

**FACTORS ASSOCIATED WITH SEVERE MATERNAL
MORBIDITY AT KENYATTA NATIONAL HOSPITAL**

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**Factors Associated with Severe Maternal Morbidity at Kenyatta
National Hospital**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

Signature.....Date.....

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This thesis has been submitted for examination with my approval as University supervisor

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Signature..... Date.....

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DEDICATION

I dedicate this thesis to my mother Faith Waithira Nduati for her continued support in all my endeavours and to my late father Samuel Nduati for fuelling my passion for learning.

I would also like to dedicate this thesis to all mothers in my life who have been an inspiration in carrying out research into maternal health care so as to improve their lives.

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ABBREVIATIONS AND ACRONYMS

| | |
|-----------------------|---|
| ANC | Antenatal Care |
| CEMD | Confidential Enquiry into Maternal Deaths |
| CS (C-section) | Caesarean Section |
| DVT | Deep Venous Thrombosis |
| Hb | Haemoglobin |
| HIV/AIDS | Human Immunosuppressive Virus/ Acquired Immunosuppressive Diseases |
| ICU | Intensive Care Unit |
| KNH | Kenyatta National Hospital |
| KDHS | Kenya Demographic Health Survey |
| MNM | Maternal Near Misses |
| PPH | Postpartum Haemorrhage |
| SMM | Severe Maternal Morbidity |
| UNICEF | United Nations Children’s Fund |
| WHO | World Health Organisation |

OPERATIONAL DEFINITIONS

- Antenatal care** is the care provided by skilled healthcare professionals to pregnant women in order to ensure the best health conditions for both the mother and baby during pregnancy. (Ali *et al.*, 2020).
- Eclampsia** is onset of generalized fits in a patient with no previous history of epilepsy and includes coma in a patient with preeclampsia (WHO, 2011).
- Maternal near miss** is the near death of a woman who has survived a complication occurring during a pregnancy or childbirth or within 42 days of the termination of pregnancy (WHO, 2011).
- Mode of delivery** entails the various means through which a baby is born which includes spontaneous vaginal delivery, forceps delivery, vacuum delivery and caesarean section.
- Postpartum haemorrhage** is the loss of more than 500mls of blood after delivery (WHO, 2011).
- Pre-eclampsia** is a systolic blood pressure of 140mmHg or more and a diastolic blood pressure of 90mmHg or more over a period of time (WHO, 2011).
- Prevalence** is the proportion of a population with a specific characteristic in a given time (Last, 2001).
- Ruptured uterus** is the spontaneous tearing of the uterus during labour (WHO, 2011).
- Sepsis** is confirmed or suspected infection with fever (WHO, 2011).

Severe maternal morbidity is any life-threatening pregnancy related complication also referred to as a maternal near miss namely; pre-eclampsia, eclampsia, sepsis, postpartum haemorrhage and ruptured uterus (Firoz *et al.*, 2013).

Three delays model is a theoretic framework conceptualized by Thaddeus and Maine in 1994 which focuses on the factors that: (1) delay the decision to seek care; (2) delay arrival at a health facility; and (3) delay the provision of adequate care resulting in maternal mortality or morbidity.

ABSTRACT

Maternal mortality is an area of particular concern in public health especially in Africa where maternal deaths are the highest in the world. Despite these high numbers comprehensive studies are difficult as maternal deaths at health facility levels are far between coupled with poor data because even routine sources such as vital registration are not well documented. This has necessitated a different approach to the issue hence the emphasis on maternal morbidity. Since women who suffer maternal morbidity encounter the same difficulties during pregnancy as the ones who die, they also have similar risk factors. Focus on maternal morbidities in other countries have shown a significant improvement in maternal health outcomes. The major objective of this study was to determine the factors associated with severe maternal morbidity and its prevalence at Kenyatta National Hospital. This was an analytical cross-sectional quantitative study. Data was collected from postnatal women admitted in the maternity wards at Kenyatta National Hospital obstetrics and gynaecology department using a structured questionnaire. 162 respondents were selected through systematic sampling and an additional 18 respondents were also included in case there were missing records. Univariate, bivariate and multivariate analysis was carried out with both descriptive statistics and inferential statistics obtained. The prevalence of severe maternal morbidity during the one month of this study was at 36.1%. The factors that were associated with the occurrence of a severe maternal morbidity were: husband's education; being married; being referred from another facility; having a pre-existing condition; experiencing a complication postnatally; stillbirth outcome and delivery via caesarean section. The most common severe maternal morbidity was pre-eclampsia. Referral status- a component of the third delay- came to the fore as a factor that projects the occurrence of severe maternal outcomes. It can therefore be inferred that the referral system in Kenya is wanting since urgent care to mothers is being delayed during the process. Policymakers at the Ministry of Health should review policy guidelines on the use of caesarean sections to ensure they are used when benefits outweigh risks.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Maternal and child mortality are essential indicators of the economic health and wellbeing of a nation. Approximately 800 women die daily due to pregnancy complications and childbirth according to the WHO (2015) report despite a global decline of 169 deaths per 100,000 live births between 2000 and 2015. In addition to this, for each woman who dies an estimated 20 women suffer long term disabilities, injuries and infections (UNICEF, 2019). Global estimates show that the highest maternal deaths at 86% occur in Southeast Asia and Sub-Saharan Africa (UNICEF, 2019). The Kenyan context according to the Kenya Demographics Health Survey (KDHS) 2014 estimates 362 maternal deaths per 100,000 live births which are still above the Millennium Development Goals of 147 per 100,000live births.

The third Sustainable Development Goals (SDGs) developed in September 2015 aims to ensure the health of all at every stage of life. In order to make strides in maternal health it is important to obtain accurate statistics regarding maternal health issues including maternal deaths, maternal morbidities and postnatal period readmissions. This study focused on severe maternal morbidities, their prevalence and associated factors. In developed countries there has been a shift in focus to maternal morbidity and maternal near misses (MNM) in assessing quality of maternal health as maternal deaths are rare (Geller et al., 2018). In the United States estimates have shown that 50-100 women suffer from severe maternal morbidity (SMM) to every maternal death (Geller *et al.*, 2018). According to this same study low- and middle-income countries still have the higher rates of severe maternal morbidity as compared to high income countries with countries like Nigeria at 17% prevalence of SMM and India at 14%. However, the biggest challenge in identifying the SMM has been an absence of a standard definition for severe maternal morbidity making comparison of studies from different countries difficult.

The WHO (2011) developed a standard approach to pregnancy complications and maternal near misses so as to evaluate the standard of excellence of care, point out areas of prioritization and funding as well as enable comparability of data obtained. The instrument's eligibility criteria for baseline assessment includes: the presence of a severe maternal complication such as severe postpartum haemorrhage, ruptured uterus; critical interventions e.g., hysterectomy and critical care admission; organ dysfunction such as cardiac arrest, dialysis and lastly maternal death (WHO, 2011).

A prospective study on determinants of maternal near misses in Nigeria found a prevalence rate of 12% with some of the causes of SMM being severe haemorrhage, hypertensive disorders, prolonged obstructed labour, septicaemia and severe anaemia (Adeoye *et al.*, 2013). It also showed that having chronic hypertension increased the chances of a near miss to up to 7 times. Phase one or two delays in seeking care were also associated with 60% of the near miss cases.

According to a study carried out at 3 referral hospitals and 23 health facilities in Bungoma, Kakamega and Busia counties in Kenya the prevalence of severe maternal morbidity was at 31.2 per 1000 deliveries (Goldenberg *et al.*, 2017). Wound infections related to caesarean sections and haemorrhage continued to be among the most frequent postpartum complications according to a study carried out at PCEA Kikuyu Hospital (Ukachukwu *et al.*, 2009).

Women who come from lower socioeconomic status and those who receive care in public facilities were found to have a higher likelihood of experiencing a maternal morbidity according to a study on socioeconomic factors on maternal morbidity in a city in North-eastern Brazil (Rosendo *et al.*, 2017). Socioeconomic factors, age, parity, attendance of ANC, delays in seeking care, mode of delivery and pre-existing conditions have been shown to have a significant relationship to occurrence of maternal morbidity (Adeoye *et al.*, 2013; Domingues *et al.*, 2016; Rosendo *et al.*, 2017; Souza *et al.*, 2010).

1.2 Problem Statement

According to the UNFPA (2015) study Kenya's maternal mortality rate stands at 510 deaths per 100,000 live births which is on the higher side on the scaling index. Despite the high numbers of maternal deaths in our country, identifying actual cases at the facilities level is quite difficult as deaths are few and far between making it difficult to carry out a comprehensive evaluation (Fillipi *et al.*, 2016). Consequently, we need to identify mothers with similar risk factors as those who die due to pregnancy-related conditions. Determining maternal morbidity therefore becomes very useful.

Maternal morbidity is defined as "any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on the woman's wellbeing (Firoz *et al.*, 2013) Maternal morbidity is a spectrum ranging from the very severe cases known as "maternal near misses" to the less severe non-life-threatening conditions. A maternal near miss is defined by the WHO as the near death of a woman who has survived a complication occurring during pregnancy or childbirth or within 42 days of the termination of pregnancy (WHO, 2011). The cases at the extreme end of the maternal morbidity spectrum are of particular interest as they occur more frequently than maternal deaths and have risk factors and characteristics that are similar to those of maternal deaths (Firoz *et al.*, 2013).

There exists a significant research gap on studies on severe maternal morbidities especially in low- and middle-income countries (Geller *et al.*, 2018). This has largely been due to a lack of a standard identification criteria for severe maternal morbidities. A systematic review of available studies on maternal near misses used a combination of the following terms: severe acute maternal morbidity, severe maternal morbidity, near miss morbidity, obstetric near-miss, maternal near miss, obstetric near miss, emergency hysterectomy, emergency obstetric hysterectomy, maternal complications, pregnancy complications and intensive care unit to identify studies for inclusion. The study found a near miss prevalence of 14.98% in Africa excluding outliers compared to 5.07% in Asia and 1.38% in North America based on the disease specific criteria (Tuncalp *et al.*, 2012).

According to a facility-based study carried out at PCEA Kikuyu Hospital in Kenya on maternal morbidity and mortality, genital tract trauma was the most common morbidity at delivery. The postpartum complications included; retained products of conception, uterine rupture, wound infections, hematomas and haemorrhage (Ukachukwu *et al.*, 2009). Studies carried out at Kenyatta National Hospital have largely focused on the ratios, causes and associated factors of maternal mortality (Oburu, 2010; Oyieke, 2006) For instance a study carried out between 2000 and 2008 at Kenyatta National Hospital found that HIV had resulted in the highest number of maternal deaths at 18.8% exceeding those by direct obstetric causes (Oburu, 2010). These studies however did not determine the prevalence of maternal morbidities at the facilities nor determine any factors that may have an association to maternal morbidity.

This study sought to address this gap by determining prevalence of severe maternal morbidity at Kenyatta National Hospital and assessing any relationship between their occurrence and identifiable risk factors. Using the WHO standardized definition and identification criteria for classifying severe maternal morbidity, this study focused of the occurrence of the following severe maternal complications: preeclampsia, eclampsia, postpartum haemorrhage (PPH), puerperal sepsis and ruptured uterus. Lastly it looked at those who received critical interventions namely: ICU admission, hysterectomy and blood transfusion.

1.3 Justification

With maternal mortality rates approximated to be at 362 deaths per 100, 000 live births in Kenya (KDHS, 2014) it is imperative that we identify the factors associated with these deaths and in turn come up with interventions to mitigate them. From previous studies these have been noted to include: socioeconomic and demographic status; mode of delivery; antenatal care attendance; and the three delays modelled by Thaddeus and Maine (1994). This study will determine whether these risk factors are of significance in the Kenyan context. Moreover, it will assess the effectiveness of existing interventions such as ANC and facility deliveries as well as their uptake among their targeted users. Since this study will be carried out at the largest referral

hospital in Kenya, it will be interesting to note additional factors if any. This study will also be useful in evaluating the loopholes in care delivery especially in our referral system. Data obtained concerning residence of the respondents would be useful in mapping out areas that have the highest uptake of services offered at this facility. This can in turn inform their community-oriented initiatives.

The results can be utilized at the community level to inform areas of emphasis in the health education provided to pregnant women during ANC visits. For example, women can be educated in avoiding the first delay in seeking care by reminding them of the danger signs in pregnancy and ensuring that they have a birth plan in advance. Moreover, the women can be encouraged to bring their husbands along since they are the decision makers in the household.

The information can be used by stakeholders such as the Ministry of Health to come up with relevant policies and to address any implementation challenges that are identified. The stakeholders at the management level such as the Director of Clinical Services and the Director of Nursing Services can use the results on the third delay to review the quality care at the hospital. This can be by addressing the waiting time; ensuring all equipment and supplies are available and increasing the number of healthcare providers where need be. The results may also be used to inform their development plans for instance establishing an obstetric ICU so as to address severe maternal morbidities in good time.

At the policy level, the outcome of this study can be used by the Ministry of Health to fuel additional funding for free maternity care. Results on delay in seeking care due to financial cost of care would give more insight on the community's awareness on free maternity care. Policy makers could then roll out advertisements to create more awareness. Moreover, this information can be used in advocacy among professionals and stakeholders to improve maternal health care and in sourcing for funding of maternal health programs.

1.4 Research Questions

1. What is the prevalence of severe maternal morbidity among postnatal mothers at Kenyatta National Hospital postnatal wards?
2. What factors are associated with the occurrence of severe maternal morbidity?
3. What is the association between the three delays and the occurrence of severe maternal morbidity?

1.5 Objectives of the study

1.5.1 Broad objective

To determine the factors associated with severe maternal morbidity and its prevalence among postnatal women at Kenyatta National Hospital.

1.5.2 Objectives of the Study

1. To assess the prevalence of severe maternal morbidity at Kenyatta National Hospital.
2. To determine the factors associated with occurrence of severe maternal morbidity.
3. To assess the association between the three delays and the occurrence of severe maternal morbidity.

1.6 Hypothesis

There is no relationship between antenatal care, mode of delivery, socioeconomic and demographic status and the three delays, on severe maternal morbidity.

1.7 Conceptual framework

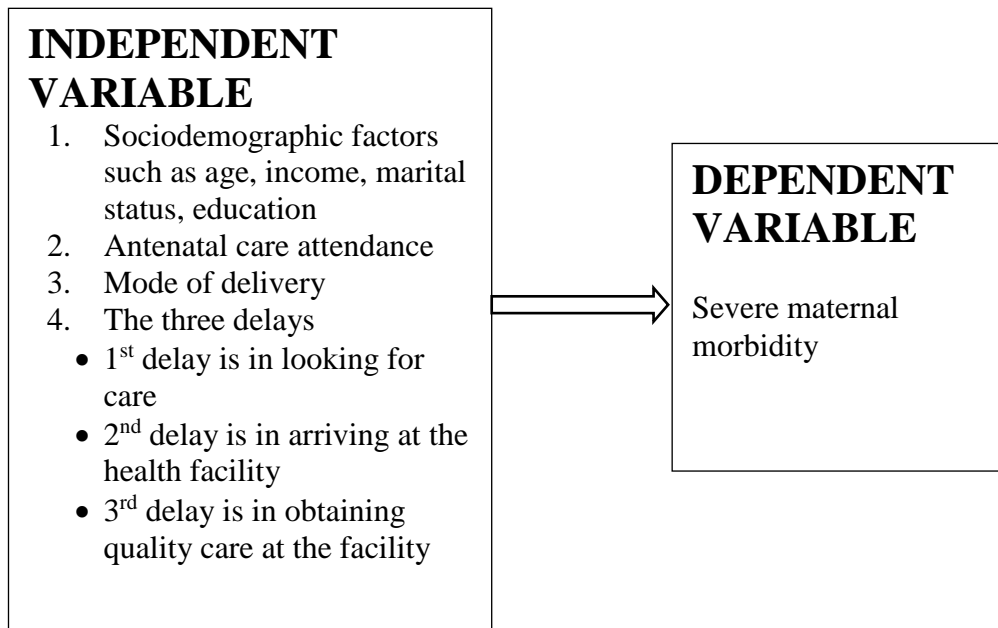


Figure 1.1: Conceptual framework for maternal near miss/ severe maternal morbidity

CHAPTER TWO

LITERATURE REVIEW

Maternal mortality and morbidity remain key public health concerns in our country. As our country is transitioning to a middle-income nation, it is unacceptable for the lives of our mothers to be lost in childbearing and their quality of life affected by complications. Maternal deaths are only a little bit of the magnitude of problems resulting from maternal morbidity, with maternal mortality being described as just a tiny part whereas the real issue is maternal morbidity (Firoz *et al.*, 2013).

According to a study carried out in the United States to compare maternal mortality rates in the U.S. with 10 other high-income countries, 52% of all maternal deaths occurred during the postnatal period (Tikkanen *et al.*, 2020). This was similar to findings from another study carried out in Ethiopia which found that 65.1% of the maternal deaths investigated occurred during the postpartum period. (Tesfay *et al.*, 2022). The postnatal period is therefore a crucial time to intervene in the occurrence of a maternal complication.

2.1 Causes of Maternal Mortality and Maternal Morbidity

The leading causes of maternal mortality are hypertensive diseases, haemorrhage, sepsis, abortive outcomes and embolisms (Say *et al.*, 2016). According to the WHO (2014) report, the largest percentage of all maternal deaths is found in Sub-Saharan Africa and Southeast Asia. These were as a result of direct causes such as haemorrhage which accounted for 36.9% of deaths in northern Africa and sepsis at 13.7% of deaths in Southeast Asia. The maternal mortality ratio associated with hypertensive disease, sepsis and haemorrhage in Sub Saharan Africa stands at 500 deaths per 100,000 live births which is shocking compared to about 100 deaths per 100,000 live births in Middle income nations such as Brazil and the Caribbean's (Ronsman & Graham, 2006).

Indirect causes -which often result from exacerbation of pre-existing conditions such as diabetes by pregnancy-, were responsible for 28.6% of deaths in Sub-Saharan

Africa. HIV/AIDS which falls under this category resulted in the deaths of 6.4% of mothers in the same area (Say *et al.*, 2016). The maternal mortality ratio was five times more in those with HIV as compared to those uninfected according to a study carried out in Rakai District in Uganda (Sewankombo *et al.*, 2000). Nevertheless, in many Sub-Saharan Africa countries there is not enough data to determine maternal deaths caused by pre-existing conditions due to under reporting.

In the first Confidential Enquiry into Maternal Deaths (CEMD) report in Kenya 2017 the majority of maternal deaths were caused by obstetric haemorrhage at 39.7%, non-obstetric complications at 19.8% and hypertensive disorders at 15.3%. Of the indirect causes of maternal mortality HIV/AIDS and anaemia were the highest, with death occurring in 1 out of every 5 women. It is also alarming to note that 9 of every 10 deaths was associated with substandard care. Distinguishing between direct and indirect causes of maternal deaths is especially important because they influence the intervention strategies employed. Illnesses such as tuberculosis, anaemia and malaria are preventable and easy to treat and so require collaborative efforts between disease control and maternal health departments (Ronsman & Graham, 2006).

Maternal health outcomes are a continuum from a natural pregnancy; maternal morbidity; severe maternal morbidity to maternal death (Geller *et al.*, 2002). Focusing on severe maternal morbidities may aid in pointing out interventions along the continuum and thus either preventing or stopping them from progressing to maternal deaths

The leading causes of maternal morbidity as reported in a WHO systematic review were hypertensive disorders; haemorrhage at different stages of pregnancy; puerperal infections; ectopic pregnancies; anaemia; urinary tract infections; perineal lacerations and postpartum depression. This has been echoed in other studies for example research done in Nigeria showed the prime cause of maternal near misses were hypertensive disorders and haemorrhage (Adeoye *et al.*, 2013). It is worth noting that urinary tract infections were the chief most pregnancy complications in the study carried out at PCEA Kikuyu Hospital (Ukachukwu *et al.*, 2009).

The magnitude of severe maternal morbidity globally has remained mostly unknown. However, studies have shown that maternal morbidity trends are similar to those of maternal deaths with higher numbers being shown in developing countries (Geller *et al.*, 2018). High income nations such as the United States have prevalence rates of 7.3 per 1000 deliveries and as low as 3.6 per 1000 deliveries in Ireland. It has been estimated to be approximately 198 per 100,000 live births in Sub Saharan Africa (Geller *et al.*, 2018).

Certain factors have been significantly associated with maternal morbidity. Socioeconomic and demographic factors such as income, education level and age have notably been associated with maternal morbidity with those from lower classes having a greater chance of experiencing SMM (Domingues *et al.*, 2016; Rosendo *et al.*, 2017). Chronic hypertension, diabetes and other pre-existing conditions have been shown to have a marked impact as a risk factor to SMM (Adeoye *et al.*, 2013). Obstetric interventions, especially caesarean sections and aided vaginal deliveries have also been seen to increase the odds of SMM (Adeoye *et al.*, 2013; Domingues *et al.*, 2016).

2.2 Determinants of Maternal Mortality and Morbidity

This study will focus on: the mode of delivery, age, parity and the three-delay model identified from previous research studies.

2.2.1 Mode of Delivery

Modes of delivery include forceps delivery, spontaneous vaginal delivery, vacuum delivery and caesarean section. Caesarean sections are indicated in prolonged or obstructed labour, antepartum haemorrhage, foetal distress, preeclampsia, eclampsia and uterine rupture. It is a critical intervention in pregnancy and according to the WHO it is recommended at a rate of 5-15% of all births. However caesarean sections have been associated with an increased likelihood for hysterectomy, blood transfusion ICU admissions and maternal death (Souza *et al.*, 2010). According to a study conducted in South Africa the risk of a mother dying after a CS (Caesarean section) was three times higher than if one had a vaginal delivery. The conditions

that were associated with death after CS included bleeding during and after the procedure; vascular collapse; anaesthesia related deaths; preeclampsia and eclampsia; embolisms; and sepsis. (Gebhardt *et al.*, 2015). There is therefore a need for ensuring that the procedure is performed only when the benefits outweigh the additional risks associated with it.

In a national survey carried out in Brazil between 2011- 2012, three levels of variables were investigated to determine their influence on maternal near misses (MNM). The first level was socio-economic and demographic variables namely age, education level, self-reported colour, conjugal status and number of previous CSs. The second level was maternity related variables which consisted of prenatal care, obstetric complications and the sum of maternity facilities explored before admission which resulted in delayed interventions. The final level was type of delivery which was classified as elective CSs, intrapartum C- sections and vaginal and forceps deliveries. After adjusting for pregnancy complications elective caesareans, prenatal care and sociodemographic variables increased the odds of MNM after a CS by nearly twice while forceps deliveries had the greatest likelihood of MNM. The study findings also showed that pregnancy complications, a lack of antenatal care, and delays when searching for delivery services were associated with maternal near misses in Brazil (Domingues *et al.*, 2016).

In relation to caesarean sections in Kenya only 9% of births were conducted through this method with women in towns and cities more likely to have caesarean sections at 15% (KDHS, 2014). Those with more education, finances as well as those more advanced in age also had a higher chance of having a caesarean section. According to the 2017 Kenyan Confidential Enquiry into Maternal Deaths (CEMD) report, of all the women who died and had delivered 63.2% had vaginal births; 2% by assisted vaginal delivery and 36.9% by caesarean section. Moreover, according to Ukachukwu *et al.*, (2009) C-sections accounted for the greatest number of septic wounds that could easily lead to septicaemia in the study carried out at PCEA Kikuyu Hospital.

2.2.2 Age

Age as a demographic variable has been shown to determine the risk of pregnancy related deaths among women with being very young or older increasing their risk markedly (Blanc *et al.*, 2013). For younger women aged below 20, the reason may be due to incomplete pelvic development that puts them at risk of obstructed labour. As for the older women this risk has been attributed to physiological changes such as reduced cardiac function and muscle atrophy (Lisonkova *et al.*, 2017).

Those advanced in age are at risk of conditions such as hypertension as a direct result of pregnancy (Blanc *et al.*, 2013). According to a comparative study by Stewart *et al.*, (1997) age is often confounded further because both the younger (<20 years) and older (>34 years) are less likely to seek comprehensive antenatal care. This may be attributed to unplanned pregnancies in the younger women and overconfidence and ignorance of increased risk in the older group.

(Black *et al ed.*, 2016)

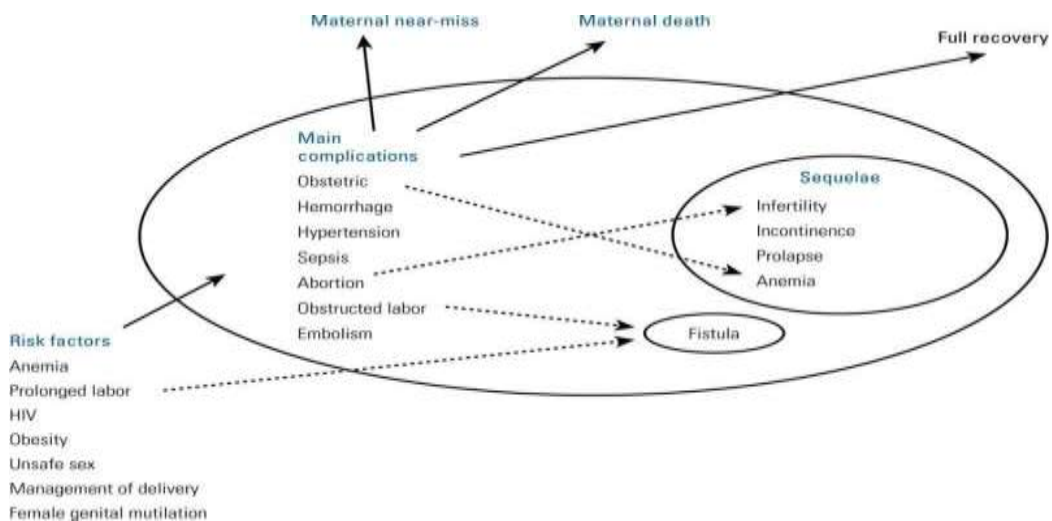


Figure 2.1: Conceptual framework in maternal health

According to a population-based study carried out in Washington State in the US the incidence of obesity, gestational diabetes and hypertension was found to increase with advance in maternal age. Moreover, the rates of severe maternal morbidities were higher among teenagers and those 39 years and above (Lisonkova *et al.*, 2017).

However, after adjustment for confounding factors such as social support among the 15–19-year-olds their risk for most maternal morbidities remained relatively similar to the 20–25-year-olds except for sepsis. Those mothers aged 40–44 years had a three times chance of suffering from shock; at an increased risk for cardiomyopathies and about eight times more likely to have amniotic fluid embolism. For those aged 45 years and above they had an elevated risk for renal failure even after adjustment for hypertension, preeclampsia and caesarean delivery. Moreover, caesarean sections were found to be common among mothers of advanced age (Lisonkova *et al.*, 2017).

The first CEMD report done in Kenya found that the median age of women who died was 27 years with the youngest being 14 years and the oldest 47 years. This is similar to findings of a maternal mortality age patterns study that found maternal deaths to be highest in the 25–29 age group and suggest that awareness efforts to reduce maternal deaths be concentrated in this age group and adjacent age groups of 20–24 and 30–34 (Blanc *et al.*, 2013).

2.2.3 Parity

The parity of a woman has also been found to influence maternal mortality. The Kenyan CEMD report of 2017 found that 63.7% of the maternal deaths investigated occurred in those on the first, second or fifth or more pregnancies. Parity has also been seen as a factor influencing ANC attendance. In a study carried out in Emevor Nigeria on determinants of ANC, 19% of women with a parity of > 4 used ANC while of those with a parity of 1–4 the percentage was 71.5% (Avusi *et al.*, 2009).

Following a study comparing ten high fertility countries (Chad, Benin, Niger, Nigeria, Mali, Ghana, Malawi, Pakistan, Tanzania and Haiti) for the relationship between high parity and 9 maternal health interventions; it was implied that maternal mortality could be reduced by close to a third with directed efforts in these health services (Sonneveldt *et al.*, 2013). Furthermore, they found a strong relationship between parity and maternal health coverage with those of high birth order quite unlikely to receive important maternal and child health services. This is thought to be due to cost implications, having less time because of the large number of children or due to a sense of less urgency as a result of experiences in previous pregnancies.

In contrast a study carried out in India found that those with a low parity were at a slightly higher risk for maternal morbidity. This was attributed to early marriages which take place when the women are in their teen years (Quraishi *et al.*, 2017).

2.2.4 The Three Delay Model

The three-delay model conceptualized by Thaddeus and Maine (1994) puts determinants of maternal deaths and maternal complications into simple and action-oriented classes. They put across that delay in receiving the required care is in three phases.

The first phase is a delay in looking for care by the individual and family. This relates to the decision maker; the women's status; the nature of the illness; approximate distance from the health facility; monetary cost of care; preceding incidences with healthcare providers and the perceived quality of care.

The second phase is a delay in arriving at a health facility with adequate personnel and amenities. This is influenced by the physical environments' accessibility; type and cost of transport as well as quality of roads.

The third phase is a delay in obtaining quality care at the facility. This can be due to poor referral systems; lack of equipment and supplies; shortage of personnel and training of available health personnel. According to the Kenyan CEMD report of 2017 poor standards of care accounted for a notable increase in maternal deaths especially beyond normal work hours.

There was a striking association between phase one and two delays in a study carried out in Nigeria which found approximately three fifths of those with SMM having experienced either delays in resolving to seek care, transport issues or seeking care in inadequately equipped facilities (Adeoye *et al.*, 2013). This study found an insulating effect from near misses among those with adequate insight on pregnancy complications. There were similar findings in Uganda after a systematic review of maternal near misses revealed that 25% of women who delayed seeking healthcare did not appreciate the severity of their condition. Insufficient fund for transport and

medical fees as well as advice from relatives against seeking care as reasons that contributed to delayed access to emergency care were cited by 1 in 5 women interviewed in the study. The role of men as decision makers was also shown to contribute to the second delay whereby up to a quarter of the near misses reported that their spouses were reluctant to give money to seek care (Okong *et al.*, 2010).

Third delay issues were enumerated in 40% of cases whereby lack of health care providers was sited with waiting times of between 1 to 4 hours reported Okong *et al.*, 2010).

However, some loopholes have been identified with the three-delay model as it assumes that most complications arise when mothers are still at home and does not take into consideration that quite a number of maternal complications arise after discharge from hospital (Pacagnella *et al.*, 2012).

2.3 Interventions to Reduce Maternal Mortality and Morbidity

Available literature shows that the maternal mortality rates of about 10 per 100,000 live births seen in high income countries and some middle-income countries have been achieved in the last century (Goldenberg and McClure, 2015). The interventions attributed to this decrease include: the implementation of antenatal care; deliveries in hospitals; use of available antibiotics to treat infections; advancement in anaesthesia, blood transfusion and making caesarean sections safer among others. In Africa accessibility and availability of these interventions is still limited especially for those in inaccessible areas.

Transitional nations such as Thailand, Sri Lanka and Malaysia achieved remarkable reduction in maternal mortality between 1960 and 1984. Thailand for example had a reduction in maternal deaths from about 400 deaths per 100,000 live births to 50 deaths per 100,000 live births in this period. Such significant differences have been attributed to a combination of interventions. These include long term investment in referral hospitals and midwifery training; regulation, control and supervision of health professionals and free maternal services (Ronsman and Graham, 2006).

Conversely these interventions can also have a marked impact in reducing maternal mortality and morbidity in Kenya.

Furthermore, certain interventions have shown a protective association against maternal morbidities. For example, the study on determinant of maternal morbidity in Nigeria by Adeoye *et al.*, (2013) showed that antenatal care had a shielding effect against maternal near misses. Assessment of ANC attendance and quality will therefore prove useful to this study as a determining factor.

2.3.1 Antenatal Care

According to the KDHS (2014) of all women with a live birth in Kenya 96% of them received prenatal care at least once from a skilled provider for their most recent pregnancy. Those women in urban areas had a slightly greater chance of receiving prenatal care from a skilled provider at 98% than those in rural areas at 94%. The percentage drops to 58% when examining how many attended the recommended four or more ANC visits.

In addition, the KDHS (2014) found that 69% of women with a live birth received iron supplements during their pregnancy while 51% of women received at least two tetanus injections during their last pregnancy. There was more use of antenatal services among women from urban areas, women with lower births order and women with higher education and wealth.

The (2017) CEMD report also showed that of every 10 women who died only 5 attended ANC and only one in five of those who attended ANC had at least four visits. This shows that increased ANC coverage could have a positive impact in reduction of maternal deaths.

Moreover, it was also noted that urinalysis test was the least performed test at 22.3% and HIV status was not recorded in 45.2% of the cases examined. This shows there is still a gap in giving the recommended care and proper documentation of vital information.

2.3.2 Deliveries in a Health Facility

The KDHS (2014) also found that of all live births for the five-year period preceding the survey only 61% were carried out in a health facility. Even though there has been an increase from the 43% of the KDHS (2008/9), approximately 4 out of 10 women in Kenya deliver at home with little or no skilled care. Mothers aged 35-49 had a smaller chance of delivering in a health facility at 52.5%. This was in contrast to those aged 20-34 who had a 62% rate of facility deliveries. What's more the greater the number of ANC visits a mother had the greater her odds of delivering at a health facility. Those in metropolitan areas were at a higher probability of being born at a health facility (82%) as compared to those in rural areas (50%). Health facility deliveries also increased among more educated and wealthy mothers.

Assistance during delivery was at 62% by a skilled birth attendant; 13% by friends and relatives; 19% by traditional birth attendants and 5% of births were unassisted. There has been a notable increase in the births assisted by a skilled provider from 44% according to the KDHS (2008/9) to the current 62% from the 2014 survey.

What's more suboptimal care was noted in the care of 92.4% of women who died with 73.3% of deaths occurring during outside normal working hours, weekends and public holidays as compared to 26.7% which occurred during normal working hours and weekdays (CEMD, 2017).

2.3.3 Postnatal Care

According to the WHO (2015) findings, a large number of maternal deaths occur during the postnatal period making it a critical time in the care of mothers and their new-borns. A systematic review on the timing of maternal mortality found that majority of maternal deaths happened on the first day (48.9%), with 24.5% of deaths occurring between days 2 and 7, and 24.9% occurring between days 8 and 42 (Dol et al., 2022). In Kenya's Demographic Health Survey (2014) report, 53% of women received postnatal care two days post-delivery with only 36% of new-borns being examined during the same period. In addition of all those neonates delivered in a health facility 52% did not receive postnatal check-ups. This shows a huge gap in the

delivery of care. A study by Pattison and Alin (2011) showed that a greater count of stillbirths, maternal deaths and neonatal deaths could be averted by skilled care as well as essential and thorough emergency obstetric care. Proper and systematic management of the third stage of labour was also shown to reduce maternal deaths by a significant amount.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

The study design engaged was a cross sectional analytical survey. The study collected information from respondents and from medical records on the factors associated with maternal morbidity at Kenyatta National Hospital.

3.2 Study Site

The study was carried out at Kenyatta National Hospital (KNH) Nairobi, Kenya. KNH was purposely selected because it is the leading referral hospital in East and Central Africa and would therefore give a realistic snapshot of the state of maternal health. It also provides an environment for medical research. It was established in 1901 and is now a leading player in the health sector in Kenya (KNH, 2020).

The hospital is located along Hospital Road off Mbagathi road. It covers an area of 45.7 hectares and within the hospital are other training institutions such as Kenya Medical Research Institute, National Laboratory Service (Ministry of Health) the University of Nairobi's College of Health Sciences and the Kenya Medical Training College.

The hospital has 50 wards, 22 outpatient clinics, 24 theatres and an Accident and Emergency department. The bed capacity is 1800, 209 of which cater for the private wing. Consultant specialists' offices are located at the Doctors Plaza near the Accident and Emergency area. Of the current total staff population of 4754, 2678 are the technical staff consisting of doctors, nurses, pharmacists, dentists and paramedics.

The department of Obstetrics and Gynaecology at the hospital provides antenatal care; maternity services; postnatal care; fertility services; emergency gynaecology; cervical cancer screening; family planning among others. They provide maternal care to nearly 10,000 women annually. Their sources of maternity patients include

referrals from other facilities; the antenatal clinics scheduled clients as well as those who come from home for delivery. Maternity patients have a separate triage area so as to prioritize them especially for the emergencies. Facilities available to them include: a maternity theatre and an acute room for those critically ill and require close monitoring. However, for those requiring dialysis and ICU care, they use the same facilities as other patients. There are approximately 8 nurses per shift in the maternity wards caring for about 77 patients. There are three maternity wards which on average have approximately 924 women admitted every month. This served as my N that is my estimated population size.

3.3 Study Population

3.3.1 Inclusion Criteria

- All postnatal women admitted in the maternity wards.
- Those who could give informed consent.

3.3.2 Exclusion Criteria

The study excluded:

- Those whose pregnancies terminated before 20weeks.
- Those who declined to give consent.

3.4 Sampling

3.4.1 Sample Size Determination

Sample size was determined using Fischer's formula:

$$n = \frac{Z^2 p(q)}{d^2}$$

Where;

n = the desired sample size (if the target population is > than 10000)

Z= the standard normal deviate at the required confidence interval in our case 1.96

p = the proportion in the target population estimated to have the characteristics being measured in this case 14.98% in Africa, according to a systematic review of studies on maternal morbidity by Tuncalp *et al.*, 2012.

q= the proportion of the target population without the characteristic being measured.

d= the level of statistical significance set.

We have our p at 14.98% and the precision at .05 level.

p≈ 15%

The sample size is:

$$n = \frac{1.96^2 0.15(0.85)}{0.05^2}$$

$$n=195.9$$

$$n \approx 196$$

However, the target population was less than 10,000. Hence the sample size was adjusted using the formula:

$$nf = \frac{n}{1 + \frac{n}{N}}$$

nf= the desired sample size (if the target population is <10000)

n= the desired sample size (if the target population is > than 10000) which is 196

N= the estimate of the population size. In our case it is 924

$$nf = \frac{196}{1 + \frac{196}{924}}$$

$$nf = 161.7$$

$$nf \approx 162$$

3.4.2 Sampling Method

The study employed the systematic sampling technique. This required estimating of k , this is the sampling ratio.

$$k = \frac{N}{nf}$$

$$k = \frac{924}{162}$$

$$k = 5.7$$

$$k \approx 6$$

Then using simple random sampling between 1 -6, the first respondent was obtained. The subsequent respondents were 1st + k . The respondents were obtained from the maternity wards. The details of the research study were explained to the women including, the benefits of the study, the option to opt out of the study, if need be, assurance of privacy and assurance of confidentiality. Thereafter any postnatal woman who was willing to sign a written informed consent answered questions from the questionnaire with the help of a research assistant with some of the data being obtained from their antenatal books and medical records. In the likelihood that a woman who was critically ill was sampled, the questionnaire was administered to them prior to discharge when they were able to answer the questions. The study was carried out for a period of one month with the help of two research assistants.

3.5 Data Collection

3.5.1 Data collection instrument

The data collection instrument was a structured questionnaire (Appendix B) administered by research assistants. The questionnaire had been developed after an in-depth literature review focusing on the main objectives of the study: socioeconomic and demographic factors; antenatal care; three delay model and the mode of delivery. The responses from the women were then used in data analysis. The questionnaire was accessed via the Kobo Toolbox mobile data collection application which is a convenient way to collect and analyse data.

3.5.2 Data collection procedure

Once respondents had been sampled and had given their consent to participate in the study, the research assistants found a quiet place to conduct the interview so as to provide privacy to the respondent. The research assistants proceeded to ask them questions in addition to asking for their antenatal booklets so as to answer some of the questions in the questionnaire. Moreover, they obtained information on the diagnosis and its severity from the respondents' medical records. The interview took about 15 minutes. It took an additional 10 minutes to read through the respondents' medical records and to check for completeness of the responses. Finally, the research assistants saved the completed questionnaire forms on the Kobo Toolbox mobile application and uploaded them at the end of the day. The research assistants used serial numbers written both on the consent forms and questionnaire to ensure anonymity while keeping track of the number of respondents interviewed.

3.5.3 Selection and training of research assistants

Two research assistants were recruited from among nursing and medical students due to the medical terminologies in the research questions. They were also fluent in both English and Swahili. They took part in a one-day training on the objectives and methodology of the study; interviewing techniques; ethical considerations and a standardized method of asking questions. They were also trained on the use of the

Kobo Toolbox mobile data collection application which included obtaining a blank form; recording the responses on the questionnaire form and uploading them. In addition, they practiced collecting data during the pre-testing of the questionnaire.

3.6 Quality assurance

3.6.1 Measure of validity and reliability

This study ensured the sample obtained and the target population had similar salient characteristics so as to establish its accuracy and meaningfulness. This was done through carrying out probability sampling as opposed to biased sampling. Moreover, pre-testing was done to ascertain the reliability of the questionnaire.

3.6.2 Pretesting

Pretesting of the study components and the study tool was done at Mbagathi Hospital to assess clarity of the questions to respondents; determine the time taken to administer the questionnaire and identify any biases. The research assistants administered 10 questionnaires for the pretesting exercise. They found that some questions that were left optional needed to be compulsory as they were crucial to the study. This information was used to improve the questionnaire and to test its effectiveness in obtaining the required data.

3.6.3 Other quality measures

The integrity of the data was maintained through various ways. First the research assistants were trained with an emphasis on the importance of accurate data; ethical practices and complete questionnaires. Moreover, they were required to keep a research journal documenting errors in the questionnaire as well as changes in the data collection procedure over time. Integrity was also maintained through a proper understanding of the roles; the research assistants in data collection and my role as the principal investigator in reviewing the data and providing guidance where inconsistencies or wrong coding was observed. The questionnaires were checked daily for completeness and missing records were communicated to prevent a repeat of the same. Moreover, daily communication via phone calls on the progress of data

collection and challenges encountered were made in addition to weekly site visits to observe the actual data collection. An additional 10% of respondents were interviewed to cater for incomplete or missing records bringing the number to 180. Lastly the data was stored in a password protected computer as well as on the password protected Kobo toolbox cloud storage.

3.7 Data Management and Analysis

Data was collected using Kobo Collect system and entered into a password protected Kobo Toolbox Database. The consent forms from the study participants were stored in a lockable cabinet in the Principal Investigator's office during collection and after analysis. Upon completion of data collection, hard copy consent forms were compared with the entered data to confirm synchrony.

Descriptive statistics were carried out where discrete variables were summarized with frequencies and percentages while continuous variables were summarized using measures of central tendency and dispersion such as mean, median, mode and standard deviation.

As the main variable of interest, factors associated with severe maternal morbidity were identified using Chi-squared tests and Fisher's exact tests at a confidence level of 95%, significance level of p value < 0.05 . Some of these factors include age, socio-economic status, pre-existing medical conditions, medical history, reproductive history, antenatal care, delays before seeking care among others.

During multivariate analysis, adjustments were made for confounders and effect modifiers in the model to determine independent factors associated with severe maternal morbidity using proportional ordinal logistic regression. All analysis was carried out using R version 4.2.1 software using the Probit model and presented using tables, graphically and in prose.

3.8 Ethical consideration

Approval was sought to conduct the study from the KNH-UoN ethics and research committee. Authorization was obtained under protocol number: P923/11/2019.

Authorization was also obtained from the Kenyatta National Hospital Obstetrics and Gynaecology department. Study participants signed an informed consent prior to taking part in the study. They were informed that participation was voluntary and that any information they gave would be handled with utmost confidentiality and only available to the study participants. They were informed of the benefits and risks and explained that they could withdraw from the study at any time. Questionnaires only had serial numbers on them. No identifiers such as names or initials were obtained to ensure participation remained anonymous. Moreover, participants were assured that all the data obtained would be used only for the purpose of the study.

CHAPTER FOUR

RESULTS

4.1 Socioeconomic and demographic characteristics of the mothers

A total of 180 postnatal women admitted in the maternity wards at Kenyatta National Hospital were recruited within a duration of four weeks between March 2020 and May 2020. This took more than a month because the Coronavirus 19 pandemic hampered data collection.

4.1.1 Age

The mean age of the respondents was 28 years (with a standard deviation of 6). The youngest respondent was 16 years while the oldest was 42 years. Figure 4.1 shows the distribution of the respondents according to age. The majority of them (52%) were aged between 20-29 years followed by those aged between 30-39 years at 36%. Those above 40 years were at 5.6 % (n=10), while 16–19-year-olds were 6.7% (n=12).

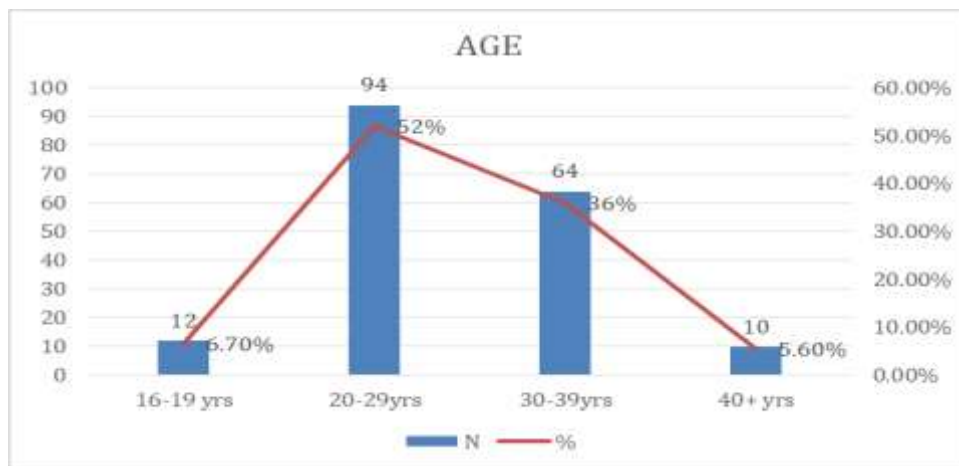


Figure 4.1: Age distribution

4.1.2 Residence

A large proportion of the women resided in the county of Nairobi at 69% (n=124) followed by Kajiado county at 12% (n=22) and Kiambu at 8% (n=14) (Figure 4.2).

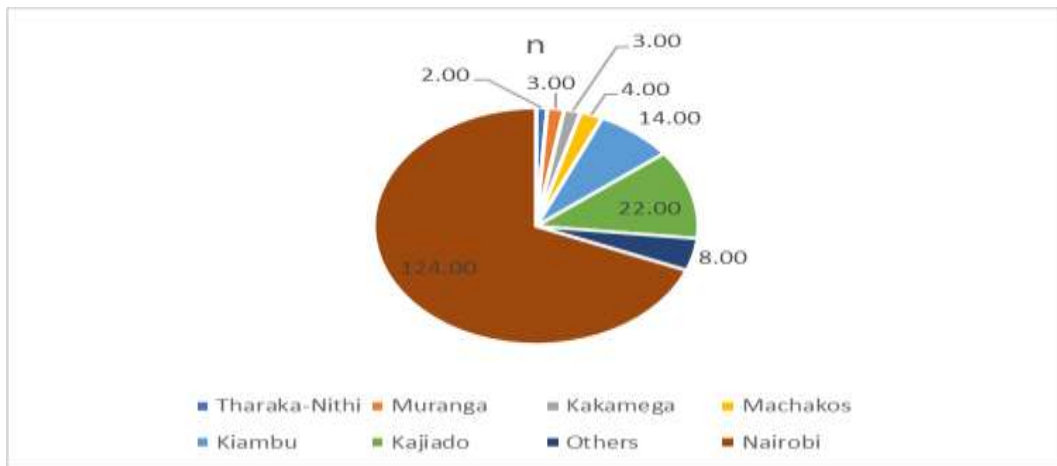


Figure 4.2: Respondent's residence

4.1.3 Marital status

The majority of women were married at 80.6% (n=145) with 16.1% (n=29) being single, 2.8% (n=5) being separated, 0.6% (n=1) being divorced and none being widowed. (Table 4.1)

4.1.4 Education and income

Most of the women had a secondary school education 39.4% (n=71) followed closely by those with some form of tertiary education at 38.3% (n=69); while 22.2% (n=40) had only a primary school education. Most of the husbands had a tertiary education at 42.6% (n=72), while 36.1% (n=61) had a secondary school education. 14% (n=26) had a primary school education while 12% (n=21) had none (Table 4.1).

Those respondents' whose main source of income was from informal employment were 35% (n=63), 33% (n=60) had no source of income and 32% (n=57) were formally employed. Most of the women 32% (n=57) reported a monthly income of less than Sh3000. 20% (n=36) reported earning Sh3000-10,000, 21% (n=37) reported earning between Sh10,000 and 20,000, 14% (n=25) earning Sh20,000-30,000 while an equal number 14% (n=25) earned more than Sh30,000 in a month (Table 4.1).

Table 4.1: Socioeconomic information of respondents

| Demographic characteristic of postnatal women admitted in KNH, 2020 | | |
|--|----------|--------------|
| Characteristics | N | N=180 |
| Marital status | 180 | |
| Married | | 159(88.3%) |
| Single | | 15(8%) |
| Separated | | 5 (2.8%) |
| Divorced | | 1(0.6%) |
| Highest Education | 180 | |
| Primary | | 40(22%) |
| Secondary | | 71(39%) |
| Tertiary | | 69(38%) |
| Husband education | 180 | |
| Tertiary institution | | 72(40%) |
| Secondary | | 61(34%) |
| Primary | | 26(14%) |
| Below Primary | | 21(12%) |
| Source of income | 180 | |
| Formal employment | | 57(32%) |
| Informal employment | | 63(35%) |
| Not employed | | 60(33%) |
| Monthly income | 180 | |
| 10000-20000 | | 37(21%) |
| 20000-30000 | | 25(14%) |
| 3000-10000 | | 36(20%) |
| >30000 | | 25(14%) |
| <3000 | | 57(32%) |

During bivariate analysis, socioeconomic and demographic factors namely; age ($p=0.5$), marital status ($p=0.2$), education of both the respondents ($p=0.3$) and their husbands ($p=0.5$), source of income ($p=0.4$) were not found to be significant (CI 95%). Monthly income however was found to be significant at p value of 0.044 (Table 4.2).

At multivariate analysis, monthly income was no longer significant while being single became significant at p value <0.02 . A single mother was less likely to have a severe maternal morbidity at odds ratio of 3.11 (95% CI 1.20, 8.11).

Husband's education became significant after adjustment during multivariate analysis. A woman whose husband had less than a primary education was at a higher probability of suffering a moderately severe maternal morbidity OR- 0.24 (95% CI 0.07, 0.75) than one whose husband had at least a secondary education.

Table 4.2: Bivariate analysis

| Bivariate Analysis | | | | | |
|--|------------------------------------|-----------------------------------|--|---------------------------------------|------------------|
| Characteristics | Maternal morbidity severity | | | | p-value |
| | N=180 | severe, N=65 (65%) | moderately severe, N=51 (28%) | not severe, N=64 (36%) | |
| Marital status | | | | | 0.2 |
| Married | 145(81%) | 56(86%) | 37(73%) | 52(81%) | |
| Single | 35(19%) | 9(14%) | 14(27%) | 12(19%) | |
| Highest Education | | | | | 0.3 |
| Primary | 40(22%) | 13(20%) | 14(27%) | 13(20%) | |
| Secondary | 71(39%) | 21(32%) | 22(43%) | 28(44%) | |
| Tertiary | 69(38%) | 31(48%) | 15(29%) | 23(36%) | |
| Source of income | | | | | 0.4 |
| Formal employment | 57(32%) | 21(32%) | 11(22%) | 25(39%) | |
| Informal employment | 63(35%) | 23(35%) | 21(41%) | 19(30%) | |
| None | 60(33%) | 21(32%) | 19(37%) | 20(31%) | |
| Monthly income | | | | | 0.044 |
| 10000-20000 | 37(21%) | 17(26%) | 6(12%) | 14(22%) | |
| 20000-30000 | 25(14%) | 8(12%) | 3(5.9%) | 14(22%) | |
| 3000-10000 | 36(20%) | 9(14%) | 16(31%) | 11(17%) | |
| >30000 | 24(14%) | 11(17%) | 9(18%) | 5(8%) | |
| <3000 | 57(32%) | 20(31%) | 17(33%) | 20(31%) | |
| Pregnancy end | | | | | <0.001 |
| Live birth | 167(93%) | 54(83%) | 50(98%) | 63(98%) | |
| Still birth | 13(7%) | 11(17%) | 1(2.0%) | 1(1.6%) | |
| Antennal care | | | | | 0.6 |
| >4 | 138(77%) | 52(80%) | 37(73%) | 49(77%) | |
| 1-3 | 42(23%) | 13(20%) | 14(27%) | 15(23%) | |
| HIV Status | | | | | 0.7 |
| Negative | 168(93%) | 59(91%) | 48(94%) | 61(95%) | |
| Positive | 12(7%) | 6(9%) | 3(6%) | 3(5%) | |
| Parity Gravity | | | | | 0.8 |
| 2 | 48(27%) | 15(23%) | 14(27%) | 19(30%) | |
| 3+ | 49(27%) | 19(29%) | 14(27%) | 16(25%) | |
| >5 | 11(6%) | 6(9%) | 3(7%) | 2(3%) | |
| Prim gravida | 72(40%) | 25(38%) | 20(39%) | 27(42%) | |
| Ever had abortion or miscarriage | | | | | 0.4 |
| Had abortion/miscarriage | 53(29%) | 23(35%) | 14(27%) | 16(25%) | |
| Never had abortion/miscarriage | 127(71%) | 42(65%) | 37(73%) | 48(75%) | |
| Any complication/pre-existing condition | | | | | <0.001 |
| Had complication/pre-condition | 69(38%) | 42(65%) | 13(25%) | 14(22%) | |
| Never had complication/pre-condition | 111(62%) | 23(35%) | 38(75%) | 50(78%) | |
| Danger signs | | | | | <0.001 |
| Experienced any danger signs | 62(34%) | 34(54%) | 15(29%) | 12(19%) | |
| Did not experienced any danger signs | 118(66%) | 30(46%) | 36(71%) | 52(81%) | |
| Problem obtaining transport | | | | | 0.5 |

| | | | | | |
|--|----------|---------|---------|---------|------------------|
| Had transport problem | 24(13%) | 8(12%) | 9(18%) | 7(11%) | |
| Never had transport problem | 156(87%) | 57(88%) | 42(82%) | 57(89%) | |
| Mode of delivery | | | | | 0.04 |
| Spontaneous vaginal delivery | 75(42%) | 26(40%) | 15(29%) | 34(53%) | |
| Caesarean section | 105(58%) | 39(60%) | 36(71%) | 30(47%) | |
| Experienced any complication | | | | | <0.001 |
| Experienced any complication | 40(22%) | 26(40%) | 6(12%) | 8(12%) | |
| Did not experienced any complication | 140(78%) | 39(60%) | 45(88%) | 56(88%) | |
| Husband education | | | | | 0.5 |
| Tertiary institution | 72(40%) | 29(45%) | 15(29%) | 28(44%) | |
| Secondary | 61(34%) | 20(31%) | 18(35%) | 23(36%) | |
| Primary | 26(14%) | 10(15%) | 9(18%) | 7(11%) | |
| None | 21(12%) | 6(9%) | 9(18%) | 6(9.4%) | |
| Individual age | | | | | 0.5 |
| 16-19 years | 12(7%) | 3(5%) | 2(4%) | 7(11%) | |
| 20-29 years | 94(52%) | 35(54%) | 27(53%) | 32(50%) | |
| 30-39 years | 64(36%) | 23(35%) | 20(39%) | 21(33%) | |
| 40+ years | 10(5%) | 4(6%) | 2(4%) | 4(6%) | |
| Decision to seek health care | | | | | 0.6 |
| >1 hr | 62(34%) | 20(31%) | 20(39%) | 22(34%) | |
| <1 hr | 118(66%) | 45(69%) | 31(61%) | 42(66%) | |
| How near is the health facility | | | | | 0.08 |
| >1 hr | 21(12%) | 6(9%) | 3(5.9%) | 12(19%) | |
| <1 hr | 159(88%) | 59(91%) | 48(94%) | 52(81%) | |
| Time to receive care | | | | | 0.8 |
| >1 hr | 60(33%) | 20(31%) | 17(33%) | 23(36%) | |
| <1 hr | 120(67%) | 45(69%) | 34(67%) | 41(64%) | |
| Referred | | | | | <0.001 |
| Referred | 111(62%) | 49(75%) | 35(69%) | 27(42%) | |
| Not referred | 69(38%) | 16(25%) | 16(31%) | 37(58%) | |
| Receive any of these intervention | | | | | 0.008 |
| Blood transfusion | 18(10%) | 11(17%) | 3(5.9%) | 4(6%) | |
| ICU admission | 7(4%) | 6(9%) | 0(0%) | 1(2%) | |
| None | 155(86%) | 48(74%) | 48(94%) | 58(92%) | |

1 Statistics presented: n (%)

2 Statistics test performed chi-square test of independence, Fisher's exact test

4.2 Pregnancy outcomes

The respondents' whose pregnancies ended in a single birth were 87.8% (n=158); 5% (n=9) ended in multiple births; 6.1% (n=11) ended in stillbirths while 1.1% (n=2) ended in miscarriages <28weeks shown in figure 4.3. The women whose babies were still alive were 93% (n=167) while 7% (n=13) of the women's babies had died postnatally.

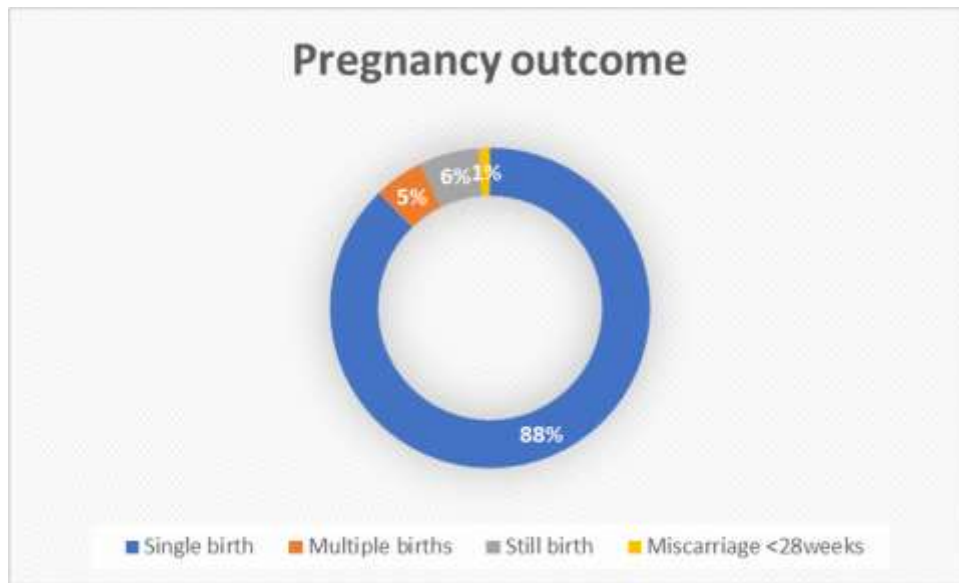


Figure 4.3: Distribution of pregnancy outcome

The pregnancy outcome of live birth or stillbirth was found to be significant at p value of <0.001 during bivariate analysis. This remained significant even after adjustment at $p = <0.0001$. Mothers who had a stillbirth were more likely to have a severe maternal morbidity at OR of 0.13 (95% CI 0.04, 0.36) which was above the threshold of severe morbidity (OR=0.18).

4.3 Severity of maternal morbidities

The women who experienced a severe maternal morbidity were 36.1% (n=65); 28.3% (n=51) experienced a moderately severe morbidity while 35.6% (n=64) did not experience a maternal morbidity (Figure 4.4). The prevalence of severe maternal morbidity at Kenyatta National Hospital was therefore 36.1%.

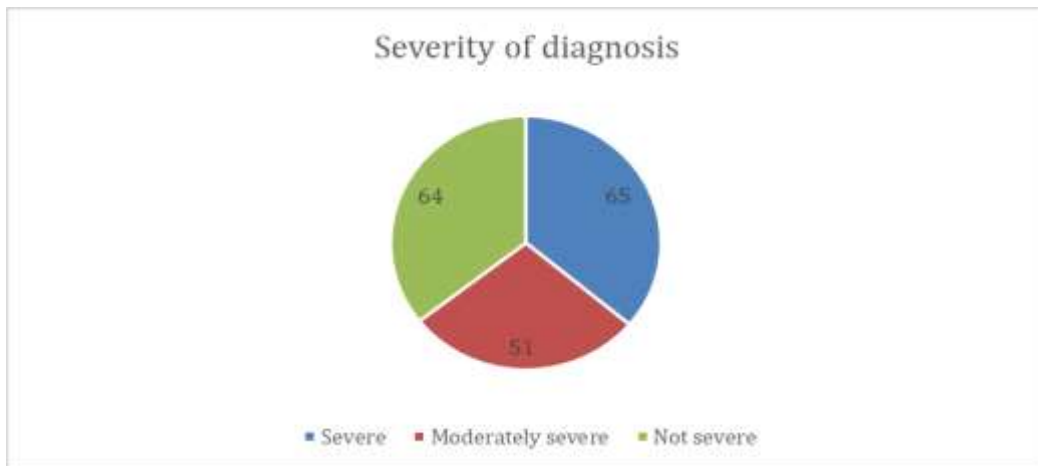


Figure 4.4: Distribution of severity of illness

4.3.1: Severe maternal complications/ morbidities

The most common severe maternal morbidity was preeclampsia/ eclampsia at 16% (n=25). Postpartum haemorrhage was at 4% (n=7) and sepsis at 2% (n=4) seen in figure 4.5.

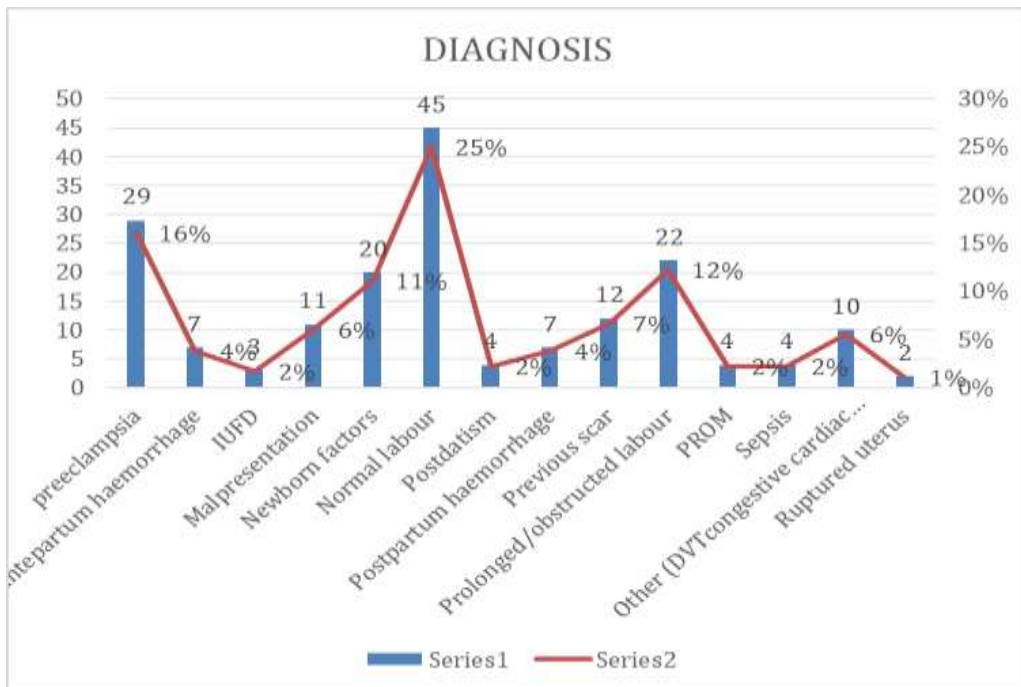


Figure 4.5: Diagnosis at admission

4.3.2: Critical interventions

The mothers who were admitted to the ICU were 3.3% (n=6), 10% (n=18) received blood transfusion while 0.6% (n=1) had a hysterectomy performed. Majority of the women 86.1% (n=155) did not receive a critical intervention. Receiving a blood transfusion and admission to ICU were significant at $p = 0.008$ during bivariate analysis but were not found to be significant after adjustment at $p = 0.5$ (95% CI 0.38, 1.60) and $p = 0.25$ (95% CI 0.09, 1.63) respectively.

4.4 Antenatal care

Uptake of antenatal services was as follows: 77% (n=138) of respondents attended more than four antenatal visits, 22% (n=39) attended 1-3 visits and only 3 (1%) respondents had not attended a single ANC visit (Figure 4.5).



Figure 4.6: Distribution of antenatal attendance

Figure 4.7 shows the respondents who had the important ANC tests carried out namely; HIV test, VDRL test, haemoglobin levels, blood group and at least one urinalysis. Having the ANC booklet was important since the research assistants used the booklets to obtain information on the number of ANC visits attended and tests done.

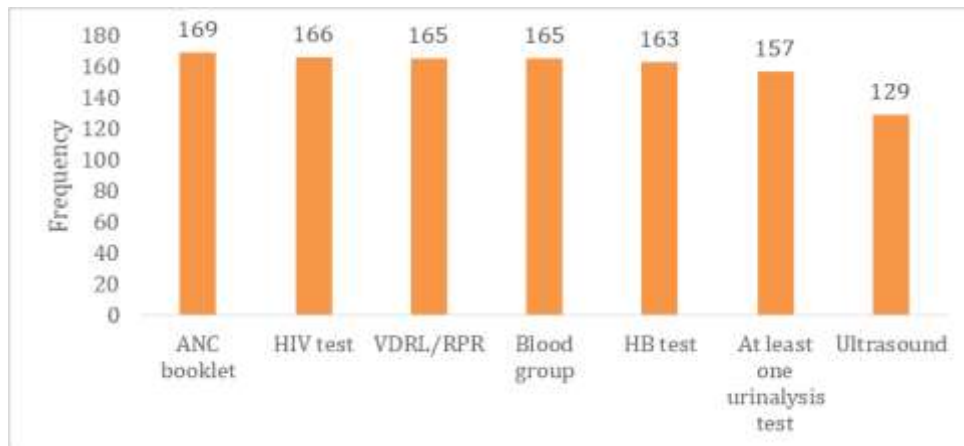


Figure 4.7: Distribution of uptake of ANC services

Antenatal care was not found to be significant at the bivariate level ($p=0.6$) when assessed with all variables of interest and also at the multivariate ($p=0.58$ 95% CI 0.70, 1.91) level of analysis.

4.5 Parity

Of the 180 respondents 40% ($n=72$) were first time mothers, 26.7% ($n=48$) were on their second pregnancy, 27.2% ($n=49$) were on their third or fourth pregnancy and 6.1% ($n=11$) were on their fifth or more pregnancy (Figure 4.8). To ascertain parity accurately the respondents were also asked whether or not they had ever had a miscarriage or abortion. 29.4% ($n=53$) said yes while 70.6% ($n=127$) said no.

Parity was not found to be significant at the bivariate level of analysis at $p= 0.8$ and also at the multivariate levels of analysis ($p=0.09$).

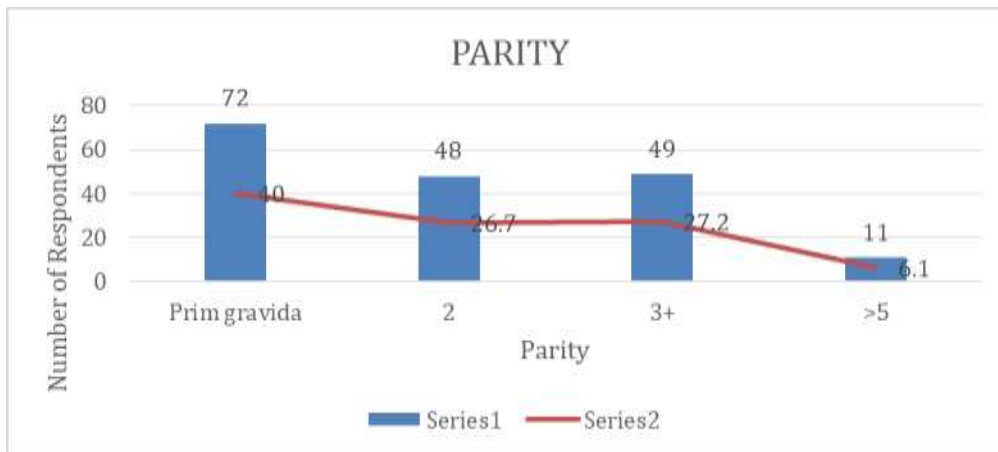


Figure 4.8: Parity of respondents

4.6 Pre-existing conditions

Hypertension was the most common pre-existing condition at 25.6% (n=21) followed by anaemia at 19.5% (n=16). Preeclampsia/eclampsia was at 14.6% (n=12), urinary tract infection at 11% (n=9) and per vaginal bleeding at 8.5% (n=7) shown in figure 4.9. Having a pre-existing condition was significant at $p < 0.001$ during the bivariate analysis and continued to be significant during the multivariate analysis at $p < 0.0001$ (95% 0.27, 0.63).

Mothers who had a pre-existing condition were more likely to suffer from a moderately severe diagnosis at OR= 0.41 (95% CI 0.27, 0.63).

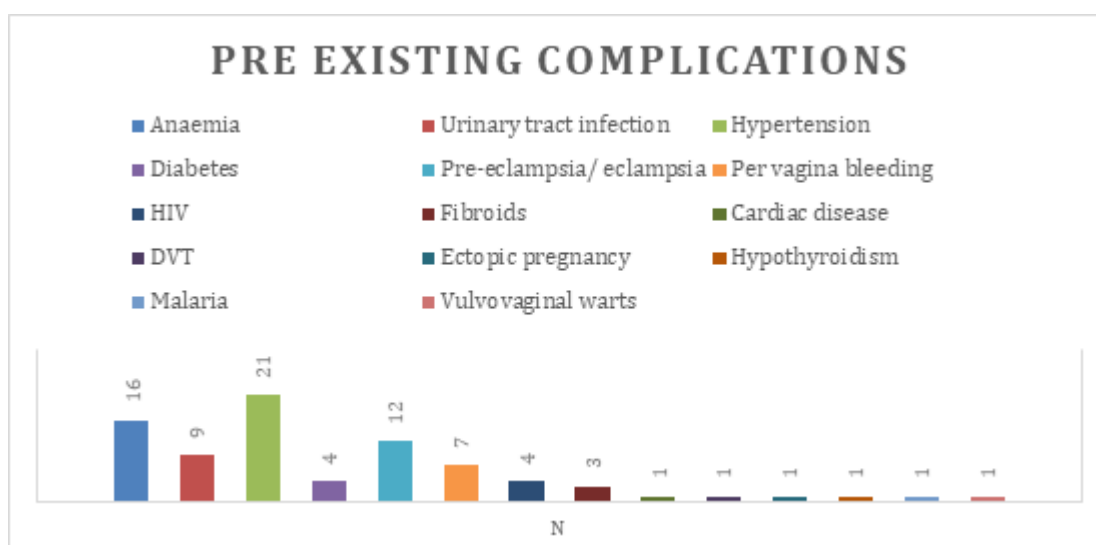


Figure 4.9: Respondents pre-existing conditions

4.7 The three delays

4.7.1 The first delay; delay to decide to seek care

The respondents who took less than one hour to make the decision to seek healthcare were 66%, while 34% took longer than one hour to make the decision. Of the 180 respondents, 34.4% (n=62) experienced a danger sign while 65.6% (n=118) did not (Table 4.3).

Table 4.3: First delay

| | | n | % |
|---|------|-----|------|
| I. Did you experience any danger signs? | Yes | 62 | 34.4 |
| | No | 118 | 65.6 |
| II. How long did it take you to make the decision to seek healthcare? | <1hr | 118 | 66 |
| | >1hr | 62 | 34 |

Those who experienced a delay 92% (n=55) did not think that the illness was serious, 18% (n=11) did not have enough money to access healthcare in case of an emergency while 5% (n=3) could not make the decision to seek care on their own without either husband or family involvement (Figure 4.10).

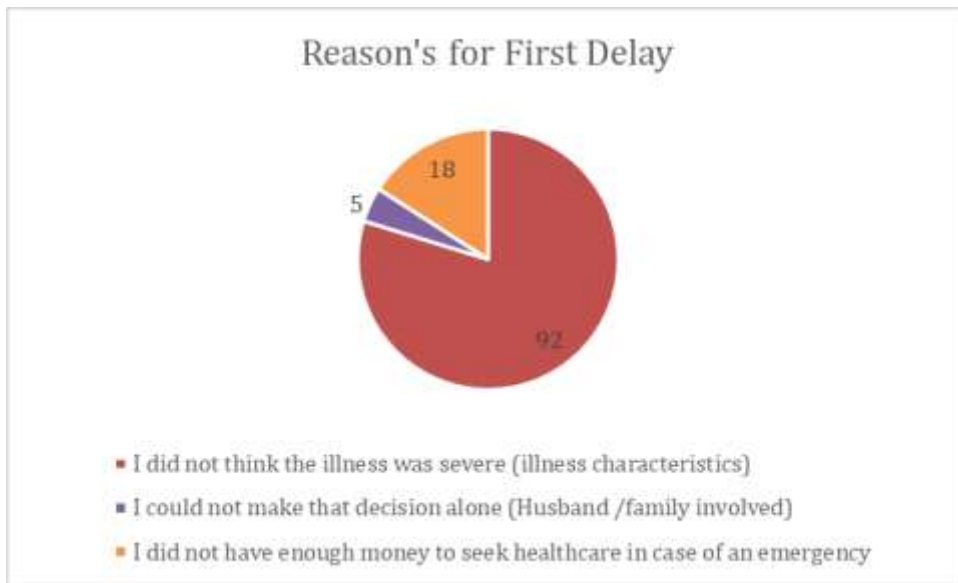


Figure 4.10: Reasons for delay in seeking care

4.7.2 Second delay; delay in arriving at health facility

Majority of the subjects 88% (n=159) responded that their homes are less than an hour from the nearest facility with 12% (n=21) living more than an hour away from the nearest health facility. Only 13.3% experienced problems obtaining transport to the hospital (Figure 4.11).

Of those who experienced a delay in arriving at the facility 58.3% (n=14) cited unavailability of vehicles to get them to hospital; 37.5% (n=9) cited lack of funds and 20.8 % (n=5) said that the roads were impassable.



Figure 4.11: Second delay

4.7.3 Third delay; delay in obtaining quality care

Once the subjects arrived at the facility, 67% (n=120) reported to have received care in less than one hour with 33% (n=60) reporting to have waited more than one hour to receive healthcare.



Figure 4.12: Reasons for delay in receiving quality healthcare

Figure 4.12 above shows that 42.1% (n=24) gave the admission process being lengthy as the reason for the delay; 33.3% (n=19) cited there not being enough health workers to attend them; 21.1% (n=12) reported that there were not enough supplies or facilities to attend to them; 1.8% (n=1) said they did not have enough money to

pay for the services while another 1.8% (n=1) cited that they required services that could not be provided at the facility.

4.7.3.1 Referral status

The majority of mothers had been referred from other hospitals at 62% (n=111) while only 38% (n=69) came to the facility directly from home. Referral is a component of the third delay as it implies that at the first facility they visited, there were not able to receive care.

During the bivariate analysis, experiencing a danger sign was significant ($p < 0.001$) while making a decision to seek care; nearness to health facility; transport problems and time taken to receive care were not found to be significant. Referral status of a respondent- a component of the third delay- was found to be significant at p value of < 0.001 .

At the multivariate stage of analysis, the first and second delays were not found to be significant. However, referral status remained significant at $p = 0.03$ with those who were not referred less probable to experience a severe maternal morbidity OR= 1.61 (95% CI 1.06, 2.46).

4.8 Mode of delivery

The respondents who had a caesarean section were 58% (n=105), while 42% (n=75) had a spontaneous vaginal delivery. Those subjects who did not experience complications postnatally were 78% (n=140), while 22% (n=40) had complications (figure 4.13).

The mode of delivery was significant at p of 0.04 during the bivariate analysis and remained significant during the multivariate analysis at $p = 0.01$. A mother who delivered via spontaneous vaginal delivery was less likely to suffer maternal morbidity at OR=1.78 (95% CI 1.19, 2.70).



Figure 4.13: Respondents' mode of delivery

4.9 Postnatal complications

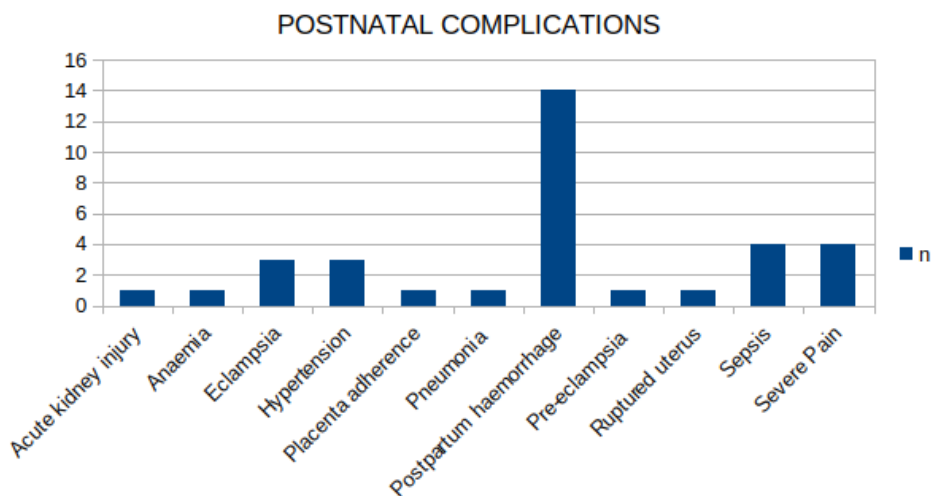


Figure 4.14: Postnatal complications

Of all the respondents 18.9% (n=34) experienced a complication postnatally. The most common complication was postpartum haemorrhage at 41.1% (n=14) shown in figure 4.14. Experiencing a complication postnatally was found to be significant at both the bivariate and multivariate analysis levels ($p = <0.001$ and $p = <0.0001$ respectively)

Table 4.4: Multivariate analysis

| Characteristic | Unadjusted OR | | | Adjusted OR | | |
|--|---------------|------------|---------|-------------|------------|---------|
| | OR | 95% CI | P value | OR | 95% CI | P value |
| Marital status | | | | | | |
| Married | — | — | | — | — | |
| Single | 3.54 | 1.30, 9.65 | 0.01 | 3.11 | 1.20, 8.11 | 0.02 |
| Pregnancy end | | | | | | |
| live birth | — | — | | — | — | |
| Still birth | 0.12 | 0.04, 0.34 | 0.00 | 0.13 | 0.04, 0.36 | <0.0001 |
| Any complication or pre-existing | | | | | | |
| Never had complication/pre-condition | — | — | | — | — | |
| Had complication/pre-condition | 0.41 | 0.27, 0.63 | <0.0001 | 0.41 | 0.27, 0.63 | <0.0001 |
| Danger signs | | | | | | |
| Did not experience any danger signs | — | — | | — | — | |
| Experienced any danger signs | 0.66 | 0.43, 1.03 | 0.06 | 0.63 | 0.41, 0.96 | 0.03 |
| Mode of delivery | | | | | | |
| Caesarean section | — | — | | — | — | |
| Spontaneous vaginal delivery | 1.85 | 1.21, 2.85 | 0.05 | 1.78 | 1.19, 2.70 | 0.01 |
| Did you experience any complication | | | | | | |
| Did not experience any complication | — | — | | — | — | |
| Experienced any complication | 0.44 | 0.25, 0.74 | 0.002 | 0.43 | 0.26, 0.73 | <0.0001 |
| Husband education | | | | | | |
| Tertiary institution | — | — | | — | — | |
| Secondary | 0.67 | 0.35, 1.29 | 0.23 | 0.68 | 0.36, 1.29 | 0.24 |
| Primary | 0.33 | 0.13, 0.79 | 0.01 | 0.34 | 0.14, 0.80 | 0.01 |
| None | 0.2 | 0.06, 0.67 | 0.01 | 0.24 | 0.07, 0.75 | 0.02 |
| Referred | | | | | | |
| Referred | — | — | | — | — | |
| Not Referred | 1.63 | 1.07, 2.49 | 0.02 | 1.61 | 1.06, 2.46 | 0.03 |
| Severe Moderately severe | 0.19 | | 0.02 | 0.18 | | 0.03 |
| Moderately severe Not severe | 0.59 | | 0.89 | 0.55 | | 0.94 |

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Prevalence of severe maternal morbidity

The prevalence of severe maternal morbidity at Kenyatta National Hospital during the one-month period was found to be at 36.1%. This was quite high compared to the prevalence in Africa determined from a systematic review of near miss studies which was at 14.98%. Moreover, this is even higher when compared to prevalence from Asia at 5.07% and North America at 1.38% (Tuncalp *et al.*, 2012). In addition to this a study carried out in Kenya on maternal near misses in 54 referral hospitals found the incidence of MNM to be at 7.2 per 1000 live births (Owolabi *et al.*, 2018). This high prevalence could be attributed to the fact that the majority of the patients who experienced a maternal morbidity had been referred from another facility (62%) hence the cases were more than could be attributed to care provided at this facility. Since KNH is the largest referral hospital in the country, they will also admit the most difficult cases which may also contribute to the high prevalence. Moreover, other diagnoses such as intrauterine foetal death and antepartum haemorrhage were included as severe maternal morbidity.

5.1.2 Socioeconomic and demographic factors associated with severe maternal morbidity

According to the results from this study age was not associated with occurrence of a severe maternal morbidity. This was contrary to studies carried out by Blanc *et al.*, (2013) and Linsokova *et al.*, (2017) which found that those who were very young and mothers older than 39 years had an increased risk for severe maternal morbidities. These differences could be because of a limited sample size which was not able to account for the other confounding factors. Age could also be confounded by good antenatal care sensitization in this particular population.

Furthermore, from this study's findings a single mother had a less chance of suffering from a severe maternal morbidity as compared to a married mother (OR=3.11 95% CI 1.20, 8.11 P=0.02). This result is contrary to that from a study carried out in Nigeria on the incidence and determinant of near miss morbidities which showed that unmarried women were three times more likely to experience a severe maternal morbidity as compared to their married counterparts (Adeoye *et al.*, 2013). Moreover, another case control study on establishing the risk factors of life-threatening maternal outcomes found no statistical significance with marital status in determining their occurrence (Goffman *et al.*, 2007). This could be because majority of the respondents were married and hence confounded the results to show that the single mothers were less likely to get an MNM.

While the mother's education level was not found to be significant, the woman whose husband had less than a secondary school education had a high likelihood of experiencing a severe morbidity at (OR=0.24 95% CI 0.07, 0.75 P=0.02). This finding is in line with that from a previous study carried out in Ghana on understanding the impact of mothers' education on utilization of health services which found that husbands' education was strongly associated with their wives increased use of health services (Greenaway *et al.*, 2012). This was correlated to education being a proxy to monetary resources which enable women access quality healthcare (Hobcraft, 1993). These findings suggest that married women still heavily depend on their husbands to make health decisions on their behalf.

5.1.3 Effect of parity on severe maternal morbidity

Parity of the mothers was not found to be significant which differs from a previous comparative study carried out of 10 highly fertile countries that found that parity was linked to maternal health coverage. Those of a high parity were found to be less likely to seek maternal health services (Sonneveldt *et al.*, 2013). This difference could be attributed to the good antenatal care uptake of most of the respondents despite their parity. Parity may also have been confounded by the women's age and education.

5.1.4 Effect of antenatal care on severe maternal morbidity

The study found that antenatal care was not significant in the likelihood of the occurrence of a severe maternal morbidity. This differed from a previous study carried out in Nigeria on the determinant of maternal morbidity that found that those who attended ANC were less likely to experience a SMM (Adeoye *et al.*, 2013). This variation may be as a result of a relatively good uptake of antenatal care among this study's respondents whereby only 1% (n=3) had no ANC attendance.

5.1.5 The three delays association with a severe maternal outcome

Women who had been referred from another facility before ending up at Kenyatta National Hospital were more likely to experience a severe maternal morbidity at $p=0.03$. Delays due to referral are an aspect of the third delay. Referral from other hospitals according to this study was because the facilities had limited resources and personnel to handle the patients' conditions. For example, those who required C-sections were referred due to lack of theatre facilities at the peripheral centres; while those with pre term babies were referred so as to access the new born intensive care unit at KNH. These findings are similar to those from a national survey carried out in Brazil (Domingues *et al.*, 2016) that found that women who searched at two or more health facilities to deliver had a fourfold odds of experiencing an MNM as compared to those who received care at the first facility, they sort care from. In addition, the study carried out in Kenya on maternal near misses also reported that most of their respondents had been referred and had already experienced the severe maternal outcome (Owolabi *et al.*, 2018).

Moreover, even though those who were referred accounted for 62% of all respondents, they all had to undergo the admission process. 42.1% of those who waited more than one hour stated that the admission process took "too long" and cited it as a source of delay. This implies a breakdown in the referral systems since there should be communication from the referring facility to the referral centre of a patient transfer. However, it is important to note that at Kenyatta National Hospital there is a triage area for pregnant women which helps in identifying those who need urgent care.

The first delay; delay in making a decision to seek care and the second delay; delay in arriving at a health facility were not found to be significant in this study at $p=0.7$ (OR=1.09), 0.08 (OR=1.82) respectively. This was in contrast to a study carried out in Ethiopia on the role of delay in MNM which found that those who lived more than 10km from the health facility hence experiencing a second delay had a 2 times likelihood of having a maternal near miss (Mulugeta *et al.*, 2019).

5.1.6 Mode of delivery and its association with severe maternal morbidity

Mode of delivery was found to be significant at all stages of analysis. Those who delivered via spontaneous vaginal delivery had a less probability of having a severe maternal morbidity as compared to those who had a caesarean section at OR=1.78 (95% CI 1.19, 2.70 $P=0.01$). These findings are similar to those of two studies carried out in Brazil that found that delivering via C-section more than doubled the odds of experiencing a SMM. (Domingues *et al.*, 2016, Pacheo *et al.*, 2014). This may be explained by the increased risk of infection, haemorrhage and hysterectomy following a C-section (Pacheo *et al.*, 2014).

According to a study carried out in Finland the occurrence of a severe maternal morbidity was 3-4 times higher in those who had a caesarean section than in those with vaginal deliveries (Pallasmaa *et al.*, 2008). This study also found that those who had a non-elective CS had a twofold chance of sepsis and 2-4 times risk of thromboembolisms

However, it is noteworthy that most of the respondents in this study had a caesarean section. This may be attributed to their conditions warranting emergency caesarean sections as the study site is a referral facility.

5.1.7 Additional factors associated with severe maternal morbidity

5.1.7.1 Pre-existing condition and postpartum complication

Those with a pre-existing condition such as hypertension, preeclampsia were at an increased odds of the occurrence of a severe maternal morbidity at OR=0.41 (95% CI 0.27, 0.63 $P=<0.0001$) as well as those who had a postpartum complication such as

sepsis and postpartum haemorrhage at OR=0.43 (95% CI 0.26, 0.73 P=<0.0001). These results were similar to those in the national survey carried out in Brazil that found that those with complications had an odd of 9.29 which was the highest odds of experiencing a maternal near miss (Domingues *et al.*, 2016). This is in line with the WHO systematic review findings that reported direct complications such as haemorrhage and indirect complications such as preeclampsia are the leading cause of maternal deaths and maternal near misses (WHO, 2015).

Moreover, another retrospective cohort study carried out in Brazil found that there was a significant increase in the risk of a SMM if the mother had comorbidities generally but even more specifically hypertension before pregnancy (Pacheo *et al.*, 2014). Although this study did not examine the association between hypertension and severe maternal morbidity it is worth noting that in this study hypertension was the most common pre-existing condition at 25.6%.

5.1.7.2 Pregnancy outcome

Those mothers whose pregnancy resulted in a stillbirth had an increased chance of experiencing a severe maternal morbidity at OR= 0.13 (95% CI 0.04, 0.36 P=<0.0001). These results are consistent with those from other studies. A study carried out using the Florida state inpatient database on association between stillbirths and severe maternal morbidity found that those who had a stillbirth delivery were at a 7 times increased risk of suffering from a SMM as compared to those with a live birth. (Lewkowitz *et al.*, 2019). Another study carried out in California also comparing still births and SMM found that stillbirth outcomes had a fourfold likelihood of being associated with a severe maternal morbidity as compared to live births (Wall-Wieler *et al.*, 2019). These studies also found that stillbirth delivery outcomes coupled with comorbidities such as placental conditions increased the chances of a severe maternal outcome.

5.2 Limitations of this study

One limitation of this study is that it only examined the postnatal period although maternal morbidity occurs prenatally as well. This is because the aim was to look at the end result of the interventions that were carried out if any.

Moreover, since this was a cross sectional study, it could only evaluate prevalence of the severe maternal morbidities at a given time but not incidence. It also could only examine determinants and aetiology but could not accurately identify causal effects. Additionally, findings could not be generalized to the population.

Another limitation to this study was the lack of funding for the project hence all payments, travel expenses and material cost were catered for by the researcher.

5.3 Conclusions

This study set out to determine the prevalence of maternal near misses and has shown that severe maternal outcomes at Kenyatta National Hospital occur quite frequently. This means that despite the strides made to improve maternal health such as free maternity care, a lot remains to be done.

The second major finding was that several factors have emerged as reliable predictors of severe maternal morbidities. One of them is husband's education. This suggests that educating men in the community regarding maternal care in pregnancy would have a positive effect on maternal outcomes. The second factor that emerged was being married. This implies that the married women may not be in a position to make health related decisions on their own. The third one was delivery via caesarean sections. The increased uptake of caesarean section as a preferred mode of delivery may be leading to the occurrence of near misses. This suggests that either many mothers come to the hospital in critical condition requiring emergency CS, or a good number are choosing the procedure as a mode of delivery. Antenatal care was not associated with the occurrence of MNMs. This is likely due to the good uptake of antenatal care services among those who deliver at Kenyatta National Hospital and facilities referring patients there.

Lastly the study wanted to find out whether the three delays had an effect on the occurrence of SMM. Referral status- a component of the third delay- came to the fore as a factor that projects the occurrence of severe maternal outcomes. It can therefore be inferred that the referral system in Kenya is wanting since urgent care to mothers is being delayed during the process. Despite the near misses, this study provides insight that presently there are multiple opportunities to improve on care.

5.4 Recommendations

The KNH obstetrics and gynaecology management team can use the findings of this research to improve the internal systems in the department. A good example is streamlining their referral systems so that those who come as referrals are treated as emergencies. Policymakers at the national and county level can also ease the referral process by increasing funding for purchase, equipping and running of government ambulances.

Obstetricians, doctors, nurses, midwives and all those involved in maternal care should put in place measures to encourage husbands' involvement in prenatal and postnatal visits. Policymakers at the Ministry of Health should formulate health messages targeting men in promotion of maternal health as they have a role to play in decision making on health matters in the home.

Policymakers at the Ministry of Health need to review policy guidelines on the use of caesarean sections to ensure they are used when benefits outweigh risks. Those who chose the procedure electively should be given all the pros and cons so that they can make informed decisions.

Stronger epidemiological studies such as cohort studies should be undertaken in order to establish whether a causal effect exists between the factors found to be significant and the occurrence of a severe maternal morbidity.

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APPENDICES

Appendix I: Informed Consent Form

Title of study: Factors associated with severe maternal morbidity among postnatal women in Kenyatta National Hospital.

Principal investigator/ institutional affiliation: Jane Nduati, Master's in public health student at JKUAT/ITROMID/KEMRI.

Introduction

The intent of this form is to offer you all the information needed so as to make an enlightened decision whether you will take part in this study or not. You are free to inquire on any matter concerning your rights as a volunteer, the benefits and risks of engaging in this study and any other matter in relation to this study you would like to know. It is important that you understand: your decision to be a part of this study is entirely voluntary; withdrawal from the study may be at any time even without offering an explanation and lastly refusal to engage in the research will not affect the services you are entitled to in this health facility or other facilities. When you have understood and decided to participate in this study, I will request you to sign on this form and write your initials.

May I continue? Yes or No.

This study has been approved by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No _____

What the study is about.

The investigator and research assistants are looking for information concerning the factors that are associated with suffering certain diseases or their symptoms as a result of pregnancy and child birth and will be asking questions to postnatal women in the maternity wards. Participants will be interviewed concerning their pregnancy and the care they received so far. There will be about 162 women involved in this study.

I am requesting you to consider joining this study.

If/when you decide to participate:

You will be asked questions by a trained interrogator in a confidential and private area where you will be comfortable. This will last approximately twenty minutes.

Any risks associated with the study?

The only potential threat of being part in this study is loss of privacy. We however will keep all your information as classified as is possible. A serial number will be used to identify you in a password-protected laptop database and will keep all of our paper records in a closed locker. Moreover we will not use your name anywhere and so your information will remain anonymous.

Are there any benefits to this study?

The information you provide to us will help us understand maternal morbidity better and will build the body of knowledge in maternal health care. We will also give you proper information on antenatal care including danger signs in pregnancy; having a birth plan to assist you in subsequent pregnancies.

What will it cost to participate in the study?

This study will not cost you any money but will require your time and honesty.

In case of any enquiries or more information you can contact the principal investigator on 0728664511 or via email at nduatijyne@gmail.com

Information on this study can also be sought through the KNH-UoN Ethics committee via email on uonknh_erc@uonbi.ac.ke or Tel: 726300-9 and via mail to Kenyatta National Hospital, P O BOX 20723 Code 00202.

Consent form

Participant's statement

I agree to willingly participate in this study having; comprehended the risks and benefits; had all my queries answered and realized that I can pull out from the study at any time.

Participant signature / Thumb stamp and initials _____

Date _____

Researcher's statement

I the undersigned, have fully demonstrated the relevant details of this research study to the participant whose initials are above and believe that the participant has understood and has on their own will give his/her consent.

Researcher's Name: _____ Date: _____

Signature _____

Witness Printed Name (If witness is essential, a witness is a one who is mutually satisfactory to both the researcher and participant)

Initials _____ **Signature /Thumb stamp:** _____ **Date;**

KIAMBATISHO A: IDHINI YA FOMU

Utafiti: Sababu ziabatanazo na madhara makali kwa afya kati ya kina mama katika Hospitali Kuu ya Kenyatta

Mtafiti mkuu/ Chuo Kikuu kinachohusika. Jina langu ni Jane Nduati, mimi ni mwanafunzi katika Shule ya afya ya Umma, Chuo Kikuu cha Jomo Kenyatta wakishirikiana na KEMRI/ITROMID. Utafiti huu utatimiza nusu ya mahitaji ya shahada ya Masters ya Afya ya Umma katika Chuo Kikuu cha Jomo Kenyatta.

Utangulizi

Lengo la fomu hii ni kukusaidia kuelewa utafiti huu ili kukuwezesha kuamua ikiwa utashiriki au la. Uko huru kuuliza swali lolote kuhusu haki zako; faida na pia hatari za kujitolea kuhusika katika huu utafiti. Ni muhimu uelewa ya kwamba kuhusika kwa utafiti huu ni kwa hiari yako, na kujiondoa wakati wowote au kukataa kujihusisha nao hauwezi kuadhiri huduma unayopata katika hospitali hii au hospitali nyingine. Utakapo elewa na kupeana hiari yako kuhusika, nitakuuliza utie sahihi katika fomu hii. Niendelea au la?

Utafiti huu umeidhinishwa na kamati ya maadili ya Hospitali ya Kenyatta na Chuo Kikuu cha Nairobi . Nambari ya usajili: _____

Madhumuni ya utafiti

Mpelelezi mkuu na wasaidizi wake wana lengo la kutafuta sababu zinazo ambatana na magonjwa fulani hasa yanayo na madhara kali kwa akina mama wakati wa uja uzito na wanapojifungua. Watawauliza maswali akina mama waliojifungua kuhusu hali yao na huduma walizopata wakiwa waja wazito na walipojifungua. Utafiti huu utahusisha takriban akina mama 162 waliojifungua. Nakukaribisha wewe kujibu maswali haya.

Ikiwa utakubali kujihusisha:

Utaulizwa maswali na mtafiti msaidizi katika mahala utakapo chagua kwa muda wa dakika ishirini. Majibu yote utakayopeana yatakuwa siri; yatatumika kwenye utafiti huu pekee yake.

Hatari

Huwezi kuwa kwa hatari yoyote kwa kushiriki utafiti huu. Uwezekano wa taarifa utakayopeana kutumika na watu wengine utazuiwa kwa kutumia tarakilishi iliyo na ulinzi wa nenosiri. Zaidi ya hayo, jina lako halitatumika mahala popote ili isijulikane ni nani aliyepoona taarifa hiyo.

Faida ya utafiti huu

Taarifa itakayoibuka baada ya utafiti huu itatumika kuelewa sababu zinazoambatana na madhara kali ya magonjwa yanayoadhiri akina mama na kuongezea ujuzi zaidi katika maswala ya akina mama. Wewe pia utafaidika kwa sababu tutakupa masomo kuhusu uja uzito; ishara ambazo ukiona unapaswa kuenda hospitalini na jinsi ya kujipanga kabla ya wakati wa kujifungua uwadie.

Gharama

Kujihusisha katika utafiti huu hautakugharimu pesa zozote ila itakugharimu muda wako na uaminifu katika kujibu mawali haya.

Mawasiliano

Ikiwa unatatizo, wasiwasi au maswali yanayohusiana na utafiti huu, tafadhali wasiliana na mtafiti mkuu kwa nambari ya simu 0728664511 au barua pepe: nduatijyne@gmail.com au pia kamati ya maadili ya Hospitali Kuu ya Kenyatta na Chuo Kikuu cha Nairobi kwa anwani ifuatayo Kenyatta National Hospital, P O BOX 20723 Code 00202. uonknh_erc@uonbi.ac.ke / 726300-9

Hati ya idhini

Nimeelewa habari iliyomo kwenye fomu hii, nimepewa nafasi ya kuuliza maswali na nimeridhika na majibu niliyopewa. Mimi nakubali kwa hiari yangu kushiriki katika utafiti huu.

Herufi za kwanza za majina _____

Saini ya mshiriki _____ Tarehe _____

Taarifa ya mtafiti

Mimi nimemwelezea mshiriki maelezo haya kadri ya uwezo wangu na nimehakikisha kwamba yako wazi kwa mshirika. Nathibitisha kwamba hajashurutishwa katika kutoa maamuzi yake na anashiriki kwa hiari yake.

Jina la mtafiti _____ Tarehe _____

Saini ya mtafiti _____

Mshuhudia (mtu ambaye amekubalika na mshiriki na mtafiti)

Herufi za kwanza za majina ya mshuhudia _____

Saini ya mshuhudia _____ Tarehe _____

Appendix II: Questionnaire

QUESTIONNAIRE ON FACTORS ASSOCIATED WITH MATERNAL MORBIDITY AT KENYATTA NATIONAL HOSPITAL

SERIAL NO [Click here to enter text.](#)

DATE [Click here to enter a date.](#)

SOCIOECONOMIC & DEMOGRAPHIC DATA

1. What is your date of birth? [Click here to enter a date.](#)
2. Age: [Click here to enter text.](#)
3. Area of residence
County: [Click here to enter text.](#)
Town: [Click here to enter text.](#)
4. What is your marital status? (Tick as appropriate)
 - a. Single
 - b. Married
 - c. Separated
 - d. Divorced
 - e. Widowed
5. What is your highest level of education?
 - a. Primary
 - b. Secondary
 - c. Tertiary institution
 - d. None
6. What is your husband's highest level of education?
 - a. Primary
 - b. Secondary
 - c. Tertiary institution
 - d. None
7. What is your main source of income?
 - a. Formal employment
 - b. Informal employment
 - c. None
8. How much is your monthly income?
 - a. <3000
 - b. 3000-10000
 - c. 10000-20000
 - d. 20,000-30,000

e. >30000

9. How did your pregnancy end?

1. Single birth

3. Still birth

2. Multiple births

4. Miscarriage <28weeks

10. Is the baby alive today?

a. Yes

b. No

11. What is your current diagnosis?

a. Pre-eclampsia/eclampsia

e. Antepartum haemorrhage

a

f. Postpartum haemorrhage

b. Ruptured uterus

g. New-born factors

c. Prolonged/

h. Any other (specify) [Click here to enter text.](#)

obstructed labour

d. Mal presentation

i. Normal labour

12. How severe is the diagnosis?

a. Not

b. Moderately severe

ot

y severe

se

c. Severe

ve

re

13. Were you referred from another facility?

Yes

No

i) If yes where from which facility?

Public hospital/ health

Private hospital/ health centre

centre

ii) Give name [Click here to enter text.](#)

iii) Check reason for referral and admission from file

j. Pre-eclampsia/eclampsia

k. Ruptured uterus

- l. Prolonged/
obstructed labour
- m. Mal presentation
- n. Antepartum
haemorrhage
- o. Postpartum haemorrhage
- p. New-born factors
- q. Any other (specify) [Click here to enter text.](#)
- r. Normal labour

14. Did you receive any of these interventions?

- a. ICU admission
- b. Blood transfusion
- c. Hysterectomy

ANTENATAL CARE

1) How many ANC clinics did you attend?

- a. None
- b. 1-3
- c. >4

2) Do you have an ANC booklet?

- a) Yes
- b) No

3) If yes from ANC booklet check for the following:

- a. HIV test Yes No
- b. VDRL/R PR Yes No
- c. Blood group Yes No
- d. HB test Yes No

e. At least one urinalysis test

- Yes
- No

4) Note any other test [Click here to enter text.](#)

5) HIV status

- a. positive
- b. negative

6) HB levels

2. If more than an hour, why did it take you more than an hour to make a decision? Tick all that are appropriate)
- a. I did not think the illness was severe (illness characteristics)
 - b. I could not make that decision alone (Husband /family involved)
 - c. I did not have enough money to seek healthcare in case of an emergency

Second delay

- i. How far is it from your home to the nearest healthcare facility?
 - a. <1hour
 - b. >1hour
- ii. Did you experience any problem obtaining transport?
 - a. Yes
 - b. No

If yes, why?

- a. There were no vehicles available
- b. I did not have the money to pay for transport
- c. The roads were impassable

Third delay

1. When you got to the health facility, how long did it take to receive care?
- a. <1hour
 - b. >1 hour
- If more than one hour, what caused the long wait? (Tick all that are appropriate)
- a. There were not enough healthcare workers
 - b. There were not enough supplies/ facilities required to assist me
 - c. I did not have enough money to receive care
 - d. I required services that they could not provide

MODE OF DELIVERY

1. How did you deliver your baby?
- a. Spontaneous vaginal delivery
 - b. Forceps delivery
 - c. Vacuum delivery

d. Caeserean section

2. Did you experience any complication?

a. Yes

b. No

3. If yes which complication

a. Postpartum
haemorrhage

c. Sepsis

d. Eclampsia

b. Ruptured uterus

e. Other (specify)

Appendix III: Letter of approval from Ethics and Research Committee



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355



KNH-UoN ERC
Email: uonknh_erc@uonbi.ac.ke
Website: <http://www.erc.uonbi.ac.ke>
Facebook: https://www.facebook.com/uonknh_erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/79

21st February 2020

Jane Nduta Nduati
Reg. No. TM310-0754/ 2016
School of Public Health
College of Health Sciences(CoHES)
J.K.U.A.T

Dear Jane

RESEARCH PROPOSAL - FACTORS ASSOCIATED WITH SEVERE MATERNAL MORBIDITY AT KENYATTA NATIONAL HOSPITAL (P923/11/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 21st February 2020 – 20th February 2021.

This approval is subject to compliance with the following requirements:

- a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
- c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- e. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. *(Attach a comprehensive progress report to support the renewal)*.
- f. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

For more details consult the KNH- UoN ERC website <http://www.erc.uonbi.ac.ke>

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
Supervisors: Prof. Kenneth Ngure (J.K.U.A.T), Mr. James Muttunga (J.K.U.A.T)

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Appendix IV: Publication

IOSR Journal of Humanities And Social Science (IOSR-JHSS)
Volume 26, Issue 9, Series 1 (September, 2021) 48-53
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www.iosrjournals.org

The effect of socioeconomic factors on severe maternal morbidity among postnatal women at Kenyatta National Hospital: a cross-sectional study

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Department of Public Health, KEMRI Graduate School, Nairobi, Kenya.

Corresponding author: Jane Nduati

ABSTRACT

Background: Maternal mortality is an area of particular concern in public health especially in Africa where maternal deaths are the highest in the world. Despite the high maternal deaths, studies have been difficult since at the facilities maternal deaths are far between and proper vital registrations are still poor in Africa. This has led to a different perspective in addressing this issue hence the emphasis on maternal morbidity. The major objective of this study was to determine the effect of socioeconomic factors on severe maternal morbidity.

Materials and methods: This was a descriptive cross-sectional quantitative study carried out in the maternity wards at Kenyatta National Hospital using a structured questionnaire. 162 respondents were selected through systematic sampling with an additional 18 respondents also included in case there were missing records. Univariate, bivariate and multivariate analysis was carried out at 95% confidence interval and p value of less than 0.05.

Results: The respondents' husband's education level ($p < 0.009$) and marital status ($p < 0.004$) were statistically significantly associated with severe maternal morbidity while respondents' education, age and monthly income were not.

Conclusion: A woman's husband having at least a secondary school education is protective against experiencing a severe maternal morbidity.

KEY WORD: Maternal mortality; severe maternal morbidity (SMM); maternal near miss

Date of Submission: 20-08-2021

Date of Acceptance: 05-09-2021

I. INTRODUCTION

Maternal deaths are only a small bit of the magnitude of problems resulting from maternal morbidity, with maternal mortality being described as just a tiny part whereas the real issue is maternal morbidity (WHO, 2015). Maternal morbidity is defined as "any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on the woman's wellbeing. The cases at the extreme end of the maternal morbidity spectrum are of particular interest as they occur more frequently than maternal deaths and have risk factors and characteristics that are similar to those of maternal deaths (Firoz et al., 2013).

Certain factors have been significantly associated with maternal morbidity. Socioeconomic and demographic factors such as income, education level and age have notably been associated with maternal morbidity with those from lower classes having a greater chance of experiencing SMM (Domingues et al 2016; Rosendo et al 2017). There exists a significant research gap on studies on severe maternal morbidities especially in low- and middle-income countries (Geller et al. 2018). This study aims to address this gap by adding to the body of knowledge on this subject especially in Kenya. This study used the WHO (2011) standard approach to pregnancy complications and maternal near misses, whose eligibility criteria for baseline assessment includes: the presence of a severe maternal complication such as severe postpartum haemorrhage, ruptured uterus. It also includes critical interventions e.g., hysterectomy and critical care admission; organ dysfunction such as cardiac arrest, dialysis and lastly maternal death (WHO, 2011).

II. MATERIALS AND METHODS

This cross-sectional descriptive study was carried out at Kenyatta National Hospital in the maternity wards between March 2020 to May 2020. A total of 180 women were interviewed and some of the information was obtained from their medical records. The inclusion criteria were all postnatal women admitted in the maternity

ward. The exclusion criteria were all antenatal women admitted in the maternity ward; those whose pregnancies terminated before 20 weeks and those who decline to give consent.

Study design: Cross-sectional descriptive study.

Study location: This was at Kenyatta National Hospital which is the leading referral hospital in East and Central Africa in the maternity wards.

Study duration: March 2020-May 2020

Sample size: 180 postnatal women

Sample size determination: The sample size was obtained using fisher's formula and adjusted for a population below 10,000. This came to 162 respondents. An additional 10% were included to cater for missing and incomplete records.

Sampling technique: The study employed the systematic sampling technique.

Data collection: Once informed consent was obtained, a research assistant interviewed the respondents using a structured questionnaire and obtained additional information from their antenatal care booklet and medical records. The questionnaire was accessed via the Kobo toolbox mobile data collection application.

Statistical analysis: Analysis was carried out using the STATA software. Descriptive statistics were carried out where discrete variables were summarized with frequencies and percentages while continuous variables were summarized using measures of central tendency and dispersion such as mean, median, mode and standard deviation. As the main variable of interest, socioeconomic factors associated with severe maternal morbidity were identified using Chi-squared tests. During multivariate analysis, adjustments were made for confounders and effect modifiers in the model to determine independent factors associated with severe maternal morbidity using binary stepwise backward logistic regression.

Ethical statement: Approval was sought to conduct the study from the Kenyatta National Hospital- University of Nairobi ethics and research committee and from the Department of Obstetrics and Gynaecology. Study participants signed an informed consent prior to taking part in the study. They were informed that participation was voluntary and that any information they gave would be handled with utmost confidentiality. They were informed of the benefits and risks and explained that they could withdraw from the study at any time. Questionnaires only had serial numbers on them. No identifiers such as names or initials were obtained to ensure participation remained anonymous.

III. RESULTS

Socioeconomic and demographic characteristics of the respondents

AGE: The mean age of the respondents was 28 years with a standard deviation of 6. The youngest respondent was 16 years while the oldest was 42 years. Figure 1 shows the distribution of the respondents according to age. The majority of them (52%) were aged between 20-29 years followed by those aged between 30-39 years at 36%. Those above 40 years were at 5.6% (10), while 16-19-year-olds were 6.7% (12).

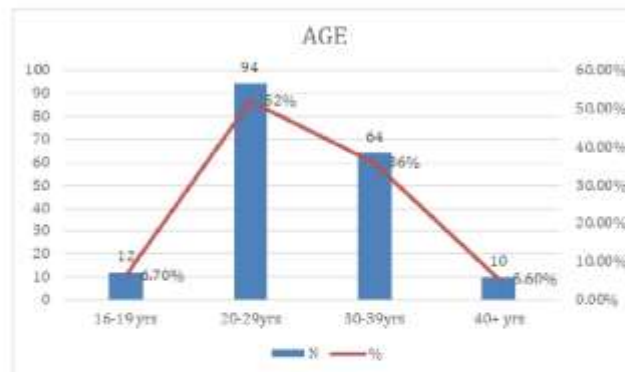


Figure 1: Age distribution

MARITAL STATUS: The majority of women were married at 81% (145) while 19% (35) were single. (Table 1)

EDUCATION: Most of the women had a secondary school education 39.4% (71) followed closely by those with some form of tertiary education at 38.3% (69); while 22.2% (40) had only a primary school education.

The effect of socioeconomic factors on severe maternal morbidity among postnatal ..

Most of the husbands had a tertiary education at 42.6% (72), while 36.1% (61) had a secondary school education. 14% (26) had a primary school education while 12% (21) had none. (Table 1)

INCOME: 35% (63) of the respondents' main source of income was from informal employment, 33% (60) had no source of income and 32% (57) were formally employed. Most of the women 32% (57) reported a monthly income of less than Sh 3000. 20% (36) reported earning 3000-10,000, 21% (37) reported earning between 10,000 and 20,000, 14% (25) earning 20,000-30,000 while an equal number 14% (25) earned more than 30,000 in a month. (Table 1)

Severity of maternal morbidities

Those who experienced a severe maternal morbidity were 36.1% (65), 28.3% (51) experienced a moderately severe morbidity while 35.1% (64) did not experience a maternal morbidity (figure 2)

Figure 2: Severity of diagnosis

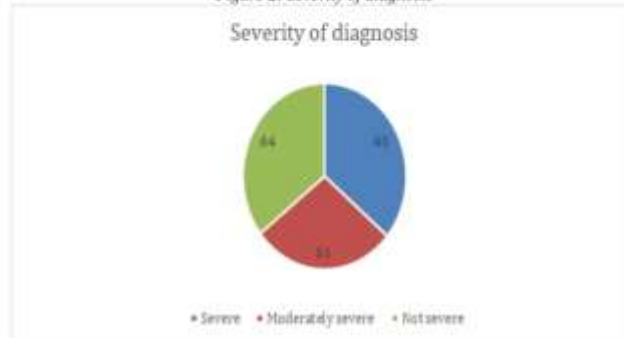


Table 1: Socioeconomic information of respondents

| Characteristic of study participants in KNH, 2020 | | |
|---|-----|----------|
| Characteristics | N | N=180 |
| Marital status | 180 | |
| Married | | 145(81%) |
| Single | | 35(19%) |
| Highest Education | 180 | |
| Primary | | 40(22%) |
| Secondary | | 71(39%) |
| Tertiary | | 69(38%) |
| Husband education | 180 | |
| Tertiary institution | | 72(40%) |
| Secondary | | 61(34%) |
| Primary | | 26(14%) |
| None | | 21(12%) |
| Individual age | 180 | |
| 16-19 years | | 12(6%) |
| 20-29 years | | 94(52%) |
| 30-39 years | | 64(36%) |
| 40+ years | | 10(6%) |
| Source of income | 180 | |
| Formal employment | | 57(32%) |
| Informal employment | | 63(35%) |
| None | | 60(33%) |
| Monthly income | 180 | |
| 10000-20000 | | 37(21%) |
| 20000-30000 | | 25(14%) |

| | |
|------------|---------|
| 3000-10000 | 36(20%) |
| >30000 | 25(14%) |
| <3000 | 57(32%) |

Data analysis

BIVARIATE ANALYSIS: Analysis was done using the chi square test of independence at a confidence level of 95%, significance level of p values 0.05. Age, marital status, education of both the respondents and their husbands, source of income was not found to be significant. Monthly income however was found to be significant at p value of 0.044.

MULTIVARIATE ANALYSIS: This was done by proportional ordinal logistic regression. After adjustments monthly income was no longer significant while being single became significant at p value 0.004. A single mother was more likely to not have a severe maternal morbidity (P =0.004, β=1.33). Husband's education became significant after adjustment. A woman whose husband had no education was at a higher probability of suffering a severe maternal morbidity (P=0.009, β = -1.5) than one whose husband had a secondary education. Age, respondents' education level remained not significant.

Table 2: Multivariate analysis from binary logistic regression

| Characteristics | Unadjusted | | | Adjusted | | | |
|------------------------|------------|---------|------------|-----------|----------|----------|-------------------|
| | Coef. | P-value | [95% CI] | Coef. | P-value | [95% CI] | |
| Severity diagnosis | | | | | | | |
| Marital status | | | | | | | |
| Single | 2.03188 | 0.022 | 0.2982205 | 3.768155 | 1.327144 | 0.004 | 0.433333 2.220956 |
| Source of income: | | | | | | | |
| Informal employment | 0.997742 | 0.052 | -2.006114 | 0.010631 | | | |
| Note | 1.162235 | 0.114 | -2.603272 | 0.278802 | | | |
| Individual age | | | | | | | |
| 16-19 yrs. | 1.602242 | 0.073 | -0.1492931 | 3.353778 | | | |
| 30-39 yrs. | 0.400801 | 0.38 | -0.4036103 | 1.295211 | | | |
| 40+ yrs. | 0.293443 | 0.716 | -1.872778 | 1.385893 | | | |
| Highest education: | | | | | | | |
| Primary | 0.194257 | 0.722 | -1.265173 | 0.876659 | 0.129574 | 0.648 | 0.686201 0.427052 |
| Tertiary institution | 1.109363 | 0.038 | -2.154949 | 0.063776 | 0.452518 | 0.104 | 0.997821 0.692785 |
| Husband education | | | | | | | |
| Secondary | 0.550674 | 0.324 | -1.645645 | 0.544286 | 0.281143 | 0.351 | 0.872382 0.310097 |
| Primary | 1.798637 | 0.021 | -3.331875 | 0.267399 | 1.011521 | 0.019 | 1.859446 0.163595 |
| Note | -2.5723 | 0.015 | -4.651675 | -0.492926 | 1.507728 | 0.009 | 2.036558 0.378898 |
| Monthly income | | | | | | | |
| 10000-20000 | -1.02127 | 0.179 | -2.510179 | 0.46764 | 0.408926 | 0.174 | 0.998809 0.180956 |
| 20000-30000 | 0.007213 | 0.993 | -1.559525 | 1.573951 | 0.074408 | 0.828 | 0.595697 0.744573 |
| 3000-10000 | 0.499419 | 0.48 | -1.884702 | 0.885863 | 0.211609 | 0.451 | 0.761818 0.3386 |
| >30000 | 1.174233 | 0.155 | -2.793415 | 0.444949 | 0.593991 | 0.087 | -1.27468 0.086698 |
| Severe/Moderate severe | -2.83979 | | | 1.311364 | | | |
| Moderate/Not severe | 0.950332 | | | 0.270632 | | | |

IV. DISCUSSION

The prevalence of severe maternal morbidity at Kenyatta National Hospital during the study period was found to be at 36.1%. This was quite high compared to the prevalence in Africa determined from a systematic review of near miss studies which was at 14.98%. Moreover, this is even higher when compared to prevalence from Asia at 5.07% and North America at 1.38% (Tuncalp et al 2012). In addition to this a study carried out in Kenya on maternal near misses in 54 referral hospitals found the incidence of MNM to be at 7.2 per 1000 live births (Owolabi et al 2018). This high prevalence could be attributed to the fact that the majority of the patients

who experienced a maternal morbidity had been referred from another facility (62%) since this the leading referral facility in the region. Therefore, the cases were more than could be attributed to care provided at this facility.

Socioeconomic and demographic factors associated with severe maternal morbidity

According to the results from this study age was not found to be of significance in the occurrence of a severe maternal morbidity. This was contrary to studies carried out by Blanc et al (2013) and Linsokova et al (2017) which found that those who were very young and mothers older than 39 years had an increased risk for severe maternal morbidities. These differences could be because of a limited sample size which was not able to account for the other confounding factors.

Furthermore, from this study's findings a single mother had a less chance of suffering from a severe maternal morbidity as compared to a married mother ($\beta=1.34$). This result is contrary to that from a study carried out in Nigeria on the incidence and determinant of near miss morbidities which showed that unmarried women were three times more likely to experience a severe maternal morbidity as compared to their married counterparts (Adeoye et al., 2013). Moreover, another case control study on establishing the risk factors of life-threatening maternal outcomes found no statistical significance with marital status in determining their occurrence (Goffman, Madden, Harrison, Merkatz, & Chazotte 2007). This suggests that more research needs to be carried out to establish whether marital status plays a role in occurrence of severe maternal outcomes.

While the mother's education level was not found to be significant, the woman whose husband had less than a secondary school education had a high likelihood of experiencing a severe morbidity at ($\beta=-1.5$). This finding is in line with that from a previous study carried out in Ghana on understanding the impact of mothers' education on utilization of health services which found that husbands' education was strongly associated with their wives increased use of health services (Greenaway, Leon, & Baker 2012). This was correlated to education being a proxy to monetary resources which enable women access quality healthcare (Hobcraft, 1993).

V. CONCLUSION AND RECOMMENDATION

The prevalence of severe maternal morbidity was substantially high at 36.1%. This is of concern and further investigation at the facility level is imperative to ensure the cause of this is understood and addressed. Moreover policymakers could use this results to inform their health education message in maternal health. Since a husband having at least a secondary education has been found to be protective against experiencing a maternal near miss, stakeholders can encourage husbands involvement in prenatal and postnatal visits.

A recommendation is made for analytical studies to be undertaken in order to establish whether a causal effect exists between husband's education and marital status on severe maternal morbidity. In addition a larger sample size is proposed so as to make the results generalizable to the population.

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Jane Nduati, et. al. "The effect of socioeconomic factors on severe maternal morbidity among postnatal women at Kenyatta National Hospital: a cross-sectional study." *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 26(09), 2021, pp. 48-53.

Appendix V: Seminar Minutes



In Search of Better Health

KEMRI GRADUATE SCHOOL

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Email: graduateschool@kemri.org

MINUTES OF SEMINAR AND PROPOSAL PRESENTATIONS HELD ON MONDAY 26th JULY 2021 AT 9AM (VIRTUAL)

| Faculty Members Present | Students Present |
|---|--|
| <ol style="list-style-type: none">1. Dr. Raphael Lihana2. Prof Kenneth Ngure JKUAT3. Prof. Wallace Bulimo4. Dr. Samson Muiuo5. Dr. Evans Amukoye6. Dr. Peter Wanzala7. Prof Anne Muigai8. Prof Matilu Mwau9. James Muttunga10. Dr. Jael Obiero11. Dr. Caroline Ngugi12. Dr. John Mwaniki13. Dr. Daniel Nyamongo JKUAT14. Dr. Steven Ger Nyanjom- JKUAT15. Prof Sam Kariuki- KEMRI | <ol style="list-style-type: none">1. Kennedy Jerry Koech2. Amina Abdullahi Ahmed3. Kayose Flaviah Kidake4. Titus Mutwiri Benjamin5. Maru Lorna Chemutal6. Mary Keah7. Betty Muriithi8. Khatra Shariff Said,9. Jane Nduati,10. Daniel Muvengei11. Japhet Katana12. George Gichuki Muthui |

R. Kariuki
26/7/2021

| | | | |
|----|--|--|--|
| 8 | <p>Khatra Shariff Said, TM313-1201/2011.</p> <p>Msc Lab management and Epidemiology</p> <p>Molecular Epidemiology of Salmonella typhi among Patients attending Garissa Provincial General Hospital.</p> <p>Prof. Zipporah Ng'ang'a 0722794883 zipnganga@gmail.com Prof. Samuel Kariuki 0722232467 samkariuki2@gmail.com.</p> | <p>1st seminar presentation</p> <ol style="list-style-type: none"> 1. How did you arrive at the 384 samples? The calculations is not correct. 2. There was too much literature in your results which should be refined. 3. Consider reporting results according to objectives and conclude similarly. 4. Make discussions better by not repeating results | <p>Discuss with your supervisors and rectify areas that need refining. Proceed to the next stage</p> |
| 9 | <p>George Gichuki Muthui TM-310-1164/2011</p> <p>Predictors of Treatment Outcomes of Childhood Tuberculosis at Mbagathi County Hospital, Nairobi: A Retrospective Cohort Study</p> <p>Prof. Simon Karanja (JKUAT) Dr. Evans Amukoye (KEMRI) Dr. Justus Simba (JKUAT)</p> | <p>Proposal Presentation</p> <ol style="list-style-type: none"> 1. Data abstraction will be done in two weeks How will you justify that? This will be seen as a very short duration for your work. 2. The ideal for MSc is to learn and master skills in the said area of specialization. 3. The use of research assistants should be discouraged since you are the owner of the work. | <p>Discuss with your supervisors and rectify areas that need refining. Proceed to the next stage</p> |
| 10 | <p>Jane Nduati, Reg no: TM310-0754/2016 Msc Public Health "Factors associated with severe maternal morbidity at Kenyatta National Hospital." Prof Kenneth Ngure, 0722362219, email:kngure@jkuat.ac.ke Mr James Muttunga, 0722808506, email: muttunga@yahoo.com</p> | <ol style="list-style-type: none"> 1. 1st seminar presentation. 2. Why did you use the word assess? How do you measure an "assessment"? 3. Need to use tables on your results. 4. Use tables for your results for better audience understanding. Try to discuss results and not repeat. Make recommendations/conclusions according to set objectives and what the study achieved. | <p>Discuss with your supervisors and rectify areas that need refining. Proceed to the next stage</p> |
| 11 | <p>GEORGE G. WAMUGO TM 305-1913/2019 Msc Molecular Medicine.</p> | <ol style="list-style-type: none"> 1. Discuss more with the supervisor and agree on how to improve on your document. | <p>Discuss with your supervisors and rectify areas that need</p> |

Raphaella
23/7/2021



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**VIRTUAL MINUTES FOR SEMINAR PRESENTATIONS HELD ON THURSDY 19TH
AUGUST 2021 AS FROM 9AM TO 3PM**

| Faculty Members Present | Students Present |
|--|---|
| <ol style="list-style-type: none">1. Dr. Raphael Lihana- Chairperson2. Prof. Simon Karanja- JKUAT3. Dr. Gideon Kikvi- JKUAT4. Dr. Lilian Musila- KEMRI5. Dr. Joseph Mutai- KEMRI6. Prof. Kenneth Ngure- JKUAT7. Prof. Vivienne Matiru- JKUAT8. Dr. Edith Limbaso- KEMRI9. Prof. Matilu Mwau- KEMRI10. James Muttunga- KEMRI11. Dr. Nyamongo- JKUAT12. Dr. Peter Wanzala- KEMRI13. Dr. Violet Wanjihia- KEMRI14. Prof. Anselimo Makokha- JKUAT15. Prof. Anne Muigai- JKUAT16. Dr. Phelgona Otieno- KEMRI17. Prof. Wallace Bulimo- KEMRI18. Dr Mercy Njeru- KEMRI19. Hillary Imire- Taking Minutes | <ol style="list-style-type: none">1. Albina Makio2. Jane Nduati3. Purity Kirori4. Dorcas Mwikali Nyamai5. Daniel Muvengei6. Amina Abdulahi7. Salim Omambia8. Bridgette Wanjiku Kimani9. Evans Obwocha Obare10. Lydia Kitui11. Mary Keah12. Maru Lorna Chemutai13. Norah Wekesa14. Kennedy Jerry Koech15. Titus Mutwiri Benjamin16. Kaara Fridah Karimi |

Raphael Lihana
20th Aug 2021

| No | Presenter | Comments | verdict |
|----|--|---|--|
| 1 | <p>Jane Nduati</p> <p>TM310-0754/2016, Factors associated with severe maternal morbidity at Kenyatta National Hospital." Prof Kenneth Nguni, 0722362219, email:kngure@jkuat.ac.ke Mr James Muttunga, 0722808506, email: muttunga@yahoo.com</p> | <ul style="list-style-type: none"> • 2nd seminar • Conclusions-When the prevalence is high what do you conclude?. • Recommendations- should be practical and actionable • Ethical considerations need to come out clearly. • What was the reasons for the questionnaires not being responded to.? Give reasons • Results- need to inform broader decision-making. • You did not conclude with your hypothesis discuss further with your supervisors. | Refine with assistance from supervisors |
| 2 | <p>Purity Kirori</p> <p>TM 310-1356/2016 Sanitary risks associated with the shallow wells water in Juja hostels Kiambu County</p> <p>Prof. Vivienne matiru Jomo Kenyatta University of Agriculture and Technology Mail vivienematiru@gmail.com +254 720792366 Dr. Joseph Mutai Kenya Medical research Institute Mail joemutai@yahoo.com +254725082352</p> | <ul style="list-style-type: none"> • 1st seminar • What were the sanitary risks? It's not coming out clearly. • Specific and broad objectives have a disconnect. • Methodology- need to rework on the variables to come up with the outcomes. • Why did you choose hostels only in Juja | Refine with assistance from supervisors |
| 3 | <p>Albina Makio TM303-0974/12</p> <p>Development and evaluation of a monoclonal and polyclonal antibody- based antigen capture assay for detection of O'Nyong -nyong virus in Kenya</p> <p>Dr. Lilian Musila, Lillian.Musila@usamru-k.org, 0728 817 872</p> | <ol style="list-style-type: none"> 1. 2nd seminar 2. Research questions- Don't set questions that are either YES or NO. 3. Objectives- look into it. 4. Discussions- Most of the specific objectives need to be refined. 5. You did not mention whether you have done publications or not in preparation for defense. 6. Change of title- will depend on BPS 7. Not all objectives were met. May need to forego all that were not covered. | May need refining and discussion with supervisors for a way forward. |

Raphaella
24th Aug 2021

Appendix VI: Anti-Plagiarism Report

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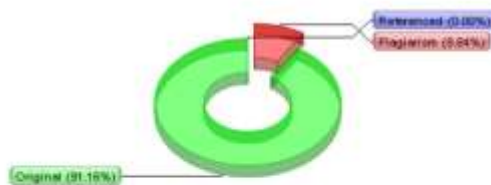
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