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AN ASSESSMENT OF RISK FACTORS ASSOCIATED WITH PREECLAMPSIA AMONG ANTENATAL CLIENTS AT NDOLA TEACHING HOSPITAL

BY

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A research dissertation submitted to the University of Lusaka in partial fulfilment of the requirements of a Master of Science in Epidemiology and Biostatistics

DECLARATION

I, **Misapa Chomba**, the undersigned, solemnly declare that the project proposal "**An Assessment of Risk Factors Associated with Preeclampsia Among Antenatal Clients at Ndola Teaching Hospital"** is based on my own work carried out during the course of my Master's study in Epidemiology and Biostatistics under the supervision of Dr. Given Moonga. The statements made and conclusions drawn are an outcome of my research work. I further certify that:

1. The work contained in the study is original and has been done under the general supervision.
2. The work has not been submitted to any other institution for any degree/diploma/certificate in this university or any other university in Zambia or abroad.
3. The guidelines provided by the university in writing the proposal were followed.
4. The material used (data, theoretical analysis, and text) from other sources has been highlighted in detail in the references.

Signed: _____ Date: 31.08.25

Supervisor:

Dr. Given Moonga

Signed: _____ Date: 31.08.2025

CERTIFICATION

The undersigned declares that the research proposal titled: “An Assessment of Risk Factors Associated with Preeclampsia Among Antenatal Clients at Ndola Teaching Hospital” is the candidate’s own original work in partial fulfillment of the requirements for the degree of Master of Science in Epidemiology and Biostatistics at the University of Lusaka.

Dr. Given Moonga
(Supervisor’s name)

Supervisor’s signature:  Date: 31.08.2025

DEDICATION

This dissertation is dedicated to my parents, whose unwavering love, sacrifices, and steadfast support have been the cornerstone of my academic journey. Their moral guidance, spiritual encouragement, emotional strength, and continued belief in my abilities sustained me throughout the demanding and often challenging period of this program.

I further dedicate this work to all those who, in one way or another, offered guidance, encouragement, prayers, and words of reassurance during this journey. The support received from family, friends, and colleagues—whether visible or behind the scenes—played a significant role in seeing this work to completion.

Above all, I acknowledge the invaluable contribution of my supervisor, whose academic guidance, patience, and commitment embodied the true meaning of mentorship. Their constructive criticism and scholarly insight greatly shaped this dissertation and contributed to my growth as an independent researcher.

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ACOG American College of Obstetrics and Gynecologists

ANC Antenatal Care

ART Antiretroviral therapy

BMI Body Mass Index

LMIC Low- and middle-income countries

NCD Non-communicable diseases

NTH Ndola Teaching Hospital

UTH University Teaching Hospital

WHO World Health Organization

ZDHS Zambia Demographic Health Survey

ABSTRACT

Background and aim: Pre-eclampsia is a major hypertensive disorder in pregnancy and among the leading cause of maternal morbidity and mortality in sub-Sahara Africa. However, evidence on the burden and associated risk factors especially in tertiary level hospitals in Zambia remains limited. Therefore, this study aimed to determine the risk factors associated with preeclampsia among antenatal clients at Ndola Teaching Hospital for the period January 2023 to December 2024.

Methodology: This was a cross-sectional study that was conducted at Ndola Teaching Hospital (NTH) by utilizing 440 maternity records from January, 2023 to December 2024. Data on social demographic characteristics, obstetric history, and clinical factors were extracted using a data extraction tool. Descriptive statistics were used to summarize participants characteristics and estimate the prevalence of pre-eclampsia. Bivariate analyses and multivariate logistics regression analysis to identify factors associated with pre-eclampsia. Model fit was assessed using Hosmer-Lemeshow goodness of fit test and variance inflation factor (VIF) analysis was conducted to determine multicollinearity. Statistical significance was set at $p < 0.05$.

Results: The prevalence of pre-eclampsia was 14.1% among the reviewed records. Factors associated with pre-eclampsia included maternal age less than 20 (AOR 2.7, CI 1.02 - 3.87, p = 0.04), maternal age more than 35 (AOR 2.9, CI 1.05 - 4.74, p = 0.03), previous history of preeclampsia (AOR 3.2, CI 1.57 - 6.56, p < 0.001), multiple pregnancy (AOR 2.4, CI 1.03 - 5.74, p value = 0.04), obesity (AOR 2.87, CI 1.48 - 5.56, p value < 0.001), chronic hypertension (AOR 4.1, CI 2.02 - 8.23, p value <0.001), and history of diabetes mellitus (AOR 2.6, CI 1.06 - 6.45, p value = 0.03). Socio-demographic factors such as education, residence, and HIV status were not associated with pre-eclampsia.

Conclusion: Pre-eclampsia remains a burden at Ndola Teaching Hospital with a relatively high prevalence with identifiable maternal and clinical risk factors.

Key words: Pre-eclampsia, obstetric factors, maternal factors, clinical factors, antenatal care

CHAPTER ONE: INTRODUCTION

1.1 Background

Preeclampsia is a complex, multi-system hypertensive disorder unique to human pregnancy, typically defined by the new onset of hypertension (systolic blood pressure > 140 mmHg or diastolic blood pressure > 90 mmHg) after 20 weeks of gestation (ACOG, 2020). The diagnostic criteria have evolved to include not only proteinuria but also signs of maternal organ dysfunction, such as renal insufficiency, liver involvement, neurological complications, or haematological issues (Brown et al., 2018; WHO, 2023). This classification underscores the systemic nature of the disease and its potential for severe, life-threatening outcomes.

Globally, preeclampsia affects an estimated 2–8% of pregnancies, but its burden is far from uniform (Magee et al., 2022). Low- and middle-income countries (LMICs) bear a disproportionate share of this burden, accounting for the vast majority of cases and related maternal and perinatal deaths (Abalos et al., 2018). The lack of access to quality antenatal care, late-stage presentation, and limited resources for effective management contribute significantly to these disparities (Say et al., 2014). Preeclampsia is a leading cause of maternal mortality, directly responsible for approximately 10% of maternal deaths worldwide (WHO, 2023).

The long-term health implications of preeclampsia extend beyond the immediate pregnancy. Women with a history of preeclampsia are at a significantly increased risk of developing chronic noncommunicable diseases (NCDs) later in life, including chronic hypertension, cardiovascular disease, and chronic kidney disease (Roberts & Hubel, 2021). This link highlights the need to view preeclampsia not just as an obstetric emergency but as a critical public health issue with lifelong consequences for maternal health (Brown et al., 2018).

The aetiology of preeclampsia remains incompletely understood, but it is believed to be rooted in abnormal placentation and a subsequent exaggerated maternal inflammatory response (Roberts & Hubel, 2021). A wide range of risk factors has been identified, from genetic predispositions to environmental and lifestyle factors. These include advanced maternal age, high pre-pregnancy BMI, pre-existing hypertension, diabetes, null parity, multiple gestation, and a personal or family history of the condition (Rolnik et al., 2022). In sub-Saharan Africa, additional factors such as socio-economic status, HIV status, and nutritional deficiencies have been explored, with varying results across different contexts (Chama et al., 2022; Osungbade & Ige, 2011).

In Zambia, the problem of preeclampsia is particularly acute. According to the Zambia Demographic and Health Survey (ZDHS) 2019, preeclampsia and eclampsia are a leading cause of maternal mortality, accounting for 23% of all maternal deaths. Facility-based data from major hospitals, such as the University Teaching Hospital (UTH) in Lusaka, further corroborate this, reporting severe preeclampsia as a top cause of emergency obstetric admissions (Chisoko, 2018). Despite this significant burden, there is a critical scarcity of published, facility-specific data on the prevalence and risk factors of preeclampsia at Ndola Teaching Hospital (NTH). As the largest tertiary referral facility in the Copperbelt Province, NTH manages a high volume of complex obstetric cases. The absence of a clear understanding of the local epidemiology and risk profile at this specific hospital represents a significant gap in evidence needed to develop effective, targeted interventions.

This study aims to fill this void by conducting a retrospective assessment of preeclampsia risk factors at NTH. By analysing a comprehensive set of variables from a large sample of antenatal and delivery records, the study seeks to provide crucial data that will inform clinical practice, enhance antenatal screening protocols, and ultimately contribute to reducing the burden of maternal and perinatal morbidity and mortality in the region.

1.2 Statement of the Problem

Preeclampsia remains a major global public health concern and a leading cause of maternal and perinatal morbidity and mortality. Globally, it is estimated at 2-8% pregnancies that complicate to eclampsia, yet other meta-analysis estimates a pooled prevalence of about 4.4% globally (Vera-Ponce et al., 2025). The burden is even disproportionately higher in low- and middle-income countries where there is limited access to quality antenatal care as well as delayed diagnosis that increase the risk of severe complications. In Sub-Saharan Africa, pre-eclampsia accounts for a significant proportion of maternal deaths and contributes to about 9% of maternal mortality, with some studies indicating that the region bears over half of the global burden (Chakulya et al., 2025). In Zambia, it also remains a significant contributor to maternal and neonatal morbidity and mortality. Some facility-based studies have reported prevalence rates ranging from 7.7% to 15% in tertiary hospitals such the Women and Newborn Hospital and Livingstone Teaching Hospital (Mukosha et al., 2022). These figures suggest a higher burden compared to global averages and reflect the challenges faced withing the Zambian healthcare system such as late antenatal booking, comorbid conditions such as hypertension and diabetes, and limited resources. Pre-eclampsia is associated with severe maternal complications such as

eclampsia, HELLP syndrome, stroke, renal failure, maternal death, and poor neonatal outcomes such as preterm birth, intrauterine growth restriction, low birth weight, and neonatal mortality.

Despite the growing burden, there is limited comprehensive, facility-based evidence on the prevalence and risk factors associated with preeclampsia at Ndola Teaching Hospital, which is one of the largest tertiary hospitals on the Copperbelt Province. Most existing studies in Zambia have been conducted in Lusaka and other sites, thereby limiting the generalizability of findings to other high-volume referral facilities. In addition, previous studies have often examined selected risk factors in isolation rather than providing a comprehensive analysis of sociodemographic, obstetric and clinical determinants.

1.3 Justification of Study

Pre-eclampsia is a leading cause of maternal and perinatal morbidity and mortality, with a particularly high burden in low- and middle-income countries like Zambia. Despite this, there is limited facility-specific data on its prevalence and risk factors at NTH, the largest tertiary referral centre in the Copperbelt Province.

This study will therefore provide critical local evidence on the prevalence of preeclampsia and the maternal health factors associated with its occurrence. The findings will help identify high-risk women, inform targeted interventions, improve antenatal screening protocols, and guide resource allocation. By generating data specific to NTH, the study will bridge the gap between national estimates and local clinical realities, contributing to improved maternal and neonatal outcomes and supporting Zambia's public health goals to reduce maternal mortality.

1.4 Main Objective

To assess the risk factors associated with preeclampsia among antenatal clients at Ndola Teaching Hospital for the period January 2023 to December 2024.

1.5 Specific Objectives

1. To estimate the prevalence of preeclampsia among antenatal and delivery records at Ndola Teaching Hospital during the study period.
2. To assess associations between key maternal health conditions (e.g., chronic hypertension, HIV status, BMI, history of preeclampsia, diabetes mellitus) and the occurrence of preeclampsia.

1.6 Research Questions

1. What is the prevalence of preeclampsia among antenatal and delivery records at Ndola Teaching Hospital between January 2023 and December 2024?
2. Which maternal health factors are independently associated with the risk of developing preeclampsia in this population?

1.7 Scope of the Study

This study focuses on antenatal and delivery records at NTH from January 2023 to December 2024. It examines the prevalence of preeclampsia and evaluates associations between maternal health factors and the occurrence of the condition. The study is limited to pregnant women who attended antenatal care or delivered at Ndola Teaching Hospital between January 2023 and December 2024. It examines selected sociodemographic, obstetric, and clinical factors in relation to the occurrence of preeclampsia. The study excludes women who received care outside the facility and records with incomplete data, thereby ensuring a focused analysis within a well-defined population and setting.

CHAPTER TWO: LITERATURE REVIEW

2.1 Global and Regional Epidemiology of Preeclampsia

The global prevalence of preeclampsia is estimated to be between 2% and 8% of all pregnancies, but this figure masks significant regional variations (Magee et al., 2022). In high-income countries, the prevalence is typically on the lower end of this range, while in LMICs, rates are often higher and associated with more severe outcomes (Abalos et al., 2018). A large systemic review and meta-analysis by Vera-Ponce et al. (2025), which included over 2.4 million participants across 70 studies, estimated the global prevalence of preeclampsia at 4.4%. Importantly, the study demonstrated significant variability depending on diagnostic criteria, with higher prevalence reported using ACOG definitions compared to ISSHP criteria. This finding highlights a key methodological limitation such as lack of standardized diagnostic criteria. This may explain the existing inconsistencies across studies.

In contrast, other global studies have reported a broader prevalence range of 2-8%, suggesting that pooled meta-analytic estimates may underestimate the burden in high-risk populations (Montgomery et al., 2024). The study by Vera-Ponce et al. (2025) also identified higher prevalence in low-income countries. This reinforces the role of health system disparities in shaping diseases distribution. Compared to other studies, this study provides more recent data and larger sample size. However, the extremely high heterogeneity limits the generalizability of its findings and suggest underlying differences in study populations and designs.

Focusing on specific high-risk populations, another global meta-analysis by Macedo et al. (2020) examined preeclampsia among adolescents and found considerable variation in prevalence across regions, with adolescents in low-resource settings experiencing disproportionately higher risks. This contrasts with general population estimates and suggests that age-specific vulnerabilities significantly influence epidemiological patters. While this study provides important subgroup insights, its focus on adolescents limits its applicability to the broader adult population.

At the regional level, a systematic review and meta-analysis conducted in sub-Saharan Africa by Meazaw et al. (2020) confirmed that preeclampsia remains a major contributor to maternal and neonatal morbidity in the region, with consistently higher burden compared to global averages. The study emphasized the interaction between clinical risk factors and structural determinants such as poor access to antenatal care and delayed diagnosis. Compared to global

meta-analyses, regional studies such as this provide more context-specific insights but may lack the broader comparative perspective needed to situate findings globally.

The burden of preeclampsia in sub-Saharan Africa is particularly pronounced. Studies from Nigeria, Tanzania, and South Africa have consistently reported higher prevalence rates and a greater contribution to maternal mortality compared to global averages (Osungbade & Ige, 2011). This is often attributed to systemic challenges such as inadequate antenatal care attendance, late booking, and poor management of pre-existing comorbidities.

These studies demonstrate that while global estimates provide an overall picture of the burden of preeclampsia, regional and population-specific studies reveal important variations driven by socio-economic, clinical, and health system factors. The inconsistencies across studies, especially in prevalence estimates, emphasizing the influence of methodological differences, including diagnostic criteria, study design, and population selection. Furthermore, although substantial evidence exists at global and regional levels, there remains a critical gap in localized, facility-specific data, particularly in tertiary hospitals within sub-Saharan Africa, where the burden may be disproportionately higher due to referral of complicated cases.

2.2 Established Risk Factors: A Global Synthesis

Numerous risk factors for preeclampsia have been identified through large-scale meta-analyses and cohort studies, as well as international guidelines. Nulliparity remains one of the strongest predictors, with first-time mothers consistently shown to have significantly higher risk compared to multiparous women (Abalos et al., 2018). Advanced maternal age is another well-documented risk factor, particularly in women aged 35 years and above, with studies suggesting that the risk nearly doubles in women older than 40 (Duckitt & Harrington, 2005; Bartsch et al., 2016).

Pre-existing maternal health conditions have also been strongly implicated. Chronic hypertension, diabetes mellitus, chronic kidney disease and autoimmune disorders such as systemic lupus erythematous and antiphospholipid antibody syndrome are consistently associated with markedly increased risks of preeclampsia (Rolnik et al., 2022). A history of preeclampsia in a previous pregnancy has been found to be a powerful predictor of recurrence, with rates ranging from 15% to 50%, depending on the severity and gestational age at onset of the index episode (Brown et al., 2018). Obesity, particularly a pre-pregnancy BMI $\geq$30 kg/m^2,

has emerged as one of the most consistent risk factors globally, with a dose–response relationship reported in several meta-analyses (Bartsch et al., 2016).

Other important determinants include multiple gestations, which increase maternal risk due to the larger placental mass and heightened cardiovascular strain, and inter-pregnancy interval, with both very short (<2 years) and very long (>10 years) intervals being associated with elevated risk (Abalos et al., 2018; Magee et al., 2022). Recent evidence has also highlighted lifestyle-related factors, including low dietary calcium intake, excessive gestational weight gain, and smoking cessation during pregnancy, which paradoxically may increase the risk due to loss of nicotine's vasodilatory effect (Duckitt & Harrington, 2005). Socioeconomic status and limited access to antenatal care have been found to indirectly influence risk by delaying diagnosis and reducing opportunities for preventive interventions (WHO, 2023).

Emerging biomarkers and genetic predispositions are also increasingly recognized. Elevated maternal serum biomarkers such as soluble fms-like tyrosine kinase-1 (sFlt-1), low placental growth factor (PlGF), and altered angiogenic profiles are now used in some clinical settings to improve early prediction of preeclampsia (Magee et al., 2022). In addition, family history of preeclampsia and maternal birth history, such as being born preterm or with low birthweight, are being explored as intergenerational risk factors (Brown et al., 2018). Collectively, these findings emphasize the multifactorial nature of preeclampsia, reflecting an interaction between maternal constitutional factors, obstetric history, and broader social determinants of health.

2.3 The Regional and Zambian Context

Studies across the sub-Saharan Africa further reinforce the multifactorial nature of preeclampsia while also revealing important contextual differences compared to global findings. A systematic review and meta-analysis by Meazaw et al. (2020) identified chronic hypertension, obesity, and a history of preeclampsia as the most consistent predictors across sub-Saharan Africa. These findings are similar with global evidence presented by Bartch et al., (2016) and Rolnik et al., (2022), suggesting that biological and clinical risk factors are largely universal. However, the African study additionally emphasized the role of limited access to antenatal care and delayed diagnosis which are not common in high income countries.

Similarly, a cross-sectional study conducted in Tanzania by Machano et al., (2020) reported that maternal age above 35years, obesity, and multiple pregnancy were significantly associated with preeclampsia. While these findings are consistent with global literature, the study also

found a strong association with low antenatal care attendance which is not emphasized in the meta-analysis. This suggests that although core biological risk factors are consistent, health seeking behavior and service utilization play an important role in resource limited settings.

In Ethiopia, a study by Wolde et al. (2019) identified rural residence, low educational status, and poor nutritional status as significant predictors of preeclampsia. These findings contrast with global studies which often report weaker or indirect associations with sociodemographic factors. This discrepancy may be explained by differences in socioeconomic inequalities and access to health care services which are very common in sub-Saharan Africa. The Ethiopian study therefore highlights that social determinants may have a more direct impact on preeclampsia risk in low-income countries compared to high income countries where clinical factors are the most dominant.

Research on preeclampsia in Zambia, while growing, remains limited and often restricted to major urban centres. For example, a study at the University Teaching Hospital (UTH) in Lusaka found that chronic hypertension, nulliparity, and maternal age above 35 were significant risk factors (Chama et al., 2022). Another study conducted in the Copperbelt Province specifically reported a preeclampsia prevalence of 8.5%, identifying a BMI ≥30 kg/m² and multiple pregnancy as strong predictors (Kapasa et al., 2020).

An important contextual factor in Zambia is the high prevalence of HIV. The relationship between HIV infection, antiretroviral therapy (ART), and preeclampsia is complex and has been a subject of ongoing research. While some studies suggest a potential protective effect of ART, others have found no significant association (Mukonka et al., 2021). For instance, a study in Zambia by Mufuta et al. (2018) found that HIV-positive women on ART had a lower odd of developing preeclampsia compared to HIV-negative women (AOR: 0.50, 95% CI: 0.32–0.80). However, the specific mechanisms and generalizability of this finding warrant further investigation.

Further evidence is provided by a study conducted at Livingstone University Teaching Hospital by Zulu et al., (2021). The study identified chronic hypertension, obesity, and previous history of preeclampsia as predictors. These findings are consistent with both global and regional evidence, reinforcing the robustness of these factors across different contexts. However, unlike some regional studies, this study did not find a significant association between parity and preeclampsia. This suggests potential variability in the influence of reproductive factors across

populations. Further, a study by Mbewe et al. (2020) in Lusaka found that late antenatal booking and poor maternal nutrition were significantly associated with increased risk of preeclampsia. These findings are consistent with global meta-analysis and emphasizes the importance of context specific factors, especially in settings were access to timely and adequate antenatal care remains limited.

2.4 Literature gap

Despite the substantial body of global and regional evidence on the epidemiology and risk factors of preeclampsia, several important gaps still remain. To begin with, global estimates of prevalence show considerable variability, largely due to differences in diagnostic criteria, study designs, and population characteristics. While meta-analyses provide useful pooled estimates, their high heterogeneity limits the applicability of findings to specific settings, especially in low- and middle-income countries.

In addition, although key risk factors such as chronic hypertension, obesity, advanced maternal age, and previous history of preeclampsia have been consistently identifies across global studies, regional evidence demonstrates that these clinical factors are often modified by contextual influences such as limited access to antenatal care, delayed diagnosis, and socioeconomic inequalities. This suggests that global findings may not fully capture complex risk factors in resource limited countries. Further, studies conducted within sub-Saharan Africa show important variations in the significance of certain risk factors. For example, parity has been seen as a significant risk factors in some studies, but in other studies no association was found. Similarly, the relationship between HIV infection, ART, and preeclampsia remains inconclusive, with conflicting findings across different studies.

Most studies in Zambia have been conducted in major urban centers such as Lusaka or have focused on selected risk factors rather than adopting a comprehensive approach that integrates sociodemographic, obstetric, and clinical determinants. There is also limited facility based evidence from tertiary referral hospitals such as Ndola Teaching Hospital, where the burden of preeclampsia may be disproportionately higher. Therefore, this study seeks to address these gaps by providing a comprehensive facility-based assessment of the prevalence and risk factors associated with preeclampsia at Ndola Teaching Hospital.

2.4 Theoretical Framework

This study is guided by a synthesis of two complementary frameworks: the Health Ecological Model and the Pathophysiological Model of Preeclampsia.

The Health Ecological Model posits that health outcomes are influenced by a complex interplay of determinants operating at multiple levels—individual, interpersonal, community, and health system (McLeroy et al., 1988). Applying this model allows the study to go beyond biological predictors and situate preeclampsia risk within broader socio-economic, behavioural, and structural determinants.

The Pathophysiological Model of Preeclampsia, on the other hand, explains the biological mechanisms that mediate disease onset and progression. Specifically, it highlights inadequate placentation, systemic endothelial dysfunction, and exaggerated maternal inflammatory response as key processes linking risk factors to the clinical manifestation of preeclampsia (Roberts & Hubel, 2021).

By integrating these two models, the study adopts a comprehensive perspective: while the ecological model highlights contextual and systemic influences, the pathophysiological model provides insight into the biological mechanisms through which these influences translate into maternal morbidity. This dual approach enables a more holistic understanding of how sociodemographic, obstetric, and clinical factors converge to shape preeclampsia risk within the specific health system and community context of Ndola, ZambiaThis study is guided by a synthesis of two complementary frameworks: the Health Ecological Model and the Pathophysiological Model of Preeclampsia. The Health Ecological Model posits that health outcomes are influenced by a complex interplay of factors at multiple levels, from the individual to the health system and community (McLeroy et al., 1988). This framework allows us to contextualize the risk factors for preeclampsia beyond simple biological predictors, incorporating socio-economic factors and health system variables. The Pathophysiological Model of Preeclampsia explains the biological mechanisms linking risk factors to the disease, specifically focusing on inadequate placentation, systemic endothelial dysfunction, and an exaggerated maternal inflammatory response (Roberts & Hubel, 2021). By integrating these two models, this study can provide a comprehensive view of how individual sociodemographic, obstetric, and clinical factors converge to influence preeclampsia risk within the specific health system and community context of Ndola, Zambia.

In this study, the Health Ecological Model and the Pathophysiological Model of preeclampsia were operationalized to guide variable selection, study design, and data analysis. Sociodemographic factors such as maternal age, education, and residence represent individual-level and social determinants within the ecological model influencing health seeking behavior and access to care. Obstetric factors such as parity, gravidity, and previous preeclampsia, reflect reproductive level influences, while clinical variables such as obesity, chronic hypertension, and diabetes represent biological mechanisms consistent with the pathophysiological model.

2.5 Conceptual Framework

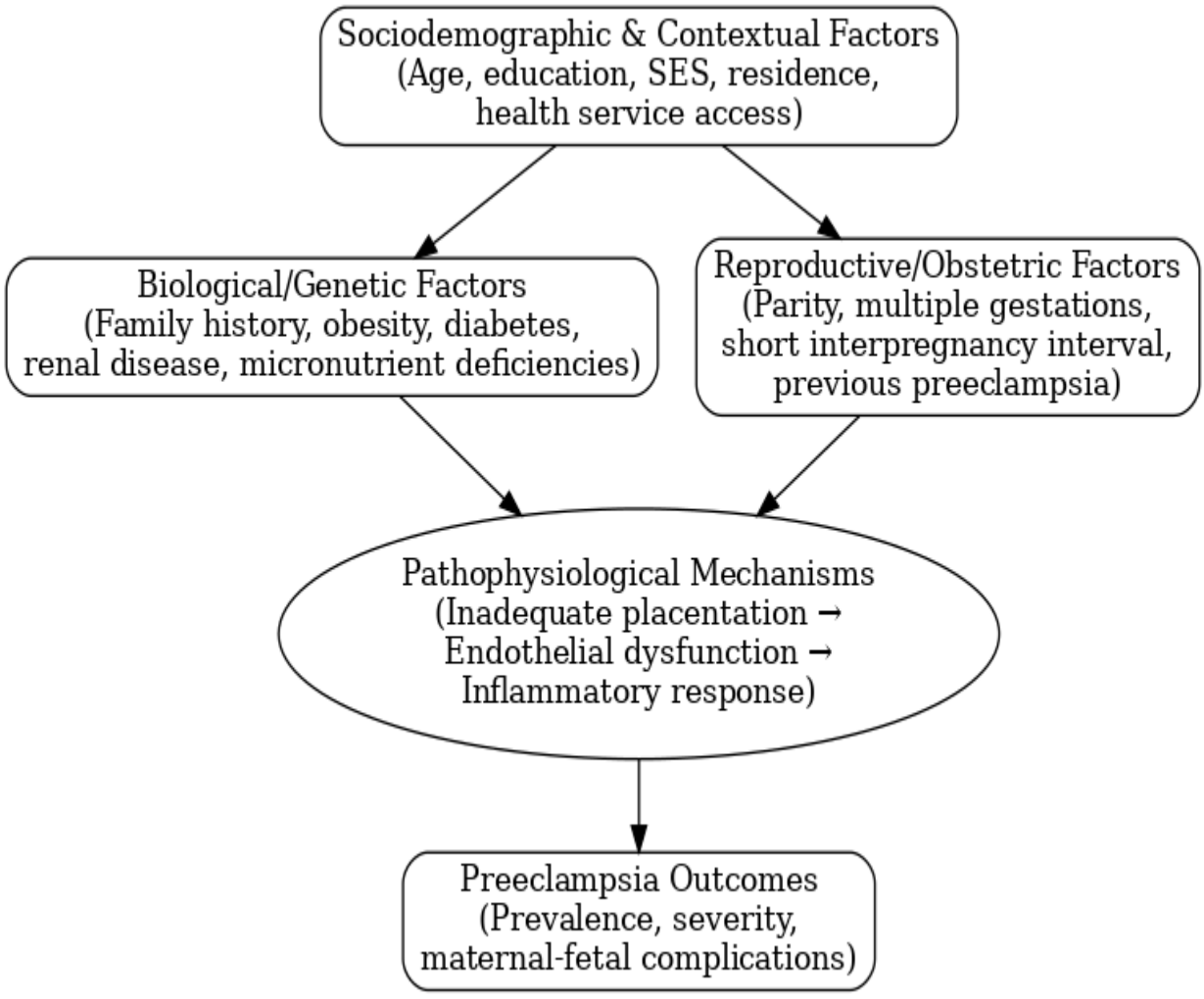

Figure 4.1 Conceptual framework

The categories in this framework are interdependent and reinforce one another across multiple levels. For example, low education may contribute to poor health-seeking behaviour, delayed antenatal care, and undiagnosed chronic hypertension, while low socio-economic status can limit dietary quality, leading to obesity and micronutrient deficiencies that elevate biological

risk. These interconnections demonstrate how sociodemographic, biological, and reproductive determinants interact through shared pathophysiological mechanisms—such as inadequate placentation, endothelial dysfunction, and inflammatory responses—to shape the prevalence and severity of preeclampsia. Ultimately, such interlinkages underscore the ecological nature of preeclampsia determinants and their cumulative impact on maternal and foetal outcomes

CHAPTER THREE: METHODOLOGY

3.1 Study Design

This is a cross-sectional study. Data was collected by reviewing existing maternity and ANC records from January 1, 2023, to December 31, 2024, at Ndola Teaching Hospital. This design is efficient and cost-effective for identifying associations between risk factors and preeclampsia within a specific time frame.

3.2 Study Approach

This study used a quantitative, retrospective approach. Quantitative methods were appropriate as the study sought to measure the prevalence of preeclampsia and identify statistically significant associations between maternal health factors and the occurrence of pre-eclampsia. The retrospective design allowed for the efficient use of existing ANC and delivery records, facilitating the collection of a large dataset over a two-year period while minimizing costs and time.

3.3 Study Setting

The study was conducted at Ndola Teaching Hospital (NTH), a large tertiary referral hospital in Ndola, Zambia. NTH serves as a primary and referral Centre for the entire Copperbelt Province, managing a high volume of pregnancies and deliveries annually. This study site was selected due to its role as the major tertiary referral hospital in the Copperbelt Province. The hospital manages a high volume of antenatal and delivery cases, including complicated and high pregnancies referred form lower-level health facilities. This makes it appropriate for assessing the prevalence and risk factors associated with preeclampsia.

3.4 Study Population

The study population comprised all women who attended ANC or delivered at NTH during the study period.

3.5 Study Sample

The study sample consisted of antenatal and delivery records selected from the estimated total population of records at Ndola Teaching Hospital between January 2023 and December 2024. Records were chosen using systematic random sampling to ensure representativeness. Only records with complete information on key variables such as maternal socio-demographics, obstetric history, clinical conditions, and preeclampsia diagnosis were included. Records with missing critical data were excluded to maintain data quality and reliability of the study findings.

3.6 Sample Size

The total population (N) of ANC and delivery records over the two-year period is estimated to be approximately 16,000. Using the Cochran formula for a known population, we calculated the sample size needed to estimate the prevalence of preeclampsia with a 95% confidence level and a 3% margin of error. Based on local studies, a conservative estimated prevalence (p) of 12% was used (Kapasa et al., 2020).

The initial sample size (n_0) is calculated as:

$$n_0 = \frac{Z^2 \times p \times (1-p)}{e^2}$$

$$n^0 = \frac{1.96^2 \times 0.12 \times 0.88}{(0.03)^2} \approx 450.75$$

Applying the finite population correction (FPC) formula:

$$n = \frac{n^0}{1 + \frac{n_0 - 1}{N}}$$

$$n = \frac{450.75}{1 + \frac{450.75 - 1}{160000}} \approx 438.4$$

The final sample size was rounded to 440 records to account for potential data extraction errors or incomplete records.

3.7 Sampling Strategy

Systematic random sampling was used to select the records. The sampling interval (k) was calculated by dividing the total estimated population by the sample size (k = N/n). For this study, k \approx. 16,000 / 440 \approx. 36. A random starting number between 1 and 36 was chosen, and then every 36th record from the facility's master registers was selected until the sample size of 440 is reached.

3.8 Data Collection Techniques

A standardized data extraction tool was developed and pre-tested to ensure data quality. Data was collected from two primary sources:

Antenatal Care (ANC) registers: These registers contain details on booking gestation, baseline blood pressure, weight, height, and medical history.

Maternity/Labour Ward records: These records provide information on delivery outcomes, gestational age at delivery, blood pressure readings throughout labour, and a final diagnosis of preeclampsia.

Data collection was conducted in a systematic and structured manner. First, eligible antenatal and delivery records within the study period were selected based on a predetermined sampling interval. Selected records were then retrieved and reviewed. Data were extracted using a standardized data extraction tool developed based on the established guidelines, including WHO and ACOG recommendations. Trained research assistants collected the data, and all the extracted information was cross checked for accuracy. Completed data extraction forms were then entered in excel before analysis.

The following variables were extracted and analysed:

Dependent Variable: Preeclampsia (diagnosed based on the ACOG/WHO criteria).

Independent Variables:

Sociodemographic: Maternal age (as a continuous variable and a categorical variable: <20, 20-34, > 35 years), residence (urban/rural), and highest education level.

Obstetric: Gravidity, parity, inter-pregnancy interval (in years), previous history of preeclampsia, and multiple pregnancy.

Clinical/Maternal Health: BMI (categorized as underweight, normal, overweight, obese), HIV status (positive/negative), chronic hypertension, and diabetes mellitus.

To ensure validity and reliability, the data extraction tool was developed based on established clinical guidelines and relevant literature. The tool was pre-tested on 10 records to ensure clarity, completeness, and appropriateness of variables. Reliability was enhanced through standardization of the data collection process. Two trained research assistants independently extracted data, and discrepancies were resolved through verification. Data entry was double

checked, and consistent coding procedures were applied to minimize errors and ensure reproducibility.

3.9 Data Analysis

Data was entered into a secure electronic database i.e excel and double-checked for accuracy and analysis was done using STATA version 14.1

Descriptive Analysis: Frequencies and percentages were used for categorical variables (e.g., preeclampsia prevalence, parity), and means with standard deviations or medians with interquartile ranges will be used for continuous variables (e.g., maternal age, BMI). To determine the prevalence of preeclampsia, the number of women diagnosed with preeclampsia was divided by the total number of records reviewed and multiplied by 100 to yield a percentage.

Bivariate Analysis: Chi-square tests was conducted to assess the association between each independent categorical variable and the outcome (preeclampsia). Independent sample t-test was used to compare the means of continuous variables between the preeclampsia and non-preeclampsia groups.

Multivariable Analysis: A multivariable logistic regression model was fitted to identify independent predictors of preeclampsia. Variables with a p-value < 0.25 in the bivariate analysis were included in the model. The model produced adjusted odds ratios (AORs) with 95% confidence intervals, controlling for potential confounding variables. Hosmer-Lemeshow test for goodness of fit and variance inflation factor (VIF) analysis were also conducted.

3.10 Validity and Reliability

To ensure validity and reliability, the data extraction tool was developed based on established clinical guidelines and relevant literature. The tool was pre-tested on 10 records to ensure clarity, completeness, and appropriateness of variables. Reliability was enhanced through standardization of the data collection process. Two trained research assistants independently extracted data, and discrepancies were resolved through verification. Data entry was double checked, and consistent coding procedures were applied to minimize errors and ensure reproducibility.

3.11 Ethical Considerations

This study utilized a cross-sectional design based on secondary data from hospital records. Ethical approval was sought from the University of Lusaka Research Ethics Committee, the Ndola Teaching Hospital Research Ethics Committee, and the Zambia National Health Research Authority (NHRA ref: FWA00033228-1308(08)/(08)/{2024}) before commencement. Since the study involves de-identified medical records, direct informed consent from participants were no required, and a waiver of consent was requested. To ensure confidentiality, all personal identifiers were removed, and anonymization was achieved through the use of unique study codes. Data was stored in password-protected electronic files with access restricted to the research team, while any paper records was securely kept under lock and key. Results were reported only in aggregated form, eliminating any possibility of linking findings to individual patients.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the results of the data analysis conducted to determine the risk factors associated with preeclampsia among antenatal clients at Ndola Teaching Hospital for the period January 2023 to December 2024. A total of 440 records were analyzed using STATA version 14.1 The results are presented in line with the study objectives beginning with characteristics of respondents, prevalence of pre-eclampsia, and factors associated with pre-eclampsia.

4.1 Socio-Demographic, Obstetric, and Clinical Characteristics of Respondents

Table 4.1 shows the socio-demographic, obstetric, and clinical characteristics of respondents at NTH. A total of 440 records of pregnant women from antenatal and labor wards were reviewed. Majority of the women were aged between 20-34 years (67.3%), most of them were from urban areas (70.9%), and that majority of the pregnant women had attained at least secondary education (48.6%).

Their obstetric characteristics showed that 67% of the women were multigravida and 64.1% were multiparous. Further, only a few had a history of pre-eclampsia 11.8% and only a few had multiple pregnancy (8.2%). Clinically, majority had normal weight (40%), 82.3% had a negative HIV status, 85.5% had no chronic hypertension, and 92.3% had no diabetes mellitus.

Table 4.1 Socio-demographic, obstetric, and clinical characteristics of respondents (N=440)

Variable Category	Variable	Frequency (n)	Percentage (%)
Sociodemographic Characteristics			
Maternal age (years)	< 20	48	10.9
	20-34	296	67.3
	≥ 35	96	21.8
Residence	Urban	312	70.9
	Rural	128	29.1
Education level	No formal education	42	9.5
	Primary	96	21.8
	Secondary	214	48.6
	Tertiary	88	20.0
Obstetric Characteristics			
Gravidity	Primigravida	164	37.3
	Multigravida	276	62.7
Parity	Nulliparous	158	35.9
	Multiparous	282	64.1
	Yes	52	11.8

History of preeclampsia	No	388	88.2
Multiple pregnancy	Yes	36	8.2
	No	404	91.8
Clinical / Maternal Characteristics			
Body Mass Index (BMI)	Underweight (<18.5 kg/m²)	38	8.6
	Normal (18.5-24.9 kg/m²)	176	40.0
	Overweight (25-29.9 kg/m²)	134	30.5
	Obese (≥30 kg/m²)	92	20.9
HIV status	Positive	78	17.7
	Negative	362	82.3
Chronic hypertension	Yes	64	14.5
	No	376	85.5
Diabetes mellitus	Yes	34	7.7
	No	406	92.3

4.2 Prevalence of pre-eclampsia

Figure 4.1 shows the prevalence of pre-eclampsia at NTH from January 2023 to December 2024. To determine the prevalence of preeclampsia, the number of patients that were diagnosed with preeclampsia (62) was divided by the total number of records reviewed (440) and multiplied by 100. Results show that 14.1% (62/440) of women were diagnosed with pre-eclampsia. The remaining 85.9% (378/440) did not develop pre-eclampsia during the study period.

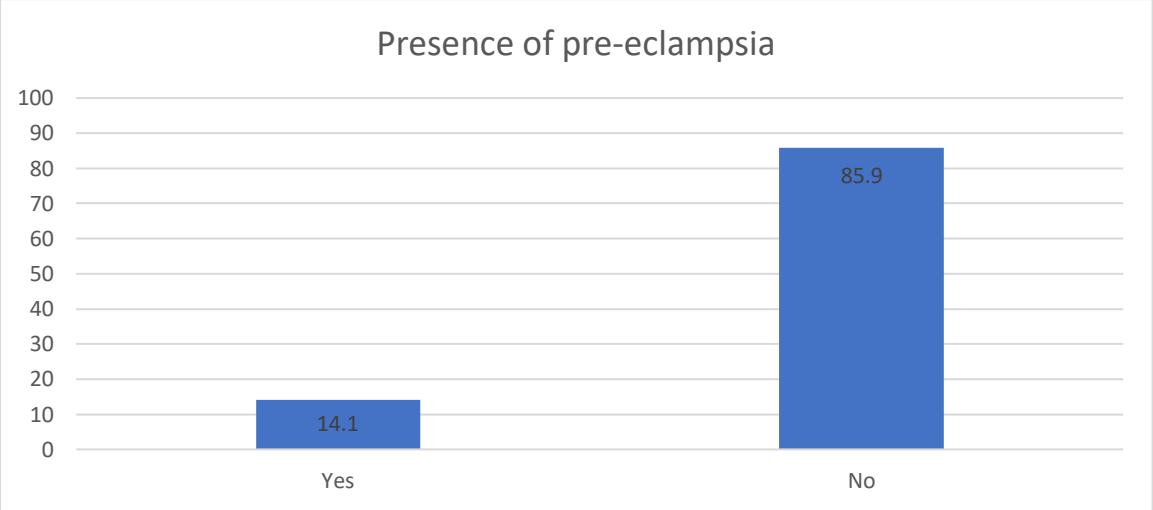

Figure 4.1 Prevalence of Pre-eclampsia

4.3 Maternal Health Factors Associated with Pre-eclampsia

Table 4.2 shows bivariate analysis of factors that were associated with pre-eclampsia at NTH during the period January 2023 to December 2024. Crude Odds Ratio (COR) and 95% confidence interval (CI) were estimated to assess the strength of association between each independent variable and development of pre-eclampsia. It was seen from the results that maternal age <20 years, maternal age ≥ 35 years, primigravida, nulliparity, history of previous pre-eclampsia, multiple pregnancy, BMI ≥ 30 kg/m² (Obese), chronic hypertension, and diabetes mellitus were significantly associated with development of pre-eclampsia ($p < 0.05$).

Table 4.2 Bivariate analysis of factors associated with pre-eclampsia at NTH

Variable	**Crude Odds Ratio (COR)**	**95% CI**	**p-value**
Sociodemographic characteristics			
Maternal age < 20 years	2.86	1.07-3.71	**0.02**
Maternal age 20–34 years (Ref)	1.00	-	-
Maternal age ≥ 35 years	3.30	1.28-4.12	**0.01**
Residence (Urban) (Ref)	1.00	-	-
Residence (Rural)	1.66	0.96-2.86	0.071
Education (≤ Primary)	1.74	0.98-3.07	0.058
Education (≥ Secondary) (Ref)	1.00	-	-
Obstetric characteristics			
Primigravida	2.02	1.17-3.49	**0.011**
Multigravida (Ref)	1.00	-	-
Nulliparous	1.85	1.07-3.20	**0.027**
Multiparous (Ref)	1.00	-	-
Previous preeclampsia	3.83	1.98-7.41	**<0.001**
No previous preeclampsia (Ref)	1.00	-	-
Multiple pregnancy	2.69	1.20-6.03	**0.016**
Singleton pregnancy (Ref)	1.00	-	-
Clinical / maternal characteristics			
BMI ≥ 30 kg/m² (Obese)	3.12	1.74-5.60	**<0.001**
BMI < 30 kg/m² (Ref)	1.00	-	-
HIV positive	0.68	0.31-1.52	0.35
HIV negative (Ref)	1.00	-	-
Chronic hypertension	4.43	2.39-8.21	**<0.001**
No chronic hypertension (Ref)	1.00	-	-
Diabetes mellitus	3.60	1.59-8.15	**0.002**
No diabetes mellitus (Ref)	1.00	-	-

To account for confounding variables, variables with p value < 0.2 were included in the multivariate logistics regression in order to determine factors that remained independently associated with development of pre-eclampsia. *Table 4.3*

Multivariate logistic regression results show that maternal age, previous history of pre-eclampsia, multiple pregnancy, obesity, chronic hypertension, and diabetes were statistically associated with pre-eclampsia. Pregnant women less than 20 years had 2.7 odds of developing pre-eclampsia compared to pregnant women aged 20-34 years (AOR 2.7, CI 1.02 - 3.87, p = 0.04), pregnant women older than 35years were 2.9 times more likely to develop pre-eclampsia compared to women aged 20-34 years (AOR 2.9, CI 1.05 - 4.74, p = 0.03), pregnant women with previous history of preeclampsia were 3.2 times more likely to develop pre-eclampsia compared to women without history of pre-eclampsia (AOR 3.2, CI 1.57 - 6.56, p < 0.001), multiple pregnancy had 2.4 times increased odds of developing pre-eclampsia compared to singleton pregnancy (AOR 2.4, CI 1.03 - 5.74, p value = 0.04), obesity had 2.9 times increased odds compared to pregnant women with BMI < 30 kg/m² (AOR 2.87, CI 1.48 - 5.56, p value < 0.001), chronic hypertension had 4.1 higher odds compared to pregnant women with no chronic hypertension (AOR 4.1, CI 2.02 - 8.23, p value <0.001), and history of diabetes had 2.6 times higher odds of developing pre-eclampsia than women without diabetes (AOR 2.6, CI 1.06 - 6.45, p value = 0.03).

The logistic regression model was a good fit as evidenced by the Hosmer-Lemeshow test (p=0.07) and there was no significant multicollinearity as all the variables had a Variance Inflation Factor (VIF) that was less than 5.

Table 4.3 Multivariable logistics regression analysis of factors independently associated with pre-eclampsia

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Sociodemographic factors			
Maternal age < 20 years	2.73	1.02 - 3.87	**0.04**
Maternal age ≥ 35 years	2.94	1.05 - 4.74	**0.03**
Maternal age 20–34 years (Ref)	1.00	-	-
Rural residence	1.42	0.78 - 2.58	0.25
Residence (Urban) (Ref)	1.00	-	-
Education ≤ Primary level	1.36	0.74 - 2.49	0.32
Education (≥ Secondary) (Ref)	1.00	-	-
Obstetric factors			
Primigravida	1.61	0.86 - 3.01	0.13
Multigravida (Ref)	1.00	-	-
Previous history of preeclampsia	3.21	1.57 - 6.56	**<0.001**
No previous preeclampsia (Ref)	1.00	-	-
Multiple pregnancy	2.43	1.03 - 5.74	**0.04**
Singleton pregnancy (Ref)	1.00	-	-
Clinical / maternal factors			
Obesity (BMI ≥ 30 kg/m²)	2.87	1.48 - 5.56	**<0.001**
BMI < 30 kg/m² (Ref)	1.00	-	-
Chronic hypertension	4.08	2.02 - 8.23	**<0.001**
No chronic hypertension (Ref)	1.00	-	-
Diabetes mellitus	2.61	1.06 - 6.45	**0.03**
No diabetes mellitus (Ref)	1.00	-	-
Hosmer-Lemeshow test p = 0.07, all VIF < 5			

CHAPTER FIVE: DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the key findings of the study that aims at determining the risk factors associated with preeclampsia among antenatal pregnant women at Ndola Teaching Hospital for the period January 2023 to December 2024. It first discusses the prevalence of pre-eclampsia at Ndola Teaching Hospital for the period January 2023 to December 2024 and lastly discusses the maternal, obstetric, and clinical associated risk factors of pre-eclampsia in the study period.

5.2 Prevalence of pre-eclampsia

The study findings showed that the prevalence of pre-eclampsia in the study period was 14.1% among antenatal and delivery records at NTH. This prevalence is relatively high and shows the burden of pre-eclampsia at a tertiary level hospital setting in Zambia. These findings are similar with a systematic review and meta-analysis that was conducted in Sub-Sahara Africa were the pooled prevalence of pre-eclampsia among pregnant women was 13% (Birhanu et al., 2023). This study finding is within the prevalence range, but on the higher side, of several other studies conducted globally and in Africa ranging from 4-15% (Noubiap et al., 2020; Mou et al., 2021; Machano et al., 2020). However, this study's finding is high than another study conducted in Copperbelt Zambia that showed lower prevalence of 5.8%. These variations can be explained by differences in socio-demographic and contextual differences in the study target settings and populations.

The relatively elevated prevalence observed in this study could be explained by several factors such as Ndola Teaching Hospital being a tertiary referral health facility which receives complicated and high risk pregnancies, including women with pre-exiting conditions such as chronic hypertension, diabetes, and previous history of pre-eclampsia. In addition, improved detection of hypertensive disorders in pregnancy in hospital settings may contribute to higher reported cases compared to community-based studies (Olotu et al., 2020).

Further, the prevalence observed in this study aligns with the theoretical model used in this study which emphasized the influence of health system level factors and population risk profile on disease burden. Being a tertiary hospital, it increases the probability of pre-eclampsia at the facility level and is consistent with the ecologic model of maternal health that link service level context to observed disease prevalence (McLeroy et al., 1988). In addition, the pathophysiological model

of pre-eclampsia suggests that a larger proportion of women at risk will result in higher observed prevalence due to increased susceptibility (Roberts & Hubel, 2021).

The study findings highlight that pre-eclampsia remains a public health and clinical concern in Zambia, especially tertiary level hospitals. This shows the need for strengthened preventive and early detection strategies that would lower the burden of pre-eclampsia at tertiary hospitals.

5.3 Maternal health factors associated with pre-eclampsia

This study identified several risk factors that were independently associated with development of pre-eclampsia. These included sociodemographic factors (extremes in maternal age), obstetric factors (previous history of pre-eclampsia, multiple pregnancy), and clinical factors (obesity, chronic hypertension, history of diabetes) in the pregnant women.

Pregnant women less than 20 years had 2.7 times higher odds of developing pre-eclampsia and pregnant women older than 35years were 2.9 times more likely to develop pre-eclampsia compared to women aged 20-34 years. This finding is consistent with several other studies from high-, middle- and low-income settings that show that extremes in age is highly associated with development of pre-eclampsia in pregnancy (Machona et al., 2020; WHO, 2025). In contrast, other sociodemographic variables such as education and residence did not show statistical associations in this study as was seen in the study by Wolde et al. (2019). This could suggest that within a tertiary hospital setting, clinical and obstetric factors may have a stronger influence than purely social determinants.

Obstetric factors from this study showed that pregnant women with previous history of preeclampsia were 3.2 times more likely to develop pre-eclampsia compared to women without history of pre-eclampsia. Further, multiple pregnancy had 2.4 times increased odds of developing pre-eclampsia compared to singleton pregnancy. These findings align with global estimates reporting recurrence rates of up to 50% in women that have a previous history of preeclampsia and other studies similarly showing an association between multiple pregnancy and preeclampsia (Brown et al., 2018; Abalos et al., 2018; Magee et al., 2022). This reinforces the role of obstetric history as a key determinant of risk.

Clinical factors demonstrated that obesity, hypertension, and history of diabetes were associated with preeclampsia. Findings showed that obesity had 2.9 times increased odds compared to pregnant women with BMI < 30 kg/m², chronic hypertension had 4.1 higher odds compared to

pregnant women with no chronic hypertension, and history of diabetes had 2.6 times higher odds of developing pre-eclampsia than women without diabetes. These study findings are consistent with several other studies that also identified history of previous pre-eclampsia, multiple pregnancy, obesity, chronic hypertension, and history of diabetes as associated risk factors of pre-eclampsia (Meazaw et al., 2020; Birhanu et al., 2023; Machona et al., 2020).

HIV status, education level, residence, and gravidity were not significantly associated with pre-eclampsia. Other studies have presented similar findings where HIV was not associated with pre-eclampsia and demographic factors such as education level and residence were not associated with pre-eclampsia (Mukonka et al., 2021; Mbila, 2022). On the contrary, some studies have reported an association between gravidity and pre-eclampsia (Birhanu et al., 2023).

The study findings also align with the established theoretical models of pre-eclampsia that suggest a multifactorial etiology. This integration highlights the importance of comprehensive risk assessment in antenatal care where both clinical and obstetric history remains cardinal to prevent pre-eclampsia (Olotu et al., 2020).

5.4 Implication for policy and practice

The findings of this study have important implications for maternal health policy and clinical practice in Zambia. The high prevalence of preeclampsia emphasizes the need for strengthened antenatal care services, especially in tertiary hospitals that manage high-risk pregnancies. Routine risk screening during antenatal visits should be enhanced to identify women at increased risk based on clinical and obstetric factors. In addition, targeted interventions such as closer monitoring, early initiation of preventive therapies, and timely referral systems should be implemented to reduce complications.

At policy level, there is need to strengthen programs addressing non-communicable diseases among women of reproductive age, particularly hypertension, obesity, and diabetes, which were identified as key risk factors in this study. Improving access to quality antenatal care and promoting early booking are also important in reducing delays in diagnosis and management. Further, the findings from this study highlight the importance of generating facility-based data to inform localized interventions. Policymakers should support routine data collection and research at tertiary hospitals to better understand and respond to the burden of preeclampsia.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study aimed at determining the risk factors associated with preeclampsia among antenatal clients at Ndola Teaching Hospital for the period January 2023 to December 2024. The findings show that pre-eclampsia remains a significant burden at tertiary level hospitals with a prevalence of 14.1%. Risk factors that were associated with pre-eclampsia included extremes in maternal age (below 20 and above 35years), previous history of pre-eclampsia, multiple pregnancy, obesity, chronic hypertension, and history of diabetes in the pregnant women. On the other hand, socio-demographic factors such as education level, residence, and HIV status were not significantly associated with pre-eclampsia.

6.2 Recommendations

Based on the findings of the study, the following recommendations are made;

1. Ndola Teaching Hospital should implement routine risk stratification protocols during early antenatal visits to identify women at risk of developing preeclampsia.
2. Antenatal care health providers should prioritize early identification of known risk factors of pre-eclampsia such as extremes of age, previous history of pre-eclampsia, multiple pregnancy, chronic hypertension, and diabetes.
3. The hospital must encourage and promote early antenatal booking for all pregnancies.
4. The Ministry of Health should integrate routine screening and management of non-communicable diseases such as hypertension, obesity, and diabetes into reproductive health services among women of reproductive age.
5. Ndola Teaching Hospital should conduct periodic training for healthcare providers on early detection and management of preeclampsia, as well as use of updated clinical guidelines.
6. Future studies should consider longitudinal study designs to understand temporal and causal relationship between risk factors and outcome
7. Future studies should also target several tertiary hospitals in Zambia to improve generalizability

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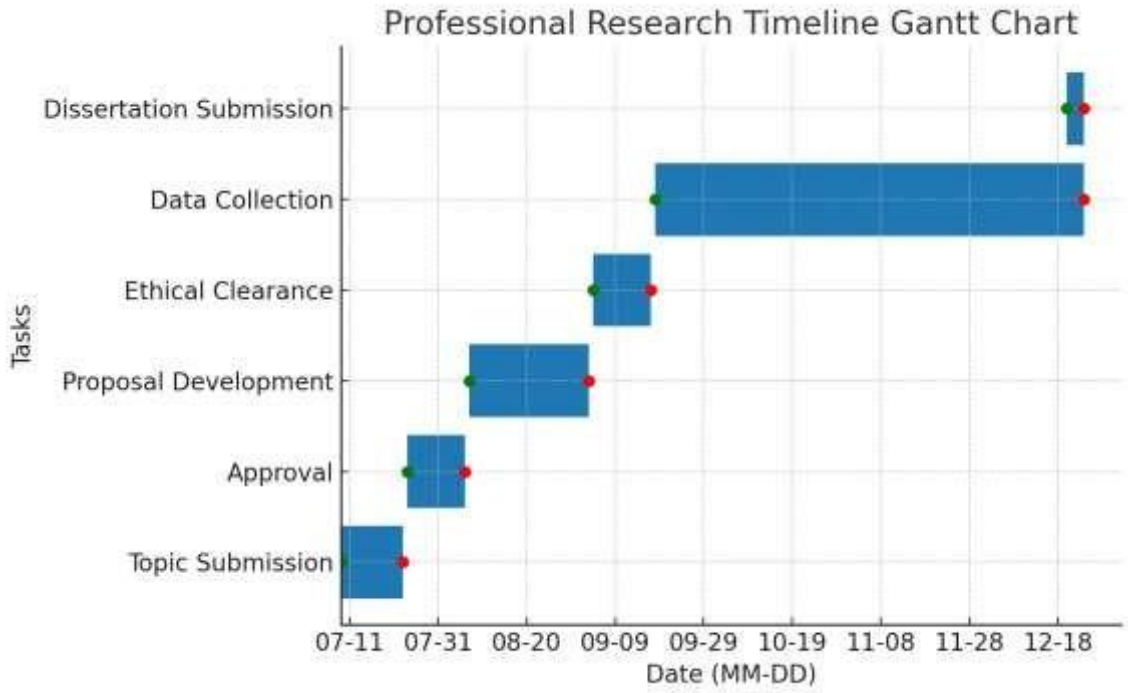
APPENDICES

Appendix I: Estimated Budget

Item	Description	Estimated Cost (ZMW
Personnel	Research Assistant (data extraction & entry support)	1,500
Travel	Local transport to/from Ndola Teaching Hospital	700
Stationery	Pens, notebooks, folders, etc	400
Printing & Photocopying	Printing of data extraction forms, reports, ethical documents	900
Internet Access	For literature review, data upload, communication	350
Data Entry Software	Contribution toward STATA license/EpiData setup	700
Contingency	To cover unforeseen expenses (e.g., extra printing)	450
Total Cost Estimated		**5,000.00**

Appendix II: Gantt Chart



Gantt chart showing the research timeline with milestone markers from topic submission to final dissertation submission on 24th December 2025

Appendix III: Information Sheet

An assessment of risk factors associated with preeclampsia among antenatal clients at Ndola teaching hospital

I am **Misapa Chomba,** a student at UNILUS conducting a study as part of the requirement in obtaining a Master of Science degree in Epidemiology and Biostatistics. This study focuses on pre-eclampsia as one of the leading causes of maternal morbidity and mortality. It aims at determining the prevalence and risk factors associated with pre-eclampsia at Ndola Teaching Hospital in the period Jan 2023 to December 2024.

The study utilizes maternal medical records to extract data on maternal, obstetric, and clinical characteristics of pregnant women during the study period. Please note that there are no monetary or material benefits for being part of this study; it is voluntary.

Risks and discomfort: There are no risks or harm in participating in this study.

Injury clause: No injury is anticipated in taking part in this study.

Benefits: There will not be any immediate benefits for participating in this study. However, many people may benefit in future if we can find answers to the questions this study is asking. No one will be asked to pay, and neither will be paid to participate in this study.

Confidentiality: All information will be kept confidential, and anonymity will be maintained. Any data collected will not be traced back to the respondent.

Appendix IV: Data Extraction sheet

Study Title: Prevalence and Factors Associated with Pre-eclampsia Among Antenatal Clients at Ndola Teaching Hospital

Section A: Identification Information

Variable	Description	Result
Record ID	Unique study identification number	
Facility	Ndola Teaching Hospital	
Year of record	Year of ANC/delivery	

Section B: Socio-Demographic Characteristics

Variable	Description	Result
Age category	<20, 20–34, ≥35	
Marital status	Single, Married, Divorced/Widowed	
Education level	None, Primary, Secondary, Tertiary	
Residence	Urban/Rural	

Section C: Obstetric Characteristics

Variable	Description	Result
Gravidity	Total number of pregnancies	
Parity	Number of previous births	
Multiple pregnancy	Yes/No	
Previous pre-eclampsia	Yes/No	

Section D: Clinical Characteristics

Variable	Description	Result

BMI	Calculated	
BMI category	Normal/Overweight/Obese	
Chronic hypertension	Yes/No	
Diabetes mellitus	Yes/No	
HIV status	Positive/Negative	

Section E: Outcome Variable

Variable	Description	Result
Pre-eclampsia diagnosis	Yes/No	

Appendix V: UNILUS Research Ethics Approval Letter

UNIVERSITY *of* LUSAKA

Passion for Quality Education: Our Driving Force

UNIVERSITY OF LUSAKA RESEARCH ETHICS COMMITTEE (UNILUS-REC)

Plot No. 37413, Off Alick Nkhata Mass Media. P. O Box 36711, Lusaka.
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UNILUS-RESEARCH ETHICS COMMITTEE

Ref no: FWA00033228-1308(08)/(08)/{2024}

Date: 18 October 2025

STUDENT NAME: **Ms. Misapa Chomba**

An assessment of risk factors associated with preeclampsia

The above research was submitted to the research ethics committee for review. The study has no major ethical problems and is approved subject to the following:

1. The study cannot be changed without express permission of the UNILUS research ethics committee.
2. Approval from the necessary authority should be sought.

Professor Kasonde Bowa

MSc(Glasgow),M.Med(UNZA),FRCS(Glasgow),FACS,FCS,DPH(LSTMH),MPH(UCL)

Chairman- UNILUS REC

Professor of Urology and Consultant Urologist

Deputy Vice-Chancellor – Research and Innovation

Executive Dean - School of Medicine and Health Sciences