DETERMINANTS OF PREECLAMPSIA AND ECLAMPSIA AMONG WOMEN DELIVERING IN COUNTY HOSPITALS IN NAIROBI, KENYA

BY

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DEDICATION

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ABBREVIATIONS AND ACRONYMS

ANC Antenatal Natal Care

APGAR: Appearance, Pulse, Grimace, Activity, and Respiration

BEmONC: Basic Emergency Obstetric & Neonatal Care

BMI: Body Mass Index

CEmONC: Comprehensive Emergency Obstetric & Neonatal Care

CMR: Child Mortality Rate

C:I: Confidence Interval

EDHS: Ethiopia Demographic and Health Survey

EmONC: Emergency Obstetric & Neonatal Care

IMR: Infant Mortality Rate

KDHS: Kenya Demographic and Health Survey

LDHS: Liberia Demographic & Health Survey

MDG: Millennium Development Goal

MMR: Maternal Mortality Rate

MOH: Ministry of Health

NMR: Neonatal Mortality Rate

OR: Odd Ratio

P : Probability

PET: Preeclampsia

RDHS: Rwanda Demographic and Health Survey

SDGs: Sustainable Development Goals

SDHS: Sierra Leone Demographic and Health Survey

TDHS: Tanzania Demographic and Health survey

UTI: Urinary Tract Infection

UDGS: Uganda Demographic and Health Survey

U5MR: Under-five Mortality Rate

WHO: World Health Organization

OPERATIONAL DEFINITIONS

Adolescent birth rate – is the number of births to women ages 15 – 19 per 1000 women in that age group per year (KDHS, 2014).

Anemia: is defined by WHO as a hemoglobin concentration below 11grams/deciliter (World Health Organization, 2011).

Chronic Hypertension is hypertension (BP ≥ 140/90 mmHg) first diagnosed before 20 weeks gestation and persistent after 12 weeks postpartum (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010).

Early Neonatal Death (END): is the death of a live newborn in the first 7 days of life (World Health Organization, 2011).

Eclampsia: is defined as a generalized seizure, generally in addition to Preeclampsia criteria (World Health Organization, 2013).

Gravidity is the condition of being pregnant, without regard to the outcome (Albert Daniel, 2012).

Gestation: is the period of about 9 months from conception to birth, during which the infant develops in the uterus (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010).

Gestational Hypertension: is hypertension (BP ≥ 140/90 mmHg) occurring for the first time after mid-pregnancy, no proteinuria, and blood pressure returns to normal before 12 weeks postpartum (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010).

Infant Mortality Rate: is the probability that a child born in a specific year or period will die before reaching the age of one year, expressed as a rate per 1000 live births (World Health Oragnization, 2011).

Maternal Death: refers to a female death from any cause related to or aggravated by the pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy (World Health Organization, 2011).

Maternal Mortality Ratio: The ratio of the number of recorded (or estimated) maternal deaths during a given time-period per 100 000 live births during the same time period (World Health Organization, 2011).

Nulliparity: is the condition in a woman who has never given birth to a child/newborn (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010).

Neonatal Mortality Rate: The proportion of newborn deaths during the first 28 completed days of life per 1000 live births in a given year or period (World Health Organization, 2011).

Preeclampsia: is defined as high blood pressure (≥ 140/90 mmHg) during pregnancy (usually after 20 weeks gestation) and has proteinuria ≥ 300 mg/24 hours or ≥ 1+ dipstick (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010).

Parity: a term used to indicate the number of pregnancies a woman has undergone that have resulted in the birth of a baby capable of survival (Michael, 2013).

Perinatal Mortality Rate (PMR): is fetal death occurring from the date of the viability of pregnancy (28 weeks) through to delivery and for 7 days after delivery (World Health Organization, 2011).

Prenatal Care: is the care of women pregnant from 28 weeks up to term (World Health Organization, 2011).

Still birth: is the death of a fetus weighing ≥ 500 grams, or of ≥ 22 weeks gestation if weight is unavailable (World Health Organization, 2011).

Under-5 Mortality Rate: The probability that a child born in a specific year or time-period will die before reaching the age of five (expressed as a rate per 1000 live births – number of deaths of children less than five years of age per 1000 live births), (World Health Organization, 2011).

Urinary Tract Infection - is an infection of the Kidney, ureter, bladder, or urethra. Pregnant women are at increased risk for urinary tract infection starting in week 6 through week 24 (World Health Organization, 2011).

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ABSTRACT

Background: Preeclampsia is defined as the onset of a new episode of high blood pressure in a woman usually after 20 weeks gestation plus proteinuria, whereas Eclampsia, on the other hand, is defined as generalized seizures in a pregnant woman who generally has preeclampsia criteria. Both preeclampsia and eclampsia are hypertensive disorders of pregnancy and thus, among the top causes of maternal death worldwide. **Objective**: The aim of this study was to identify the factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals.

Methodology: This was a hospital-based unmatched case-control study conducted among women of reproductive age (15-49 years) who gave birth at Nairobi County Hospitals and admitted to the postnatal ward July-September, 2019 with a sample size of 352 participants (88 cases and 264 controls). Cases were women of reproductive age (15-49 years) admitted to postnatal wards having been diagnosed with preeclampsia (high blood pressure during pregnancy, ≥140/90 mmHg, plus proteinuria ≥300 mg/24 hours or ≥ 1+ dipstick) and/or eclampsia (high blood pressure during pregnancy, proteinuria plus generalized seizures). Controls were women of reproductive age (15-49years) admitted to postnatal wards without preeclampsia/eclampsia during the same time as cases. Pumwani, Mama Lucy Kibaki, and Mbagathi hospitals were purposely selected because these were 3 of 4 Nairobi County Hospitals delivering preeclamptic and/or eclamptic women. Proportional allocation of sample size was made to the study hospitals based on their delivery caseload. Women of reproductive age (15-49 years) admitted to postnatal wards during the study period and satisfying the inclusion criteria were recruited until the agreed sample was reached. Cases were enrolled successively until the required sample size was obtained. For each case, 3 controls were selected using a simple random sampling technique with a sampling frame for controls consisting of a list of women admitted to the post-natal ward without preeclampsia/eclampsia who were recruited at the time of selection of the cases at the same hospitals. The sampling frame was updated as per deliveries and admissions taking place in said hospitals during the study period.

Information or data were gathered using a structured interviewer-administered questionnaire and data abstraction tool. Data were analyzed using Stata version14. Descriptive analysis was carried out, where, categorical variables were presented in percentages or proportions, whereas,

continuous variables were presented in means, standard deviations, range, and histogram. This was followed by bivariable mixed-effect logistic regression analysis and a multivariable mixed-effect logistic regression analysis using the significant variables from bivariable analysis. A modified Hosmer-Lemeshow goodness-of-fit test was carried out; after which, variables with significance less than 0.05 were considered as factors linked with preeclampsia/eclampsia.

Results: Of the 352 participants enrolled in the study, 25% were confirmed as cases and 75% controls. Among the cases (n=88), 94.32% were diagnosed with Preeclampsia and 5.68% diagnosed with eclampsia. At the multivariable level, women with preeclampsia/eclampsia were more likely to be 35-49 years of age comparing to their counterparts (AOR=5.9; 95% CI: 1.1-33.3, p=0.042). The odds of developing preeclampsia/eclampsia were 3.1 times higher in postnatal mothers with occupation as housewife comparing to mothers with other occupations (AOR=3.1; 95% CI: 1.1-8.8, p=0.034). Nulliparous or primiparous women were more likely to develop preeclampsia/eclampsia than those that were multiparous (AOR=7.5; 95% CI: 1.5-37.5, p=0.015) / (AOR=2.1; 95% CI: 1.1-4.2, p=0.031). Lastly, postnatal mothers with preeclampsia/eclampsia were more likely to have personal history of hypertension comparing to their counterparts (AOR=7.1; 95% CI: 2.6-19.3, p=0.001). The association between personal history of hypertension and preeclampsia/eclampsia was statistically significant.

Conclusion: The following conclusions were made with reference to the study findings: Personal history of hypertension, older/advanced maternal age (35-49 years), occupation, and parity were factors significantly associated with preeclampsia/eclampsia.

Recommendations: Health workers in Maternal and Child Health (MCH) units of health facilities should emphasize the risk factors for preeclampsia/eclampsia to pregnant and postnatal mothers during their health talks in the health facilities. Future studies should investigate the association between UTI in pregnancy and preeclampsia/eclampsia in a multi-County study in Kenya.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Preeclampsia is a pregnancy-precise condition that occurs in a woman with a new episode of high blood pressure (BP ≥ 140/90 mmHg) after 20 weeks gestation and has proteinuria (≥ 300 mg/24 hours) or ≥ 1+ dipstick (Cunningham Gray F., Leveno Kenneth J., Bloom Steven L., 2010). Eclampsia, on the other hand, is defined as a pregnant woman with high blood pressure, proteinuria and generalized seizures. These conditions (preeclampsia and eclampsia) are multi-factorial diseases and have a genetic predisposition; thus, the exact cause is still unknown. Preeclampsia is, for the most part, a frequent problem during pregnancy that complicates about 5-10% of pregnancies and about 20% of first pregnancies (Kahnamoueiaghdam F., Amani F., 2015).

Hypertensive disease of pregnancy include preeclampsia, eclampsia, gestational hypertension, and chronic hypertension. Unlike preeclampsia/eclampsia, in both gestational and chronic hypertension, there is high blood pressure during pregnancy but often no proteinuria. However, in gestational hypertension the elevated blood pressure returns to normal before 12 weeks postpartum while for chronic hypertension, the high blood pressure persists after 12 weeks postpartum. It is projected that globally 13% of maternal death is due to hypertensive disorders of pregnancy, but is to a large extent high in developing countries where the estimation is between 20 – 80% in Africa and Latin America (Wandabwa J., Doyle P., Kiondo P., 2010). Among the hypertensive disorders of pregnancy, preeclampsia and eclampsia account for the second leading cause of maternal mortality, worldwide (Bibbins-Domingo K., Grossman DC, Curry SJ, 2017).

Preeclampsia also accounts for increasing maternal and perinatal/infant morbidity and mortality, and it is a major (15-20%) cause of maternal mortality in developed countries (Shamsi Uzma, Saleem Sarah, 2013); thus, significantly impacting SDG3 – that is, good health and wellbeing by 2030 (United Nations, 2016).

Many risk factors have been associated with pre-eclampsia/eclampsia and can be classified in various categories, namely: a) Socio-demographic – to include maternal age, child sex, education, marital status, occupation or socio-economic status, residence, ethnicity/race; b) Clinical – to include high blood pressure, body mass index, hemoglobin level or anemia in pregnancy, urine protein level, Urinary Tract Infection (UTI) in pregnancy among others; c) Reproductive and obstetric – to include number of ANC visits, time of first ANC visit, gravidity, parity, mode of delivery, age at first marriage, age at first pregnancy, nature of gestation, child sex; d) Behavioral and family history-related factors – to include alcohol use, tobacco use, hypertension family history, diabetes family history, hypertension personal history, diabetes personal history, traditional treatment (Kahnamoueiaghdam F., Amani F., 2015).

Other factors like environmental and health system factors were not emphasized in this study and can be recommended for future studies. For example, health system factors like referral services to Emergency Obstetric and Neonatal Care (EmONC) clients, and quality of service delivery at health facility have been shown to limit effective control of preeclampsia in developing countries and may thus, lead to poor maternal and fetal health outcomes (Osungbade, Kayode O. and Ige, 2011).

1.2 Background to the study

The maternal mortality ratio in Sub-Saharan Africa is estimated to be 510 maternal deaths per 100,000 live births (World Health Organization, 2015). In Rwanda, Maternal Mortality Ratio (MMR) is 210 maternal deaths per 100,000 live births, Infant Mortality Rate (IMR) is 32 infant deaths per 1000 live births, and under 5 Mortality Rate is 50 deaths per 1000 live births (National Institute of Statistics of Rwanda (NISR) [Rwanda], MOH [Rwanda], 2015) while in Tanzania, MMR is 556 motherlyl deaths per 100,000 live births, IMR is 43 infant deaths per 1000 live births and under 5MR is 67 deaths per 1000 live births (MoHCDGEC, MoH, NBS, OCGS, 2016). In Uganda, Maternal Mortality Ratio is 336 motherly deaths per 100,000 live births, IMR is 43 infant deaths per 1000 live births and under 5MR is 64 deaths per 1000 live births (Uganda Bureau of Statistics, 2016) while in Ethiopia, MMR is 412 motherly deaths per 100,000 live births, IMR is 48 infant deaths per 1000 live births and under 5MR is 67 deaths per 1000 live births (Central Statistical Agency, 2016).

In West Africa, Liberia and Sierra Leone remain African countries grappling with poor maternal health indicators with maternal mortality ratio at 1072 deaths per 100,000 live births (LISGIS, MOH, 2013) and 1165 maternal deaths per 100,000 live births (SLDHS, 2013), respectively. This is unacceptably high. Other important health indicators are not any better, with under-five and infant mortality rates being 94 and 54 deaths per 1000 live births (LISGIS, MOH, 2013), and 156 and 92 deaths per 1000 live births (SLDHS, 2013), respectively. However, the lowest recorded maternal mortality ratio (< 5 motherly deaths per 100,000 live births) is found in countries like Finland, Greece, Iceland, Poland, & Sweden (World Health Organization, 2015).

Kenya has made some significant progress in reversing maternal and child health indicators, however, more needs to be done since maternal mortality ratio is at 362 deaths per 100,00 live births; infant mortality rate in Kenya is 39 deaths per 1000 live births; perinatal mortality rate is 29 deaths per 1000 pregnancies; the neonatal and under five (5) mortality rates being 22 & 52 deaths per 1000 live births, respectively (KDHS, 2014). Sparse distribution of health facilities offering maternal health service inadequately trained health care providers with skills in basic and comprehensive emergency obstetric and neonatal care compounds challenges in providing maternal health care services. In Kenya, the median age at first marriage among women of reproductive age is 20.2 years; 58% of women make the recommended four or more ANC visits during their pregnancies; the proportion of birth attended by trained health workers is 61.8%; contraceptive prevalence rate is 58% while contraceptive discontinuation rate is 31%; the unmet need for family planning is 17.5% (or 18%); adolescent birth rate is 96.3 per 1000 women aged 15-49 years(KDHS, 2014); 33% of women are either overweight/obese (BMI $\geq$ 25 kg/m^2), with 10% of them being obese (BMI $\geq$ 30 kg/m^2) (KDHS, 2014).

In Kenyan counties with poor maternal outcomes, most dispensaries and health centers are not ready to provide Basic Emergency Obstetric and Neonatal care (BEmONC) in line with standards while nearly 50% of hospitals are not ready to provide Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) services, as required by standards (MEASURE EVALUATION PIMA, 2016).

There is evidence that risk factors such as maternal age, marital status, education, ethnicity, parity, occupation, UTI in pregnancy, family/personal history of hypertension and diabetes are significantly associated with preeclampsia/eclampsia (Sarka Lisonkova and Joseph KS, 2013;

Guerrier Gilles, Oluyide Bukola, 2013; Bilano Ver Luanni, Ota Erika, 2014; Xiao J, Shen F, Xue Q, 2014). Early and late marriage/pregnancy have also been related to preeclampsia and eclampsia (Sarka Lisonkova and Joseph KS, 2013; Ganchimeg T., Mori R., 2013). However, education is also associated with alcohol use, tobacco use, occupation, anemia in pregnancy and number of ANC visit, which together are related to preeclampsia/eclampsia (Babalalo, 2014; Ezugwu, Mbah and Chigbu, 2013**;** Lasebikan, Victor O. and Ola, 2016**;** Desalu, OO, Iseh, KR, Olokoba, 2010). Similarly, there is evidence that maternal age, residence and religion are associated with a number of ANC visits, which is a term is related to the occurrence of preeclampsia/eclampsia (Guerrier Gilles, Oluyide Bukola, 2013; Babalalo, 2014).

1.3 Statement of the research problem

1.3.1 Problem statement

Pregnancy and childbirth that result in maternal morbidity and mortality arising from pre-eclampsia and eclampsia remain a public health problem. From the literature review, marriage and pregnancy at an early and late/advanced reproductive ages have been associated with preeclampia and eclampsia (Sarka Lisonkova and Joseph KS, 2013; Ganchimeg T., Mori R., 2013). In Kenya, this is no exception as young Kenyan women are getting married, pregnant and delivering at an early and advanced age; a situation which can also increase their risk of developing preeclampsia and eclampsia. This is evident from the high adolescent birth rate (96.3 per 1000 women aged 15-49 years), the median age at first marriage (20.2 years), high unmet need for contraception, and poor access to family planning services (KDHS, 2014; Ministry of Health [Kenya], 2016).

Furthermore, the absence of ANC visits and less than 4 ANC visits have been associated with the occurrence of preeclampsia and eclampsia (Bilano Ver Luanni, Ota Erika, 2014; Guerrier Gilles, Oluyide Bukola, 2013). In Kenya, this is also a problem as 42% of Kenyan women of reproductive age (15-49 years) do not attend 4 or more antenatal care (ANC) visits as recommended by the World Health Organization and 38% of Kenya women delivering outside the health facility with the assistance of non-skilled providers (KDHS, 2014). Thus, this situation can increase the risk of Kenyan women developing preeclampsia and eclampsia.

Alcohol consumption, tobacco use, hypertension, and diabetes have also been associated with preeclampsia and eclampsia (Patra J., Bakker R., 2011; Vanker A., Barnett W., 2016; Kahnamoueiaghdam F., Amani F., 2015). This is also a problem in Kenya as women of reproductive age (15-49) are also consuming alcoholic beverages (29%), using tobacco (1%), hypertensive (9%), and diabetic (1%) and can thus, increase their risk of developing preeclampsia and eclampsia (KDHS, 2014). Lastly, anemia and UTI in pregnancy have been associated with preeclampsia and eclampsia (Bilano Ver Luanni, Ota Erika, 2014; Ali AbdelAziem A., Rayis Duria A., 2011). However, published information on the association of clinical factors or predictors like anemia/UTI in pregnancy and preeclampsia/eclampsia are very limited in Kenya.

Many pregnant women seek antenatal care and delivery services at primary health facilities where resources are limited and specialized obstetrics skills are lacking. Women at risk or diagnosed with preeclampsia/eclampsia at primary health facilities are usually referred to high risk specialized obstetrics clinics/hospitals for follow-ups or emergency action at secondary and tertiary health facilities, compounding the problem.

1.4 Justification for the study

Kenya has made some significant progress in reversing maternal and child health indicators. However, the current figures are still unacceptably high with maternal mortality ratio of 362 deaths per 100,00 live births (KDHS, 2014), but the global SDG 2030 target is < 70 maternal deaths per 100,000 live births (World Health Organization, 2015). The childhood mortality rates in Kenya are Infant Mortality Rate (IMR) 39 deaths per 1000 live births and Under-five(5) mortality rate (U5MR) 52 deaths per 1000 live births (KDHS, 2014), compared to the global SDG 2030 target of: IMR 19 deaths per 1000 live births and U5MR is 25 deaths per 1000 live births, respectively (World Health Organization, 2015). Perinatal mortality rate in Kenya is 29 perinatal deaths per 1000 pregnancies while Neonatal mortality rate is 22 deaths per 1000 live births (KDHS, 2014). Therefore, the proportional contribution of neonatal mortality to IMR is 56.4%; meaning in a single year, 56.4% of the infant deaths occur in the first month in Kenya.

According to a few related studies done in Kenya, preeclampsia and eclampsia are not commonly found in the Kenyan population. In fact, a full account of the risk factors or determinants of preeclampsia and eclampsia has not been well established in the Kenyan population (Itoh Megumi, Were F., Owidhi M., 2017). To address this gap including others previously mentioned, some risk factors of preeclampsia/eclampsia namely maternal socio-demographic, reproductive, obstetrics, clinical, behavioral and family history-related factors in addition to antenatal healthcare-seeking behavior were investigated with a view of informing policy, creating awareness, and formulating strategies to improve antenatal care and delivery services among women of reproductive age in Kenya.

1.5 Research questions

1. What are the socio-demographic factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals?

2. What are the reproductive & obstetric factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals?

3. What are the clinical factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals?

4. What are the behavioral & family history-related factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals?

1.6 Study objectives

1.6.1 Broad study objectives

The broad objective of the study was to identify the factors associated with preeclampsia/eclampsia among women delivering at Nairobi County Hospitals.

1.6.2 Specific objectives

Specific objectives were to:

1. Identify the socio-demographic factors associated with Preeclampsia/eclampsia among women delivering at Nairobi County Hospitals.

2. Identify the reproductive & obstetric factors associated with Preeclampsia/eclampsia among women delivering at Nairobi County Hospitals.

3. Identify the clinical factors associated with Preeclampsia/eclampsia among women delivering at Nairobi County Hospitals

4. Identify the Behavioral and Family history-related factors associated with Preeclampsia/eclampsia among women delivering at Nairobi County Hospitals.

1.7 Study hypotheses

H_{01}: There is no association between socio-demographic factors and preeclampsia/eclampsia.

H_{02}: There is no association between reproductive and obstractic factors and preeclampsia/ eclampsia.

H_{03}: There is no association between maternal clinical factors and preeclampsia/eclampsia.

H_{04}: There is no association between behavioral and family history-related factors and preeclampsia/eclampsia.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Preeclampsia is defined as high blood pressure in a woman usually after 20 weeks gestation plus proteinuria, whereas Eclampsia, is defined as generalized seizures in a pregnant woman with preeclampsia criteria. In this section, a detailed review of the literature was carried out on the determinants of preeclampsia and eclampsia among women of reproductive age thus guiding the development of the conceptual framework.

2.2 Prevalence of preeclampsia and eclampsia

Preeclampsia affects 2–10% of pregnant women globally and eclampsia 0.03–0.05% (Wandabwa J., Doyle P., Kiondo P., 2010). However, the overall prevalence of preeclampsia according to studies varies from 4.5% to 23% (Kahnamoueiaghdam F., Amani F., 2015). Preeclampsia affects about 4% of pregnancies in the United States of America (Bibbins-Domingo K., Grossman DC, Curry SJ, 2017). In Kenya, the incidence of preeclampsia is about 0.3% (Itoh Megumi, Were F., Owidhi M., 2017) while the prevalence is 6.1% (Otieno Abuya Norbert, 2012). Similarly in Ethiopia, the prevalence of preeclampsia is about 5% (Wagnew Maereg, Dessalegn M., Worku A., 2016). In Nigeria, the prevalence of preeclampsia ranges between 2% - 16.7% (Osungbade, Kayode O. and Ige, 2011).

2.3 Effects of preeclampsia and eclampsia

Maternal and fetal complications in addition to maternal and fetal mortality are much greater in mothers with pre-eclampsia and eclampsia than those without (Kahnamoueiaghdam F., Amani F., 2015). Preeclampsia is the second top cause of maternal death globally, may lead to grave maternal complications (stroke, eclampsia, and organ failure), and poor perinatal outcome for the fetus and infant especially intrauterine development restriction, low birth weight, and stillbirth

(Bibbins-Domingo K., Grossman DC, Curry SJ, 2017)**.** Preeclampsia develops in 20% of first pregnancies and entails more than 40% of premature birth resulting from treatment (Kahnamoueiaghdam F., Amani F., 2015). It is projected that globally 13% of maternal death is due to hypertensive disorders of pregnancy, but is much elevated in developing countries where the estimate is between 20 – 80% in Africa and Latin America (Wandabwa J., Doyle P., Kiondo P., 2010).

Presently, about 98% of maternal, fetal, and neonatal death related to preeclampsia and eclampsia occur in Low-Income Countries, with much of that death in South Asia and Sub-Saharan Africa (Goldenberg Robert L., Jones Bonnie, 2014). Preeclampsia also accounts for increasing maternal & perinatal/infant morbidity and mortality, and it is a major cause of maternal mortality 15-20% in developed countries (Shamsi Uzma, Saleem Sarah, 2013); thus, significantly impacting SDG3 – that is, good health & wellbeing by 2030 (United Nations, 2016).

2.4 Determinants of preeclampsia and eclampsia

Epidemiologic research remains rooted in the concept of interrelated causal factors for disease occurrence (Dohoo Ian, Martin Wayne, 2012). The word determinants refer to the risk factors and other causes that influence the occurrence of a disease or health-related event(s). Preeclampsia and eclampsia may have a genetic predisposition but the exact cause of these medical conditions are still unknown; thus, they are multifactoral or multi-causal diseases and it is important to fully investigate their various risk factors/predictors across different populations or countries. Among the many characteristics or risk factors of preeclampsia and eclampsia, this session has reviewed pieces of literature on the socio-demographic, reproductive and obstetric,

clinical, and behavioral/family history-related factors with the aim of identifying those associated with the problem in the Kenyan population.

2.4.1 Socio-demographic factors

The socio-demographic factors are education, maternal age, marital status, occupation, residence, ethnicity, and religion.

In the USA, African-American race, older maternal age & unmarried status were risk factors significantly associated with early inception of preeclampsia while younger maternal age was found to be highly associated with delayed onset of preeclampsia (Sarka Lisonkova and Joseph KS, 2013). A prospective study on the relationship between maternal age and preeclampsia conducted in India found out that 56.10% of patients less than 20 years developed preeclampsia while for those greater than 30 years of age, the rate of developing preeclampsia showed a positive correlation with progression in age (Kumari, 2016). A low socioeconomic status was the predictor of rigorous preeclampsia and eclampsia in Uganda (Wandabwa J., Doyle P., Kiondo P., 2010). In Nigeria, a retrospective case-control study of factors linked with rigorous preeclampsia and eclampsia found out that occupation such as housewife was a factor associated with a higher risk of developing severe preeclampsia and eclampsia (Guerrier Gilles, Oluyide Bukola, 2013). A WHO multi-country secondary analysis of risk factors of preeclampsia and eclampsia and its adverse outcomes found out that factors such as maternal age $\geq$ 30 years and low education achievement were significantly associated with increased risk of preeclampsia and eclampsia (Bilano Ver Luanni, Ota Erika, 2014).

Regional ethnicity may be a risk factor for preeclampsia. In China, a population study found out that Chinese ethnicity is a factor for low risk of developing preeclampsia; thus, this was

dependent on lifestyle and cohabitation with a partner (Xiao J, Shen F, Xue Q, 2014) whereas a hospital-based study in Ethiopia on Preeclampsia and associated factors among ANC clients found that 53.7% of participants were of the Muslim religion though religion had no significant association with preeclampsia (Tessema, Gizachew A. and Ayele, 2015).

2.4.2 Reproductive and obstetric factors

In Ethiopia, primigravida, multiple pregnancies, and change of paternity after previous pregnancy were factors linked with preeclampsia and eclampsia among pregnant women attending delivery and antenatal services (Grum Teklit, Seifu Abiy, 2017); Shegaze Mulugeta, Markos Yohannes, 2016). Studies conducted in Ethiopia and Nigeria found out that age at first pregnancy/marriage and trimester of first ANC visit (especially 2nd and third trimesters) have increased risk of developing preeclampsia/eclampsia (Shegaze Mulugeta, Markos Yohannes, 2016; (Guerrier Gilles, Oluyide Bukola, 2013).

A study conducted in Nigeria found out that primiparity and less than 4 ANC visits during pregnancy were factors associated with a higher risk of developing severe preeclampsia and eclampsia (Guerrier Gilles, Oluyide Bukola, 2013). Similarly, a WHO multi-country secondary analysis of risk factors of preeclampsia and eclampsia and its adverse outcomes found out that nulliparity and absence of ANC were significantly linked with higher risk of preeclampsia and eclampsia whereas women who delivered male babies were associated with double risk of developing severe preeclampsia and eclampsia in a case-control study conducted in Uganda (Wandabwa J., Doyle P., Kiondo P., 2010).

In Kenya, a descriptive cross-sectional study among 229 pregnant women attending antenatal clinics in health centers of Kibera slums (Nairobi) found out that less than 38% of respondents

were aware of associated symptoms of preeclampsia, and 25.8% were primigravidae (Otieno Abuya Norbert, 2012). From the literature mentioned above, early marriages and pregnancies (age group 15-24 years), absence of ANC visit or less than 4 ANC visits have been associated with developing preeclampsia and eclampsia. Similarly in Kenya, young females are no exception to said risks considering the following statistics from the Kenya Demographic and Health Survey 2014 (KDHS, 2014): the median age at first marriage among women of reproductive age is 20.2 years; adolescent birth rate is 96.3 per 1000 women aged 15-49 years; Women attending four or more ANC visits were 58%; contraceptive prevalence rate is 58% while contraceptive discontinuation rate is 31%, and the percentage of birth attended by skilled health personnel is 61.8%. In Kenya, the total fertility rate is 3.9; however, teenage pregnancy is one in five adolescent 15-19 years age group (Ministry of Health [Kenya], 2016).

2.4.3 Clinical factors

A study conducted in Sudan found out that the greater the severity of anemia during pregnancy the greater the risk of preeclampsia, preterm delivery, low birth weight and stillbirth (Ali AbdelAziem A., Rayis Duria A., 2011). An epidemiological study investigating the risk factors and impacts of preeclampsia among pregnant mothers in Cairo, Egypt found out that UTI in pregnancy in pregnancy was a significant risk factor for developing preeclampsia (El-Moselhy, Essam A., Khalifa, Hamed O., Amer, 2011); whereas, a WHO multi-country secondary analysis of risk factors of preeclampsia and eclampsia and its adverse outcomes found out that UTI in pregnancy and severe anemia were significantly linked with higher risk of preeclampsia and eclampsia (Bilano Ver Luanni, Ota Erika, 2014).

2.4.4 Behavioral and family history-related factors

In Ethiopia, alcohol use and family history of hypertension were factors found to be associated with preeclampsia and eclampsia among pregnant women attending delivery and antenatal services (Grum Teklit, Seifu Abiy, 2017; Shegaze Mulugeta, Markos Yohannes, 2016); whereas chronic hypertension and diabetes before pregnancy were the predictors of preeclampsia and eclampsia in Iran (Kahnamoueiaghdam F., Amani F., 2015). In a retrospective case-control study in Nigeria, the use of traditional treatment during pregnancy was found to be a factor associated with a higher risk of developing severe preeclampsia and eclampsia (Guerrier Gilles, Oluyide Bukola, 2013). A hospital-based unmatched case-control study on the determinants or risk factors of preeclampsia in India and Ethiopia where simple random sampling technique was used; found out that family history of hypertension, history of diabetes, and obesity in young age were the significant risk factors of preeclampsia (Ganesh, Kumar S., Unnikrishnan B., Nagaraj K., 2010; Endeshaw, Mulualem, Abebe, Fantu, Work, 2016).

Studies conducted in Ethiopia and Sweden found out that alcohol and tobacco use during pregnancy was significantly associated with the occurrence of preeclampsia/eclampsia (Grum Teklit, Seifu Abiy, 2017; (Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010)**.**

In Kenya, tobacco use occurs among 1% of women of reproductive age (15-49 years) whereas, 29% of Kenyan women consume alcoholic beverage for 1-2 days in every two weeks (KDHS, 2014). Like alcohol consumption and tobacco use, hypertension and diabetes are major risk factors for Cardio-pulmonary disease, stroke, and even maternal hypertensive disorders like preeclampsia and eclampsia. Thus, high blood pressure and diabetes occur in 9% and 1% of Kenyan women, respectively (KDHS, 2014).

2.5 Conceptual framework

The conceptual framework below illustrates the relationship between risk factors predicted to cause pre-eclampsia and/or eclampsia. The relationships between explanatory/independent variables/factors and outcome (preeclampsia/eclampsia) are illustrated in the conceptual framework below.

In the conceptual framework (figure 1), the explanatory/independent variables/factors can be categorized into four and the relationships between them to that of the outcome are described as follows: i) Socio-demographic factors – which include education, maternal age, marital status, occupation, residence, ethnicity, and religion ii) Reproductive and obstetric factors, which include age at first marriage, age at first pregnancy, number of ANC visits, time/trimester of first ANC visit, gravidity, parity and child sex; iii) Clinical factors – namely, Urinary Tract Infection (UTI) in pregnancy and anemia in pregnancy. Like other studies, UTI in pregnancy was defined as a urinary pus cell count greater than 5 per high power field or >5per microliter; 6-10phf (mild-moderate UTI in pregnancy), >10phf (severe UTI in pregnancy and normal is 0-5phf ((Boye, Alex, Siakwa, Peter M., Boampong, Johnson N., 2012). iv) Behavioral and family history-related factors – namely, alcohol use, tobacco use, hypertension family history, diabetes family history, hypertension personal history, diabetes personal history, and use of traditional treatment.

The socio-demographic factors are basically distant variables. Some may be independently associated with preeclampsia/eclampsia and also related to other factors which in terms, are associated with the outcome (preeclampsia/eclampsia). Regarding independent variables/factors that are reproductive/obstetric, clinical, and behavioral/family history-related, they are most often the weakest links health programs can control/prevent or advert to significantly reduce the risk of developing preeclampsia/eclampsia. The outcome is preeclampsia/eclampsia. The extra

baggage is that preeclampsia and eclampsia are among the leading causes of maternal mortality worldwide and health programs should significantly reduce their risk factors in the population.

For instance, studies conducted in Nigeria, Ethiopia, and Sweden found out that education is independently associated with preeclampsia/eclampsia, but also related to other factors (number of ANC visit, anemia in pregnancy, occupation, alcohol use, tobacco use) which in term are associated with the outcome (Babalalo, 2014; Grum Teklit, Seifu Abiy, 2017**;** Guerrier Gilles, Oluyide Bukola, 2013**;** Bilano Ver Luanni, Ota Erika, 2014**;** Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010)**.** Maternal age, like residence and religion, is independently associated with preeclampsia/eclampsia but they are also related to a number of ANC visit which is associated with preeclampsia/eclampsia (Babalalo, 2014; Bilano Ver Luanni, Ota Erika, 2014).

Occupation, like alcohol use and tobacco use, is independently related to preeclampsia/eclampsia (Guerrier Gilles, Oluyide Bukola, 2013; Grum Teklit, Seifu Abiy, 2017; Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010) whereas; occupation is also related to alcohol use and tobacco use which are also associated with preeclampsia/eclampsia (Grum Teklit, Seifu Abiy, 2017; Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010)**.** Thus, alcohol use may interact with tobacco use even though alcohol consumers are more likely to smoke/use tobacco but this may vary across different populations.

Similarly, parity is independently associated with preeclampsia/eclampsia but also related to UTI in pregnancy which is also related to preeclampsia/eclampsia (Grum Teklit, Seifu Abiy, 2017; Haider, Gulfareen, Zehra, Nishat, Munir, 2010).

Gravidity and child sex may interact with parity but independently, they are related to the occurrence of preeclampsia/eclampsia (Gilles Guerrier 2013; Otieno 2012; Wandabwa 2010). Anemia in pregnancy is independently associated with the outcome but also related to UTI in pregnancy which in term is associated with preeclampsia/eclampsia (Emiru, Tazebew, Beyene, Getenet, Tsegaye, 2013; Haider, Gulfareen, Zehra, Nishat, Munir, 2010; Bilano Ver Luanni, Ota Erika, 2014).

In the conceptual frame, the number of ANC may interact trimester of first ANC visit but both of them are independently related to preeclampsia (Guerrier Gilles, Oluyide Bukola, 2013). Marital status, ethnicity, age at first pregnancy, age at first marriage, personal/family history of hypertension, personal/family history of diabetes, and traditional treatment use are other explanatory factors that are independently related to preeclampsia/eclampsia, according to studies (Sarka Lisonkova and Joseph KS, 2013; Xiao J, Shen F, Xue Q, 2014; Shegaze Mulugeta, Markos Yohannes, 2016; Ganesh, Kumar S., Unnikrishnan B., Nagaraj K., 2010; Endeshaw, Mulualem, Abebe, Fantu, Work, 2016; Kahnamoueiaghdam F., Amani F., 2015; Guerrier Gilles, Oluyide Bukola, 2013).

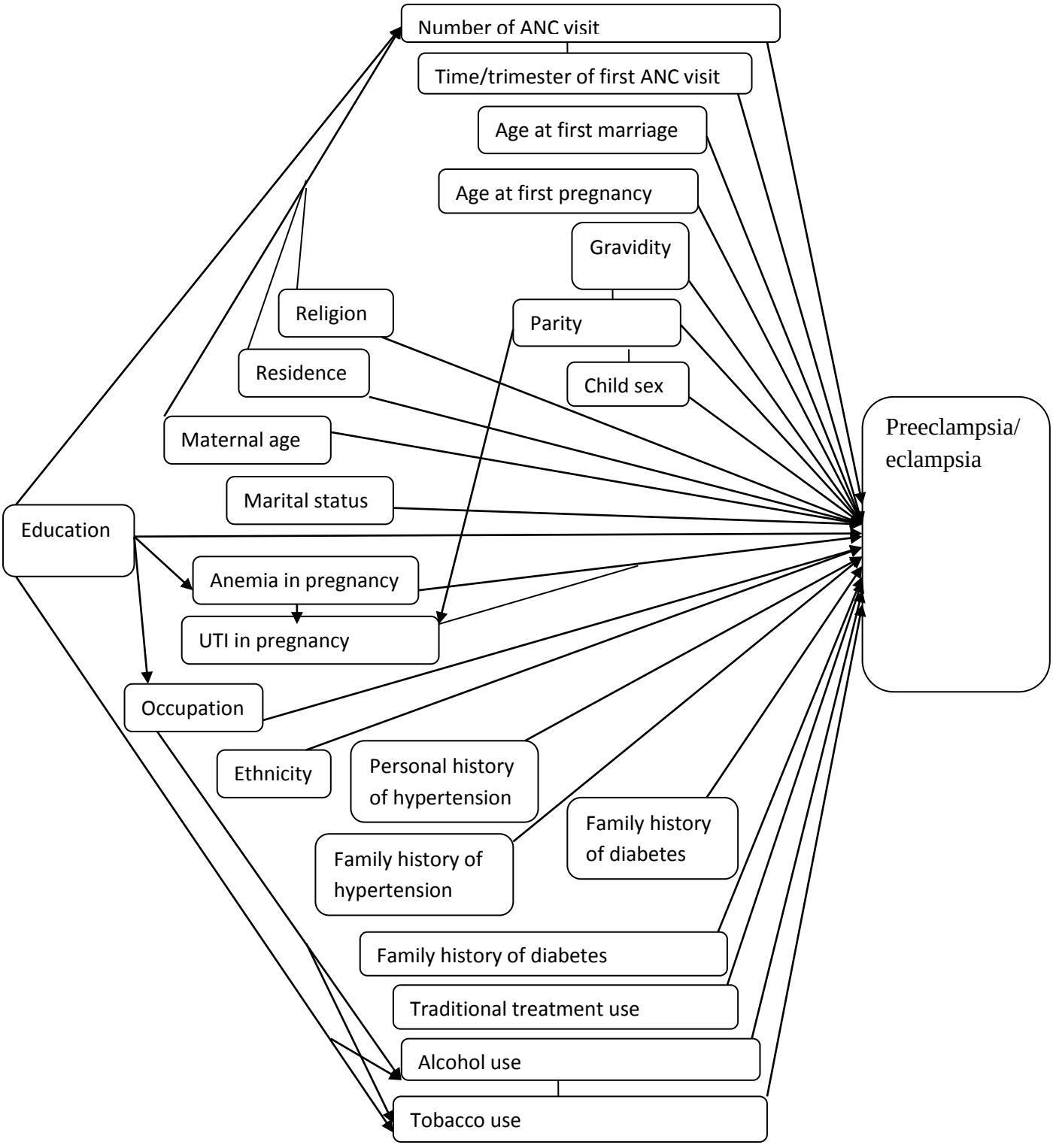

Figure 1: Conceptual framework

CHAPTER THREE: METHODOLOGY

3.1 Study design

This was a hospital-based unmatched case-control study carried out at Nairobi County Hospitals' postnatal ward. This study design was chosen because it is appropriate for identifying risk factors associated with pre-eclampsia and/or eclampsia, which are latent conditions among gravid women.

3.2 Study area

Nairobi is the capital city of Kenya and has about 4.6 million people. Furthermore, it is estimated that about 58% of Nairobi's population lives in slums or slum-like conditions. This study was carried out at Mbagathi District Hospital (Kibra constituency), Mama Lucy Kibaki Hospital (Embakasi Central), and Pumwani Maternity Hospital (Kamukunji) in Nairobi County. These are public county hospitals offering primary, secondary, and tertiary health care services to Nairobi residents and neighboring counties such as Kajiado, Kiambu and Machakos counties. Thus, they are 3 of 4 Nairobi County Hospitals delivering preeclamptic and/or eclamptic women. Pumwani Maternity and Mama Lucy Kibaki hospitals are located east of Nairobi County, while, Mbagathi district hospitals is located south of Nairobi. Mbagathi is situated at the heart of the second-largest informal settlement in Africa known as "Kibra slums", whereas, Pumwani hospital largely serves the very poor of the county such as Mathare slums, in addition to the larger Eastland. Similarly, Mama Lucy Kibaki hospital is also at the heart of Eastland (Nairobi City County Ministry of Health [Kenya], 2017).

3.3 Study population

The study population was women of reproductive age (15-49 years) who gave birth at Nairobi County Hospitals and admitted to the postnatal ward July-September, 2019.

3.4 Definition of cases and controls

Case was defined as a woman of reproductive age (15-49 years) admitted in postnatal wards having been diagnosed of preeclampsia (high blood pressure during pregnancy, ≥140/90 mmHg, plus proteinuria ≥300 mg/24 hours or ≥ 1+ dipstick) and/or eclampsia (high blood pressure during pregnancy, proteinuria plus generalized seizures) at Nairobi County Hospitals July-September 2019. Control, on the other hand, was defined as a woman of reproductive age (15-49 years) admitted to the postnatal ward without preeclampsia/eclampsia at Nairobi County Hospitals July-September, 2019. The case was selected after the physician (medical officer or consultant obstetrician/gynecologist) had made a diagnosis (preeclampsia/eclampsia) and client admitted to the postnatal ward. The diagnosis involved history taking, physical assessment, and laboratory investigation; thus, women were included as cases if they satisfied the diagnostic criteria mentioned in the case definition above.

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

The inclusion criteria were:

1) A postnatal ward mother that met/satisfied the definition of a case or control;

2) Those that gave informed consent to participate in the study;

3) A postnatal ward mother who delivered in 3 of the 4 Nairobi county hospitals; namely, Pumwani, Mama Lucy Kibaki, and Mbagathi hospitals and

4) A case or control less than 18 years old was included in the study, but both patient and parent/guardian signed consent form each.

3.5.2 Exclusion criteria

The omission criteria were:

1) A postnatal ward mother with a severe medical situation and who couldn't give consent

2) Mutuini hospital, as also a Nairobi County Hospital, was excluded from the study because of lack of an operating theater and preeclampsia/eclampsia were not delivered there; hence such cases were often referred to or patients advised to deliver at other higher-level facilities.

3) A woman of reproductive age (15-49 years) admitted to post-natal ward of Nairobi County Hospitals July-September 2019, but had one or more of the following conditions: Chronic hypertension, Gestational hypertension, Cardiac/heart disease, Liver disease and Kidney disease;

4) Cases and controls that had been interviewed before and still admitted were considered as exclusion criteria;

5) A case or control admitted to a postnatal ward of Nairobi County Hospitals July-September 2019, but declined to participate in the study;

6) A woman with the previous history of convulsions was excluded from the study and

7) A parent/guardian whose relative is a case or control was excluded from the study; additionally, no parent/guardian served as a proxy in answering the questionnaire.

3.6 Sampling and sample size determination

3.6.1 Sample size determination

The sample size of 352 participants (264 controls & 88 cases) was determined as specified by Kelsey, Jennifer and others (Kelsey Jennifer L., Whittemore Alice S., Evans Alfred S., 1996) for case-control studies as follow: -

$$n_1 = \frac{(Z_\alpha + Z_\beta)^2 \overline{pq}(r+1)}{r(p_1 - p_2)^2}, \qquad p_1 = \frac{p_2 OR}{1 + p_2(OR - 1)}$$

$$\bar{p} = \frac{p_1 + rp_2}{r + 1}, \quad \bar{q} = 1 - \bar{p}$$

$$n_2 = rn_1,$$

$N_1 = \underline{(1.96+0.84)^2\ (0.462887323)\ (0.537112677)\ (3+1)}$
$3\ (0.591549295 - 0.42)^2$
$= 88.3$ or **88** (cases)

$N_2 = r\ n_1$ **Total sample size** $= n_1 + n_2 = 88 + 264 =$ **352**
$= 3\ (88)$
$=$ **264** (controls)

Since the outcome is rare in the Kenyan population, the ratio of 3 controls to 1 case was used in calculating the sample size but still maintained the statistical power of the study; $\mathbf{N_1}$ is the number of cases while $\mathbf{N_2}$ is the number of controls. Furthermore, $\mathbf{P_1}$ is the proportion of cases exposed thus, was the proportion of women with pre-eclampsia and/or eclampsia that attended less than 4 ANC visits; $\mathbf{P_2}$ is the proportion of controls exposed and this was the proportion of women without pre-eclampsia and/or eclampsia that attends less than 4 ANC visit, that was set at 42% (KDHS, 2014); $\mathbf{Z_\alpha}$ (1.96) and $\mathbf{Z_\beta}$ (-0.84) were the required values specifying the 2-tailed confidence level (95%) and statistical power (80%) desired respectively. The **odds** for attending less than 4 ANC visits being the primary exposure was set at 2 (universally acceptable) and **r**=3, is the ratio of controls to cases. Given these figures, the desired sample size of 352 participants (88 cases and 264 controls) was computed.

3.6.2 Sampling technique and procedure

Pumwani, Mama Lucy Kibaki, and Mbagathi hospitals were purposely selected because these are 3 of 4 Nairobi County Hospitals delivering preeclamptic and/or eclamptic women. Proportional allocation of sample size was made to the study hospitals based on their delivery caseload. Women of reproductive age (15-49 years) admitted to postnatal wards during the study period

and satisfying the inclusion criteria were recruited until the agreed sample size was reached. Cases were enrolled successively until the required sample size was obtained. For each case, 3 controls were selected using a simple random sampling technique with sampling frame for controls consisting of a list of women (who fulfilled the inclusion criteria) admitted to post-natal ward without preeclampsia/eclampsia which were recruited at the time of selection of the cases at Nairobi County Hospitals July-September, 2019. The sampling frame was updated as per deliveries taking place in study hospitals from July-September 2019.

3.6.2.1 Selection of study participants

3.6.2.1.1 Selection of cases

All cases that met the case definition and criteria were selected during the study period, July-September 2019, to obtain the required sample of 88 cases. In a typical month at least 19, 10, and 4 cases of Preeclampsia/eclampsia occur at Pumwani, Mama Lucy, and Mbagathi Hospitals respectively (Nairobi City County Ministry of Health [Kenya], 2017). On average, monthly deliveries at the study hospitals, Pumwani Maternity Hospital, Mama Lucy Kibaki Hospital, and Mbagathi District Hospital were 1600, 800, and 470 respectively. Based on sample size determination from the formula above, 88 cases were proportionally sampled from the three (3) hospitals. The amount of delivery from each hospital was divided by the total number of deliveries in the three hospitals, that is, 2870 to determine proportional contribution for each hospital. In view of this, from Pumwani maternity hospital, 1600 was divided by 2870 and multiplied by 88 to yield a sample size of 49, similarly, from Mama Lucy Kibaki Hospital, 800 was divided by 2870 and multiplied by 88 to give 25 cases during the study period (July-

September 2019). Lastly, for Mbagathi hospital, 470 divided by 2870 and multiplied by 88 to yield 14 cases also during the study period (July-September 2019). See table 1.

3.6.2.1.2 Selection of controls

Controls were simple random sampled from a list of women admitted to each of the 3 hospitals' post-natal ward without preeclampsia/eclampsia which was recruited at the time of selection of the cases. A total of three (3) controls for each case were selected by the time of selection to cases. The sampling frame was updated as per deliveries taking place in study hospitals from July-September 2019.

Based on average, monthly deliveries at the study hospitals, Pumwani maternity, Mama Lucy Kibaki, and Mbagathi were 1600, 800, and 470 respectively. This also meant that at least 53, 27, and 16 deliveries occur in these hospitals respectively, on a typical day in a month. Based on sample size determination from the formula above, 264 controls were proportionally sampled from the three hospitals. The number of deliveries from each hospital was divided by the total number of deliveries in the three hospitals, that is, 2870 to determine proportional contribution for each hospital. In view of this, from Pumwani maternity hospital, 1600 was divided by 2870 and multiplied by 264 to yield a sample size of 147. Similarly, from Mama Lucy Kibaki Hospital, 800 was divided by 2870 and multiplied by 264 to give 74 controls. Lastly, for Mbagathi hospital, 470 divided by 2870 and multiplied by 264 to yield 43 controls. (See table 1 below).

Table 1: Distribution of required sample of 88 cases and 264 controls among study hospitals

Study hospital	Total delivery per month (Ave.)	Proportion	Cases (n=88) n (%)	Controls (n=264) n (%)	Total n (%)
Pumwani	1600	0.557	49 (55.7)	147 (55.7)	196 (55.7)
Mama Lucy Kibaki	800	0.279	25 (28.4)	74 (27.9)	99 (28.1)
Mbagathi	470	0.164	14 (15.9)	43 (16.4)	57 (16.2)
Total	2870	1	88	264	352

3.7 Data collection

3.7.1 Recruitment, training, and pretesting

The data were collected by the principal investigator (or researcher) and six (6) research assistants. The research assistants were those who had done several other studies for research institutions; some of them had a background in nursing and were final year Master students in other Universities in Kenya. Orientation training was conducted for research assistants at each of the study hospitals. The research assistants were fluent in both English and Kiswahili languages to ensure smooth translation of the questions and responses. The actual pretesting, using ten percent (10%) questionnaires of the desired sample, was carried out at Kenyatta National Hospital (KNH) – a National Teaching and Referral Hospital located hospital road, Nairobi, Kenya. From the pretesting, we received important feedback on how questions were to be recorded or restructured. Those questions that were ambiguous were modified and a revised questionnaire was prepared and approved by course supervisors before actual data collection started.

3.7.2 Method of data collection

The ideal mode of data collection was a questionnaire; since it allows for more data collection in a short period of time and with minimum interruptions to the respondent's schedules. The questionnaire was divided into four (4) parts A, B, C, and D. Part A captured the Socio-demographic factors; part B includes questions that captured reproductive and obstetrics factors; part C and D include questions that captured the clinical and behavioral/family history-related factors, respectively

The primary data collection method was applied in this study, using a pretested structured quantitative questionnaire. Initially, the questionnaire was prepared in English then translated to local/national language (Kiswahili) and back to English to retain conceptual reliability. Under the supervision of principal investigator, trained research assistants administered a structured questionnaire to post-natal mothers. The questions were in a closed-ended format and structured in line with study objectives.

Additionally, some secondary data were collected from study participant medical records at Nairobi County Hospitals, using a data abstraction tool. The data abstraction tool was in English version only; since it was only used by research assistants who were already fluent in both English and Swahili languages. Information in the data abstraction tool was already captured in the questionnaire which had a Swahili version. Data collectors obtained consent from study participants.

The pretesting phase was conducted in July 2019 and actual data collection occurred in August and September 2019. The strategies used to enhance smooth data collection were as follows: 1) Properly engaging each of the three hospitals' management teams including the postnatal wards in-charge, and 2) visiting the three study hospitals (Pumwani, Mama Lucy Kibaki, and

Mbagathi) every other day to supervise and monitor the data collection process. Additionally, my co-investigators (Lecturer/Supervisor) also visited the field to supervise and monitor the data collection process as well.

3.8 Data processing and analysis

The filled questionnaires were first checked for completeness then followed by the entry of data collected from the field into computer micro-soft excel spreadsheets, cleaned, formatted, coded and audited for quality and consistency using Epi-info software before exporting the data set to Stata-version 14.0 computer programming software. The data were analyzed for descriptive statistics: a) Continuous variables, for example, mean, range and standard deviation, and b) Qualitative variables – percentages or proportions. A bivariable mixed-effect logistic regression analysis was used to determine socio-demographic, reproductive and obstetric, clinical, behavioral and family history related factors that were significant at a $P \leq 0.20$. The variables found to be significant at the bivariable analysis plus those found important from previous studies were used in the multivariable mixed-effect logistic regression model (Walker, Stefan and Tiemeier, 2009). Confounding was assessed in the multi-variable model. The variables that didn't meet the threshold that is, a p-value less than 0.05 were dropped from the model sequentially only after the odds ratio of the remaining variables in the model changed substantially, roughly 30%. Examining for 2-way interaction between the remaining variables in the model was carried out. The prognostic capability of the model was tested using a modified Hosmer-Lemeshow goodness-of-fit test. Lastly, variables with a p-value of less than 0.05 were considered as factors related with preeclampsia/eclampsia.

3.9 Minimization of biases and errors

The potential biases were likely to include selection bias, ascertainment bias, admission rate bias, and referral bias. Selection bias was minimized by using randomly selected study subjects. Ascertainment bias was minimized by including cases ascertained by the Obstetrician at the hospitals providing care, hospital-based control bias was reduced by choosing controls without clinical features of pre-eclampsia and eclampsia at the same hospitals, whereas, referral bias was reduced by choosing study participants using probability and sampling techniques. Misclassification bias which could affect both cases and controls was minimized by including cases and controls determined by the obstetrician. Pretested structured interview questionnaires, simple random sampling and training research assistants helped in reducing systematic and measurement errors. Lastly, confounders were controlled for by conducting logistic regression analysis.

3.10 Ethical considerations

The ethical issues about this study included confidentiality, privacy, consent, and security for data. Confidentiality and privacy were achieved by ensuring that only trained research assistants for each study hospital handled patient files, encoded data using non-identifiable characters, sought informed consent from the study participants and kept data in safe custody. Ethical research approval was sought from Kenyatta National Hospital and the University of Nairobi Ethics and Research Committee and Nairobi City County Government – Public Health Division. The administrations of Pumwani, Mama Lucy Kibaki, and Mbagathi hospitals, as well as the National Commission for Science, Technology and Innovation (NACOSTI), also gave permission letters for the study.

For postnatal ward mothers that were less than 18 years old, both the patient admitted and parent/guardian were given assent and consent explanation form respectively, to read and then sign if agrees. The parent/guardian only consent (or agree) for relative admitted (less than 18 years) to participate in the study but did not serve as a proxy in answering the questionnaire. Both consent and assent forms had Swahili versions just in case one could not understand the English versions.

CHAPTER FOUR: STUDY RESULTS

4.1 Socio-demographic characteristics of the respondents

The study participants were 352; of whom 88 were cases and 264 were controls. Among the cases, preeclampsia accounted for 83 (94.3%) and Eclampsia 5 (5.7%). This was a multicenter study conducted in Pumwani Maternity Hospital which had 196 participants (55.7%), Mama Lucy Kibaki Hospital with 99 participants (28.1%) and Mbagathi District Hospital with 57 participants (16.2%). The distribution of study participants by study hospital is presented in table 2 and figure 2.

Table 2: Distribution of study participants by study hospital

Variable	Cases (n=88) n (%)	Controls (n=264) n (%)	Total n (%)
Study Hospital			
Mama Lucy Kibaki	25 (28.4)	74 (28.0)	99 (28.1)
Mbagathi District	14 (15.9)	43 (16.3)	57 (16.2)
Pumwanity maternity	49 (55.7)	147 (55.7)	196 (55.7)

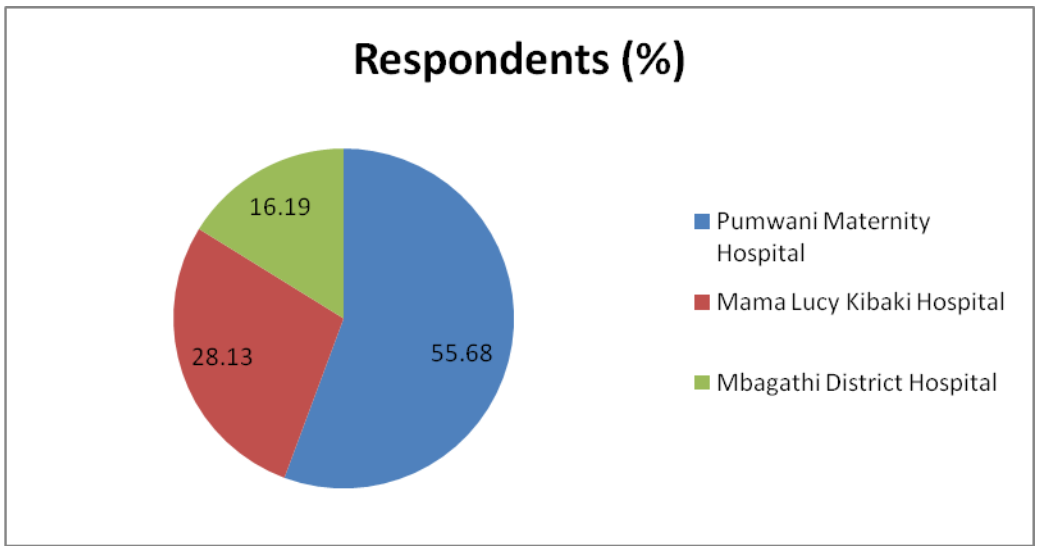

Figure 2: Study hospital by respondents

The mean maternal age of the study participants was 26.1 years (SD=5.5); the mean maternal age for controls being 26.1 years with a standard deviation 5.3 years (range: 18-41 years) and the mean maternal age of cases being 27.6 years with 5.9 standard deviation (Range: 17-42). About 81% of cases and 83% of controls were mothers aged between 20 – 34 years old. Among the controls and cases, 71 (26.9%) and 23 (26.1%) had primary level of education respectively whereas 140 (53.0%) of the controls and 40 (45.5%) of cases had a secondary level of education. In terms of marital status, 80.7% of cases and 80.7% of controls were married. The majority of cases 49 (55.7%) and controls 114 (43.2%) had an occupation as housewife.

With regard to the County of residence, 247 (93.6%) of controls and 86 (97.7%) of cases were residents of Nairobi County. Mothers of Kenyan ethnicity accounted for 258 (97.7%) of controls and 86 (97.7%) of cases whereas, those of non-Kenyan ethnicity were 2 (2.3%) of cases and 6 (2.3%) of controls. Among the cases and controls, 97.7% and 97.0% were Christians respectively; whereas Muslim mothers were 8 (3.0%) for controls and 2 (2.3%) for cases. The study population's socio-demographic factors are presented in table 3 and figure 3.

Table 3: Socio-demographic characteristics of the respondents

Variable	Cases n(%)	Controls n(%)	Total n(%)
Education Level			
No education	1 (1.1)	1 (0.4)	2 (0.6)
Primary education	23 (26.1)	71 (26.9)	94 (26.7)
Secondary education	40 (45.5)	140 (53.0)	180 (51.1)
Tertiary education	24 (27.3)	52 (19.7)	76 (21.6)
Maternal Age			
<20	4 (4.55)	19 (7.2)	23 (6.5)
20-34	71 (80.7)	220 (83.3)	291 (82.7)
35-49	13(14.8)	25 (9.5)	38 (10.8)
Marital status			
Married	71 (80.7)	213 (80.7)	284 (80.7)
Separated	0 (0.0)	4 (1.5)	4 (1.1)
Single	16 (18.2)	45 (17.1)	61 (17.3)
widowed	1 (1.1)	2 (0.8)	3 (0.9)
Occupation			
Salaried employee	10 (11.4)	26 (10.0)	36 (10.2)
House wife	49 (55.7)	114 (43.2)	163 (46.3)
Merchant/business	22 (25.0)	91 (34.5)	113 (32.1)
Other occupation	7 (8.0)	33 (12.1)	40 (11.4)
County of residence			
Nairobi	86 (97.7)	247 (93.6)	333 (94.6)
Other counties	2 (2.3)	17 (6.4)	19 (5.4)
Specific place of residence			
Urban/estate	42 (47.7)	143 (54.2)	185 (52.6)
Rural	0 (0.0)	8 (3.0)	8 (2.3)
Informal settlement	46 (52.3)	113 (42.8)	159 (45.2)
Ethnicity			
Kenyan	86 (97.7)	258 (97.7)	344 (97.7)
Non-Kenyan	2 (2.3)	6 (2.3)	8 (2.3)
Religion			
Christian	86 (97.7)	256 (97.0)	342 (97.2)
Muslim	2 (2.3)	8 (3.0)	10 (2.8)

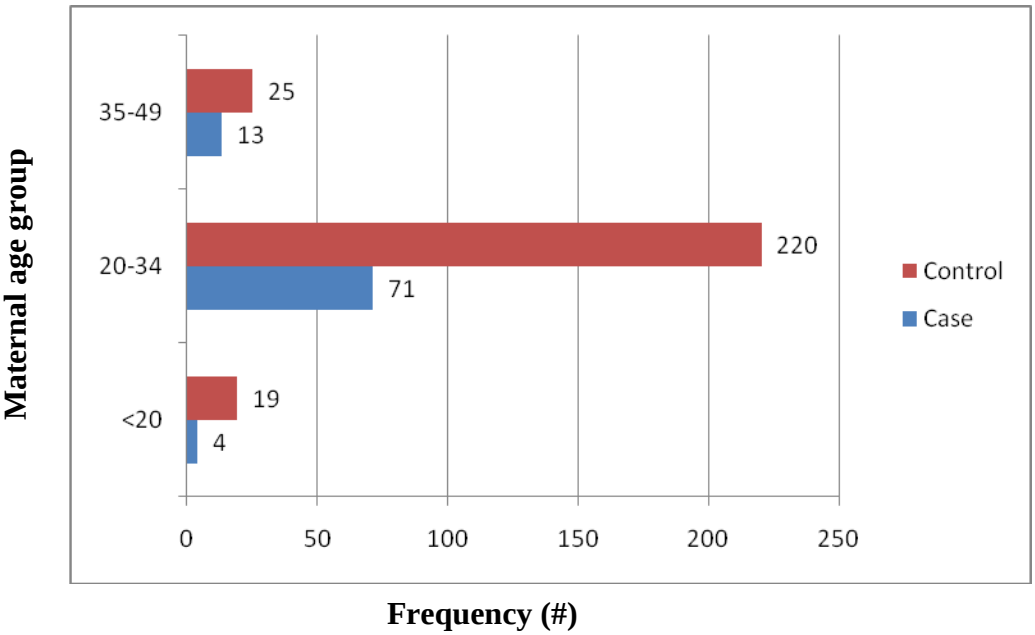

Figure 3: Distribution of maternal age group by cases and controls

4.2 Reproductive and obstetric characteristics of the respondents

The mean age at first marriage among study participants was 21.8 years (SD=3.6; range 14-35 years); the mean for cases being 22.6 years (SD=4.1; range 16-33 years) and that for controls being 21.5 years (SD=3.4; range 14-35 years). Similarly, the mean age at first pregnancy among study participants was 21.56 years (SD=3.6 years; range 14-38); the mean for controls and cases being 21.3 years (SD=3.4, range: 14-38 years) and 22.2 years (SD=3.8; range 14-32 years), respectively. The study also found out that 32.1% of mothers (n=352) were teenagers (<20 years) when they had their first pregnancy whereas 67.9% of mothers(n=352) were late adolescents and young adults (20-34 years) when they had their first pregnancy. Conversely, 28.4% of mothers (n=292) were teenagers (<20 years) when they first got married while 32.1% of mothers (n=352) were also teenagers when they first got pregnant. Similarly, 71.6% of mothers (n=292) were late

adolescents and young adults (20-34 years) when they first got married while 67.9% of mothers (n=352) were also late adolescents and young adults (20-34 years) when they first got pregnant.

Sixty-one percent of the postnatal mothers attended their first ANC visit in the second trimester of pregnancy with cases being 53 (60.2%) and controls 162 (61.4%) whereas eleven percent of controls and 6.8% of cases attended their first ANC visit in the third trimester of pregnancy. In the first trimester, 27 (30.7%) of cases and 71 (26.9%) of controls attended their first ANC visit. The mean number of ANC visits among postnatal mothers was 3.9 visits (SD=1.5; range 0-12) with mean for controls being 3.9 (SD=1.4; range 0-12) and mean of cases being 3.8 (SD=1.6; range 1-8). The mean gravidity was 2.1 pregnancies with a standard deviation 1.1 (range 1-6). Additionally, the mean parity was 1.8 live births with a standard deviation of 1.0 (range 0-6). Male babies born to postnatal mothers were 41(46.6%) and 138(52.3%) among cases and controls, respectively; whereas female babies born to cases and controls were 44(50%) and 121(45.8%), respectively. Furthermore, 3(3.4%) of cases and 5(1.9%) of controls gave birth to twin/multisex (male and/or female). This means the total male and female babies born to postnatal mothers, despite the nature of gestation, were 187(51.9%) and 173(48.1%) respectively. The reproductive and obstetric factors of the study population are presented in table 4 and figure 4:

Table 4: Reproductive and obstetric characteristics of the respondents

Variable	Cases n(%)	Controls n(%)	Total n(%)
Time/Trimester FirstAnc Visit			
None	2 (2.3)	2 (0.8)	4 (1.1)
First trimester	27 (30.7)	71 (26.9)	98 (27.8)
Second trimester	53 (60.2)	162 (61.4)	215 (61.1)
Third trimester	6 (6.8)	29 (11.0)	35 (10.0)
Number of ANC Visits			
Mean	3.8±1.6	3.9±1.5	3.9±1.5
Range	1-8	0-12	0-12
Gravidity			
Mean±SD	2.2±1.4	2.0±1.0	2.1±1.1
Range	1-6	1-6	1-6
Parity			
Mean	1.8±1.2	1.9±1.0	1.8±1.0
Range	0-6	0-5	0-6

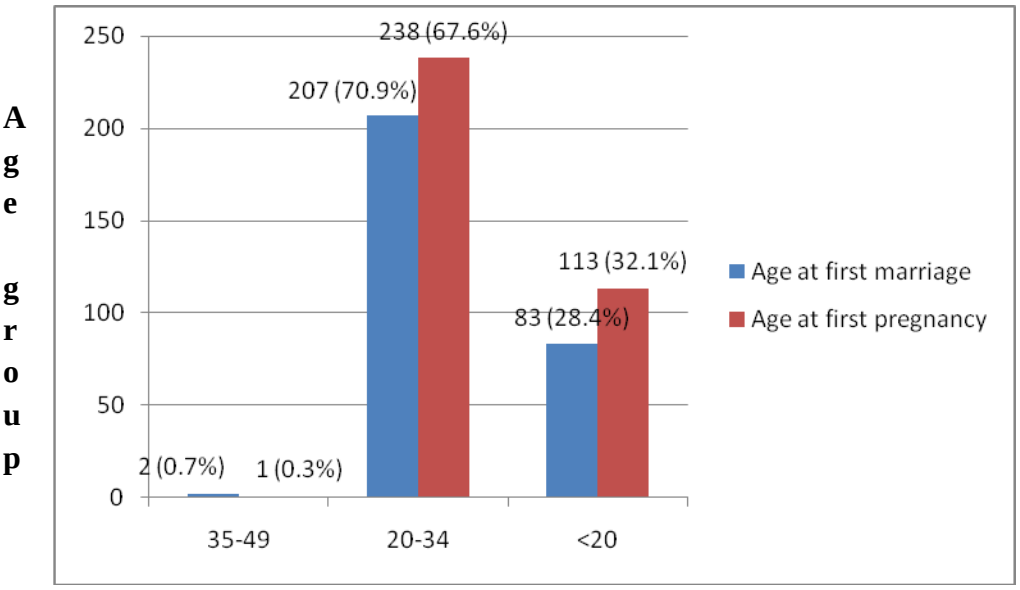

Figure 4: Distribution of age at first pregnancy and age at first marriage

Additionally, 50 (56.8%) of cases had Caesarean section delivery and 38 (43.2%) had Normal/spontaneous vaginal delivery whereas for the controls, 118 (44.7%) had Caesarean section delivery and 146 (55.3%) had Normal/spontaneous vaginal delivery. The cesarean section rate by study hospitals was 71.9, 13.1 and 24.6 per 100 live births for Pumwani, Mama Lucy Kibaki and Mbagathi hospitals respectively.

In this study stillbirth among cases and controls were 7(7.9%) and 18(6.8%), respectively; whereas cases and controls that had normal live births were 81(92.1%) and 246(93.2%) correspondingly. Among study participants whose birth weights were recorded (n=342), the mean birth weight was 3036.9 grams and standard deviation of 597.9 grams (range 960-4500); with the mean birth weight for cases being 2708.7 grams (SD=714.4, range 985-4500) and mean birth weight for controls being 3147.1 grams (SD=509.3, range 960-4400). Low birth weight babies accounted for 32.6% of cases and 9.8% of controls compared to normal birth weight babies which were 66.3% among cases and 89.8% among controls.

For study participants (n=345) whose APGAR score at five minutes were recorded, the overall mean was 8.31 (SD=2.4, range 0-10); with the mean APGAR score at 5 minutes for cases being 8.2 (SD=2.5, range 0-10) and 8.4 (SD=2.4, range 0-10) for controls. Babies with normal APGAR score at 5 minutes accounted for 78 out of 87cases (89.7%) and 236 out of 258 controls (91.5%) compared to the moderately-severely depressed babies which were 10.3% among cases and 8.5% among controls. The birth outcomes among the study population are presented in table 5 and figure 5.

Table 5: Descriptive statistics of birth outcomes among cases and controls

Variable	Cases n(%)	Controls n(%)	Total n (%)
Mode of Delivery			
Caesarean section delivery	50(56.8)	118(44.7)	168 (47.7)
Normal/spontanous vaginal delivery	38(43.2)	146(55.3)	184 (52.3)
Fetal status			
Normal Live birth	81(92.1)	246(93.2)	327 (92.9)
Still Birth	7(7.9)	18(6.8)	25 (7.1)
Birth Weight (grams)			
Low birthweight	28(32.6)	25(9.8)	53 (15.5)
Normal birth weight	57(66.3)	230(89.8)	287 (83.9)
High birthweight	1(1.2)	1(0.39)	2 (0.58)
Mean±sd	2708.7±714.4	3147.1±509.3	3036.9±597.9
Range	985-4500	960-4400	960-4500
APGAR Score at Five minutes			
Normal	78(89.7)	236(91.5)	314 (91.0)
Moderately depressed	2(2.3)	4(1.6)	6 (1.7)
Severely depressed	7(8.1)	18(7.0)	25 (7.3)
Mean±sd	8.2±2.5	8.4±2.4	8.3±2.4
Range	0-10	0-10	0-10

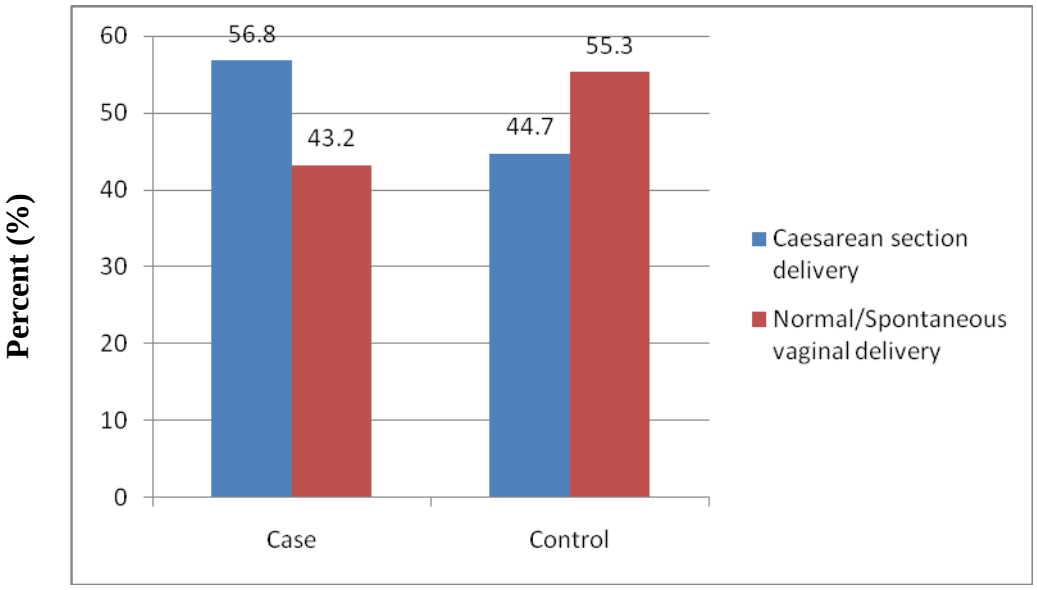

Figure 5: Mode of delivery among study participants

4.3 Clinical characteristic of the respondents

The mean hemoglobin level on admission for delivery was 11.91g/dl with a standard deviation of 1.47g/dl (range: 6.4-15.8) whereas the mean number of Pus cells on admission for delivery was 10.21 per high power field (HPF) with a standard deviation of 6.89 HPF (range: 2-30). Among study participants with hemoglobin levels recorded (n=337 or 95.7%) on admission for delivery, 256(76%) had normal hemoglobin levels and 81(24%) had mild-moderate and severe levels of anemia. Furthermore, mothers with normal hemoglobin levels were 67(77.9%) and 189(75.3%) of cases and controls, respectively. Those with mild-moderate and severe levels of anemia were 19(22.1%) and 62(24.7%) of cases and controls respectively.

Among study participants with urinary pus cell count recorded (n=66 or 18.8%) on admission for delivery, 21(31.8%) had normal urinary pus cells count levels and 45(68.2%) had mild-moderate and severe UTI in pregnancy. Moreover, mothers with normal urinary pus cell counts were 3 (23.1%) and 18(34%) of cases and controls, respectively. Those with mild-moderate and severe levels of UTI were 10(76.9%) and 35(66%) of cases and controls respectively. The clinical factors of the study population are presented in table 6:

Table 6: Descriptive statistics of clinical characteristics of the respondents

Variable	Cases	Controls	Total
Haemoglobin Level on admission for Delivery (g/dl)			
Mean±SD	12.0±1.5	11.9±1.5	11.9±1.5
Range	7-15.3	6.4-15.8	6.4-15.8
Pus cells count on admission for Delivery (phf)			
Mean±SD	10.2±6.3	10.2±7.1	10.2±6.9
Range	2-25	2-30	2-30

4.4 Behavioural and family history-related characteristic of the respondents

Tobacco use among cases was reported by 5 (5.7%) as compared to 4 (1.5%) among controls whereas alcohol use was reported by 8 (8.1%) and 17 (6.4%) among cases and controls respectively. Only 4 (4.6%) of cases reported being using traditional treatment compared to 16 (6.1%) of the controls. From the 20 mothers who said they use traditional treatment during pregnancy, 14 (70%) specifically took traditional/local herbs and the purposes were for protection/safety of pregnancy, detoxification/cleansing of the body system, back pain in 7 (35%), 4 (20%), and 4 (20%), respectively. None of the study participants had a personal history of diabetes however; 4 (4.6%) of cases and 21 (7.95%) of controls had a family history of diabetes. A personal history of hypertension was reported by 16 (18.2%) among cases and 9 (3.4%) among controls whereas the family history of hypertension was reported by 19 (21.6%) among cases and 36 (13.6%) among controls. The behavioral and family history-related factors of the study population are presented in table 7.

Table 7: Behavioral and family history-related characteristics of the respondents

Variable	Cases n(%)	Controls n(%)	Total n(%)
Tobacco use			
No	83 (94.3)	260 (98.5)	343 (97.4)
Yes	5 (5.7)	4 (1.5)	9 (2.6)
Time of Tobacco Use			
Before and during pregnancy	5 (100.0)	3 (0.8)	8 (88.9)
Before pregnancy	0 (0.0)	1 (0.3)	1 (11.1)
Alcohol Use			
No	80 (90.9)	247 (93.6)	327 (92.9)
Yes	8 (9.1)	17 (6.4)	25 (7.1)
Time of Alcohol use			
Before and during pregnancy	2 (25.0)	1 (5.9)	3 (12.0)
Before pregnancy	5 (62.5)	14 (82.4)	19 (76.0)
During pregnancy	1 (12.5)	2 (11.8)	3 (12.0)
Traditional Treatment use			
No	84 (95.5)	248 (93.9)	332 (94.3)
Yes	4 (4.6)	16 (6.1)	20 (5.7)
Personal history of diabetes			
NO	88 (100.0)	264 (100.0)	352 (100.0)
YES	0 (0.0)	0 (0.0)	0 (0.0)
Family history of diabetes			
No	84 (95.5)	243 (92.1)	327 (92.9)
Yes	4 (4.6)	21 (8.0)	25 (7.1)
Personal history of hypertension			
No	72 (81.8)	255 (96.6)	327 (92.9)
Yes	16 (18.2)	9 (3.4)	25 (7.1)
Family history of hypertension			
No	69 (48.7)	228 (86.4)	297 (84.4)
Yes	19 (21.6)	36 (13.6)	55 (15.6)

4.5 Results of bivariable analyses

In the bivariable mixed-effect logistic regression analysis, the emphasis is placed on the factors hypothesized to associate significantly with preeclampsia (PET) and eclampsia; that is, socio-demographic, reproductive and obstetrical, clinical and behavioral and family history-related factors.

4.5.1 Socio-demographic factors in relation to preeclampsia/eclampsia status

The socio-demographic factors hypothesized to significantly associate with preeclampsia/eclampsia include maternal age, maternal level of education, marital status, maternal occupation, maternal County of residence, ethnicity and religion.

Compared to mothers aged less than 20 years, mothers 20-34 years of age were 1.5 times more likely to suffer preeclampsia/eclampsia (OR=1.5, 95% CI=0.5-4.7, p=0.451) whereas mothers aged 35-49 years were 2.5 times more likely to experience preeclampsia/eclampsia than mothers aged less than 20 years (OR=2.5, 95% CI=0.7-8.8, p=0.163).

Postnatal mothers from government/private occupation were 1.8 times more likely to suffer from preeclampsia/eclampsia than those from other occupations (OR=1.8, 95% CI=0.6-5.4, p=0.286) whereas those that have an occupation as housewives were 2.0 times more likely to develop preeclampsia/eclampsia than other occupations. Similarly, mothers that have merchant/business occupation were more likely to develop preeclampsia/eclampsia than other occupations (OR=1.1, 95% CI=0.5-2.9, p=0.789).

Postnatal mothers from Nairobi County were at increased risk of preeclampsia/eclampsia compared to those from other counties (OR=3.0, 95% CI=0.7-13.1, p=0.152). The associations between socio-demographic factors and preeclampsia/eclampsia are summarized in table 8.

Table 8: Association between socio- demographic factors and preeclampsia/eclampsia

Variable	Cases n(%)	Controls n(%)	χ^2	Crude OR (95% CI)	p-value
Age group					
<20	4(4.6)	19(7.2)		Ref	
20-34	71(80.7)	220(83.3)		1.5(0.5-4.7)	0.451
35-49	13(14.8)	25(9.5)	2.44	2.5(0.7-8.8)	0.163
Education Level					
Up to Primary	24(27.3)	72(27.3)		Ref	
Secondary	40(45.5)	140(53.0)		0.9(0.5-1.5)	0.603
Tertiary	24(27.3)	52(19.7)	2.47	1.4(0.7-2.7)	0.34
Marital Status					
Married	71(80.7)	213(80.7)		2(0.2-16.9)	0.524
Separated/Widowed	1(1.1)	6(2.3)		Ref	
Single	16(18.2)	45(17.1)	0.46	2.1(0.2-19.1)	0.498
Occupation					
Salaried employee	10(11.4)	26(9.9)		1.8(0.6-5.4)	0.286
House Wife	49(55.7)	114(43.2)		2.0(0.8-4.9)	0.116
Merchant/Business	22(25.0)	91(34.5)		1.1(0.5-2.9)	0.789
Others	7(8.0)	33(12.5)	5.34	Ref	
County of Residence					
Nairobi	86(97.7)	247(93.6)		3.0(0.7-13.1)	0.152
Other County	2(2.3)	17(6.4)	2.05	Ref	
Specific Place of Residence					
Informal/Rural Settlement	46(52.3)	121(45.8)		Ref	
Urban/Estate	42(47.7)	143(54.2)	1.09	1.3(0.8-2.1)	0.295
Religion					
Christians	86(97.7)	256(97.0)		0.7(0.2-3.6)	0.712
Muslims	2(2.3)	8(3.0)	0.14	Ref	

4.5.2 Reproductive and obstetric factors in relation to preeclampsia/eclampsia status

We hypothesized that reproductive and obstetrics factors, likely associated with preeclampsia/eclampsia were maternal age, age at first marriage, age at first pregnancy, number of ANC visits, Time/trimester of first ANC visit, gravidity, parity, and child-Sex.

Nulliparous mothers were about 5 times more likely to suffer from preeclampsia/eclampsia than multiparous mothers (OR=4.8, 95% CI=1.0-22.4, p=0.045) whereas primiparous mothers were 1.4 times more likely to develop preeclampsia/eclampsia than those that were multiparous (OR=1.4, 95% CI=0.9-2.3, p=0.187). Nulliparous mothers, though were at increased risk of suffering preeclampsia/eclampsia; however, the association was not statistically significant in that the 95% confidence included 1 despite a p-value of 0.045 (OR=4.8, 95% CI=1.0-22.4, p=0.045). Therefore, there was no significant association between parity and development of preeclampsia and or eclampsia. Compared to mothers aged 20 years and above, teenage mothers were 30% less likely to develop preeclampsia/eclampsia (OR=0.7, 95% CI=0.4-1.3, p=0.199).

Compared to mothers whose first antenatal care visit was in the first trimester of pregnancy, mothers whose first antenatal care visit was in the second and third trimesters were at reduced risk of preeclampsia/eclampsia (OR=0.8, 95% CI=0.5-1.4, p=0.473 and OR=0.5, 95% CI=0.2-1.4, p=0.191). Mothers whose age at first marriage was <20 years old were 10% less likely to develop preeclampsia/eclampsia than those that were ≥20 years old (OR=0.9, 95% CI=0.5-1.6, p=0.659) whereas mothers whose age at first pregnancy was <20 years old were 0.7 times likely to develop preeclampsia/eclampsia than those that were ≥20 years old (OR=0.7, 95% CI=0.4-1.3, p=0.199). The associations between reproductive and obstetric factors and preeclampsia/eclampsia are summarized in table 9.

Table 9: Association between reproductive and obstetric factors and preeclampsia/eclampsia

Variable	Cases n(%)	Controls n(%)	χ^2	Crude OR (95% CI)	p-value
Age at First Marriage					
<20	19(26.4)	64 (29.1)		0.9 (0.5-1.6)	0.659
≥20	53(73.6)	156(70.9)	0.19	Ref	
Age at First Pregnancy					
<20	24(27.3)	89(33.7)		0.7(0.4-1.3)	0.199
≥20	64(72.7)	175(66.3)	1.25	Ref	
Number of ANC Visits					
<4	39(44.3)	106(40.2)		1.2(0.7-1.9)	0.492
≥4	49(55.7)	158(59.9)	0.47	Ref	
Time/Trimester First ANC Visit					
Up to First trimester	29(33.0)	73(27.7)		Ref	
Second trimester	53(60.2)	162(61.4)		0.8(0.5-1.4)	0.473
Third Trimester	6(6.8)	29(11.0)	1.78	0.5(0.2-1.4)	0.191
Gravidity					
Primigravida	37(42.1)	99(37.5)		Ref	
Multigravida	51(58.0)	165(62.5)	0.57	0.8(0.5-1.4)	0.449
Parity					
Nulliparous	4(4.6)	3(1.1)		4.8(1.0-22.4)	**0.045**
Primiparous	42(47.7)	109(41.3)		1.4(0.9-2.3)	0.187
Multiparous	42(47.7)	152(57.6)	5.08	Ref	
Child Sex					
Male	41(46.6)	138(52.3)		0.5(0.1-2.2)	0.35
Female	44(50.0)	121(45.8)		0.6(0.1-2.6)	0.505
Multi-sex	3(3.4)	5(1.9)	1.31	Ref	

4.5.3 Clinical factors in relation to preeclampsia/eclampsia status

Anemia and urinary tract infections in pregnancy were hypothesized to relate significantly to the occurrence of preeclampsia and eclampsia. Compared to mothers with the normal number of pus cells (0-5phf) on admission for delivery, mothers with mild-moderate and severe UTI (6-10phf and >10phf) in pregnancy on admission were 1.7 times more likely to develop preeclampsia/eclampsia (OR=1.7, 95% CI=0.4-7.0, p=0.454). Mothers with mild-moderate and

severe levels (7-10.9g/dl and <7g/dl) of anemia on admission for delivery were 0.9 times likely to suffer from preeclampsia/eclampsia than those with normal hemoglobin level (≥11 g/dl); (OR=0.9, 95% CI=0.5-1.6, p=0.625). The associations between clinical factors and preeclampsia/eclampsia are presented in table 10.

Table 10: Association between clinical factors and preeclampsia/eclampsia status

Variable	Cases n(%)	Controls n(%)	χ^2	Crude OR (95% CI)	p-value
Pus cells count on admission for delivery					
Normal	3 (23.1)	18 (34.0)		Ref	
Mild-moderate and severe UTI in pregnancy	10 (76.9)	35 (66.0)	0.56	1.7 (0.4-7.0)	0.454
Haemoglobin level on admission for delivery					
Normal	67(77.9)	189(75.3)		Ref	
Mild-Moderate and severe level of anaemia	19(22.1)	62(24.7)	0.24	0.9(0.5-1.6)	0.625

4.5.4 Behavioral and family history-related factors in relation to preeclampsia/eclampsia Status

Further, the relationships between alcohol use, tobacco use, traditional treatment use, diabetes, and hypertension with preeclampsia/eclampsia were assessed. History of diabetes and hypertension were personal and family history.

Postnatal mothers who used tobacco were significantly 3.9 times more likely to develop preeclampsia/eclampsia than those who did not use tobacco (OR=3.9, 95% CI=1.0-14.9, p=0.046). Postnatal mothers who used tobacco though were at increased risk of suffering preeclampsia/eclampsia; however, the association was not statistically significant in that the 95% confidence included 1 despite a p-value of 0.046 (OR=3.9, 95% CI=1.0-14.9, p=0.046). On the

other hand, mothers with a personal history of hypertension were 6.3 times more likely to suffer from preeclampsia/eclampsia (OR=6.3, 95% CI=2.7-14.8, p=0.001) than those without a personal history of hypertension. In addition, there was a significant association between Hypertension personal history and development of PET and/or eclampsia (p<0.001). The associations between behavioral and family history-related factors and preeclampsia/eclampsia are presented in table 11.

Table 11: Association between behavioral and family history-related factors and preeclampsia/eclampsia

Variable	Cases n(%)	Controls n(%)	χ^2	Crude OR (95% CI)	p-value
Alcohol Use					
YES	8(9.1)	17(6.4)		1.5 (0.6-3.5)	0.404
NO	80(90.9)	247(93.6)	0.7	Ref	
Tobacco use					
YES	5(5.7)	4(1.5)		3.9 (1.0-14.9)	**0.046**
NO	83(94.3)	260(98.5)	4	Ref	
Personal history of hypertension					
YES	16(18.2)	9(3.4)		6.3 (2.7-14.8)	**<0.001**
NO	72(81.8)	255(96.6)	17.69	Ref	
Family history of hypertension					
YES	19(21.6)	36(13.6)		1.7 (0.9-3.2)	0.078
NO	69(78.4)	228(86.4)	3.12	Ref	
Family history of diabetes					
YES	4(4.6)	21(8.0)		0.6 (0.2-1.7)	0.287
NO	84(95.5)	243(92.1)	1.13	Ref	
Traditional Treatment use					
YES	4(4.5)	16(6.1)		0.7 (0.2-2.3)	0.596
NO	84(95.5)	248(93.9)	0.28	Ref	

4.6 Results of the multivariable analysis

Multivariable mixed-effect logistic regression model was used to determine the effect of various socio-demographic, reproductive and obstetric, clinical, behavioral and family history-related factors. Only variables that reached a p ≤0.2 from the bivariable analysis were moved forward for multivariate analysis. Those variables that are of interest from previous studies were also moved forward for multivariate analysis despite not meeting the stated threshold requirement. Three models were compared: the model with only variables that reached a p≤ 0.2 at bivariate analysis plus two other variables (hemoglobin level and number of ANC visit) of interest from previous studies; a model with only variables that reached a p≤ 0.2 at bivariable analysis plus hemoglobin level only; and a model with only variables that reached a p≤ 0.2 at bivariate analysis plus number of ANC visit only. The model which included hemoglobin level and a number of ANC visits had the least Akaike Information Criteria (AIC) hence the best model. However, the interaction was also tested but none of the interaction terms was significant.

From the best model, mothers with advanced age 35-49 years were 5.9 times more likely to develop preeclampsia/eclampsia when compared to those aged less than 20 years (AOR=5.9, 95% CI=1.1-33.3, p=0.042). Mothers who had an occupation as housewife were significantly more likely to suffer from preeclampsia/eclampsia compared to those with other occupations (AOR = 3.1; 95% CI: 1.1-8.8, p=0.034).

Mothers that had less than 4 ANC visits were 1.8 times more likely to suffer preeclampsia/eclampsia; however, the association was not statistically significant in that the 95% confidence included 1 despite a p-value of 0.041 (AOR=1.8, 95% CI=1.0-3.3, p=0.041). Compared to mothers who were multiparous, nulliparous and primiparous were significantly associated with increased risk of developing preeclampsia/eclampsia (AOR=7.5, 95% CI=1.5-37.5, p=0.015) and (AOR=2.1, 95% CI=1.1-4.2, p=0.031) respectively.

Mothers with preeclampsia/eclampsia were 7.1 times more likely to personal history of hypertension comparing to their counterparts (AOR=7.1, 95% CI=2.6-19.3, p=0.001). The associations between risk factors and preeclampsia/eclampsia are presented in table 12.

Table 12 a): Risk factors of preeclampsia/eclampsia

Variable	Cases n(%)	Controls n(%)	Adjusted OR (95% CI)	p-value
Age Group				
<20	4(4.6)	19(7.2)	Ref	
20-34	71(80.7)	220(83.3)	2.2(0.5-8.8)	0.28
35-49	13(14.8)	25(9.5)	5.9(1.1-33.3)	**0.042**
Occupation				
Salaried employee	10(11.4)	26(9.9)	2.1(0.6-7.5)	0.241
House Wife	49(55.7)	114(43.2)	3.1(1.1-8.8)	**0.034**
Merchant/Business	22(25.0)	91(34.5)	1.5(0.5-4.6)	0.469
Others	7(8.0)	33(12.5)	Ref	
County of Residence				
Nairobi	86(97.7)	247(93.6)	2.6(0.6-12.4)	0.224
Other Counties	2(2.3)	17(6.4)	Ref	
Age at First Pregnancy				
<20	24(27.3)	89(33.7)	1.05(0.5-2.1)	0.902
>=20	64(72.7)	175(66.3)	Ref	
Number of ANC Visits				
<4	39(44.3)	106(40.2)	1.8(1.0-3.3)	**0.041**
>=4	49(55.7)	158(59.9)	Ref	
Time/Trimester First ANC Visit				
Up to First trimester	29(33.0)	73(27.7)	Ref	
Second trimester	53(60.2)	162(61.4)	0.9(05-1.7)	0.74
Third Trimester	6(6.8)	29(11.0)	0.5(0.1-1.6)	0.214
Parity				
Nulliparous	4(4.6)	3(1.1)	7.5(1.5-37.5)	**0.015**
Primiparous	42(47.7)	109(41.3)	2.1(1.1-4.2)	**0.031**
Multiparous	42(47.7)	152(57.6)	Ref	

Table 12 b): Risk Factors of preeclampsia/eclampsia (Continued)

Variable	Cases n(%)	Controls n(%)	Adjusted OR (95% CI)	p-value
Haemoglobin Level on admission for Delivery				
Normal	67(77.9)	189(75.3)	Ref	
Mid-Moderate level anaemia and severe	19(22.1)	62(24.7)	0.9(0.5-1.9)	0.968
Tobacco use				
YES	8(9.1)	17(6.4)	1.7(0.4-7.8)	0.518
NO	80(90.9)	247(93.6)	Ref	
Personal history of hypertension				
YES	16(18.2)	9(3.4)	7.1(2.6-19.3)	**<0.001**
NO	72(81.8)	255(96.6)	Ref	
Family history of hypertension				
YES	4(4.6)	21(8.0)	1.2(0.6-2.5)	0.633
NO	84(95.4)	243(92.0)	Ref	

4.7 Limitation of the study

This study had some limitations. First, not all admission for delivery had their hemoglobin level (337 out of 352 study participants) and pus cells count (only 66 out of 352) recorded in the study hospitals, therefore; if this study was repeated in other facilities with better recording of lab results of maternal admission, then the findings could be different. Secondly, it might have had recall-bias about some factors such as the specific traditional treatment use and purpose of using the said treatment. Lastly, the hospital-based approach included only women attending the study hospitals.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1: Discussion

5.1.1: Socio-demographic factors in relation to preeclampsia/eclampsia

The first objective of this study was to identify the socio-demographic factors associated with preeclampsia/eclampsia among women delivering in Nairobi County hospitals.

Women with preeclampsia/eclampsia were more likely to be 35-49 years of age comparing to their counterparts (AOR=5.9, 95% CI=1.1-33.3, p=0.042). This was in line with other studies in Pakistan, Ethiopia, and Sweden which showed increased risk in a similar age group (Tessema, Gizachew A. and Ayele, 2015; Shamsi Uzma, Saleem Sarah, 2013; Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010). However, another study done in India found out that pregnant women age less than 20 years were roughly 4 times increased risk of experiencing preeclampsia compared to those greater than 20years (Kumari, 2016).

A study conducted in Iran has linked the obstetric danger of advanced maternal age to aging – mediated vascular damage (Kahnamoueiaghdam F., Amani F., 2015). This is because as a woman gets advanced age, she is more likely to develop heart/blood vessel related problems chiefly due to the steady failure of compliance of said vessels that are mainly linked with the ageing of uterine blood vessels and arterial firmness. Furthermore, as the age of a woman advances, the hemodynamic adaptation during pregnancy becomes more complicated (Tessema, Gizachew A. and Ayele, 2015). Thus, the reason why preeclampsia/eclampsia is more likely in older women is biologically plausible.

The odds of developing preeclampsia/eclampsia were 3.1 times higher in postnatal mothers with occupation as housewife comparing to mothers with other occupations (AOR=3.1, 95% CI=1.1-8.8, p=0.034). The association between occupation as housewife and preeclampsia/eclampsia

was statistically significant. A similar finding was obtained from a study done in Nigeria (Guerrier Gilles, Oluyide Bukola, 2013). This could be due to stress-related factors arising from low socio-economic status and low wealth index.

Marital status was not found to be associated with developing preeclampsia/eclampsia during this study. However, marital status was found to be significantly associated with the development of preeclampsia in a study done in Ethiopia ((Tessema, Gizachew A. and Ayele, 2015).

5.1.2: Reproductive and obstetric factors in relation to preeclampsia/eclampsia

According to the results of this study, women who were nulliparous or primiparous were at increased risk of developing preeclampsia/eclampsia than those who were multiparous. This was concurrent with several studies in Uganda, Pakistan, and Ethiopia that found the same findings (Wandabwa J., Doyle P., Kiondo P., 2010; Shamsi Uzma, Saleem Sarah, 2013; Grum Teklit, Seifu Abiy, 2017). Several hypotheses have linked nulliparity to a maternal immune maladaptation (Kahnamoueiaghdam F., Amani F., 2015); This is for the reason that nulliparity is due to early trophoblastic invasion and how the mother reacts to it. The breakdown or malfunction of the normal invasion of trophoblastic cells leads to maladaptation of the coiled arterioles, which are linked to the causation of preeclampsia (Wandabwa J., Doyle P., Kiondo P., 2010).

Mothers that attended less than 4 ANC visits were at increased risk of developing preeclampsia/eclampsia when compared with those that attended 4 or more ANC visits. This is comparable to a study conducted in Nigeria (Guerrier Gilles, Oluyide Bukola, 2013). Long-distance from a health facility, limited knowledge about ANC services coupled with low socio-

economic status could possibly be responsible for postnatal mothers not meeting the WHO recommended 4 or more ANC visits; a situation which could predispose mothers to obstetric complications such as preeclampsia and eclampsia. In this study however, the association between a number of ANC visits and the outcome was not statistically significant in that the 95% confidence included 1 despite a p-value of 0.041 (AOR = 1.8; 95% CI: 1.0-3.3, p=0.041).

Compared to mothers whose age at first pregnancy was 20 years or more, preeclampsia/eclampsia was protective in mothers who got their first pregnancy as teenagers (<20 years) and the association was not statistically significant with the risk of the outcome (preeclampsia/eclampsia). This contradicts a study conducted in India (Kumari, 2016). The study also found out that 32.1% of postnatal mothers were teenagers (<20 years) when they first got pregnant. This was comparable to a study conducted in Ethiopia (Tessema, Gizachew A. and Ayele, 2015). There was no association between age at first pregnancy and risk of preeclampsia/eclampsia.

5.1.3: Clinical factors in relation to preeclampsia/eclampsia

The study results found out that anemia and UTI in pregnancy were not significantly associated with preeclampsia/eclampsia; however, this finding contradicts studies conducted in Egypt, Sudan, and by WHO (Ali AbdelAziem A., Rayis Duria A., 2011; El-Moselhy, Essam A., Khalifa, Hamed O., Amer, 2011; Bilano Ver Luanni, Ota Erika, 2014). Mothers with mild-moderate and severe levels (7-10.9g/dl and <7g/dl) of anemia on admission for delivery were 0.9 times likely to suffer from preeclampsia/eclampsia than those with normal hemoglobin level (≥11 g/dl); thus, this finding contradicts a study conducted in Egypt and by WHO (Ali AbdelAziem A., Rayis Duria A., 2011; Bilano Ver Luanni, Ota Erika, 2014).

On the other hand, mothers with mid-moderate and severe UTI (6-10phf and >10phf) in pregnancy on admission for delivery were 1.7 times more likely suffer from preeclampsia/eclampsia than those with normal (0-5phf); this was comparable to a study conducted in Egypt and by WHO (El-Moselhy, Essam A., Khalifa, Hamed O., Amer, 2011; Bilano Ver Luanni, Ota Erika, 2014). Thus, the clinical factors (anemia in pregnancy, UTI in pregnancy)were not associated with the risk of preeclampsia/eclampsia.

5.1.4: Behavioural and family history-related factors in relation to preeclampsia/eclampsia

The study found out that mothers who use tobacco were 1.7 times likely to suffer from preeclampsia/eclampsia than those not using tobacco. Also, there was no association between tobacco use and the risk of preeclampsia/eclampsia. This was comparable to other studies conducted in Ethiopia and Sweden (Tessema, Gizachew A. and Ayele, 2015; Wilkstrom, Anna-Kann, Stephansson, Olof and Cnattingius, 2010).

Women with hypertension personal history were more likely to suffer from preeclampsia/eclampsia than those without a personal history of hypertension. A similar finding was found from a study done in Nigeria (Guerrier Gilles, Oluyide Bukola, 2013). Lifestyle modifications/behavioral factors might be the reason for influencing women to an increased threat of preeclampsia/eclampsia. For instance, mothers taking-in an unhealthy diet; eating food high in fats and carbohydrates could increase their triglyceride levels, narrows blood flow and may predispose them to develop hypertensive disorders in pregnancy.

In the bivariable analysis, mothers with a family history of hypertension were 1.7 times likely to suffer preeclampsia/eclampsia when compared to those without a family history of hypertension. This was in line with a study conducted in Ethiopia ((Tessema, Gizachew A. and Ayele, 2015).

Genetic factors might be the reason for influeancing women to an increased threat of preeclampsia/eclampsia.

Postnatal mothers using traditional treatment were 30% less likely to suffer from preeclampsia/eclampsia when compared to those not using the traditional treatment, during bivariable analysis. This, however, contradicts a study conducted in Nigeria (Guerrier Gilles, Oluyide Bukola, 2013).

5.2: Conclusion

The following are concluding statements in line with specific objectives of the study:

- Advanced maternal age (35-49 years) and occupation as housewife were factors found to be significantly associated with the occurrence of preeclampsia/eclampsia.
- There was a statistically significant association between nulliparity or primiparity, and the occurrence of preeclampsia/eclampsia.
- Anemia in pregnancy was 10% less likely to develop preeclampsia/eclampsia; suggesting anemia in pregnancy reduced risk of developing preeclampsia/eclampsia
- Lastly, the study found out that a personal history of hypertension was strongly associated with the occurrence of preeclampsia/eclampsia.

5.3: Recommendation

5.3.1 Recommendations for practice or action

Based on the study findings, this study makes the following recommendations to policymakers, county government, hospital management teams, and other relevant institutions:

1. Health Workers in Maternal and Child Health (MCH) units of health facilities should emphasize the risk factors for preeclampsia/eclampsia to pregnant and postnatal mothers during their health talks in the health facilities. These messages should be extended to other pregnant and postnatal mothers in the catchment areas of the health facilities through Community Health Workers (CHWs).
2. Maternity In-charges should ensure that hemoglobin level and pus cell count for pregnant women are ordered and results recorded in the admission notes for delivery.

5.3.2 Recommendation for further study

In this study, only 66 out of 352 participants (18.8%) had their urinary pus cells recorded on admission for delivery and whether UTI in pregnancy is actually not associated with preeclampsia/eclampsia needs further investigation. Additionally, whether anemia during pregnancy is actually protective in Kenya also needs further investigation in a larger and broad-based study. In this study, 337 out of 352 participants (96%) had their hemoglobin levels recorded on maternal admission for delivery. Considering these two gaps, I would like therefore to recommend the following for future studies:

1) Association between UTI and preeclampsia/eclampsia in a multi-county study;

2) That a similar study covering more counties and involving both public and private health facilities be conducted to investigate the relationship between anemia in pregnancy and preeclampsia/eclampsia.

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APPENDICES

Appendix 1: Informed Consent Explanation (for participants ≥18 years)

Study Title: "Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya".

My name is Dr. Gorbee Gabriel Logan, a student in the School of Public Health, University of Nairobi, pursuing a Masters in the area of Public Health, University of Nairobi, Kenya. I would like to carry out a research study on **"**Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya". This is to kindly request you to participate in this study to enable me to complete my studies at the University. However, before we begin, I would like to inform you of the following:

1. This study results will solely be used for this study and not for any other reason
2. Your participation is voluntary, and you are free to opt-out of the study at any time
3. There will be no reward for participating in this study.
4. There will be no penalty of benefits to which you are entitled to this hospital, just in case you refuse to participate in the study.
5. Upon reading or listening to the explanation, you are free to ask any question (s) that will enable you to clearly understand the nature of the study.
6. All the information in this study will be kept in confidence and no one will be allowed to access it fully or partially without express authority from the author.

Background Information

Preeclampsia/eclampsia, as hypertensive disorders of pregnancy, are among the leading causes of fetal and maternal morbidity and mortality. Hence, they are multi-causal diseases that represent a serious public health problem that needs to be fully investigated in the Kenyan population.

Purpose

This study aims to identify the factors associated with pre-eclampsia and/or eclampsia among women delivering in Nairobi County Hospitals; thus, impacting maternal and child health.

Procedures

During this research, we shall ask you questions regarding your socio-demographic, reproductive and obstetric, clinical, behavioral and family history related factors. From your medical records, we will also obtain some information on you and the baby.

Risks

There may be inconveniences due to the length of the interview, discussion on sensitive personal matters regarding you and your baby. We will try to use a short time as much as possible for the interview.

Benefits

The study may not directly benefit you, but study findings will be used to inform policy, create awareness and formulate strategies to improve antenatal care and delivery services among pregnant women in Kenya.

Compensation

There will be no payment for you taking part in this study.

Contact:

Just in case you have any concerns about this study, you may call Gorbee Gabriel Logan at 0790327896. Or for any question (s) regarding your rights as a research subject you may contact the secretary of the KNH/UON Ethical and research committee, P.O. Box 20723-0020, Nairobi, Tel. 020726300-9

Thank you for your time, and if you agree to participate in this study, please fill the form below:

Certificate of Consent

I……hereby provide informed consent to take part in this study on the determinants of Preeclampsia and Eclampsia among women delivering in Nairobi County Hospitals, Kenya. I have understood the nature of the study and its purpose. The risks and benefits of participating in this study have fully been explained to me.

Name of participant…….. Sign……

Interviewer/investigator……..Sign……

Ufafanuzi wa Fomu ya Idhini (kwa mshiriki)

Kichwa cha Utafiti: "Vigezo vya Pre-Eclampsia na Eclampsia miongoni mwa wanawake wanaohudhuria hospitali za katambalimbali za Nairobi, Kenya."

Jina langu ni Dr Gorbee Gabriel Logan, mwanafunzi katika shule ya afya ya umma, chuo kikuu cha Nairobi, niko kwenye masomo ya shahada ya uzamili katika eneo la afya ya umma, chuo kikuu cha Nairobi, Kenya. Ningependa kufanya utafiti juu ya "vigezo vya Pre-Eclampsia na Eclampsia kati ya wanawake wanaojifungua katika hospitali ya katambalimbali mjini Nairobi, Kenya". Ningependa kukuomba ushiriki katika utafiti huu ili nipate kumaliza masomo yangu katika chuo kikuu. Hata hivyo, kabla ya kuanza, ningependa kukujulisha yafuatayo:

1. Matokeo haya ya utafiti yatatumika tu kwa ajili ya utafiti huu na si kwa sababu nyingine yoyote
2. Ushiriki wako ni wa hiari, na wewe u huru kuacha kushiriki wakati wowote
3. Hakutakuwa na malipo kwa kushiriki katika utafiti huu.
4. Hakutakuwa na adhabu ya faida ambazo una haki katika hospitali hii iwapo hutakubali kushiriki katika utafiti.
5. Baada ya kusoma au kusikiliza maelezo, uko huru kuuliza swali lolote ambalo litakuwezesha kuelewa vizuri hali ya utafiti.
6. Taarifa yote katika utafiti huu zitahifadhiwa kwa uaminifu na hakuna mtu atakayeruhusiwa kuzipata kikamilifu au sehemu bila mamlaka ya wazi kutoka kwa mwandishi.

Utangulizi

Preeclampsia na / au Eclampsia, kama ugonjwa wa shinikizo la damu ya mimba, ni miongoni mwa sababu zinazosababisha ugonjwa wa fetusi wakati wa uzazi. Kwa hiyo, ni magonjwa mengi ya kawaida ambayo yanawakilisha shida kubwa ya afya ya umma ambayo inahitaji kuchunguzwa kikamilifu katika idadi ya watu wa Kenya.

Kusudi

Utafiti huu una lengo la kutambua sababu zinazohusiana na eclampsia na / au eclampsia kati ya wanawake wanaohudhuria baadhi za hospitali za kaunti za Nairobi; hivyo, kuathiri afya ya uzazi wa mtoto.

Taratibu

Wakati wa utafiti huu, tutakuuliza maswali kuhusiana na mambo yako, mfano, kuhusiana na historia yako ya kijamii, ya uzazi, ya kiafya na ya familia. Pia Kutoka kwenye rekodi zako za matibabu, tunaweza tutapata habari kiasi juu yako na mtoto.

Hatari

Kunaweza kuwa na usumbufu kutokana na urefu wa mahojiano, majadiliano juu ya mambo ya kibinafsi kuhusu wewe na mtoto wako. Tutajaribu kutumia muda mfupi iwezekanavyo kwa mahojiano.

Faida

Utafiti huu hauwezi kukufaidi moja kwa moja, lakini matokeo ya utafiti yatatumika kuwajulisha wana sera, kujenga ufahamu na kupanga mikakati ya kuboresha huduma za ujauzito na uzazi kati ya wanawake wajawazito nchini Kenya.

Fidia

Hautapokea malipo yoyote kwa kushiriki katika utafiti huu.

Anwani:

Iwapo una maswali au wasiwasi kuhusu utafiti huu, tafadhali ujiskie huru kuwasiliana na Gorbee Gabriel Logan kwa nambari 0790327896. Au kwa swali lolote kuhusu haki zako kama mshiriki unaweza kuwasiliana na katibu wa kamati ya KNH / UON ya kimaadili na ya utafiti, sanduku la posta 20723-0020, Nairobi, simu. 020726300-9

Asante kwa muda wako, na ikiwa unakubali kushiriki katika utafiti huu, tafadhali jaza fomu hapa chini:

Cheti cha Idhini

Mimi ..... natoa idhini ya kukubali kushiriki katika utafiti huu juu ya maamuzi ya Preeclampsia na Eclampsia kati ya wanawake wanaohudhuria hospitali za Nairobi County, Kenya. Nimeelewa asili ya utafiti na kusudi. Hatari na faida za kushiriki katika utafiti huu zimeelezwa kikamilifu.

Jina la mshiriki ..... Sahihi .....

Mtafiti ..... Sahihi.....

Appendix 2: Informed Consent Explanation (for parent/guardian if patient < 18 years)

Study Title: "Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya".

My name is Dr. Gorbee Gabriel Logan, a student in the School of Public Health, University of Nairobi, pursuing a Masters in the area of Public Health, University of Nairobi, Kenya. I would like to carry out a research study on **"**Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya". This is to kindly request you to agree for your patient/relative (**less than 18 years old**) admitted, to participate in this study to enable me to complete my studies at the University. However, before we begin, I would like to inform you of the following:

1. This study results will solely be used for this study and not for any other reason
2. Your agreement/consent for her to participate is voluntary, and you are free to refuse her participation in the study at any time
3. There will be no reward for your patient/relative participating in this study.
4. There will be no penalty of benefits to which you are entitled to this hospital, just in case you refuse for your patient/relative to participate in the study.
5. Upon reading or listening to the explanation, you are free to ask any question (s) that will enable you to clearly understand the nature of the study.
6. All the information in this study will be kept in confidence and no one will be allowed to access it fully or partially without express authority from the author.

Background Information

Preeclampsia/eclampsia, as hypertensive disorders of pregnancy, are among the leading causes of fetal and maternal morbidity and mortality. Hence, they are multi-causal diseases that represent a serious public health problem that needs to be fully investigated in the Kenyan population.

Purpose

This study aims to identify the factors associated with pre-eclampsia and/or eclampsia among women delivering in Nairobi County Hospitals; thus, impacting maternal and child health.

Procedures

During this research, we shall ask your patient/relative admitted questions regarding her socio-demographic, reproductive and obstetric, clinical, behavioral and family history related factors. From her medical records, we will also obtain some information on her and the baby.

Risks

There may be inconveniences due to the length of the interview, discussion on sensitive personal matters regarding your patient/relative and her baby. We will try to use a short time as much as possible for the interview.

Benefits

The study may not directly benefit you or your patient/relative, but study findings will be used to inform policy, create awareness and formulate strategies to improve antenatal care and delivery services among pregnant women in Kenya.

Compensation

There will be no payment for you taking part in this study.

Contact:

Just in case you have any concerns about this study, you may call Gorbee Gabriel Logan at 0790327896. Or for any question (s) regarding your rights as a research subject you may contact the secretary of the KNH/UON Ethical and research committee, P.O. Box 20723-0020, Nairobi, Tel. 020726300-9

Thank you for your time, and if you agree for your patient/relative to participate in this study, please fill the form below:

Certificate of Consent

I……hereby provide informed assent for my patient/relative admitted to the postnatal ward to take part in this study on the determinants of Preeclampsia and Eclampsia among women delivering in Nairobi County Hospitals, Kenya. I have understood the nature of the study and its purpose. The risks and benefits of my patient/relative (less than 18 years old) to participate in this study have fully been explained to me.

Name of participant…….. Sign……

Interviewer/investigator……..Sign……

Appendix 3: Informed Assent Explanation (for minor or < 18 years)

Study Title: "Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya".

My name is Dr. Gorbee Gabriel Logan, a student in the School of Public Health, University of Nairobi, pursuing a Masters in the area of Public Health, University of Nairobi, Kenya. I would like to carry out a research study on **"**Determinants of Pre-Eclampsia and Eclampsia among women delivering in County Hospitals in Nairobi, Kenya". This is to kindly request you to agree as a minor (**less than 18 years old**), to participate in this study to enable me to complete my studies at the University. However, before we begin, I would like to inform you of the following:

1. This study results will solely be used for this study and not for any other reason
2. Your agreement to participate is voluntary, and you are free to refuse participation in the study at any time
3. There will be no reward for you participating in this study.
4. There will be no penalty or benefits to which you are entitled to this hospital, just in case you refuse to participate in the study.
5. Upon reading or listening to the explanation, you are free to ask any question (s) that will enable you to clearly understand the nature of the study.
6. All the information in this study will be kept in confidence and no one will be allowed to access it fully or partially without express authority from the author.

Background Information

Preeclampsia/eclampsia, as hypertensive disorders of pregnancy, are among the leading causes of fetal and maternal morbidity and mortality. Hence, they are multi-causal diseases that represent a serious public health problem that needs to be fully investigated in the Kenyan population.

Purpose

This study aims to identify the factors associated with pre-eclampsia and/or eclampsia among women delivering in Nairobi County Hospitals; thus, impacting maternal and child health.

Procedures

During this research, we shall ask your patient/relative admitted questions regarding her socio-demographic, reproductive and obstetric, clinical, behavioral and family history related factors. From her medical records, we will also obtain some information on her and the baby.

Risks

There may be inconveniences due to the length of the interview, discussion on sensitive personal matters regarding your patient/relative and her baby. We will try to use a short time as much as possible for the interview.

Benefits

The study may not directly benefit you or your patient/relative, but study findings will be used to inform policy, create awareness and formulate strategies to improve antenatal care and delivery services among pregnant women in Kenya.

Compensation

There will be no payment for you taking part in this study.

Contact:

Just in case you have any concerns about this study, you may call Gorbee Gabriel Logan at 0790327896. Or for any question (s) regarding your rights as a research subject you may contact the secretary of the KNH/UON Ethical and research committee, P.O. Box 20723-0020, Nairobi, Tel. 020726300-9

Thank you for your time, and if you agree for your patient/relative to participate in this study, please fill the form below:

Certificate of Assent

I……hereby provide informed assent to take part in this study on the determinants of Preeclampsia and Eclampsia among women delivering in Nairobi County Hospitals, Kenya. I have understood the nature of the study and its purpose. The risks and benefits to participating in this study have fully been explained to me.

Name of participant…….. Sign……

Interviewer/investigator……..Sign……

Ufafanuzi wa Fomu ya Idhini ya Watoto (kwa mzazi /mlezi)

Kichwa cha Utafiti: "Vigezo vya Pre-Eclampsia na Eclampsia kati ya wanawake wanaohudhuria hospitali za kata Nairobi, Kenya".Jina langu ni Dr Gorbee Gabriel Logan, mwanafunzi katika shule ya afya ya umma, chuo kikuu cha Nairobi, niko kwenye masomo ya shahada ya uzamili katika eneo la afya ya umma, chuo kikuu cha Nairobi, Kenya. Ningependa kufanya utafiti juu ya "Vigezo vya Pre-Eclampsia na Eclampsia miongoni mwa wanawake wanao tembelea baadhi ya hospitali ya kata mjini Nairobi, Kenya". Hii ni kukuomba kwa uaminifu kukubaliana na mgonjwa / jamaa wako (chini ya umri wa miaka 18) aliyelazwa, kushiriki katika utafiti huu ili nipate kumaliza masomo yangu chuo kikuu. Hata hivyo, kabla ya kuanza, ningependa kukujulisha yafuatayo:

1. Matokeo haya ya utafiti yatatumika tu kwa ajili ya utafiti huu na si kwa sababu nyingine yoyote
2. Mkataba wako / idhini yake ya kushiriki ni ya hiari, na wewe u huru kukataa kushiriki kwake katika utafiti wakati wowote
3. Hakutakuwa na malipo kwa mgonjwa / jamaa wako kushiriki katika utafiti huu.
4. Hakutakuwa na adhabu kwa mgonjwa iwapo mgonjwa / jamaa yako hataki kushiriki katika utafiti.
5. Baada ya kusoma au kusikiliza maelezo, wewe u huru kuuliza swali lolote ambalo litakuwezesha kuelewa vizuri hali ya utafiti.
6. Taarifa yote katika utafiti huu zitahifadhiwa kwa uaminifu na hakuna mtu atakayeruhusiwa kuzipata kikamilifu au sehemu bila mamlaka ya wazi kutoka kwa mwandishi.

Utangulizi

Preeclampsia na / au Eclampsia, kama ugonjwa wa shinikizo la damu ya mimba, ni miongoni mwa sababu zinazosababisha maradhi na vifo vya watoto. Kwa hivyo, ni magonjwa mengi ya kawaida ambayo yanawakilisha shida kubwa ya afya ya umma ambayo inahitaji kuchunguza kikamilifu katika idadi ya watu wa Kenya.

Kusudi

Utafiti huu una lengo la kutambua sababu zinazohusiana na eclampsia na / au eclampsia kati ya wanawake wanaohudhuria hospitali mbali mbali za Nairobi County; hivyo, kuathiri afya ya uzazi na mtoto.

Taratibu

Wakati wa utafiti huu, tutamuuuliza maswali mgonjwa / jamaa yako kuhusiana na mambo yake kama vile,historia ya kijamii, ya kizazi na ya familia.Pia kutoka kwenye rekodi zake za matibabu, tunaweza tutapata habari kiasi juu yake na mtoto.

Hatari

Kunaweza kuwa na usumbufu kutokana na muda mrefu wa mahojiano, majadiliano juu ya masuala ya kibinafsi kuhusu mgonjwa / jamaa yako na mtoto wake. Tutajaribu kutumia muda mfupi iwezekanavyo kwa mahojiano.

Faida

Utafiti huu hauwezi kukusaidia wewe au mgonjwa / jamaa yako moja kwa moja, lakini matokeo ya utafiti yatatumiwa kuwajulisha wanasera, kujenga ufahamu na kuandaa mikakati ya kuboresha huduma za ujauzito na utoaji wa huduma kati ya wanawake wajawazito nchini Kenya.

Fidia

Hautapokea malipo yoyote kwa kushiriki katika utafiti huu.

Anwani:

Iwapo una maswali au wasiwasi kuhusu utafiti huu, tafadhali ujiskie huru kuwasiliana na Gorbee Gabriel Logan kwa nambari 0790327896. Au kwa swali lolote kuhusu haki zako kama mshiriki unaweza kuwasiliana na katibu wa kamati ya KNH / UON ya kimaadili na ya utafiti, sanduku la posta 20723-0020, Nairobi, simu 020726300-9

Asante kwa wakati wako, na ikiwa unakubaliana na mgonjwa / jamaa yako kushiriki katika utafiti huu, tafadhali jaza fomu hapa chini:

Hati ya ruhusa

Mimi ..... natoa kibali cha kushiriki kwa mgonjwa / jamaa yangu aliyelazwa kwa kata ya kujifungua baada ya kujifungua katika utafiti huu wa vigezo vya Preeclampsia na Eclampsia miongoni mwa wanawake wanaojifungua katika hospitali za Nairobi County, Kenya. Nimeelewa asili ya utafiti na kusudi. Hatari na manufaa ya mgonjwa / jamaa yangu (chini ya umri wa miaka 18) kushiriki katika utafiti huu wameelezwa kikamilifu.

Jina la mshiriki ..... Sahihi.....

Mtafiti .... Sahihi .....

Appendix 4: Interview Questionnaire

ID NO _____ CASE: Preclampsia ☐ Eclampsia ☐

CONTROL ☐

A. Socio-demographic factors:

1. How old are you? (in years) _____
2. What is your level of education?
    a. No education
    b. Primary
    c. Secondary
    d. Tertiary
3. What is your marital status?
    a. Single
    b. Married
    c. Widowed
    d. Divorced
    e. Separated
4. Which work/job are you doing to earn a living (income)?
    a. Government/private employee
    b. house wife
    c. merchant/business
    d. others(specify)_____
5. Where do you live?
    a) Which County _____
    b) Which specific place/area in the county
        i) Urban/Estate
        ii) Rural
        iii) Informal settlement
        iv) Others (specify) _____

B. Reproductive & Obstetrics factors:

1. How old were you (in years) when you first got married? _____
2. How old were you (in years) when you had your first pregnancy? _____
3. How many pregnancies have you had?
    a. 1
    b. 2
    c. 3
    d. 4
    e. Others (specify) _____
4. How many of your pregnancy resulted in live birth?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. Others (specify) _____
5. What type of delivery did you undergo?
    a. Normal vaginal delivery
    b. Caesarean section delivery
    c. Assisted vaginal delivery
    d. Others(specify)_____
6. What is the sex of your child?
    a. Male
    b. female
    c. other(specify)_____
7. What is the fetal status following delivery?
    a. Normal live birth
    b. Stillbirth

C. Clinical factors(See data abstraction tool)

D. Behavioral & Family history related factors:

1. a) Do you smoke cigarettes, take-in or consume other forms of tobacco products?
    a. YES {If Yes, proceed to 1b}
    b. NO {If No, avoid 1b and continue with 2}

    b) If yes, when last did you smoke cigarette or consume other forms of tobacco products?
    i) Before pregnancy
    ii) During pregnancy
    iii) Before and during pregnancy
2. a) Do you drink alcoholic beverage (s)?
    a. YES {If Yes, proceed to 2b}
    b. NO {If No, avoid 2b and continue with 3}

    b) If yes, when last did you drink alcoholic beverage (s)?
    i) Before pregnancy
    ii) During pregnancy
    iii) Before and during pregnancy
3. Have you ever been diagnosed with Diabetes before this pregnancy?
    a. YES
    b. NO
4. Do you have a family member(s) with a history of being diagnosed of Diabetes?
    a. YES
    b. NO
5. Have you ever been diagnosed with hypertension before this pregnancy?
    a. YES
    b. NO
6. Do you have a family member(s) with a history of being diagnosed of hypertension?
    a. YES
    b. NO
7. a) Did you ever use traditional treatment during this pregnancy?
    a. Yes

b. No

b) If yes, which specific treatment and for what purpose? _____

_____

8. Which ethnic group do you belong to?
    a. Kikuyu
    b. Luhya
    c. Luo
    d. Kalenjin
    e. Kamba
    f. Kisii
    g. Others (specify)_____
9. Which religion do you belong to?
    a. Christian
    b. Muslim
    c. Others (specify)_____

Maswala ya Maswala ya Mahojiano

(Kujazwa na mama aliyelazwa baada ya kujifungua)

Nambari ya kitambulisho: _____ Kesi: Preeclampsia ☐ Eclampsia ☐

Udhibiti ☐

A. Taarifa ya mgonjwa

1. Una umri gani? (kwa miaka) _____

2. Una kiwango gani cha elimu?

   a. Sina elimu

   b. Shule ya msingi

   c. Shule ya sekondari

   d. Shule ya kiufundi/chuo kikuu

3. Hali yako ya ndoa ni gani?

   a. Sijaoleka

   b. Nimeoleka

   c. Mjane

   d. Tumetalakiana

   e. Kutengana

4. Ni kazi gani unayofanya kupata kipato (mapato)?

   a. Serikali/mfanyakazi binafsi

   b. Mke wa nyumba

   c. Mfanyabiashara

   d. Nyingine (taja) _____

5. Unaishi wapi?

a) Kaunti gani _____

b) Mahali gani haswa kwa kaunty?

   i. Mjini

   ii. Kijijini

   iii. Makazi yasiyo rasmi

   iv. Nyingine (Taja)

B. Uzazi:

1. Ulikuwa na umri gani (kwa miaka) wakati uliolewa kwanza? _____

2. Ulikuwa na umri gani (kwa miaka) wakati ulipata mimba yako ya kwanza? _____

3. Je, umekuwa mjamzito mara ngapi?

   a. 1
   b. 2
   c. 3
   d. 4
   e. Wengine (taja) _____

4. Je! Ni mimba ngapi uliweza kujifungua watoto waliohai?

   a. 0
   b. 1
   c. 2
   d. 3
   e. 4
   f. Wengine (taja) _____

5. Ni aina gani ya kujifungua uliyopitia?

   a. Kuzaa kwa kawaida
   b. Kuchinjwa / oparesheni
   c. Kusaidiwa kuzaa
   d. Nyingine (taja) _____

6. Jinsia ya mtoto wako ni upi?

   a. Kiume
   b. Kike
   c. Nyingine (taja)

7. Je! Ni nini hali ya mtoto kufuatia kujifungua?

   a. Kawaida na mwenye pumzi
   b. Hakuhitimu

C. Mambo ya kliniki (Ona fomu iliyojazwa kutoka kadi ya kliniki)

D. Mambo ya kimaadili na familia kuhusiana na historia:

1. a) Je, huwa unavuta sigara au aina nyingine za bidhaa za tumbaku?

   i. Ndio {Ikiwa ndio, endelea kwa 1b}

   ii. Hapana {Kama hapana, usijibu1b na uendelee na 2}

b) Ikiwa ndio, wakati wa mwisho ulivuta sigara au kutumia bidhaa za tumbaku ni lini?

   a. Kabla ya ujauzito

   b. Wakati wa ujauzito

   c. Kabla na wakati wa ujauzito

2. a) Je, unatumia kinywaji cha pombe?

   a. Ndio {Ikiwa ndio, endelea kwa 2b}

   b. Hapana {Kama hapana, usijibu 2b na uendelee na 3}

b) Ikiwa ndio, ulitumia kileo mwisho lini?

   a. Kabla ya ujauzito

   b. Wakati wa ujauzito

   c. Kabla na wakati wa ujauzito

3. Je,umewahi patikana na ugonjwa wa kisukari kabla ya mimba hii?

   a. Ndio

   b. Hapana

4. Je,una jamaa wa familia aliye na historia ya kupatikana na ugonjwa wa kisukari?

   a. Ndio

   b. Hapana

5. Je,umewahi patikana na ugonjwa wa shinikizo la damu kabla ya mimba hii?

   a. Ndiyo

   b. Hapana

6. Je, una jamaa wa familia aliye na historia ya kupatikana na shinikizo la damu?

   a. Ndio

   b. Hapana

7. a) Je, umewahi tumia matibabu ya jadi/kienyeji wakati wa ujauzito huu?

a. Ndio

b. Hapana

b) Iikwa ndio, ni matibabu gani na kwa kusudi gani? _____

_____

8. Je, wewe ni wa kabila gani?

a. Kikuyu

b. Luhya

c. Luo

d. Kalenjin

e. Kamba

f. Kisii

g. Wengine (taja) _____

9. Je, wewe ni wa dini gani?

a. Mkristo

b. Muislamu

c. Ingine (taja) _____

Appendix 5 Data Abstraction Tool

(To be filled by a research assistant using medical records of postnatal mothers)

Case _____ Control _____

ID#	**Variables**							
	Reproductive and Obstetric factors						Clinical factors	
			Time of first ANC visit			Apgar score		
	#. ANC visit	Birth weight	LMP	Date of first ANC visit	Trimester of pregnancy: 1^{st}, 2^{nd}, 3rd	Apgar score at 5 min	Hemoglobin level (Hgb) on adm. For delivery Note: write **NA** if no result available in pt. record	Number of pus cells in urine on Adm. For delivery Note: write **NA** if no result available in pt. record

Appendix 6 Study Variables

Dependent variable

Dependent variable was pre-eclampsia and/or eclampsia status measured as binary categorical variable.

Independent variables

The independent variables of interest were maternal age, education, residence, marital status, occupation, ethnicity, religion, maternal age, age at first marriage, age at first pregnancy, number of antenatal care visit, Time/trimester of first ANC visit, gravidity, parity, child sex, anemia in pregnancy, urinary tract infection (UTI) in pregnancy, alcohol use, tobacco use, hypertension family history, diabetes family history, diabetes personal history, hypertension personal history, and traditional treatment use. All of these explanatory variables were more or less potential confounders and a determination of which one is actually a confounder was made during analysis. All of these variables were defined and measured as explained in the table below.

Definition and measurement of explanatory variables

Variable	Type	Definition and measurement
Maternal age	**Continuous**	This was defined as the present age of postnatal mother in completed years that met the inclusion criteria for cases and controls measured as a continuous variable from 15-49 years grouped into 1= < 20 years, 2= 20-34 years, 3=35-49 years.
Education	**Ordinal**	This was the level of education of postnatal mother that met the inclusion criteria for cases and controls captured as an ordinal categorical variable from 0 to 3, where, 0 = no education, 1 = primary level of education, 2 = secondary level of education and 3 = tertiary level of education.
Marital status	**nominal**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls habiting with a man as husband, measured as nominal variable, coded 1=single, 2=married, 3=widowed, 4=divorced, 5=separated.
Occupation	**Nominal**	This was defined as the work/job a postnatal mother that met the inclusion criteria for cases and controls is doing to earn a living (income) measured as categorical variable from 1 to 4; where 1 = government/private employee, 2 = house wife, 3 = merchant, and 4 = others.

County of Residence	**Nominal**	This was defined as the county of residence where a postnatal mother that met inclusion criteria for cases and controls was living measured categorical variable from 1 to 6, where 1=Nairobi, 2=Kiambu, 3=Machakos, 4=Kajiado, 5=Muranga, and 6=others
Specific Area of residence	**Nominal**	This was defined as the specific area/place in county of residence where a postnatal mother that met the inclusion criteria for cases and controls was living measured as categorical variable from 1 to 4, where, 1=urban/estate, 2=rural, 3= informal settlement, & 4=others.
Ethnicity	**Nominal**	This was defined as the ethnic group a postnatal mother that met the inclusion criteria for cases and controls belongs to measured as categorical variable coded from 1-7, where 1=Kikuyu, 2=Luhya, 3=Luo, 4=Kalenjin, 5=Kamba, 6=Kisii, and 7=Others.
Religion	**Nominal**	This was defined as the religion of a postnatal mother that met the inclusion criteria for cases and controls measured as categorical variable coded 1-3, where 1=Christian, 2=Muslim, and 3=Others
Age at first marriage	**Continuous**	This was defined as the age in completed years of a postnatal mother at first marriage that met the inclusion criteria for cases and controls measured as continuous variable from 15-49 years grouped into 1=<20 years, 2=20-34 years, 3=35-49 years

Age at first pregnancy	**Continuous**	This was defined as the age in completed years of a postnatal mother at first pregnancy that met the inclusion criteria for cases and controls captured and measured as continuous variable from 15-49 years grouped into1= <20 years, 2=20-34 years, 3=35-49 years.
Number of antenatal care visit	**Discrete**	This was defined as the number of visit(s) a postnatal mother that met the inclusion criteria for cases and controls made during her antenatal care follow-up at health facility measured as discrete variable from 0, 1, 2, 3, 4, and so on; where 0=no ANC visit, 1=ANC1 visit, 2=ANC2 visit, 3=ANC3 visit, and 4=ANC4 or more visits
Time/trimester of first ANC visit	**Ordinal**	This was obtained by recording the date of last menstrual period (LMP) and date of first ANC visit to compute weeks of gestation which will then be computed into trimester of pregnancy for a postnatal mother that met the inclusion criteria for cases and controls measured as a categorical variable from 1 to 3; where 1 = first trimester, 2 = second trimester, and 3 = third trimester
Gravidity	**Discrete**	This was defined as the number of pregnancy a postnatal mother that met the inclusion criteria for cases and controls had without regard to the outcome measured as a discrete variable from 1, 2, 3, and so on; grouped/coded 1 = primigravida and 2 = multi-gravidae (meaning 2 or more pregnancies).

Parity	**Discrete**	Parity was defined as the number of pregnancy a postnatal mother who met the inclusion criteria for cases and controls had that resulted into a viable child/live birth captured as discrete variable measured from 0, 1, 2, and so on; where 0 = nulliparous, 1 = primiparous, & 2 = multiparous (means 2 or more live births).
Child sex	**Nominal**	This was defined as the sex of the fetus during pregnancy of a postnatal mother that met the inclusion criteria for cases and controls and confirmed after delivery measured as a categorical variable from 1-3, where 1=male, 2=female, and 3=others (meaning multi-sex)
Anaemia in pregnancy	**continuous**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls but had anaemia on admission for delivery measured as a continuous variable and grouped from 1-4, where 1 is ≥11g/dl (normal), 2=7-10.9g/dl (mild-moderate anaemia in pregnancy), 3= <7g/dl (severe anaemia in pregnancy), 4=not available
Urinary Tract Infection (UTI) in pregnancy	**continuous**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls but had UTI on admission for delivery measured as a continuous variable and grouped from 1-4, where 1=0-5phf (normal), 2=6-10phf (mild-moderate UTI in pregnancy), 3= >10phf (severe UTI in pregnancy), and

		4=not available
Alcohol use	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that took-in or consumed alcoholic beverage measured as a binary categorical variable, (yes/no), coded 1=yes and 0=no, where 1 was use alcohol and 0 otherwise no alcohol use.
Time of alcohol use	**Nominal**	This was defined as the time a postnatal mother that met the inclusion criteria for cases and controls used alcoholic beverage measured as a categorical variable from 1-3, where 1=before pregnancy, 2=during pregnancy, and 3=before and during pregnancy
Tobacco use	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that smokes cigarette, or consume/use other forms of tobacco products measured as a binary categorical variable, (yes/no), coded 1=yes and 0=no, where 1 was use tobacco and 0 otherwise was no tobacco use.
Time of tobacco use	**Nominal**	This was defined as the time a postnatal mother that met the inclusion criteria for cases and controls used tobacco/tobacco products measured as a categorical variable from 1-3, where 1=before pregnancy, 2=during pregnancy, and 3=before and during pregnancy
Hypertension personal history	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that had a

		personal history of hypertension measured as a binary categorical variable, (yes/No), coded 1 = yes & 0 = no; where 1 was with personal history of hypertension and 0 was with no personal history of hypertension.
Diabetes personal history	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that had a personal history of Diabetes measured as a binary categorical variable, (yes/No), coded 1 = yes & 0 = no; where 1 was with personal history of diabetes and 0 was with no personal history of diabetes.
Hypertension family history	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls, and had biological family members (sisters, mother, father, & brothers) with history of hypertension measured as a binary categorical variable, (yes/No), coded 1 = yes & 0 = no; where 1 was with family history of hypertension and 0 was with no family history of hypertension.
Diabetes family history	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that had biological family members (sisters, mother, father, & brothers) with history of Diabetes measured as a binary categorical variable, (yes/No), coded 1 = yes & 0 = no; where 1 was with family history of Diabetes and 0 was with no family history of Diabetes.

Traditional treatment use	**Binary**	This was defined as a postnatal mother that met the inclusion criteria for cases and controls that used traditional treatment/medicine measured as a binary categorical variable, (yes/no), coded 1 = yes & 0 = no; where 1 was use traditional treatment and 0 did not take/use traditional treatment.
Specific treatment use	**Nominal**	This was defined as the specific traditional treatment a postnatal mother that met the inclusion criteria for cases and controls took measured as a categorical variable from 1-4, where 1=traditional/local herbs, 2=Ayurvedic/Chinese medicine, 3=traditional/local chalk, and 4=traditional/local ointment
Purpose for specific treatment use	Nominal	This was defined as the purpose for which a postnatal mother that met the inclusion criteria for cases and controls use specific traditional treatment measured as a categorical variable 1-6, where 1=protection/safety of pregnancy, 2=iron supplement, 3=back pain, 4=detoxification/cleansing of the body system, 5=appetite, and 6=chest/heart burn

Appendix 7: Ethical Clearance – KNH-UON ERC

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/274

11th July, 2019

KENYATTA NATIONAL HOSPITAL APPROVED 11 JUL 2019 KNH/UoN-ERC P. O. BOX 20723 - 00202 NAIROBI

Dr. Gorbee Gabriel Logan
Reg. No. H57/6923/2017
School of Public Health
College of Health Sciences
University of Nairobi

Dear Dr. Logan

RESEARCH PROPOSAL: DETERMINANTS OF PRE-ECLAMPSIA AND ECLAMPSIA AMONG WOMEN DELIVERING IN COUNTY HOSPITALS IN NAIROBI, KENYA (P426/05/2019)

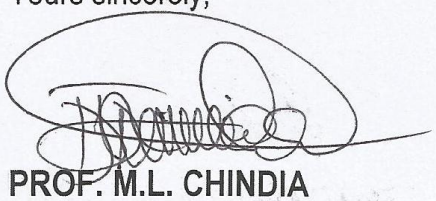
This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 11th July 2019 – 10th July 2020.

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. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. 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*).
g. 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.

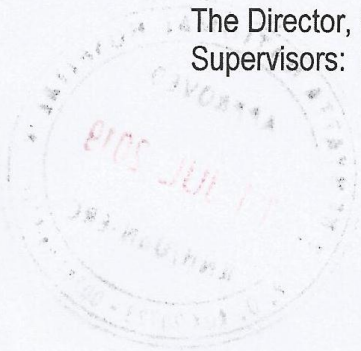
For more details consult the KNH- UoN ERC website**http://www.erc.uonbi.ac.ke**

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
The Director, School of Public Health, UoN
Supervisors: Dr. Peter Njoroge, Mr. Lambert Nyabola



Appendix 8: Letter of Research Authorization – Nairobi City County

NAIROBI CITY COUNTY

Telephone 020 344194

web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

DEVOLUTION AND PUBLIC SERVICE MANAGEMENT

REF: NCC/HRD/HRM/11/904/JWN/2019

17TH JULY, 2019

GORBEE GABRIEL LOGAN
UNIVERSITY OF NAIROBI
P.O BOX 19676-00202
NAIROBI.

RE: RESEARCH AUTHORIZATION

Reference is made to your letter dated 12th July, 2019 on the above subject matter;

The Nairobi City County Government has approved your request subject to the following;

1. The period of Data Collection will be from 15th July, 2019 to 30th September, 2019.
2. You are expected to adhere to the rules and regulations pertaining to the Data Collection.
3. That during your research study there will be no costs devolving on the County.
4. That you undertake to indemnify the County against any claim that may arise from your Data Collection.
5. You are required to submit a **Copy of the final data document collected** within two weeks after completion to the Human Resource Development Department.
6. Research will be on;
   "Determinants of pre- eclampsia and eclampsia among women delivering in County Hospitals in Nairobi, Kenya"
7. You are supposed to pay data collection fee of **Kshs. 30,000/=**

By a copy of this letter the Medical Superintendents, **Pumwani Maternity Hospital, Mama Lucy Hospital and Mbagathi Hospital** are requested to accord you the necessary assistance.

CHIEF ADMINISTRATIVE OFFICER

EUNICE MUSAU
CHIEF ADMINISTRATIVE OFFICER – (CHS).

CC: MEDICAL SUPERINTERDENT – PUMWANI MATERNITY HOSPITAL
- MAMA LUCY HOSPITAL
- MBAGATHI HOSPITAL

Appendix 9: Letter of Research Authorization – Pumwani Maternity Hospital

NAIROBI CITY COUNTY

Telephone: +254 218 2114
Website: www.nairobi.go.ke

City Hall
P. O. Box 30075-00100
Nairobi
KENYA

COUNTY HEALTH SERVICES:
PUMWANI MATERNITY HOSPITAL:

PMH/DMOH/75/0712/2019

30TH JULY 2019

To:
DR. GORBEE GABRIEL LOGAN
UNIVERSITY OF NAIROBI
P. O. BOX 19676 – 00202
NAIROBI.

RE: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the research entitled "**Determinants of Pre-Eclampsia and Eclampsia among Women Delivering in County Hospitals in Nairobi, Kenya**" has been approved.

You are hereby allowed to collect data. We look forward to receiving a summary of the research findings upon completion of the study.

Yours sincerely,

PUMWANI MATERNITY HOSPITAL
P. O. Box 42849-00100, NAIROBI
TEL. NRB. 6763291-4/ 6762965

DR. BETH MAINA
DEPUTY MEDICAL SUPERINTENDENT

Appendix 10: Letter of Research Authorization – Mama Lucy Kibaki Hospital

MAMA LUCY KIBAKI HOSPITAL-EMBAKASI
P.O. Box 1278-00515
NAIROBI

REPUBLIC OF KENYA
MINISTRY OF HEALTH
NAIROBI CITY COUNTY

Telephone: Nairobi
020 - 2297000

E-mail: medsupnedh@yahoo.com

When replying please quote

OUR REF: MLKH/ADM/RES/1/4/( )

DATE: 24th July, 2019

Gorbee Gabriel Logan
University Of Nairobi
P. O. BOX 19676- 00202,
NAIROBI

RE: TEMPORARY PERMISSION TO COLLECT DATA

TITLE: "DETERMINANT OF PRE- ECLAMPSIA AND ECLAMPSIA AMONG WOMEN DELIVERING IN COUNTY HOSPITALS IN NAIROBI, KENYA."

Refer to your application to collect data on the above research in this institution.

This is to inform you that the hospital has given you temporary permission to allow you collect data which expires after the next Research Committee Meeting.

MAMA LUCY KIBAKI HOSPITAL
24 JUL 2019
P.O. Box 1278-00515, BURUBURU

DR. MUSA MOHAMMED
MEDICAL SUPERINTENDENT

Appendix 11: Letter of Research Authorization – Mbagathi District Hospital

NAIROBI CITY COUNTY

Tel: 2724712, 2725791, 0721 311 808
Email: mbagathihosp@gmail.com

Mbagathi Hospital
P.O. Box 20725- 00202
Nairobi

COUNTY HEALTH SERVICES

Ref: MDH/RS/1/VOL.1

22nd July 2019

Dr. Gorbee Gabriel Logan
UON

RE: RESEARCH AUTHORIZATION

This is in reference to your application for authority to carry out a research on *"Determinants of pre-eclampsia and eclampsia among women delivering in Mbagathi Hospital"*

I am pleased to inform you that your request to undertake the research in the hospital has been granted.

On completion of the research you are expected to submit one hard copy and one soft copy of the research report / thesis to this office.

MBAGATHI HOSPITAL
23 JUL 2019
Tel: 0721 311 808
P.O. BOX 20725 - 00202

Dr. D. Kimutai
Chairman – Research Committee
Mbagathi Hospital

Appendix 12: Letter of Research Authorization – NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **838252**

Date of Issue: **20/August/2019**

RESEARCH LICENSE

This is to Certify that Dr.. Gorbee Gabriel of University of Nairobi, has been licensed to conduct research in on the topic: DETERMINANTS OF PRE-ECLAMPSIA AND ECLAMPSIA AMONG WOMEN DELIVERING IN COUNTY HOSPITALS IN NAIROBI, KENYA for the period ending : 20/August/2020.

License No: **NACOSTI/P/19/245**

838252

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix 13: Plagiarism Report

Turnitin Originality Report

DETERMINANTS OF PREECLAMPSIA AND ECLAMPSIA AMONG WOMEN DELIVERING IN COUNTY HOSPITALS IN NAIROBI, KENYA by Gorbee Gabriel Logan

From Public Health (Master of Public Health)

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