study is to find out the main causes of severe illness or death in pregnant women or women who have recently delivered, establish ways to prevent them and improve the care they recieve.

BENEFITS
You have a condition from which many women have died. There will be no direct benefit to you, but by participating in this study you will help us understand your condition better and find out ways we can improve treatment for women with this condition. This will help us reduce the number of women dying or having serious complications

RISKS
There are no risks involved from participating in the study. There will be no tests e.g. blood or urine tests or treatment given for the study. All tests and treatment you recieve will be the usual care that anyone with your condition recieves

EXPECTATIONS
By agreeing to participate you are expected to answer questions regarding your present illness, past medical history and your reproductive life. You are also agreeing to let the study team obtain information from your file about any tests and treatment you recieve while in hospital.

CONFIDENTIALITY
The information you provide will be recorded on forms with no names or any infromation that will identify you and this is what will be used to analyse the information we receive and report findings.

VOLUNTARY PARTICIPATION
You are free to participate in this study. You are aslo free not to participate. You can stop participation at any time. Your decision will not affect the type of care you recieve. You are also free to ask questions now and at any other time. Should you have any questions in future please contact Dr Maureen Owiti by phone or mail as indicated above.

DECLARATION

I have explained to the respondent the nature and purpose of the study as described above. The respondent has been informed of their right to ask questions and I have clarified any issues to the best of my ability.

Investigators signature: _____ Date: _____

CONSENT

I have understood the nature and purpose of this study and hereby voluntarily consent to participate.

Participants signatue: _____ Date: _____

Spouse/Partner's signature: _____ Date: _____

Parent's/sibling's signature: _____ Date: _____

Study No _ _ _ _ _ _ Date: _ _/_ _/_ _ _ _

NEAR MISS MATERNAL MORBIDITY AND MATERNAL MORTALITY AT KENYATTA NATIONAL HOSPITAL, NAIROBI

ELIIBILITY CHECKLIST:

1. Does the woman fulfill the following criteria	Yes	No
Is she pregnant		
Is she within 42 days post-partum		
Is she within 42 days of termination of pregnancy		
Is she wlling and able to consent		

If **yes** to any of the above then go question 2 if **No** to all of the above then **STOP** she is not eligible

2. Eligibility criteria for identification as near miss	Yes	No
Haemorrhage with shock		
Coagulation defects		
Blood transfusion ≥ 3 units		
Severe pre-eclampsia and or HELLP syndrome		
Eclampsia		
Uterine rupture or impending rupture		
Septic shock		
Hb < 6 g/dl		
Pulmonary oedema		
SPO_2 <90% for more than 90 min		
Ratio PaO2/FiO_2 <300mmHg		
Cardio-respiratory arrest		
Oliguria: <400ml/24h		
Urea > 15mml/l		
Creatinine>400mmol/l		
Coma		
Sub-arachnoid or intraparenchymatous haemorrhage		
Jaundice with preeclampsia		
Diabetic ketoacidosis		
Thyrotoxic crisis		
Acute thrombocytopaenia requiring transfusion of platelets		
Emergency hysterectomy for any reason		
Intubation and ventilation other than for general anaesthesia		
Admission to ICU for whatever reason		
Systolic pressure <90mmHg for more than 60 min associated with epidural or spinal anaesthesia		
Failure in endotracheal intubation requiring anaesthetic reversion		
Other specify		

If **YES** to any of the above criteria then go to page 2 if **NO** to all of the above then **STOP** she is not eligible

Study No _ _ _ _ _ Date: _ _/_ _/_ _ _ _

NEAR-MISS MATERNAL MORBIDITY AND MATERNAL MORTALITY AT KENYATTA NATIONAL HOSPITAL, NAIROBI

PATIENT STUDY NO. _ _ _ _ _

Date of admission _ _/_ _/_ _ _ _ dd/mm/yyyy

Time of admission _ _ :_ _ hrs

Date of recruitment _ _/_ _/_ _ _ _ dd/mm/yyyy

SOCIO-DEMOGRAPHIC CHARACTERISTICS

3. Age (years) _ _ Date of birth _ _/_ _/_ _ _ _ dd/mm/yyyy
4. Marital status:

Staus	Yes	No	Status	Yes	No
Single			Separated		
Married			Widowed		
Divorced			Other		

If other please state _____

5. Residence: _____
6. Education: Total no. of years _____
7. Participant's occupation:_____

Occupation	Yes	No	Occupation	Yes	No
Unemployed			Professonal		
Semi-skilled			Skilled		
Other			State other:		

8. Partner's ocupation:_____

Occupation	Yes	No	Occupation	Yes	No
Unemployed			Professonal		
Semi-skilled			Skilled		
Other			State other:		

9. Patient's income per month in KShs _____
10. Partner's income per month in KShs _____
11. Total family income in last 3 months in KShs _____

Study No _ _ _ _ _ Date: _ _/_ _/_ _ _ _

12.What material is your house made of

Material	Yes	No	Material	Yes	No
Concrete/bricks			Wood		
Metalic sheets			Mud		
Other			State other:		

13.How many rooms does your house have? _____

14.Does your home have piped water ? 1) Yes ___ 2) No ___

15.Does your house have an inside toilet? 1) Yes___ 2) No ___

OBSTETRIC HISTORY

Pregnancy	Date	Sex	Wt	Place	Gestation	Mode	Complications	Child status
1								
2								
3								
4								
5								
6								
7								
8								

ANC

16.Did she attend ANC? 1) Yes ___ 2) No ___

17.If yes state where

1) KNH __ 2) Municipal/City council__ 3) Private clinic

4) private doctor ___ 5) private hospital __ 6) Other

18.If not KNH please state name of institution _____

19.Does she have her ANC card 1) Yes ___ 2) No ___

If **yes** then answer question **20-24** if **no** ask what she knows otherwise go to question **25**

20.No of ANC visits __ __

21.Date of first ANC visit _ _/_ _/_ _ _ _ dd/mm/yyyy

22.Gestation at first ANC visit __ __ /40 + __ days

23.ANP: Blood group __ __ Hb __ __ . __ g/dl VDRL __ HIV ____

Urine: proteins __ __ __ sugar __ __ __ ketone __ __ __

24. Was the following checked at first ANC visit?

Weight	1) yes _____	2) no _____
BP	1) yes _____	2) no _____
FH	1) yes _____	2) no _____
Pallor	1) yes _____	2) no _____

If pregant answer questions **25-27** otherwise go to question **28**

25. Last menstrual period _ _ /_ _ / _ _ _ _ dd/mm/yyyy

26. Gestation at admission __ __ /40 + ___ days

27. How was gestation calculated?

Dates	1) yes __	2) no ___
U/S	1) yes __	2) no ___
Quickening	1) yes __	2) no ___
Fundal height	1) yes __	2) no ___

If post-partum or post-abortal

28. Date of delivery/ abortion __ __ /__ __/ __ __ __ __ dd/mm/yyyy

29. No of days post-partum/ post abortal __ __

30. Where was the patient delivered or evacuated?

1) KNH __ 2) Municipal/City council __ 3) Private clinic __

4) private hospital __ 5) GOK _____ 6) Other __

31. If not KNH please state:

Name of institution/place of birth: _____

Time elapsed between delivery and arrival at KNH _____ hrs/days

32. Did the mother deliver in same institution where she attended ANC?

1) Yes ___ 2) No ___

33. If no to question **32** why?

1) Financial reasons	1) Yes ___	2) No ___
2) Did not like services	1) Yes ___	2) No ___
3) Distance	1) Yes ___	2) No ___
4) Lack of facilities eg theatre	1) Yes ___	2) No ___
5) Other	1) Yes ___	2) No ___

If other please state: _____

Study No _ _ _ _ _ Date: _ _/_ _/_ _ _ _

PAST MEDICAL HISTORY

34.Previous admissions 1) Yes _____ 2) No _____

35.Previous surgery 1) Yes _____ 2) No _____

36.Does the patient have any of the following medical conditons

Condition	Yes	No	Condition	Yes	No
Hypertension			Diabetes		
Asthma			Cardiac disease		
Renal disease			HIV		
Epilepsy			Other		

NB if other please specify _____

HISTORY AT ADMISSION

37.Is the patient

Ante-partum 1) Yes ___ 2) No ___

Intra-partum 1) Yes ___ 2) No ___

Post-partum 1) Yes ___ 2) No ___

Post-abortal 1) Yes ___ 2) No ___

Other 1) Yes ___ 2) No ___ Specify _____

38.Vital signs at admission/time of identifcation as a near miss:

Pulse _ _ _ bpm BP _ _ _/_ _ _ mmHg Temp_ _ . _ °C

39.Is the patient directly from home? 1) Yes ___ 2) No ___

If yes to question **39** answer questions **40-42** if no go to question **43**

40.Time taken to reach KNH in hrs __ __ hrs

41.Any delays from patients perspective 1) Yes ___ 2) No ___

42.Reason for delay

Decision making 1) Yes ___ 2) No ___

Transport 1) Yes ___ 2) No ___

Finances 1) Yes ___ 2) No ___

Distance 1) Yes ___ 2) No ___

Hospital 1) yes __ 2) no ___ 3) Hours _____

Other 1) Yes ___ 2) No ___

Specify _____

43.Diagnosis at admission

Condition	Yes	No	Condition	Yes	No
APH			Anaemia		
PPH			Pueperial sepsis		
Severe preeclampsia			Septic abortion		
Eclampsia			Uterine rupture		
Ectopic pregnancy			Impending rupture		
Prolonged labour			Other		

If other state: _____

44.Place of admisssion

Casualty 1) Yes ____ 2) No ____

Labour ward 2) Yes ____ 2) No ____

45.**MODE OF DELIVERY**

Mode of delivery	Yes	No	Mode of delivery	Yes	No
SVD			C/S*		
Vaccuum			Hyserotomy*		
Breech			Multiple gestation*		
Other*					

*Specify_____

_____

46.Date of delivery:__ __/__ __/__ __ __ __ dd/mm/year

47.Gestation at delivery __ __ / 40

48.Place of delivery

1) KNH __ 2) Municipal/City council __ 3) Private clinic __

4) Private hospital __ 5) GOK _____ 6) Other __

49.If not KNH then specify name of facility/place of bith _____

50.If KNH then duration of hospital stay till delivery:

Ante-partum __ __ days

Intra-partum __ __ hours

Study No _ _ _ _ _ Date: _ _/_ _/_ _ _ _

REFERRAL

51.Is the patient a referral from another health facility?

1) yes _____ 2) no _____

52.If yes name of referring facility _____

53.If yes then time taken to reach KNH __ __ hrs

54.Reason for delay

Decision making	1) Yes ___	2) No ___
Transport	1) Yes ___	2) No ___
Finances	1) Yes ___	2) No ___
Distance	1) Yes ___	2) No ___
Other	1) Yes ___	2) No ___

55.Is there a referal note 1) yes ___ 2) no _____

56.What is the referring diagnosis?

Condition	Yes	No	Condition	Yes	No
APH			Anaemia		
PPH			Pueperial sepsis		
Severe preeclampsia			Septic abortion		
Eclampsia			Uterine rupture		
Ectopic pregnancy			Impending rupture		
Prolonged labour			Other		

If other state: _____

57.Diagnosis at admission

Condition	Yes	No	Condition	Yes	No
APH			Anaemia		
PPH			Pueperial sepsis		
Severe preeclampsia			Septic abortion		
Eclampsia			Uterine rupture		
Ectopic pregnancy			Impending rupture		
Prolonged labour			Other		

If other state: _____

58.Is the referring diagnosis the same as the admission diagnosis

1) Yes __ 2) No __

FOLLOW UP & MATERNAL OUTCOME

59. Date of admission _ _ / _ _ / _ _ _ _ dd/mm/yyyy

60. Date identified as near miss/mortality _ _ / _ _ / _ _ _ _ dd/mm/yyyy

61. Duration of hospital stay prior to identification as near miss _ _ days

62. Date of discharge/death _ _/ _ _/ _ _ _ dd/mm/yyyy

63. Duration of total hospital stay in days ____ (Upto maximum 42 days post partum or termination of pregnancy)

64. LAB INVESTIGATIONS:

Investigation	Date	Yes	No	Qty	Remarks
FBC/PCV					
LFTs					
GXM/Blood group					
Urine for M/C/S					
U/E/C					
BGA					
Pus swab for M/C/S					
Other					

If other then specify _____

65. IMAGING

Investigation	Date	Yes	No	Qty	Remarks
U/S					
SXR					
CT SCAN					
ECHO					
CXR					
ECG					
MRI					
OTHER					

If other then specify _____

68. INTERVENTIONS

Intervention	Date	Yes	No	Qty	Remarks
MVA/D&C					
Exploratory laparotomy					
Manual removal of placenta					
Emergency hysterectomy					
Uterine or internal iliac artery ligation					
Dialysis					
CVP monitoring					
Intubation & ventilaton other than for surgery					
Other					

69.Transfers:

Place	Yes	No	Admission date	Date of discharge	Stay in days (max 42 pp)
ICU					
HDU					
Renal Unit					
Wards					

70.Final diagnosis:

Diagnosis	Yes	No	Diagnosis	Yes	No
APH			Anaemia		
PPH			Pueperial sepsis		
Severe preeclampsia			Septic abortion		
Eclampsia			Uterine rupture		
Ectopic pregnancy			Impending rupture		
Prolonged labour			Other		

If other state: _____

71.Maternal outcome

1) Near miss _____ 2) Death _____

72.If near miss has patient suffered any long term complications?

1) Yes ___` 2) No ___

73.If yes to question 72 please state long term complication

Complication	Yes	No	Complication	Yes	No
Visual impairement			Renal failure		
Brain/nerve damage			Infertility		
Other			Unknown		

If other please state: _____

FOETAL OUTCOME

74.Gestation at birth __ __ /40

75.Sex: Baby 1 1) Male _____ 2) Female _____

Baby 2 1) Male _____ 2) Female _____

Baby 3 1) Male _____ 2) Female _____

76.Birth weight in grams

Baby 1 _____ g

Baby 2 _____ g

Baby 3 _____ g

77.Condition at birth:

	Live birth	FSB	MSB
Baby 1			
Baby 2			
Baby 3			

78.If alive then Apagar score: 1min _____ 5 min _____10 min _____

Apgar score	1min	5 min	10 min
Baby 1			
Baby 2			
Baby 3			

Study No __ __ __ __ Date: __/__/__

79.Outcome after delivery:

Place of birth	KNH		Other	
	Yes	No	Yes	No
Disharged to mother				
Admitted NBU				
Neonatal death prior to admission in NBU				
Other				

If other specify _____

80.Admission to NBU:

Baby 1 1) Yes _____ 2) No _____

Baby 2 1) Yes _____ 2) No _____

Baby 3 1) Yes _____ 2) No _____

81.If yes to question 80 age at admission to NBU in days

Baby 1: __ __ days

Baby 2: __ __ days

Baby 3: __ __ days

82.If yes to question 80 state indication for admission to NBU

Condition	Baby			Condition	Baby		
	1	2	3		1	2	3
Sepsis				Birth Aspyxia			
Jaundice				Prematurity			
Respiratory distress				Congenital abnormality			
Mother's condition				Other			

If other please state

_____