ADVERSE PERINATAL OUTCOMES AND THE ASSOCIATED FACTORS AMONG WOMEN WITH AND WITHOUT HYPERTENSIVE DISORDERS OF PREGNANCY AT MUHIMBILI NATIONAL HOSPITAL IN TANZANIA: A RETROSPECTIVE STUDY

Magdalena A. Haule (BScN)

Master of Science (Midwifery and Women Health) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2021

.

Muhimbili University of Health and Allied Sciences

School of Nursing

ADVERSE PERINATAL OUTCOMES AND THE ASSOCIATED FACTORS AMONG WOMEN WITH AND WITHOUT HYPERTENSIVE DISORDERS OF PREGNANCY AT MUHIMBILI NATIONAL HOSPITAL IN TANZANIA: A RETROSPECTIVE STUDY

By

Magdalena A. Haule

A dissertation submitted in partial fulfillment of the Requirement for the Degree of Master of Science (Midwifery and Women Health) of

Muhimbili University of Health and Allied Sciences
October, 2021

CERTIFICATION

The undersigned certifies that she has read and hereby recommends for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled "**Adverse Perinatal outcomes and the associated factors among Women with and without Hypertensive Disorders of Pregnancy at Muhimbili National Hospital in Tanzania**", in partial fulfilment of the requirements for the degree of Master of Science in Midwifery and Women Health of the Muhimbili University of Health and Allied Sciences.

…….....

Dr. Beatrice Mwilike

(Supervisor)

Date: ……..……

……

Ms. Dorkasi L. Mwakawanga

(Co-supervisor)

Date: ……..……

DECLARATION AND COPYRIGHT

I, Magdalena A. Haule, declare that this is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature …….. Date……

ACKNOWLEDGEMENT

I wish to express my sincere gratitude and appreciation to Dr. Beatrice Mwilike (Supervisor) and Ms. Dorkasi L. Mwakawanga (co-supervisor) for their supervision, constructive criticism, and patience during the preparation of this dissertation. Despite their many responsibilities, they could spare time to go through my work and give constructive ideas. I also thank them for bearing with me when I was having difficulties in finishing the work on time. I have learned a lot from them especially planning activities, keeping time, and doing research.

This study would not have succeeded without the financial support from the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) (Tanzania). Therefore, I would like to thank MoHCDGEC for the support they gave in the realization of the study.

I am grateful to the staff in the Maternity Block I at Muhimbili National Hospital especially ward 38 and 39 Nurse In-charge, Dr Mganga (Obstetrician), and my colleagues who have contributed a lot by giving their constructive criticism. I have gained a lot of new knowledge from their vast knowledge, skills, and experience. I would also like to thank Executive Director – Muhimbili National Hospital, Head of department Medical Records. Research assistants Jafary Lutavi (Midwife), Glory Masimango (Midwife), Yohana Chuwa (Midwife), and Mr. Mgaya (senior Health Recorder) contributed a lot by working closely with me during data collection. Last but not least I would like to thank my husband Dr. Mussa K. Msemo with my family at large for the huge support they offered during this entire period.

DEDICATION

I dedicate this dissertation to my Husband Dr. Mussa K. Msemo, my children Kassim Junior and Safina, and My father Adelgoth Haule for their endurance during my master program.

ABSTRACT

Background: Adverse perinatal outcomes are multifactorial in etiology, and remain a major cause of perinatal morbidity and mortality. The contribution of hypertensive disorders in pregnancy to the adverse perinatal outcome has not been fully established, specifically the magnitude of the different types of hypertensive disorders in pregnancy and their contribution to adverse perinatal outcomes has not been fully established.

Objective: To examine the adverse Perinatal outcomes and the associated factors among Women with and without Hypertensive Disorders of Pregnancy at Muhimbili National Hospital in Tanzania.

Materials & methods: A retrospective case control study using secondary data was carried out among women who delivered at Muhimbili National Hospital (MNH) from December 2020 to March 2021.Patient's record files were retrieved from the medical records department to extract the data recorded at delivery Data analysis was done by SPSS. comparisons at bivariate and multivariate levels were carried by chi-square test and logistics regression analysis respectively; significance was set a P-value of 0.05%

Results: A higher proportion of participants with hypertensive disorders in pregnancy (61.5%) had delivered newborns with the presence of any adverse outcome compared to those without hypertensive disorders in pregnancy (38.5%). The determinants for adverse perinatal outcomes were age between 15-19 years, living in Temeke and Kigamboni, hemoglobin level, gestation age, Preterm delivery, and normal ranges for urea, normal platelets count, HIV/AIDS and anemia.

Conclusion: Adverse perinatal outcome was higher in women with hypertensive disorders compared to those without hypertensive disorders in pregnancy. Furthermore, perinatal death occurred at a higher proportion in women with hypertensive disorders.

Recommendation: The referral system needs to be well organized to improve and manage diseases at the lower health facilities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AKI	Acute Kidney Injury
C/S	Caesarean Section
HDP	Hypertensive disorders in pregnancy
HELLP	Haemolysis, Elevated Liver Enzymes and Low Platelets
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
PPH	Postpartum Hemorrhage
SGA	Small for Gestational Age
USA	United States of America

DEFINITION OF TERMS

Hypertensive Disorders of pregnancy: Are the diseases of pregnancy mainly characterized with four defined categories including gestational hypertension; pre-eclampsia and eclampsia; superimposed preeclampsia and chronic hypertension.

Specific disorders

Gestational Hypertension: This is a form of hypertensive disorder characterized by blood pressure 140/90 mmHg after the 20th week of pregnancy in a previously normotensive woman.

Preeclampsia: This is a form of hypertensive disorder characterized by hypertension (blood pressure) of 140/90 mmHg after the 20th week of pregnancy in a woman who was previously normotensive. Proteinuria: urinary excretion 300 mg/L or 500 mg/24 h in the absence of urinary tract infection.

Eclampsia: This is a form of hypertensive disorder which occurs in a woman with pre-eclampsia. It is characterized by seizures not attributed to other causes.

Superimposed Preeclampsia: This is a form of hypertensive disorder characterized by chronic hypertension with the development of proteinuria during pregnancy

Chronic Hypertension: This is a form of the hypertensive disorder is characterized by hypertension present before the 20th week of pregnancy, persistent for more than 6 weeks postpartum, or both.

Adverse perinatal outcomes are outcomes like prematurity, low birth weight, SGA, stillbirth and low Apgar score.

Perinatal period commences at 22 completed weeks (154 days) of gestational age and ends seven completed days after birth.

Low birth weight; is defined as a birth weight of less than 2500grams.

Small for Gestational Age (SGA); refers to the new born whose birth weight is less than the 10^{th} percentile for gestational age.

Prematurity; is the term for the broad category of neonates born at less than 37 weeks' gestational age.

Stillbirth; is the baby with no sign of life at or after 28 weeks of gestational age.

APGAR SCORE; is a quick test performed on a baby at one and five minutes after birth.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The adverse perinatal outcome has been a worldwide threat and remains to be a major cause of perinatal morbidity and mortality (Vats and Paul, 2016; Xiong *et al.*, 2018; Asseffaid and Demissie, 2019). Globally, it is evidenced that 2.7 million neonates die annually in the perinatal period (Baquiet al., 2016). Out of this number, 0.7 million deaths are reported to be linked with intrapartum-related events (Liu et al., 2016). Majority of the deaths (98%) take place in low- and middle-income countries (Blencowe et al., 2016). Perinatal mortality makes up a considerable portion of the overall burden of newborn and child mortality (Liu et al., 2016). A study involving six low- and middle-income countries reported the prevalence of perinatal mortality **over** all neonatal mortality to be 46% across six countries studied (Baqui et al., 2016). Baqui and his colleagues described Tanzania as having one of the highest prevalence of perinatal mortality occurring in the first 24 hours (Baqui et al., 2016) and yet factors associated with adverse perinatal outcome including perinatal mortality in women with HDPs are not well established. The limited published studies on pregnancy outcomes linked with HDPs in Tanzania have focused on maternal outcomes (Pembe et al., 2014; Macheku et al., 2015; Mooij et al., 2015a, 2015b; Mrema et al., 2018).

The adverse perinatal outcome is caused by various known factors such as Maternal factors including socio-demographics, obstetric characteristics, pregnancy-related syndromes including hypertensive disorders in pregnancy and other medical co-morbidities like HIV, Malaria, Anemia and sickle cell disease. Hypertensive disorders affect 10–22% of pregnancies around the world. The incidence of hypertensive disorders ranges from 8 to 15% worldwide, 16% in primigravida, and 7% in multigravida (Xiong et al., 2018; Asseffaid and Demissie, 2019). The prevalence is noted to vary from country to country. In the USA it is estimated to be 6.4% of deliveries; in Sweden, it is 1.5% of pregnancies while

it is 20% of pregnancies in Africa (Vats and Paul, 2016). These disorders have been reported as a leading cause of both maternal and neonatal morbidity and mortality (Xiong et al., 2018). Globally, maternal mortality is estimated to range from 2-30%. It increases by 10-15% and remains high with the range of 20-50% due to preeclampsia and 30-50% due to eclampsia in developing countries (Rajamma and Sridevi, 2016). A study done in Uganda in 2016 shows that the mortality rate due to hypertensive disorders was 5% (Nakimuli et al., 2016). In 2015, it was reported that Tanzania has high maternal mortality ratio of 556 per 100000 live births (TDHS 2015).

Maternal factors such as socio-demographics, obstetric characteristics, pregnancy-related syndromes including hypertensive disorders in pregnancy and other medical co-morbidities are known to contribute to adverse perinatal outcomes. However, the contribution of hypertensive disorders in pregnancy to adverse perinatal outcome are not well-known, particularly, the magnitude of the different types of hypertensive disorders in pregnancy and their contribution to adverse perinatal outcome (Baqui et al., 2016; Lawn et al., 2016; Plotkin et al., 2018). The current study intends to analyze factors associated with adverse perinatal outcomes among women with hypertensive disorders of pregnancy at Muhimbili National Hospital in Dar es Salam, Tanzania.

1.2 Problem statement

Adverse Perinatal outcome especially perinatal mortality has raised global concern. The decline in perinatal mortality has been shown to remain stagnant, mainly in the middle and low-income countries and mostly associated with HDPs (Mpembeni, 2014).

Tanzania is a key contributor to the global burden of perinatal mortality with 51,000 neonatal and 43,000 stillbirths occurring annually (Plotkin *et al.*, 2018). While a reduction in under-five deaths in Tanzania has been notable, such reduction in neonatal mortality is acknowledged to be much slower, whereby 40% of children under five mortality occur among neonates (UNICEF, 2015) with the highest mortality occurring in the first 24 hours (Baqui *et al.*, 2016).

Despite the high rates of adverse perinatal outcome including perinatal mortality in Tanzania, there is scarce of information concerning factors associated with adverse perinatal outcome in women with hypertensive disorders in pregnancy. Limited published studies have focused on maternal outcomes (Macheku et al., 2015; Mrema et al., 2018). Adding to that, the contribution of hypertensive disorders in pregnancy to adverse perinatal outcomes is not well known, specifically the magnitude of the different types of hypertensive disorders in pregnancy and their contribution to adverse perinatal outcomes (Macheku et al., 2015; Mrema et al., 2018). Therefore, research connecting adverse perinatal outcomes and specific hypertensive disorders in pregnancy is needed to help combat this problem.

1.3 Conceptual Framework

Figure 1 presents the conceptualization of the perceived association between extents of adverse perinatal outcome and maternal and obstetric factors. From the figure, it is shown that adverse perinatal outcome depends on the maternal and obstetric factors and maternal co-morbidities. Maternal factors like the type of hypertensive disorders such as chronic hypertension, gestational hypertension, and pre-eclampsia, eclampsia, pre-eclampsia superimposed on chronic hypertension may lead to an adverse perinatal outcome like prematurity, Low birth weight, SGA, stillbirth, a low Apgar score for fetal. Obstetric factors like low parity, low gestational age, having twins, CS and induced labor may lead to adverse perinatal outcomes. Co-morbidities like malaria, HIV, and anemia may also lead to adverse perinatal outcome

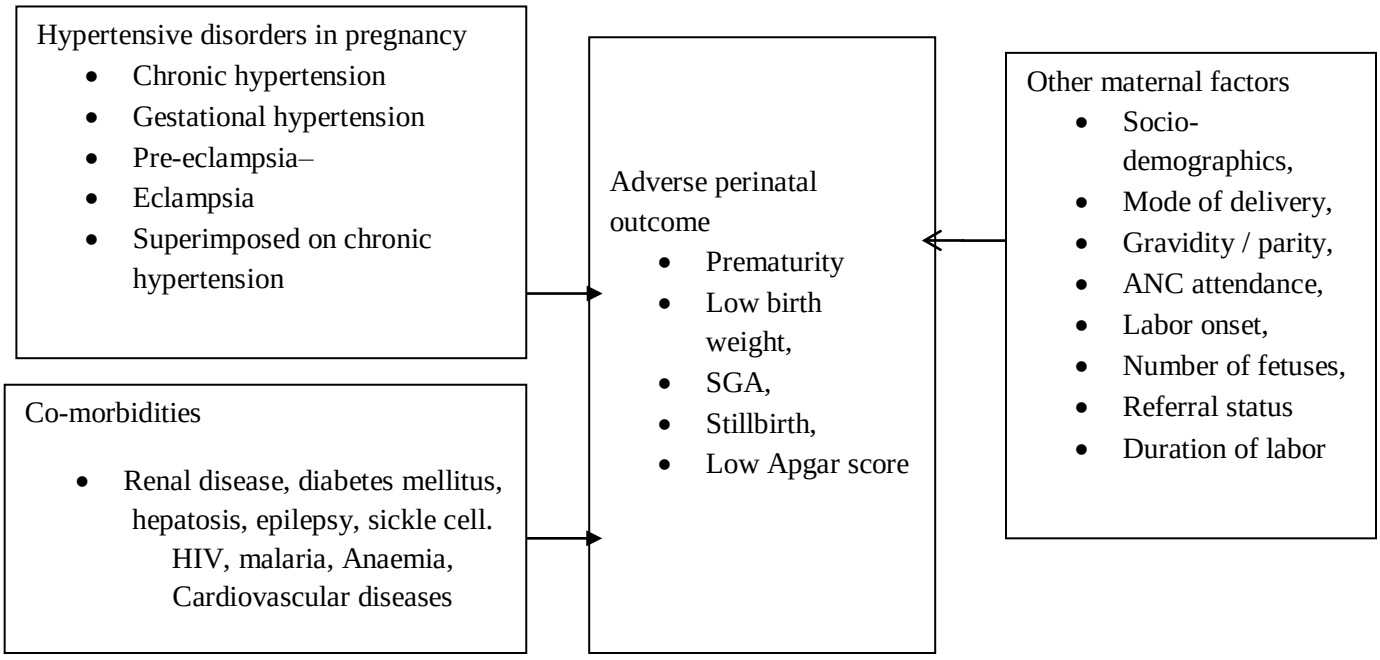

Figure 1: Conceptual framework for understanding adverse perinatal outcome and associated factors.

1.4 Rationale

Identifying risk factors associated with adverse perinatal outcomes among women with hypertensive disorders in pregnancy will enable their categorization into those requiring early obstetric care (including birth plan and preparedness) and /or drug management. This will be useful for health care providers at MNH and the whole country in general as a guide for strengthening interventions throughout pregnancy for early signs and symptoms of hypertensive disorders in pregnant. Also, the results will help public health officials to determine if there is need of increasing fetal surveillance in the form of laboratory assessments, non-stress tests, and/or biophysical profiles. The results of this study will also help the principal investigator to attain her master degree. In addition, the knowledge gained from this study will also aid policy makers and concerned parts to improve newborn care to reduce morbidity and mortality during the perinatal period.

1.5 Research hypothesis

1.5.1 Null hypothesis

There is no difference in the proportion of adverse perinatal outcome among women with hypertensive disorders in pregnancy and without hypertensive disorders in pregnancy

1.5.2 Alternative hypothesis

There is a difference in the proportion of adverse perinatal outcomes among women with hypertensive disorders in pregnancy and without hypertensive disorders in pregnancy.

1.6 Research question

1.6.1 Main research questions

What are the factors associated with adverse perinatal outcomes among women with and without hypertensive disorders in pregnancy at Muhimbili National Hospital, Dar es Salaam, Tanzania?

1.6.2 Specific Research questions

1. What is the proportion of adverse perinatal outcomes among women with hypertensive disorders in pregnancy and without hypertensive disorders in pregnancy at Muhimbili National Hospital, Dares Salaam, Tanzania?
2. What are the maternal factors (socio-demographic and obstetric) associated with adverse perinatal outcomes among women with hypertensive disorders in pregnancy at Muhimbili National Hospital, Dares Salaam, Tanzania?
3. What medical co-morbidities are associated with adverse perinatal outcomes among women with hypertensive disorders in pregnancy at Muhimbili National Hospital, Dares Salaam, Tanzania?

1.7 Study Objectives

1.7.1 Broad Objective

To determine Adverse Perinatal outcomes and the associated factors among Women with and without Hypertensive Disorders of Pregnancy at Muhimbili National Hospital in Tanzania

1.7.2 Specific Objectives

1. To determine the association between hypertensive disorders in pregnancy with adverse perinatal outcomes.
2. To determine the association between other maternal factors (socio-demographic and obstetric) and adverse perinatal outcomes.
3. To determine the association between maternal medical co-morbidities with adverse perinatal outcomes.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Association between adverse perinatal outcomes and HDPs

Perinatal mortality is used as one of the indicators of the quality of health care provided during the antenatal and perinatal periods (Mpembeni, 2014). Globally approximately 136 million births occur annually, out of this 3.7 million are estimated to die during the neonatal period and 3.3 million being stillbirths (Mpembeni, 2014). Perinatal mortality in low- and middle-income countries is five times higher than in high-income countries. For example, 10 deaths per 1000 total births in high-income countries is corresponding to 50 per 1000 in low and middle-income countries(Liu *et al.*, 2016). In Africa, perinatal mortality is reported to be 62 deaths per 1000 births (Blencowe *et al.*, 2016). In Tanzania, perinatal mortality is reported to be 26/ 1000 live births (Mpembeni, 2014). A study done in Northern Tanzania by Perry in 2018 found a perinatal mortality rate of 58 per 1000 live births among local non-referred births (Perry, 2018). It is hypothesized that with the increasing severity of maternal hypertensive disorder the perinatal outcomes of birth weight and mortality risks will be negatively impacted (Perry, 2018).

Hypertensive disorders of pregnancy (HDP) are diseases of the pregnancy including chronic (preexisting) hypertension, gestational hypertension, preeclampsia, eclampsia, and preeclampsia superimposed on chronic hypertension (Berhan and Endeshaw, 2015). These disorders continue to be a foremost global threat due to the connection they have with both high adverse maternal and perinatal outcomes(Adu-Bonsaffoh *et al.*, 2017a). The adverse perinatal outcomes associated with these disorders are normally because of placental insufficiency, placental abruption and complications related to prematurity (Adu-Bonsaffoh *et al.*, 2017a). The global estimate of perinatal mortality rates due to hypertensive disorders is estimated to range from 47 to 370 per 1000 births and 8–10% (Redman, 2011)for pre-term births with the highest mortality rate occurring in patients with severe pre-eclampsia and eclampsia (Browne *et al.*, 2015). In developing countries, preeclampsia and eclampsia are the main sources of perinatal mortality which account for 25% (Browne *et al.*, 2015).

Studies show that about 16% of 2.6 million stillbirths (Susannah *et al.*, 2016), 10% of perinatal mortality (8/1000live births) are allied to HDP(Souza, 2014). Pre-eclampsia/eclampsia is related to troubled vascular manifestations, oxidative stress, and endothelial damage which by consequence affect the normal placental functioning resultant in poorer perfusion and nutrient supplementation towards the growing foetus (Adu-Bonsaffoh *et al.*, 2017a). This may end up in perinatal morbidity and mortality (Wolde, Segni, and Woldie, 2011). In severe preeclampsia, where the risk of maternal mortality is less than1%, that of perinatal mortality is approximately 13%(Adu-Bonsaffoh *et al.*, 2017a).

The present data propose higher risks of perinatal adverse outcomes in women with HDP in comparison compared to women without HDP globally(Adu-Bonsaffoh, Obed, and Seffah, 2014; Payne *et al.*, 2014; Nathan *et al.*, 2018; Lugobe *et al.*, 2020). A study connecting hypertensive disorders in pregnancy and stillbirth rates in China revealed the rate of stillbirth in women with a hypertensive disorder in pregnancy to be 21.9 per 1000 births(Xiong *et al.*, 2018). After adjustment, the odds ratio for stillbirth in women with HDPs was 3.1 (CI: 2.85–3.37) as compared with those with no HDPs. The odds for superimposed preeclampsia in this study was 6.66 (95% CI: 5.57–7.96) and for eclampsia was 4.15 (95% CI: 3.81–4.52). In Brazil, a study showed higher odds of prematurity and neonatal complications in women with preeclampsia and eclampsia compared to those with no preeclampsia and eclampsia (Rezende *et al.*, 2020). Vats and Paul did their study in India, they reported a high rate of perinatal mortality in HDPs as compared to women with no HDPs(Vats and Paul, 2016). Other adverse perinatal outcomes reported were birth weight >2.5kg and Apgar score <7 at 5 minutes after birth. In this study, it is reported that early neonatal death only occurred in women with HDPs while none of the death occurred in women with no HDPs.In addition, the study that was done in Pakistan by Nisa and his colleagues revealed higher odds of fetal complications including meconium aspiration syndrome, preterm birth, and low birth weight in women with hypertensive disorders in pregnancy than women with no hypertensive disorders in pregnancy(Nisa, Shaikh, and

Kumar, 2019). A seven years retrospective analysis of a national registry of Netherlands to assess neonatal morbidity among mothers with a hypertensive disorder revealed that neonates from mothers with hypertensive disorders in pregnancy had higher odds (OR=2.0; 95% CI, 1.8 –2.2)for admission to the newborn intensive care unit compared with neonates from mothers with hypertensive disorders in pregnancy(Langenveld *et al.*, 2011).

In Africa, some studies have been conducted. A study done by Endeshaw and Berhan in 2014 in Ethiopia reported a mortality rate of 290/1000 total births in women with HDPs as compared to those with no HDPs(Berhan and Endeshaw, 2015). In this study, perinatal mortality is reported to be much higher in patients with preeclampsia (49.4%) and eclampsia (44.4%), perinatal deaths (261/322, 81%) was more common in patients with antepartum onset of HDP and 75% of the mortality were preterm. Another study done in Zimbabwe by Ngwenya and his colleagues in 2017 showed that almost half (49.6%) of newborn women with HDPs died because of stillbirth(Ngwenya, 2017). A Ghanaian study reported the incidence of adverse perinatal outcomes to be high among women with HDPs(Dassah *et al.*, 2019). In this study, the adverse perinatal outcomes included low Apgar score, preterm births, low birth weight, and stillbirths. Among the perinatal adverse outcomes, preterm births and stillbirths were prevalent in women with eclampsia and pre-eclampsia.

In Tanzania, there is a scarcity of such studies linking hypertensive disorders and perinatal outcomes. The few published studies have focused on maternal outcomes and are perhaps further limited by the deficiency of risk estimates for adverse outcomes associated with specific HDPs (Pembe *et al.*, 2014; Macheku *et al.*, 2015; Mooij *et al.*, 2015a, 2015b; Mrema *et al.*, 2018).

The studies done on HDPs and pregnancy outcomes have highlighted maternal predictors for the adverse perinatal outcome, these include maternal outcome and the specific HDPs.For the case of specific HDPs, the majority of the studies show that preeclampsia and eclampsia have a contribution (Berhan and Endeshaw, 2015; Xiong *et al.*, 2018;

Dassah *et al.*, 2019; Rezende *et al.*, 2020). A study from China revealed increased odds for stillbirths with various forms of HDPs including superimposed preeclampsia (AOR= 6.66 (95% CI: 5.57–7.96), preeclampsia and eclampsia (AOR=4.15 (95% CI: 3.81–4.52), chronic hypertension (AOR=2.32 (95% CI: 1.87–2.88) and gestational hypertension(AOR= 1.21 (95% CI: 1.08–1.36)(Xiong *et al.*, 2018). Rezende et al 2020 reported an association between chronic hypertension and adverse perinatal outcome including prematurity and neonatal complications in Brazil(Rezende *et al.*, 2020).In addition, Nisa and his colleagues in Pakistan conducted a study on the impact of pregnancy-related hypertensive disorders on the perinatal outcome (Un Nisa, Shaikh, and Kumar, 2019), in this study perinatal complication like a low birth weight was more prevalent in mothers with preeclampsia and preterm birth in women with eclampsia. A study in Haiti that assessed three categories of HDPs including hypertension, preeclampsia, and eclampsia revealed that the highest odds of adverse perinatal outcome such as low birth weight baby (AOR= 5.00, 95% CI 2.84–8.79) and stillbirths (AOR= 6.34, 95% CI 3.40–11.82) were found in women with eclampsia as compared to other categories of HDPs(Bridwell *et al.*, 2019).

Additional few published studies from Africa have also linked the effect of HDPs and adverse perinatal outcomes. A cross-section study that was conducted in Mulago Hospital, Uganda addresses several determinants for the adverse perinatal outcome(Kiondo *et al.*, 2014), in this study, severe pre-eclampsia (AOR= 5.17, 95% CI: 2.36-11.3) was seen to the independent factor for adverse perinatal outcome. A study from a tertiary hospital in Ghana on HDPs was conducted by Adu-Bonsaffoh and his colleagues in 2017 found that most of the adverse perinatal outcomes were significantly more common in those with preeclampsia compared to the other hypertensive disorders(Adu-Bonsaffoh *et al.*, 2017b). A study that was done in South Africa in 2018 by Nathan and his colleagues showed that higher rates of perinatal mortality were from women who were admitted at their early gestation(Nathan *et al.*, 2018).

2.2 Association between other maternal factors (socio-demographic and obstetric) and adverse perinatal outcomes

Several other maternal factors such as pre-existing hypertension, parity, gestational age at delivery and management (timing of drug administration) characteristics have been identified as risk factors for adverse perinatal outcomes among women with HDP(Kiondo *et al.*, 2014; Adu-Bonsaffoh *et al.*, 2017b; Li *et al.*, 2018; Nathan *et al.*, 2018; Yamamoto *et al.*, 2018; Asseffaid and Demissie, 2019; Bridwell *et al.*, 2019; Dassah *et al.*, 2019). An Ethiopian study revealed an association of obstetric factors like high diastolic blood pressure, non-use of ANC, and maternal complications with adverse perinatal outcomes(Asseffaid and Demissie, 2019). A prospective cohort study conducted by Nathan and his colleagues in 2018 on Maternal and perinatal adverse outcomes in women with pre-eclampsia reported early gestation at admission to be the most determinant for perinatal mortality(Nathan *et al.*, 2018). An analysis of 1396 cases of HPDs in China by Li and his colleagues revealed that among women with HDPs, factors like living in a rural area, multigravida, having polycystic ovary syndrome, hemolysis, elevated liver enzymes, and low platelet count, systemic lupus erythematosus, thyroid disease, or liver disease were significantly associated with increased risk for perinatal mortality (Li *et al.*, 2018). A prospective cohort study from Japan on Incidence of and risk factors for severe maternal complications associated with hypertensive disorders after 36 weeks' gestation showed that the rate of transient tachypnea of neonate (TTN) and perinatal complications significantly decreased with an increase in gestational age(Yamamoto *et al.*, 2018).

2.3 Association between maternal medical co-morbidities with adverse perinatal outcomes

Several co-morbidities such as sickle cell disease, renal disease, diabetes mellitus, hepatosis, epilepsy, HIV, malaria, anaemia, and cardiovascular diseases have been identified as risk factors for adverse perinatal outcomes. A systematic review and meta-analysis including19 studies from 9 different countries done in 2016 reported an increased risk of perinatal mortality in women living with sickle cell disease (Boafor *et al.*, 2016). In this study, the pooled odds ratio of perinatal mortality was 4.05. Muganyizi et al did a study on adverse pregnancy outcomes in women with sickle cell disease in Tanzania and reported increased incidence of low birth weight and birth asphyxia compared to those without sickle cell disease (Muganyizi and Kidanto, 2013)

For cardiovascular disease and renal disease, Asma et al have reported higher odds of fetal death, preterm birth, and low birth weight for females with cardiovascular and renal disease compared with those without cardiovascular and renal disease (Asma *et al.*, 2014). HIV has been shown to relate to adverse perinatal outcomes. In 2016, Sansone et al, after evaluating the risk of preeclampsia in pregnant women with HIV, released the results from a 26-year population-based retrospective cohort study, which showed after adjusting confounders that women living with HIV with hypertensive disorders had a significantly higher risk of preterm birth at less than 37 weeks of gestation compared with women living without HIV (Sansone et al., 2016).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study design

The design was a retrospective case-control study. This design was chosen because it allows the collection of information of two compared groups (one group with hypertensive disorders in pregnancy and the control group with no hypertensive disorders in pregnancy) and the expected outcome (adverse perinatal outcome) (Ajay and Micah, 2014). With this design, data on women with hypertensive disorders in pregnancy and those with no hypertensive disorders in pregnancy were collected concurrently.

3.2 Study Area

The study was conducted at Muhimbili National Hospital (MNH). MNH is the largest referral hospital in the United Republic of Tanzania. Research Center with a 1,500-bed facility, attending 1,000 to 1,200 outpatients per day, admitting 1,000 to 1,200 inpatients per week, is also a teaching hospital for the Muhimbili University of Health and Allied Sciences (MUHAS).

The hospital receives maternal cases mostly from the Municipal hospitals and the districts of the Coast region. Occasionally patients are received from upcountry. The hospital has 2 maternity blocks which have seven wards. Four wards are reserved for admission of women with antenatal and postnatal complications and women with sick children. One ward has an area reserved as an intensive care-like unit for patients with some of the hypertensive disorders in pregnancy such as severe preeclampsia, eclampsia, and critically ill patient. The number of deliveries per month is between 400 and 450 with an average of 120 to 125 deliveries of women with hypertensive disorders in pregnancy per month and with an average of 280 to 285 deliveries of women without hypertensive disorders in pregnancy per month. Hypertensive disorder in pregnancy patients at MNH are either admitted to the labor ward or postnatal ward unless they need intensive care, in which instance they are admitted to the Intensive Care Unit (ICU). Neonates of women with a hypertensive disorder in pregnancy are admitted to the Neonatal Unit or the Neonatal

Intensive Care Unit (NICU) for observation or treatment depending on the needs of the particular neonate.

3.3 Study Population

The study population was all women who delivered at MNH from January to December 2020. The population included cases (women with a hypertensive disorder in pregnancy) and control group (women without hypertensive disorder in pregnancy). At MNH, the number of deliveries per month is between 400 and 450 with an average of 120 to 125 deliveries of women with hypertensive disorders in pregnancy per month and with an average of 280 to 285 deliveries of women without hypertensive disorders in pregnancy per month.

3.3.1 Cases

Cases were all women with confirmed hypertensive disorders in pregnancy who delivered at MNH from January to December 2020.

3.3.2 Controls

Controls were all women without hypertensive disorders in pregnancy who delivered at MNH from January to December 2020.

3.4 Study duration

The study duration was from December 2020 to March 2021.

3.5 Sample size estimation

The following formula was used for sample size calculation as stipulated by (Ajay and Micah, 2014).

$$n = \frac{\{Z_{\beta}\sqrt{[P1\,(1-P1) + P0(1-P0)]} + Z_{\alpha}\sqrt{[2\,\bar{p}\,(1-\bar{p})]}\}^2}{(P0-P1)^2}$$

Where,

n= Sample size for each group

P1= the proportion of adverse perinatal outcome among women with HDPs (exposed)

P0=the proportion of adverse perinatal outcome among women without HDPs(unexposed)

$\bar{p}$ =The average proportion exposed

Average proportion exposed ($\bar{p}$) = (P1+ P0)/2

Z_β= 0.84 for power (1-β) of study is 80%

Z_α= Desired level of statistical significance, for 0.05 significance level= 1.96

(Z_α= the standard normal deviate at 95 confidence level=1.96 for two-sided comparisons depending on the hypothesis being tested).

Thus, assuming that,

The Odds Ratio= 2

r (ratio of controls to cases) = 1:1

Z_β= for 80% power is 0.84,

Z_α= for 0.05 significance level= 1.96

p_1 = 0.22 (proportion of adverse perinatal outcome among women with HDPs to(Browne *et al.*, 2015)

P_0= 0.14 (proportion of adverse perinatal outcome among women without HDPs to(Browne *et al.*, 2015)

$$n = \frac{\{0.84\sqrt{[0.22\ (1- 0.22) + 0.14(1- 0.14)]} + 1.96\sqrt{[2\ x0.18(1- 0.18)]}\}^2}{0.0064}$$

Sample size (n) = 370.

After Adjusting for 10%, the sample size was 407 women. A minimum of 814 files was studied, 407 files of women with HDPs and 407 files of women without HDPs.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

All patients who fulfill the following criteria:

1. All files of women with the diagnosis of a hypertensive disorder during pregnancy.
2. All files of women who gave birth between 1st January 2020 and 31st December 2020

3.6.2. Exclusion criteria

i. Known Hypertensive before pregnancy
ii. Patients files with significant incomplete records
iii. Unknown /unrecorded hypertensive disorders status.

Selection of controls

The selection of the control matched the maternal age, of the cases.

3.7 Sampling Procedure

3.7.1 Sampling Procedure for the cases

The Hospital Management Information System (HMIS) application called JEEVA was used to obtain the numbers of patients diagnosed with hypertensive disorders in pregnancy between 1st January 2020 and 31st December 2020. A Systematic Random Sampling method was used to select files of patients by dividing the estimated total number of delivery of women with HDPs in twelve months (1440) with an estimated sample size (407) to obtain a random sampling interval 3 (the 'kth' value). After obtaining the sampling interval, the first file was selected by using simple random sampling by lottery method, in this method; thereafter, the rest were selected systematically until the sample size is reached. Files with known Hypertensive before pregnancy and incomplete records were excluded from the study.

3.7.2 Sampling Procedure for the controls

The Hospital Management Information System (HMIS) application called JEEVA was used to obtain the numbers of patients with no hypertensive disorders in pregnancy between 1st January 2020 and 31st December 2020. A Systematic Random Sampling method was used to select files of patients by dividing the estimated total number of delivery of women without HDPs in twelve months thus between 1st January 2020 and 31st December 2020 (3360) with an estimated sample size (407) to obtain a random sampling interval 8 (the 'kth' value). After obtaining the sampling interval, the first file was selected by using simple random sampling by lottery method, in this method; thereafter, the rest were

selected systematically until the sample size is reached. All files had equal chances to be selected.

3.8 Data Collection Tools

The principal investigator and three assistants extracted information from patients' records using a checklist for maternal, co-morbidities, and Obstetric factors which include: maternal age, gravidity, parity, gestational age at delivery, mode of delivery, number of fetuses born at delivery, hypertensive disorders, the onset of HDP (Antepartum or before, Intrapartum, Postpartum), labor onset (Spontaneous, induced, direct CS), maternal co-morbidities such as sickle cell disease, renal disease, diabetes mellitus, hepatosis, epilepsy, HIV, malaria, anaemia, and cardiovascular diseases and adverse perinatal outcome (prematurity, low birth weight, SGA, stillbirth and low Apgar score). The checklist was in the English language.

3.9 Data collection procedures

Data collection was done from December 2020 to March 2021 by using a structured checklist. Before the visit to the study area, the members of the research team were provided with the particulars of hospital departments that they were to survey for the particular day. At each patient file, a researcher conducted observation and fill the checklist to find out the proportion of newborns with the adverse perinatal outcome and its associated factors among women with hypertensive disorders in pregnancy. The information includes demographic data, maternal age, gravidity, parity, gestational age at delivery, mode of delivery, number of fetuses born at delivery, hypertensive disorders, the onset of HDP (Antepartum or before, Intrapartum, Postpartum), labor onset (Spontaneous, induced, direct CS), maternal co-morbidities such as sickle cell disease, renal disease, diabetes mellitus, hepatosis, epilepsy, HIV, malaria, anaemia, and cardiovascular diseases and adverse perinatal outcome (prematurity, low birth weight, SGA, stillbirth, and low Apgar score).

3.10 Selection and training of research assistants

Three assistants with a profession and experience in midwifery practices were selected. They were trained and familiarized with the study objectives and how to collect data using the tools provided.

3.11 Pre-testing/piloting of tools:

For pre-testing of the checklist, expert opinion (obstetricians) during the development of the checklist was sought whereby information was checked for clarity, meaningfulness, and context. For validity and reliability, the checklist extracted the important information for the research from the files. Files with important missing information were excluded.

3.12 Variables and Measures

3.12.1 Dependent variable

Perinatal outcome (adverse outcome including prematurity, low birth weight, SGA, stillbirth, and low Apgar score or normal outcome)

The dependent variable in this study was measured as a categorical variable with a scale of 0-1 where “1” stood for the presence of adverse perinatal outcome (a newborn presenting any of the following outcomes: - prematurity, low birth weight, SGA, stillbirth, and low Apgar score) while “0” stood for the normal perinatal outcome.

3.12.2 Independent variables

HDP -HDP (chronic hypertension, gestational hypertension, pre-eclampsia–eclampsia, pre-eclampsia superimposed on chronic hypertension)

All these variables were measured as categorical variables except for maternal age whereby the ages were measured in numerical variables.

Maternal co-morbidities

- Sickle cell disease
- Renal disease
- Diabetes mellitus,

- Hepatosis,
- Epilepsy
- HIV
- Malaria,
- Anaemia,
- Cardiovascular diseases

Other maternal factors

- Parity
- Gestational age (weeks)
- Number of fetuses (singleton, twin)
- Antenatal care
- Onset of HDP (Antepartum or before, Intrapartum, Postpartum)
- Labor onset (Spontaneous, induced, direct CS)
- Mode of delivery
- Maternal complication (Preterm delivery, Abruption placenta, APH, HELLP Syndrome, AKI)
- Maternal outcome (dead, discharged)
- Maternal age
- In this study, parity, gestation age, ANC visits were measured in numbers.

3.13 Data management and analysis

3.13.1 Data management

To ensure reliability and accuracy of data which was collected, the principal investigator and a researcher experienced in midwifery practices collected data from medical records and compared this with the Health Management Information System (HMIS) registry to confirm the accuracy of the data.

Data collected were sorted and checked daily to check their completeness. In case of discrepancies or missing data, the medical records were checked again to make the necessary adjustment.

3.13.2 Data analysis

Data analysis was be done by Statistical Package for Social Sciences (SPSS) version 23 (Ajay and Micah, 2014).. Univariate analysis such as frequency and means were used to summarize and describe obtained data. The outcome variables (perinatal outcome among cases and control) were computed by cross tabulation of perinatal outcome among cases and control to have a comparison of the perinatal outcome among the two groups.

Bivariate and multivariate regression models were used to estimate the associations between selected predictor variables and adverse perinatal outcome. Bivariate analysis that was considered in this study was chi-square test for categorical variables and t-test for continuous variables. Multivariate analysis that was considered in this study was multiple logistic regression analysis.

A statistically significant association was considered when the odds ratio (OR) 95% confidence interval did not include the number 1 and a P-value less than 0.05. Variables which did not show statistical significance in the bivariate analysis were excluded from the multivariate analysis.

3.14 Ethical issues

Ethical clearance was requested from the Muhimbili University of Health and Allied Sciences (MUHAS) research and publication Committee for conducting this research. Apart from that, letters to seek permission to conduct the research were sent to the Executive Director of MNH. Retrieval of information was conducted confidentially by the researcher and assistant and no name of the patients was used in the data collection protocol. Informed consent was not required as there was no direct contact with the patients. However, all ethical protocols were adhered to regarding the research.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents the results of the study produced by quantitative analysis. It starts by describing the general characteristics of the study participants. This is followed by the substantive findings of the study, presented according to the research objectives. These findings have been used to provide the foundation for the conclusions and implications outlined in chapter six. A total of 786 files of women with hypertensive disorders in pregnancy and without hypertensive disorders in pregnancy who had given birth at Muhimbili National Hospital were recruited in the study.

4.2 General characteristics of the Study Population

Table 1 shows the general characteristics of study participants of patients with hypertensive disorders in pregnancy and without hypertensive disorders. In this study, the mean age, gravidity, parity, hemoglobin level and gestation age of the study population was 29.3± 5.8, 2± 1, 1± 1, 11.06± 1.52, and 36.20± 3.40 respectively.

Table 1: General characteristics of study participants (N = 786)

Character	With HDP (n=393)	Without HDP (n=393)	Total
Age (years)			
15-19	14 (3.6%)	12 (3.1%)	26 (3.3%)
20-24	76 (19.3%)	61 (15.5%)	137 (17.4%)
25-29	124 (31.6%)	123 (31.3%)	247 (31.4%)
30-34	109 (27.7%)	110 (28.0%)	219 (27.9%)
35-39	53 (13.5%)	68 (17.3%)	121 (15.4%)
>39	17 (4.4%)	19 (4.8%)	36 (4.6%)
Place of residence			
Ilala	127 (32.8%)	117 (29.8%)	244 (31.3%)
Kinondoni	61 (15.5%)	91 (23.2%)	152 (19.3%)
Temeke	110 (28.4%)	60 (15.3%)	170 (21.8%)
Ubungo	49 (12.5%)	63 (16.0%)	112 (14.2%)
Kigamboni	26 (6.6%)	35 (8.9%)	61 (7.8%)
Out of Dar es Salaam	20 (5.1%)	27 (6.9%)	47 (6.0%)
Education level			
No formal education	13 (3.3%)	6 (1.5%)	19 (2.4%)
Primary education	115 (29.3%)	83 (21.1%)	198 (25.2%)
Secondary education	223 (56.7%)	216 (55.0%)	439 (55.9%)
Higher education	42 (10.7%)	88 (22.4%)	130 (16.5%)
Marital status			
Single	55(14.2%)	59(15.0%)	114(14.6%)
Married	338(86.0%)	334(85.0%)	672(85.5%)
Employment status			
Employed	125(31.8%)	136(34.6%)	261(33.2%)
Not employed	268(68.2%)	257(65.4%)	525(66.8%)
Family history of HDP			
Yes	48(12.4%)	0(0.0%)	48(6.2%)
No	345(87.8%)	393(100.0%)	738(93.9%)
Gravidity			
Mean gravidity	2± 1	2± 1	2± 1
Parity			
Mean parity	1± 1	1± 1	1± 1

Hb			
Mean Hb	10.98± 1.50	11.14± 1.54	11.06± 1.52
Platelet counts			
Normal range	293(74.6%)	392(99.7%)	685(87.2%)
Abnormal range	100(25.4%)	1(0.3%)	101(12.8%)
AST			
Normal range	288(73.3%)	393(100.0%)	681(86.6%)
Abnormal range	105(26.7%)	0(0.0%)	105(13.4%)
ALT			
Normal range	353(89.8%)	393(100.0%)	746(94.9%)
Abnormal range	40(10.2%)	0(0.0%)	40(5.1%)
ANC visits			
Up to 4 visits	222(56.5%)	331(79.1%)	533(67.8%)
Below 4 visits	171(43.5%)	82(20.9%)	253(32.2%)
Urea			
Normal range	252(64.1%)	393(100.0%)	645(82.1%)
Abnormal range	141(35.9%)	0(0.0%)	141(17.9%)
Creatinine			
Normal range	310(78.9%)	393(100.0%)	703(89.4%)
Abnormal range	83(21.1%)	0(0.0%)	83(10.6%)
Uric acid			
Normal range	181(46.1%)	393(100.0%)	574(73.0%)
Abnormal range	212(53.9%)	0(0.0%)	212(27.0%)
Gastation age			
Mean Gestation age	35.39± 3.32	37.01± 3.27	36.20± 3.40

4.3. Proportion of Adverse perinatal outcome among cases and controls

Among the 786 files studies, 514 women had newborns with adverse perinatal outcomes. Table 2 shows women with and without HDPs who had newborns with adverse outcomes.

Table 2: Across-tabulation on the distribution of adverse perinatal outcome (N=786)

Adverse perinatal outcome	**HDP status**			
	With HDP	**Without HDP**	X^2	**P-value**
Presence of any adverse outcome	316(61.5%)	196(38.5%)	78.281	<0.0001
Perinatal death	30(81.1%)	7(18.9%)	15.004	<0.0001
Prematurity	246(59.0%)	171(41.0%)	28.733	<0.0001
Small for gestation age	69(72.6%)	26(27.4%)	22.139	<0.0001
Low birth weight	253(72.7%)	95(27.3%)	128.731	<0.0001
Low Apgar in 1minute	139(73.5%)	50(26.5%)	55.178	<0.0001
Low Apgar in 5 minutes	96(75.0%)	32(25.0%)	38.225	<0.0001
Still birth	65(79.3%)	17(20.7%)	31.370	<0.0001

A higher proportion of participants with hypertensive disorders in pregnancy (61.5%) had delivered newborns with the presence of any adverse outcome compared to those without hypertensive disorders in pregnancy (38.5%) and these variations were statistically significant (χ^2 =78.281, p<0.0001).

4.4 Maternal factors associated with adverse perinatal outcomes

The relationship between maternal factors (socio-demographic and obstetric factors) and adverse perinatal outcomes is shown in table 3.

Table 3: Association between maternal factors and adverse perinatal outcomes

Factors	Crude Odds	p-value	Adjusted Odds	p-value
Age (years)				
15-19	0.4(0.1-1.3)	0.132	8.2(1.3-30.7)	0.024
20-24	0.7(0.3-1.4)	0.284	2.6(0.2-28.1)	0.427
25-29	0.8(0.4-1.6)	0.513	1.5(0.2-13.2)	0.698
30-34	0.7(0.3-1.4)	0.331	3.4(2.1-28.1)	0.263
35-39	0.8(0.4-1.8)	0.628	0.9 (0.1-7.5)	0.955
>39	Reference		Reference	
Place of residence				
Ilala	0.9 (0.4-1.6)	0.646	1.3(0.1-11.9)	0.825
Kinondoni	0.9(0.5-1.9)	0.971	2.0(0.2-19.8)	0.572
Temeke	0.3(0.2-0.7)	0.002	4.0(1.2-13.9)	0.027
Ubungo	1.2(0.6-2.4	0.625	1.2(0.1-11.2)	0.893
Kigamboni	0.8 (0.4-1.7)	0.522	3.9(1.1-14.8)	0.042
Out of Dar es Salaam	Reference		Reference	
Education level				
No formal education	0.7 (0.2-1.8)	0.412	0.7(0.1-7.5)	0.732
Primary education	0.4(0.3-0.7)	<0.0001	1.9(0.5-7.6)	0.369
Secondary education	0.6(0.4-0.9)	0.01	1.0(0.3-3.4)	0.983
Higher education	Reference		Reference	
Employment status				
Employed	1.2(0.9-1.7)	0.222	1.6(0.6-4.1)	0.367
Not employed	Reference		Reference	
Gravidity	0.8 (0.7-0.9)	0.033	40.5(0.5-2.1)	0.104
Parity	0.8 (0.7-0.9)	0.04	0.1(0.05-4.1)	0.107
AST				
Normal range	0.3(0.2-0.7)	0.003	0.4(0.1-1.3)	0.148
Abnormal range	Reference		Reference	
Platelet counts				
Normal range	0.2(0.1-0.5)	0.001	0.2 (0.1-0.7)	0.009
Abnormal range	Reference		Reference	

ALT				
Normal range	0.2(0.05-0.8)	0.027	0.3(0.1-2.2)	0.248
Abnormal range	Reference		Reference	
ANC visits				
Up to 4 visits	0.5(0.3-0.8)	0.008	0.7(0.3-1.6)	0.401
Below 4 visits	Reference		Reference	
Urea				
Normal range	0.6(0.4-1.1)	0.081	0.3(0.1-0.8)	0.02
Abnormal range	Reference		Reference	
Creatinine				
Normal range	0.2(0.1-0.5)	0.001	0.4(0.1-1.6)	0.203
Abnormal range	Reference		Reference	
Delivery mode				
SVD	1.4(0.8-2.4)	0.241	1.6(0.8-3.3)	0.195
Cesarean section	Reference		Reference	
Gestation age	0.5(0.4-0.6)	<0.0001	0.4(0.3-0.5)	<0.0001
HB	0.8(0.7-0.9)	<0.0001	0.8(0.6-0.9)	0.014
Preterm delivery				
Yes	29.1(14.1-0.1)	<0.0001	5.4(2.1-14.0)	0.001
No	Reference		Reference	

The results of the unadjusted analysis showed that adverse perinatal outcomes were significantly associated with education level, place of residence, gravidity, parity, ALT, AST, ANC visits, creatinine level, Platelet counts, urea, mode of delivery, gestation age, preterm delivery and hemoglobin level ($p<0.05$).

In multivariate analysis of the fitted multiple logistic regression model indicated that education level, gravidity, parity, ALT, AST, ANC visits, and creatinine were no longer significant (p value>0.05). On the other hand, age, place of residence, urea level, Platelet counts, gestation age, preterm delivery, and hemoglobin level were significant factors associated with adverse perinatal outcomes ($p<0.05$). The adjusted odds ratio (AOR) of the fitted model revealed that women aged 15-19 years had significantly higher risks for getting newborns with adverse perinatal outcomes [AOR=8.2, CI: 1.3-30.7] than those aged twenty years and above. The odds of adverse perinatal outcomes were observed to be

significantly higher among women who lived in Temeke (AOR=4.0, CI: 1.2-13.9) and Kigamboni (AOR=3.9, CI: 1.1-14.8) in comparison to those women who lived in other places.

Gestation age and haemoglobin level were other significant factors, unadjusted odds of adverse perinatal outcomes were observed to decrease by a unit increase in haemoglobin level (AOR=0.8, CI: 0.6-0.9) and gestation age (AOR=0.4, CI: 0.3-0.5). Preterm delivery had higher adjusted odds [AOR=5.4, CI: 2.1-14.0] of adverse perinatal outcomes. Those women whose urea and platelets counts were in the normal range had significantly lower adjusted odds (AOR=0.3, CI: 0.1-0.8 and AOR=0.2, CI: 0.1-0.7respectively) for getting newborns with adverse perinatal outcomes

4.5 Co-morbidities associated with adverse perinatal outcomes

The relationship between maternal comorbidities and adverse perinatal outcomes is shown in table 4.

Table 4: Association between comorbidities and adverse perinatal outcomes

co-morbidities	Crude Odds	p-value	Adjusted Odds	p-value
Sickle Cell Disease				
Positive	0.7 (0.2-1.8)	0.487	0.7(0.1-7.5)	0.862
Negative	Reference		Reference	
Renal Disease				
Positive	0.9 (0.4-1.6)	0.646	1.3(0.1-11.9)	0.825
Negative	Reference		Reference	
Diabetes Mellitus				
Positive	1.1 (0.2 - 5.8)	0.948	1.2 (0.2-6.5)	0.866
Negative	Reference		Reference	
Epilepsy				
Positive	0.7 (0.2-0.8)	0.472	0.7(0.1-7.5)	0.992
Negative	Reference		Reference	
HIVAIDS				
Positive	4.6(1.4-15.3)	0.013	4.0(1.2-13.6)	0.025
Negative	Reference		Reference	
Malaria				
Positive	1.1(0.4-3.1)	0.917	1.2(0.4-3.5)	0.792
Negative	Reference		Reference	
Anemia				
Positive	1.9 (1.4-2.6)	<0.0001	1.9(1.4-2.6)	<0.0001
Negative	Reference		Reference	
Cardiovascular Diseases				
Positive	2.7 (0.3-22.9)	0.373	2.7(0.3-23.7)	0.367
Negative	Reference		Reference	

Both the results of the unadjusted and adjusted analysis showed that adverse perinatal outcomes were significantly associated with HIV/AIDS and Anemia ($p<0.05$) co-morbid conditions. The adjusted odds ratio (AOR) of the fitted model revealed that women who were HIV positive had significantly higher odds for getting newborns with adverse perinatal outcomes [AOR=4.0, CI: 1.2-13.6] than those who were HIV negative. The odds of adverse perinatal outcomes were observed to be significantly higher among women who anemic (AOR=1.9, CI: 1.4-2.6) in comparison to those women who were not anemic.

4.6 Determinants for adverse perinatal outcomes

In this study, the determinants for adverse perinatal outcomes as shown in tables 3 and 4 are age between 15-19 years [AOR=8.2, CI: 1.3-30.7], living in Temeke (AOR=4.0, CI: 1.2-13.9) and Kigamboni (AOR=3.9, CI: 1.1-14.8), hemoglobin level (AOR=0.8, CI: 0.6-0.9), gestation age (AOR=0.4, CI: 0.3-0.5), Preterm delivery [AOR=5.4, CI: 2.1-14.0], normal ranges for urea (AOR=0.3, CI: 0.1-0.8) and platelets count (AOR=0.2, CI: 0.1-0.7), HIV/AIDS [AOR=4.0, CI: 1.2-13.6] and anemia (AOR=1.9, CI: 1.4-2.6).

CHAPTER FIVE

5.0 DISCUSSION

This study assessed the adverse perinatal outcomes and the associated factors among Women with and without Hypertensive Disorders of Pregnancy at Muhimbili National Hospital in Tanzania. In this study higher proportion of newborns with the presence of any adverse outcome was observed in mothers with hypertensive disorders in pregnancy compared to those with no with hypertensive disorders in pregnancy. Consistent with previous findings 71% (Berhan and Endeshaw, 2015), and 11.1% (Asseffaid and Demissie, 2019), this study has shown high perinatal mortality among women with HDP.

Perinatal death was seen in 81.1% of cases with hypertensive disorder of pregnancy whereas in controls there were only 18.9% deaths. This difference was found to be statistically significant (<0.0001). These results are higher in comparison to those reported by Wolde Z et al in Ethiopia who observed that 9% of live babies ended up in neonatal death (Wolde, Segni and Woldie, 2011) Vats and Paul found that 9.88% of newborns of women with hypertensive disorders in pregnancy ended up in perinatal death (Vats and Paul, 2016). The difference in the incidence of perinatal death across studies could be due to the difference in the quality of antenatal care service and management of the hypertensive disorder of pregnancy between the study areas. In support of these findings, Vats, and Paul did their study in India, they reported a high rate of perinatal mortality in HDPs as compared to women with no HDPs (Vats and Paul, 2016).

Some studies in Africa also support the findings of this study. Endeshaw and Berhan did a study in 2014 in Ethiopia and reported perinatal mortality to be much higher in patients with preeclampsia (49.4%) and eclampsia (44.4%) (Berhan and Endeshaw, 2015). A study from Zimbabwe by Ngwenya and his colleagues in 2017 showed that almost half (49.6%) newborn women with HDPs died (Ngwenya, 2017).

This study showed that the incidence of low birth weight (LBW) was significantly higher among women with HDP. This might be due to intrauterine growth retardation following placental inefficiency, the other reason may be interventional delivery regardless of the gestational age, particularly on eclamptic to avoid more maternal and perinatal morbidity and mortality. This result is inconsistent with Bridwell et al., 2019 who found that in Haiti the odds of LBW were higher (AOR= 5.00, 95% CI 2.84–8.79) in babies of women with HDP (Bridwell *et al.*, 2019). Adu-Bonsaffoh et al in Ghana also found that women with HDP were more likely to deliver babies with low birth weight (Adu-Bonsaffoh *et al.*, 2017b). In Sudan, a prospective hospital-based showed that most of the newborns with LBW were found in the group of women with HDP while newborns with very low birth weight were found in women with eclampsia (Langenveld *et al.*, 2011). Moreover, WHO multi-country survey showed that women with HDP delivered newborns with LBW with the most prevalence of preeclamptic (34.3%) and eclamptic (44.6%) women (Berhan and Endeshaw, 2015).

The incidence of small for gestational age of newborns in this study was 72.6% among women with HDP in comparison to those with no HDP (27.4%). This was higher than the findings reported from countries like Ghana (Adu-Bonsaffoh et al., 2017a) where the incidence was 6.3%, Madagascar where the incidence was 25.7% (Mooij *et al.*, 2015b), and South Africa where the incidence was 17% (Asseffaid and Demissie, 2019). The risk of delivering babies before gestation age among women with HDP could be connected with intrauterine growth retardation following the decrease of flow of uteroplacental blood as well as the development of ischemia in women HDP.

The incidence of stillbirth among women with HDP in this study was 79.3%. This result was higher compared with the study conducted in Mizan Tepi, Ethiopia in which the incidence is 9.1% (Machano and Joho, 2020), Zimbabwe in which the incidence is 5.4% (Perry, 2018) and Ghana, in which the incidence is 6.8%) (Adu-Bonsaffoh et al., 2017b). This difference could be due to the difference in the quality of antenatal care and obstetric care service among health care institutions. The increased risk of stillbirth among women

with HDP might be associated with decreased uteroplacental blood flow and placental ischemia (Berhe *et al.*, 2019).

This study showed the decreased odds of adverse perinatal outcome with a unit increase in gestation age. These findings are consistent with several other studies (Ananth and Basso, 2010; Ndaboine *et al.*, 2012; Abalos *et al.*, 2014). Additional prospective cohort studies were done in 2018 on perinatal outcomes reported early gestation at admission to be the most determinant for perinatal mortality (Nathan et al., 2018). The finding of a strong association of adverse perinatal outcome with low gestational age is perhaps due to the increased risk of adverse perinatal outcome among newborns with HDP. In 393 women with HDP, 313 mothers had babies with adverse perinatal. The consequence of HDP has possibly exposed numerous newborns to premature delivery and its complications (Berhan and Endeshaw, 2015).

In this study, women who delivered preterm were at an increased risk of adverse perinatal outcomes. This is similar to what has been found by other researchers. Khashu et al studied perinatal outcomes related to preterm birth at 33 to 36 weeks gestation (Khashu *et al.*, 2009); they showed that the perinatal mortality rate was 8 times higher in the pre-term newborns than in term newborns. Correspondingly, Young and colleagues in their study found that the mortality rate in preterm newborns was higher compared to newborns at term (Young *et al.*, 2007).

This study showed lower odds of adverse perinatal outcome with a normal range of platelet counts. These findings are consistent with Li and his colleagues in China who showed that low platelet count, was significantly associated with increased risk for an adverse perinatal outcome such as perinatal mortality (Li et al., 2018). Younger maternal age in this study was seen to be a significant factor for adverse perinatal outcomes. This finding is supported by a study by (pdf 8 in dissertation folder), they reported that mothers less than 18 years were at increased risk for having newborns with adverse perinatal outcome including LBW (AOR= 1.25; 95% CI 1.00–1.56). The younger girls are likely to deliver newborns with

adverse perinatal outcomes due to the immaturity of their reproductive organs to support the development of the infant in the uterus consequential in growth restriction (Gortzak-Uzan *et al.*, 2001). However, this finding is consistent with studies done elsewhere (Gortzak-Uzan *et al.*, 2001) in which they show that extreme maternal age is significantly associated with adverse pregnancy outcomes such as low birth weight.

This study found that mothers who had commodities such as HIV and anaemia had increased risks of having newborns with adverse perinatal outcomes. Similar results were reported by Sansone et al in a 26-year population-based retrospective cohort study, this study showed that women living with HIV had a significantly higher risk of preterm birth at less than 37 weeks of gestation compared with women living without HIV (Sansone et al., 2016). Although this study did not assess the uptake of ART and viral load and CD4 counts in women living with HIV/AIDS, published studies have linked low CD4 cell counts and advanced HIV disease as risk factors for adverse perinatal outcomes among HIV-infected women (Lambert *et al.*, 2000). HIV in pregnancy is reported to increase the risk of adverse perinatal outcomes including low birth weight, stillbirths, preterm births and perinatal mortality(Olagbuji *et al.*, 2010). The finding of a positive association between anaemia and adverse perinatal outcome in this study is in line with the study conducted by(Stephen *et al.*, 2018).

In Tanzania, adverse pregnancy outcome like preterm and LBW are reported to be the leading causes of neonatal deaths contributing to 30% of the deaths (Stephen *et al.*, 2018), in these outcomes, anaemia in pregnancy is pointed to increase the risk (Mericq *et al.*, 2017).

This study had several limitations. Since this study was retrospective there is some information that was missing e.g. mother's height, booking weight. Therefore, it was difficult to determine the Body Mass Index and weight gain parameters.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

A higher proportion of participants with hypertensive disorders in pregnancy had delivered new-borns with the presence of any adverse outcome compared to those without hypertensive disorders in pregnancy. Perinatal death occurred at a higher proportion in women with hypertensive disorders in pregnancy compared to those without hypertensive disorders in pregnancy. The determinants for adverse perinatal outcomes are age between 15-19 years place of residence, haemoglobin level, gestation age, and Preterm delivery, normal ranges for urea, platelets count, HIV/AIDS and anaemia.

6.2 Recommendations

Based on the above findings we recommend that antenatal care should be improved to identify risk factors and to detect early women with HDP.

The referral system needs to be well organized to improve and manage diseases at the lower health facilities.

To improve neonatal and maternal care so as to prevent perinatal morbidity and mortality.

REFERENCES

Abalos, E. *et al.* (2014) 'Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health.', *BJOG: an international journal of obstetrics and gynaecology*, 121(1), pp. 14–24. doi: 10.1111/1471-0528.12629.

Adu-Bonsaffoh, K. *et al.* (2017a) 'Perinatal outcomes of hypertensive disorders in pregnancy at a tertiary hospital in Ghana', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 17(1), pp. 1–7. doi: 10.1186/s12884-017-1575-2.

Adu-Bonsaffoh, K. *et al.* (2017b) 'Perinatal outcomes of hypertensive disorders in pregnancy at a tertiary hospital in Ghana', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 17(1), pp. 1–8. doi: 10.1186/s12884-017-1575-2.

Adu-Bonsaffoh, K., Obed, S. A. and Seffah, J. D. (2014) 'Maternal outcomes of hypertensive disorders in pregnancy at Korle Bu Teaching Hospital, Ghana', *International Journal of Gynecology and Obstetrics*. International Federation of Gynecology and Obstetrics, 127(3), pp. 238–242. doi: 10.1016/j.ijgo.2014.06.010.

Ajay, S. and Micah, B. (2014) 'Sampling techniques and determination of sample size in applied statistics research: an overview.', *International Journal of Economics, Commerce and Management*, 2(11), pp. 1–22.

Ananth, C. V. and Basso, O. (2010) 'Impact of pregnancy-induced hypertension on stillbirth and neonatal mortality', *Epidemiology*, 21(1), pp. 118–123. doi: 10.1097/EDE.0b013e3181c297af.

Asma, S. *et al.* (2014) 'Original article', pp. 1–9. doi: 10.1111/trf.12780.

Asseffaid, N. A. and Demissie, B. W. (2019) 'Perinatal outcomes of hypertensive disorders in pregnancy at a referral hospital, Southern Ethiopia', *PLoS ONE*, 14(2), pp. 1–10. doi: 10.1371/journal.pone.0213240.

Baqui, A. H. *et al.* (2016) 'Neonatal mortality within 24 hours of birth in six low- and lower-middle-income countries', *Bulletin of the World Health Organization*, 94(10), pp. 752-758B. doi: 10.2471/blt.15.160945.

Berhan, Y. and Endeshaw, G. (2015) 'Maternal mortality predictors in women with hypertensive disorders of pregnancy: a retrospective cohort study', *Ethiopian journal of health sciences*, 25(1), pp. 89–98. doi: 10.4314/ejhs. v25i1.12.

Berhe, A. K. *et al.* (2019) 'Effect of pregnancy induced hypertension on adverse perinatal outcomes in Tigray regional state, Ethiopia: a prospective cohort study', *BMC pregnancy and child health*, 3(10), pp. 1–21. doi: 10.21203/rs.2.14708/v3.

Blencowe, H. *et al.* (2016) 'National, regional, and worldwide estimates of stillbirth rates in 2015, with trends from 2000: A systematic analysis', *The Lancet Global Health*. Blencowe et al. Open Access article distributed under the terms of CC BY-NC-ND, 4(2), pp. e98–e108. doi: 10.1016/S2214-109X (15)00275-2.

Boafor, T. K. *et al.* (2016) 'Pregnancy outcomes in women with sickle-cell disease in low and high income countries: a systematic review and meta-analysis', pp. 691–698. doi: 10.1111/1471-0528.13786.

Bridwell, M. *et al.* (2019) 'Hypertensive disorders in pregnancy and maternal and neonatal outcomes in Haiti: The importance of surveillance and data collection', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 19(1), pp. 1–12. doi: 10.1186/s12884-019-2361-0.

Browne, J. L. *et al.* (2015) 'Perinatal outcomes after hypertensive disorders in pregnancy in a low resource setting', *Tropical Medicine and International Health*, 20(12), pp. 1778–1786. doi: 10.1111/tmi.12606.

Dassah, E. T. *et al.* (2019) 'Maternal and perinatal outcomes among women with hypertensive disorders in pregnancy in Kumasi, Ghana', *PLoS ONE*, 14(10), pp. 1–13. doi:

10.1371/journal.pone.0223478.

Gortzak-Uzan, L. *et al.* (2001) 'Teenage pregnancy: Risk factors for adverse perinatal outcome', *Journal of Maternal-Fetal Medicine*, 10(6), pp. 393–397. doi: 10.1080/jmf.10.6.393.397.

Khashu, M. *et al.* (2009) 'Perinatal outcomes associated with preterm birth at 33 to 36 weeks' gestation: A population-based cohort study', *Pediatrics*, 123(1), pp. 109–113. doi: 10.1542/peds.2007-3743.

Kiondo, P. *et al.* (2014) 'Adverse neonatal outcomes in women with pre-eclampsia in Mulago Hospital, Kampala, Uganda: a cross-sectional study', *The Pan African medical journal*, 17(Supp 1), p. 7. doi: 10.11694/pamj.supp.2014.17.1.3014.

Lambert, J. S. *et al.* (2000) 'Risk factors for preterm birth, low birth weight, and intrauterine growth retardation in infants born to HIV-infected pregnant women receiving zidovudine', *Aids*, 14(10), pp. 1389–1399. doi: 10.1097/00002030-200007070-00012.

Langenveld, J. *et al.* (2011) 'Neonatal outcome of pregnancies complicated by hypertensive disorders between 34 and 37 weeks of gestation: A 7-year retrospective analysis of a national registry', *American Journal of Obstetrics and Gynecology*. Elsevier Inc., 205(6), pp. 540.e1-540.e7. doi: 10.1016/j.ajog.2011.07.003.

Li, X. *et al.* (2018) 'Risk factors for adverse maternal and perinatal outcomes in women with preeclampsia: analysis of 1396 cases', *Journal of Clinical Hypertension*, 20(6), pp. 1049–1057. doi: 10.1111/jch.13302.

Liu, L. *et al.* (2016) 'Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals', *The Lancet*. The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY license, 388(10063), pp. 3027–3035. doi: 10.1016/S0140-6736(16)31593-8.

Lugobe, H. M. *et al.* (2020) 'Risks of adverse perinatal and maternal outcomes among

women with hypertensive disorders of pregnancy in southwestern Uganda', *PLoS ONE*, 15(10), pp. 1–12. doi: 10.1371/journal.pone.0241207.

Machano, M. M. and Joho, A. A. (2020) 'Prevalence and risk factors associated with severe pre-eclampsia among postpartum women in Zanzibar: A cross-sectional study', *BMC Public Health*. BMC Public Health, 20(1), pp. 1–10. doi: 10.1186/s12889-020-09384-z.

Macheku, G. S. *et al.* (2015) 'Frequency, risk factors and feto-maternal outcomes of abruptio placentae in Northern Tanzania: A registry-based retrospective cohort study', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 15(1), pp. 1–10. doi: 10.1186/s12884-015-0678-x.

Mericq, V. *et al.* (2017) 'Long-term metabolic risk among children born premature or small for gestational age', *Nature Reviews Endocrinology*, 13(1), pp. 50–62. doi: 10.1038/nrendo.2016.127.

Mooij, R. *et al.* (2015a) 'Characteristics and outcomes of patients with eclampsia and severe pre-eclampsia in a rural hospital in Western Tanzania: A retrospective medical record study', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 15(1), pp. 1–7. doi: 10.1186/s12884-015-0649-2.

Mooij, R. *et al.* (2015b) 'Characteristics and outcomes of patients with eclampsia and severe pre-eclampsia in a rural hospital in Western Tanzania: A retrospective medical record study', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 15(1), pp. 1–7. doi: 10.1186/s12884-015-0649-2.

Mpembeni, R. (2014) 'Perinatal Mortality and Associated Factors Among Deliveries in Three Municipal Hospitals of Dar Es Salaam, Tanzania', *Journal of Pediatrics & Neonatal Care*, 1(4), pp. 1–7. doi: 10.15406/jpnc.2014.01.00022.

Mrema, D. *et al.* (2018) 'The association between pre pregnancy body mass index and risk of preeclampsia: A registry based study from Tanzania', *BMC Pregnancy and Childbirth*.

BMC Pregnancy and Childbirth, 18(1), pp. 1–8. doi: 10.1186/s12884-018-1687-3.

Muganyizi, P. S. and Kidanto, H. (2013) 'Sickle Cell Disease in Pregnancy: Trend and Pregnancy Outcomes at a Tertiary Sickle Cell Disease in Pregnancy: Trend and Pregnancy Outcomes at a Tertiary Hospital in Tanzania', (June 2014). doi: 10.1371/journal.pone.0056541.

Nathan, H. L. *et al.* (2018) 'Maternal and perinatal adverse outcomes in women with pre-eclampsia cared for at facility-level in South Africa: A prospective cohort study', *Journal of Global Health*, 8(2), pp. 1–10. doi: 10.7189/jogh.08.020401.

Ndaboine, E. M. *et al.* (2012) 'Maternal and perinatal outcomes among eclamptic patients admitted to Bugando Medical Centre, Mwanza, Tanzania.', *African journal of reproductive health*, 16(1), pp. 35–41.

Ngwenya, S. (2017) 'Severe preeclampsia and eclampsia: Incidence, complications, and perinatal outcomes at a low-resource setting, mpilo central hospital, bulawayo, Zimbabwe', *International Journal of Women's Health*, 9, pp. 353–357. doi: 10.2147/IJWH.S131934.

Olagbuji, B. N. *et al.* (2010) 'Obstetric and perinatal outcome in HIV positive women receiving HAART in urban Nigeria', *Archives of Gynecology and Obstetrics*, 281(6), pp. 991–994. doi: 10.1007/s00404-009-1186-x.

Payne, B. A. *et al.* (2014) 'A Risk Prediction Model for the Assessment and Triage of Women with Hypertensive Disorders of Pregnancy in Low-Resourced Settings: The miniPIERS (Pre-eclampsia Integrated Estimate of RiSk) Multi-country Prospective Cohort Study', *PLoS Medicine*, 11(1), pp. 1–13. doi: 10.1371/journal.pmed.1001589.

Pembe, A. B. *et al.* (2014) 'Maternal mortality at muhimbili national hospital in Dar-es-Salaam, Tanzania in the year 2011', *BMC Pregnancy and Childbirth*, 14(1), pp. 1–7. doi: 10.1186/1471-2393-14-320.

Perry, J. S. (2018) *The Association Between Maternal Hypertensive Disorders and*

Perinatal Mortality in Kigoma Region, Tanzania: 2011-2015, *Georgia State University ScholarWorks*. Available at: https://scholarworks.gsu.edu/iph_theses/620.

Plotkin, M. *et al.* (2018) 'Tracking facility-based perinatal deaths in Tanzania: Results from an indicator validation assessment', *PLoS ONE*, 13(7). doi: 10.1371/journal.pone.0201238.

Redman, C. W. G. (2011) 'Hypertension in pregnancy: The NICE guidelines', *Heart*, 97(23), pp. 1967–1969. doi: 10.1136/heartjnl-2011-300949.

Rezende, G. P. *et al.* (2020) 'Maternal and Perinatal Outcomes of Pregnancies Complicated by Chronic Hypertension Followed at a Referral Hospital', *Revista Brasileira de Ginecologia e Obstetricia*, 42(5), pp. 248–254. doi: 10.1055/s-0040-1709190.

Souza, J. P. (2014) 'The World Health Organization Multicountry Survey on Maternal and Newborn Health project at a glance: the power of collaboration.', *BJOG: an international journal of obstetrics and gynaecology*, 11(1), pp. 286–290. doi: 10.1111/1471-0528.12690.

Stephen, G. *et al.* (2018) 'Anaemia in Pregnancy: Prevalence, Risk Factors, and Adverse Perinatal Outcomes in Northern Tanzania', *Hindawi*, 1(1), pp. 1–9. doi: 10.1155/2018/1846280.

Susannah, B. *et al.* (2016) 'Stillbirths: Investment in ending preventable stillbirths by 2030 will yield multiple returns and help achieve multiple Sustainable Development Goals', *The Lancet*, pp. 1–5.

Un Nisa, S., Shaikh, A. A. and Kumar, R. (2019) 'Maternal and Fetal Outcomes of Pregnancy-related Hypertensive Disorders in a Tertiary Care Hospital in Sukkur, Pakistan', *Cureus*, 11(8), pp. 1–7. doi: 10.7759/cureus.5507.

Vats, K. and Paul, M. (2016) 'Study of fetal outcome in hypertensive disorders of pregnancy in a tertiary care maternity hospital of Delhi', *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 5(11), pp. 3773–3777. doi: 10.18203/2320-1770.ijrcog20163494.

Wolde, Z., Segni, H. and Woldie, M. (2011) 'Hypertensive disorders of pregnancy in jimma university specialized hospital.', *Ethiopian journal of health sciences*, 21(3), pp. 147–54. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22434994%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3275872.

Xiong, T. *et al.* (2018) 'Hypertensive disorders in pregnancy and stillbirth rates: A facility-based study in China', *Bulletin of the World Health Organization*, 96(8), pp. 531–539. doi: 10.2471/BLT.18.208447.

Yamamoto, R. *et al.* (2018) 'Incidence of and risk factors for severe maternal complications associated with hypertensive disorders after 36 weeks' gestation in uncomplicated twin pregnancies: A prospective cohort study', *Journal of Obstetrics and Gynaecology Research*, 44(7), pp. 1221–1227. doi: 10.1111/jog.13650.

Young, P. C. *et al.* (2007) 'Mortality of late-preterm (near-term) newborns in Utah', *Pediatrics*, 119(3), pp. 659–668. doi: 10.1542/peds.2006-2486.

APPENDIX

Appendix 1 Data Collection Tool **MR NO…….**

Check List

	Demographics			
1	Age			
2	Weight			
3	BMI			
4	Place of residence			
5	Education			
6	Occupation			
7	Marrital status			
	Obstetric Factors			
4	Chronic Hypertension			
5	Renal Disease			
6	Diabetes			
7	History of HDP			
8	Family history of HPD			
9	Smoker			
10	Number of fetus			
11	Gravidity			
12	Parity			
	Maternal factors			
11	Gestational Hypertension			
12	Pre eclampsia without S. features			
13	Pre eclampsia with S. features			
14	Eclampsia			
15	HELLP syndrome			
16	Hemoglobinelevel			
17	Platelet Count			
18	AST			
19	ALT			
20	Urea			
21	Creatinine			
22	Other signs or symptoms			
23	Urine protein			

24	Preterm delivery			
25	PPH			
26	Abruptio placenta			
27	AKI			
28	Mode of delivery			
29	Date of delivery			
	Perinatal Outcomes			
31	Gestational Age at delivery			
32	Premature			
33	Birth weight			
34	SGA			
35	Low Birth weight			
36	Apgar 1minute			
37	Apgar 5minute			
38	Still birth			
	Maternal Co-morbidities			
39	Sickle cell disease			
40	Renal disease			
41	Diabetes Melitus			
42	Epilepsy			
43	HIV/AIDS			
44	Malaria			
45	Anaemia			
46	Cardiovascular diseases			

Appendix 2: Approval for ethical clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR - RESEARCH AND PUBLICATIONS

Ref. No.DA.282/298/01.C/ Date: 13/05/2021

MUHAS-REC-05-2021-610

Magdalena Adelgoth Haule,
MSc. Midwifery and Women's Health,
School of Nursing
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: ADVERSE PERINATAL OUTCOMES AND ASSOCIATED FACTORS AMONG WOMEN WITH HYPERTENSIVE DISORDERS OF PREGNANCY AT MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM - TANZANIA

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 13/05/2021
EXPIRATION DATE OF APPROVAL: 12/05/2022

STUDY DESCRIPTION:
Purpose:
The purpose of this retrospective case control study is to examine factors associated with adverse perinatal outcomes among women with hypertensive disorders of pregnancy at Muhimbili National Hospital in Dar es Salam, Tanzania.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%20638.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country,
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Muhimbili University of Health and Allied Sciences
DIRECTOR
Research & Publications
Box 65001

Dr. Bruno Sunguya
Chairman, MUHAS Research and Ethics Committee

Cc: Director of Postgraduate Studies

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1038; Direct Line:+255-22-2152489;Telefax:+255-22-2152489;E-mail:drp@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix 3: Permission to collect data at MNH

THE UNITED REPUBLIC OF TANZANI

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

MUHIMBILI NATIONAL HOSPITAL

In reply please quote;

Ref. No.: MNH/TRCU/Perm/2021/123 Date: 18th May, 2021

Head of Department
Medical Records
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	**Magdalena Adelgoth**
Title	**"Adverse Perinatal Outcomes and Associated Factors Among Women with Hypertensive Disorders of Pregnancy at Muhimbili National Hospital Dar es Salaam Tanzania."**
Institution	Muhimbili University of Health and Allied Sciences
Supervisor	Dr. Beatrice Mwilike
Co - Supervisor	Ms. Dorkasi L. Mwakawanga
Period	18th May 2021, to 30th September, 2021

Approval has been granted to the above mentioned student to collect data at MNH.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval.

Sincerely,

HEAD, TEACHING, RESEARCH & CONSULTANCY UNIT
P. O. Box 65000
DAR-ES-SALAAM
MUHIMBILI NATIONAL HOSPITAL

Reid B. Mchome
Coordinator –Teaching, Research and Consultancy Unit

c.c DICT
c.c **Magdalena Adelgoth**

Upanga West, Kalenga Street, Plot No. 10480/3, P.O. BOX 65000, Dar es Salaam, Tanzania.
Telephone: +255-22-2151367-9, Telephone: +255-22-2151351-2
Email: info@mnh.or.tz, Website: www.mnh.or.tz

Appendix 4: Introduction Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

Ref. No. HD/MUH/T.487/2019 17th May, 2021

EXECUTIVE DIRECTOR,
MUHIMBILI NATIONAL HOSPITAL,
P.O BOX 65000,
DSM-TANZANIA.

Re: INTRODUCTION LETTER

The bearer of this letter is Magdalena Adelgoth Haule (HD/MUH/T.487/2019), a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MSc. Midwifery and Women's Health.

As part of her studies she intends to do a study titled: **"Adverse Perinatal Outcomes And Associated Factors Among Women With Hypertensive Disorders Of Pregnancy At Muhimbili National Hospital, Dar es Salaam - Tanzania".**

The research has been approved by the Chairman of University Senate.

Kindly provide her with the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Ms. Victoria Mwanilwa
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Nursing, **MUHAS**
cc: Magdalena Adelgoth Haule

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz