

Prevalence and Associated Factors of Preeclampsia Among Expectant Mothers in Imvepi Refugee Settlement, Terego District

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Abstract

Background

Preeclampsia is major contributor of maternal and perinatal mortality in Uganda and continues to pose a significant public health challenge due to its increasing prevalence and multifactorial causes. Despite its impact, limited research has been conducted in Uganda. The study aims to determine the prevalence and factors associated with preeclampsia among Expectant Mothers in Imvepi Refugee Settlement, Terego District.

Methods

A facility-based cross-sectional study was conducted at Imvepi Refugee settlement, Terego district from March to December 2024. The study included Expectant Mothers who visited the selected facilities for antenatal care during the period, totalling 422 participants. Data were collected through structured interviews and review of medical records. Data were cleaned in Excel and analysed using STATA version 14. Descriptive statistics summarized key variables, while logistic regression identified factors associated with preeclampsia. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to determine the strength of these associations.

Results

The prevalence of preeclampsia was 16.4%. Significant factors included being unmarried (AOR = 1.733, 95% CI: 1.057–2.503, $p = 0.014$), eating three meals a day (AOR = 1.719, 95% CI: 1.435–3.196, $p = 0.046$), having had ever experienced pregnancy complications (AOR = 1.448, 95% CI: 1.056–2.771, $p = 0.017$), and having caesarean section (AOR = 2.341, 95% CI: 1.098–4.988, $p = 0.028$).

Conclusion

Preeclampsia remains prevalent in Imvepi Refugee Settlement. Marital status, nutrition, pregnancy history, and mode of delivery were significantly associated factors with the condition. Strengthening antenatal care services is crucial for early detection and management of preeclampsia, especially in refugee settings.

Background to the Study

Preeclampsia (PE) is a hypertensive disorder of pregnancy that typically occurs after 20 weeks of gestation and is characterized by high blood pressure and proteinuria exceeding 300 mg/day (19). Globally, preeclampsia complicates approximately 2–10% of pregnancies and is a leading cause of maternal and perinatal morbidity and mortality (39). It contributes to over 500,000 maternal deaths, 50,000 newborn deaths, and indirectly to millions of neonatal deaths each year (26). Despite global efforts to reduce maternal mortality, an estimated 830 women still die daily from pregnancy-related complications (59, 41),

alongside over 7,000 child deaths per day due to pregnancy-associated issues (51, 52). More than half of these maternal deaths occur in low-income settings, particularly in sub-Saharan Africa (21).

At the continental level, the prevalence of preeclampsia in Africa ranges from 2% to 10% of pregnancies, with variations across different regions influenced by socioeconomic factors, access to healthcare, and geographic location (49, 4). For example, prevalence rates of 4.3% in Nigeria (49), 6.1% in Ethiopia (4) and maternal mortality contributions of 8.9% due to pregnancy-induced hypertension in Ghana highlight its widespread impact (8). Sub-Saharan Africa bears a disproportionate burden, with approximately 550 of the 830 daily maternal deaths occurring in the region (56). Women in low-resource countries are at a significantly higher risk of developing preeclampsia compared to their counterparts in high-income nations (60).

In Uganda, maternal mortality remains high, despite some progress. The maternal mortality ratio declined from 438 per 100,000 live births in 2011 to 368 in 2022 (50). However, this remains more than double the global average of 152 deaths per 100,000 live births (12). Gestational hypertension, including preeclampsia, is a key contributor to maternal deaths, accounting for 2% of all maternal deaths (32, 23). Yet, national prevalence estimates for preeclampsia have not been established in the past five years (54). This gap in data hampers effective prevention, early detection, and management strategies.

In Terego District, specifically within Imvepi refugee settlement, the situation is even direr. Although health education describes preeclampsia as a condition marked by hypertension, edema, dizziness, proteinuria, and headache, little or no published literature exists detailing its prevalence and associated risk factors. Local data from DHIS2 (2022/23) reports that three out of eight expectant mothers were diagnosed with preeclampsia, contributing to maternal and fetal complications often linked to a lack of knowledge about its risk factors. Early detection, timely management, and increased awareness among expectant mothers and healthcare workers are therefore crucial to improving maternal outcomes (42). This study seeks to ascertain the prevalence and factors associated with preeclampsia among expectant mothers in Terego District to bridge these critical gaps in knowledge and practice.

Purpose of the Study

The purpose of this study is to fill the existing knowledge gaps regarding the burden and determinants of preeclampsia in refugee contexts, particularly in Imvepi Refugee Settlement. By generating context-specific, community-based data, the study aims to inform targeted interventions, improve early detection and management practices, and contribute to better maternal health outcomes in humanitarian settings. It is hypothesized that preeclampsia prevalence in Imvepi is influenced by a combination of individual, maternal, and environmental factors, which are uniquely shaped by the challenges of displacement and limited health service access.

Study Objectives/ Purpose

Main Objective

To ascertain the prevalence and Associated Factors of Preeclampsia among Pregnant Women in Imvepi Refugee Settlement, Terego District.

Specific Objectives

The study considered the following research questions

- i. To assess the prevalence of preeclampsia among Expectant Mothers in Imvepi Refugee Settlement in Terego District.
- ii. To identify the individual-level factors associated with preeclampsia among Expectant Mothers in Imvepi Refugee Settlement in Terego District.
- iii. To assess the maternal-related factors associated with preeclampsia among Expectant Mothers in Imvepi Refugee Settlement in Terego District.

Research Questions

The study considered the following research questions

- i. What is the prevalence of preeclampsia among expectant mothers in Imvepi Refugee Settlement in Terego District?
- ii. What are the individual-level factors to preeclampsia among expectant mothers in Imvepi Refugee Settlement in Terego District?
- iii. What are the maternal-related factors to preeclampsia among expectant mothers in Imvepi Refugee Settlement in Terego District?

Narrative of the Conceptual Framework

The diagram illustrates the relationship between the dependent variables (preeclampsia) and the independent variables (Associated Factors). Dependent Variable was Preeclampsia with the outcome of a gestational systolic blood pressure surpassing 140mmHg accompanied by the sudden onset of proteinuria with yes indicating its presence and no its absence. Therefore, those whose blood pressure was below 140mmHg shall be considered as normal and above 140mmHg was having preeclampsia.

Individual factors such as age, family type, education, marital status, religion, and employment status. In this study, they are considered as the expectant mother's age, educational level (no education, primary, secondary, tertiary), marital status married or unmarried (Single, divorced, widow, others), religion (Christian, Muslim, other), employment status employed or unemployed (self, full, contract, partial), and family type extended or nuclear and pregnancy related factors like type of pregnancy (single, twins, others), parity, gravidity (number of pregnancies; pregnancy complications (yes or no), history of miscarriages (yes or no), and mode of delivery (normal, cesarean section).

Materials and Methods

Study Design, Period, and Setting

A facility-based cross-sectional study was conducted in Imvepi Refugee Settlement in Terego District to assess the prevalence and associated factors of preeclampsia among expectant mothers. The study was carried out in selected public, private, and NGO-supported health facilities that provide antenatal care services. Terego District has 27 health facilities, including one Health Center IV, sixteen Health Center IIIs, and ten Health Center IIs, from which selected facilities formed the study sites. The study population consisted of expectant mothers who were five months pregnant or more, as preeclampsia commonly occurs during the second trimester and later stages of pregnancy.

Participants and Eligibility Criteria

The study population consisted of expectant mothers attending antenatal care services in selected health facilities within Imvepi Refugee Settlement in Terego District. Participants included pregnant women aged 18 years and above who were willing to participate in the study and available for the required interview and blood pressure measurements used to assess preeclampsia.

Expectant mothers who had pregnancy-related complications that could prevent them from completing the interview were excluded. In addition, women already taking antihypertensive medications such as beta-blockers or calcium channel blockers were not included, as these drugs could mask signs of gestational hypertension and affect the accuracy of the assessment.

Sample Size Estimation

The sample size estimation for the research was calculated using Kish and Leslie formula for quantitative cross-sectional studies (16).

$$n = \frac{z^2 * P(1 - P)}{\sigma^2}$$

n = minimum sample size, Z = standard normal variate (at 5% type 1 error, $P < 0.05$) = 1.96.

p = Proportion of mothers with preeclampsia. Since preeclampsia in Imvepi refugee settlement is not known, 50% will be used.

σ^2 = margin of error on p (at 5%), $n = (1.96)^2 \times 0.5(1-0.5) / (0.05)^2$, $n = 3.8416 \times 0.5 (0.5) / 0.0025$

$n = 0.9604 / 0.0025$, $n = 384$ Expectant Mothers

Considering non-response of 10% of the expectant mothers who meet the eligibility criteria

$= 384 + 10\% \text{ of } 384 = 384 + 38 = \sim 422$

Therefore, n is 422.

Data Collection Procedure and Tools

Data were collected using a pretested structured questionnaire administered to expectant mothers through face-to-face interviews. The questionnaire gathered information on socio-demographic characteristics, knowledge and awareness of preeclampsia, and maternal-related factors, and was adapted from previously validated tools (13, 30). Before the main study, the tool was pretested among 42 respondents in a nearby refugee health facility to ensure clarity and relevance, and necessary adjustments were made. The reliability of the questionnaire showed good internal consistency with a Cronbach's alpha of 0.82.

A multistage cluster sampling technique was used to select participants. First, 16 health facilities were randomly selected from facilities within Imvepi Refugee Settlement. The total sample of 422 participants was then proportionally allocated to each facility based on antenatal attendance. Finally, simple random sampling was used to select eligible expectant mothers at each facility.

In addition to interview data, clinical information was obtained from medical records, and objective measurements were taken using digital blood pressure monitors and urine dipstick tests to assess blood pressure and proteinuria. These procedures were conducted by trained health personnel to ensure accuracy and consistency.

Operational Definitions

Preeclampsia

Refers to the presence of gestational hypertension, characterized by a systolic blood pressure ≥ 140 mmHg, measured on two occasions at least four hours apart after 20 weeks of gestation, along with newly developed proteinuria (≥ 0.3 g in a 24-hour urine sample or ≥ 30 mg/mmol in a spot sample), (6).

Expectant Mothers

Women with pregnancies of gestational age ≥ 5 months at the time of the study (58).

Gestational Age

Determined using the last normal menstrual period (LNMP). If unknown, gestational age was estimated using fundal height or ultrasound findings (57).

Gravidity

The total number of pregnancies, including abortions, ectopic pregnancies, and all other documented pregnancies (55).

Parity

The number of deliveries after 28 weeks of gestation, including stillbirths and intrauterine fetal demise (IUFD), as recorded in medical records (15).

Proteinuria

Assessed using urine dipstick testing. Women with readings of + 1 or higher were classified as having proteinuria (35)

Prevalence

The proportion of pregnant women with systolic blood pressure ≥ 140 mmHg on two separate readings, at least four hours apart, and concurrent proteinuria, observed between July 1 and August 31, 2024 (14).

Perceived Needs

An individual's self-assessment of the seriousness of their health condition, which influences their decision to seek care based on their personal experience and understanding (7).

Evaluated Needs

Needs determined through professional medical assessment, prompting care-seeking behavior based on clinical findings and recommendations (7).

Study Variables and their Measurements

The main outcome variable in this study was preeclampsia, defined as systolic blood pressure of ≥ 140 mmHg or diastolic blood pressure of ≥ 90 mmHg occurring after 20 weeks of gestation, together with the presence of proteinuria ($\geq + 1$ on a urine dipstick test). The outcome was recorded as a binary variable (Yes/No).

Blood pressure was measured using a calibrated digital blood pressure monitor while the participant was seated and had rested for at least five minutes. Two measurements were taken and the average value was recorded. Urine samples were also collected and tested using a urine dipstick to detect proteinuria. Participants were classified as having preeclampsia when elevated blood pressure was accompanied by a positive urine protein result. For participants whose measurements could not be taken at the time of the interview, recent clinical records from antenatal visits were reviewed to obtain blood pressure and urinalysis results.

Independent variables included socio-demographic characteristics such as age, education level, marital status, religion, employment status, and family type. Individual-level factors included household income, number of antenatal care visits, meal frequency, caffeine consumption, occupation, and distance to the health facility. Maternal-related factors included type of pregnancy (single or multiple), parity, gravidity, pregnancy complications, and mode of delivery.

Data Quality Assurance and Measures

To ensure the quality of data, the research assistants were recruited and trained on the objectives of the study, ethical considerations, and proper administration of the questionnaire. The data collection tool was pretested among 42 expectant mothers at Ocea HC II in Madi-Okollo District to assess clarity, relevance, and suitability. Feedback from the pretest helped improve the wording and structure of the questionnaire.

The validity of the study tools was ensured through expert review, alignment with the study objectives and conceptual framework, and comparison of selected findings with available facility records and DHIS2 data. The reliability of the instrument was assessed using Cronbach's Alpha (0.82), indicating good internal consistency.

During data collection, trained research assistants administered the questionnaires, while the principal investigator supervised the process and checked completed questionnaires daily for completeness, accuracy, and consistency to minimize errors and ensure reliable data.

Data Management and Analysis

The data were analysed using STATA version 14 software, with the results presented in tables (Hirvonen-Ere, 2022). Following the determination of significance, the researcher performed a regression analysis to validate the hypotheses. This comprehensive approach ensured a thorough exploration and understanding of the relationships among the research variables. Quantitative data collection was carried out using existing survey questionnaires comprising both dichotomous and multiple-choice closed-end questions. The appropriate data codes were documented and applied to the collected data. Data were entered into the excel sheet. Data entry was verified for accuracy and consistency, and any errors or discrepancies were corrected. Data were cleaned and coded to ensure that it was accurate and consistent. This included removing duplicates, correcting errors, and standardizing variables.

The univariate analysis, presented as descriptive statistics, was used to summarize the characteristics of the sample. The statistical analysis took the form of both descriptive and inferential statistics. The descriptive statistics used to measure preeclampsia prevalence were presented as frequencies, percentages, and tables. Inferential statistics were also used to identify factors associated with preeclampsia. The viewpoints concerning preeclampsia, the associated factors, and the patterns were scrutinized through this descriptive assessment. The distribution of demographic variables such as age and education, among others, was presented using frequency tables with numbers and percentages.

Bivariate analysis was used to examine the relationship between each independent variable and preeclampsia, which was treated as a binary outcome (present or absent). Binary logistic regression estimated the strength and direction of these associations. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to show the likelihood of developing preeclampsia based on each factor. Variables with a p-value of 0.05 or less were considered statistically significant and selected for further analysis. Selection for the final model was based on statistical significance, biological relevance, low collinearity, and support from existing research. This ensured that only the most meaningful predictors were included in the multivariable analysis

Multivariate logistic regression analysis was performed to examine the effect of multiple independent variables on the likelihood of developing preeclampsia, a binary outcome variable (presence or absence of preeclampsia). This statistical technique estimates the probability of an event occurring by computing odds ratios (ORs), which indicate both the strength and direction of the association between predictor variables and the outcome. The model uses the logit function (log of the odds) and applies the maximum likelihood estimation method to identify the best-fitting model for the data. Variables that showed a p-value less than

0.2 in the bivariate analysis were included in the multivariate model to control for potential confounding factors. A backward elimination procedure was then applied, in which all eligible variables were initially entered into the model, and those with the least statistical contribution were sequentially removed until only variables with significant effects remained. This approach was chosen for its efficiency in identifying the most meaningful predictors while minimizing the risk of over fitting. Variables with a p-value less than 0.05 and 95% confidence intervals (CIs) that did not include 1 were considered statistically significant. The final multivariate model identified factors independently associated with preeclampsia, providing a strong evidence base for targeted interventions aimed at improving maternal health outcomes.

RESULTS

Socio-demographic characteristics

The average age of participants was 24.1 years (± 3.4 SD), with the majority (319 out of 422; 75.6%) aged between 18 and 34 years. In terms of education, 160 respondents (37.9%) had attained primary education. Most participants were married, accounting for 366 (86.7%) of the total. The majority identified as Christians (290; 68.7%). More than half of the respondents (229; 54.3%) lived in nuclear families. Regarding household size, 325 respondents (77.0%) reported living in households with more than 15 members. 291 participants (69.0%) were unemployed.

Table 1: Showing the Socio-demographic Characteristic of the Respondents

Variables	Frequency n	Percentage %
Current Age		
18-34-youth	319	75.6
34 and above-adults	103	24.4
Level of Education Attained		
No Education	67	15.9
Primary	160	37.9
Secondary	91	21.6
Tertiary	104	24.6
Current Marital Status		
Married	366	86.7
Unmarried	56	13.3
Religion Affiliation		
Christianity	290	68.7
Muslim	132	31.3
Type of Your Family		
Extended	193	45.7
Nuclear	229	54.3
Number of Family Members		
<5	97	23.0
>5	325	77.0
Employment Status		
Employed	131	31.0
Unemployed	291	69.0

Source: Primary Data (2025)

Prevalence of preeclampsia among Expectant mothers in Imvepi Refugee Settlement in Terego District.

For blood pressure, 16.4% had a reading above 140 mmHg, indicating pre-eclampsia, while respondents (83.6%) had a reading below this threshold, indicating normal or mildly elevated blood pressure.

Regarding proteinuria, the majority of the respondents 78.9% had no detectable protein in their urine, indicating the absence of significant kidney damage. A smaller proportion had trace amounts of proteinuria 9.7%, and an even smaller percentage 11.4% had higher levels of proteinuria (1+ or more)

4.3 Individual Factors associated with the risk of Preeclampsia among Expectants Mothers

Unmarried respondents had significantly higher odds of developing preeclampsia compared to their married counterparts (COR = 2.478; 95% CI: 1.736–3.971; p = 0.022), suggesting that unmarried women were more than twice as likely to experience preeclampsia. Similarly, those who reported eating more than three meals a day had greater odds of developing preeclampsia compared to those who ate once daily (COR = 1.818; 95% CI: 1.495–3.509; p = 0.008).

Table 2: Individual Factors Contribute to the risk of Preeclampsia among Expectants Mothers

Variables	Preeclampsia		COR (95% CI)	p-value
	Yes (%)	No (%)		
Current Age				
18-34-youth	50(15.7)	269(84.3)	1.0	0.509
34 and above-adults	19(18.4)	84(81.6)	0.822(0.459-1.471)	
Level of Education Attained				
No Education	12(17.9)	55(82.1)		0.969
Primary	29(18.1)	131(81.9)	0.986(0.469-2.072)	
Secondary	9(9.9)	82(90.1)	1.988(0.785-5.053)	
Tertiary	19(18.3)	85(81.7)	0.976(0.439-2.169)	
Current Marital Status				
Married	57(15.6)	309(84.4)	1.0	0.022
Unmarried	12(21.4)	44(78.6)	2.478(1.736-3.971)	
Religion Affiliation				
Christianity	51(17.6)	239(82.4)	1.0	0.310
Muslim	18(13.6)	114(86.4)	1.351(0.755-2.418)	
Type of Your Family				
Extended	29(15.0)	164(85.0)	1.0	0.500
Nuclear	40(17.5)	189(82.5)	0.836(0.496-1.408)	
Number of Family Members				
≤5 members	13(13.4)	84(86.6)	1.0	0.372
>5 members	56(17.2)	269(82.8)	0.743(0.388-1.426)	
Employment Status				
Employed	18(13.7)	113(86.3)	1.0	0.332
Unemployed	51(17.5)	240(82.5)	0.750(0.419-1.342)	
Income per Month				
≤ 219,000 shillings (Low Income / Poor)	55(17.7)	256(82.3)	1.0	0.217
>219,001 shillings	14(12.6)	97(87.4)	1.489(0.792-2.799)	
Distance from home to the health facility				
≤5 km				1.0
>5 km	61(17.9)	280(82.1)	1.0	

	8(9.9)	73(90.1)	1.988(0.911-4.340)	0.085
Number of ANC visits				
≤4 times	35(16.0)	184(84.0)	1.0	
>4 times	34(16.7)	169(83.3)	0.945(0.564-1.584)	0.831
Number of meals in a day				
Once	7(13.0)	47(87.0)	1.0	
Twice	9(18.4)	40(81.6)	0.662(0.226-1.973)	0.451
Thrice	13(10.2)	115(89.8)	1.818(1.495-3.509)	0.008
More	40(20.9)	151(79.1)	0.562(0.236-1.338)	0.193

Source: Primary Data (2025)

Maternal-related factors associated with the risk of Preeclampsia among Expectants Mothers

Respondents with multiple pregnancies had half the odds of developing preeclampsia compared to those with singleton pregnancies (COR = 0.490; 95% CI: 0.232–0.832; p = 0.006), indicating a higher risk among multiple pregnancies. Those who had a history of pregnancy complications were 1.71 times more likely to develop preeclampsia than those without such history (COR = 1.714; 95% CI: 1.253–2.257; p = 0.041). Respondents whose most recent delivery was by caesarean section were over twice as likely to develop preeclampsia compared to those who delivered spontaneously (COR = 2.352; 95% CI: 1.134–4.877; p = 0.022).

Table 3: Maternal-related Factors Contribute to the Risk of Preeclampsia among Expectants

Variables	Preeclampsia		COR (95% CI)	p-value
	Yes (%)	No (%)		
First pregnancy				
No	52(17.8)	240(82.2)	1.0	
Yes	17(13.1)	113(86.9)	1.440(0.797-2.602)	0.227
Type of pregnancy carried				
Single	58(15.2)	323(84.8)	1.0	
Multiple pregnancy	11(26.8)	30(73.2)	0.490(0.232-0.832)	0.006
Number deliveries				
≤4 deliveries	34(15.2)	189(84.8)	1.0	
>4 deliveries	35(17.6)	164(82.4)	0.843(0.503-1.412)	0.517
Pregnancies have you carried so far				
≤4 pregnancies	31(14.0)	190(86.0)	1.0	
>4 pregnancies	38(18.9)	163(81.1)	0.700(0.417-1.175)	0.177
Ever experienced pregnancy complications				
No				
Yes	54(17.0)	264(83.0)	1.0	
	15(14.4)	89(85.6)	1.714(1.253-2.257)	0.041
Most recent mode of delivery				
Normal	12(29.3)	29(70.7)	1.0	
Caesarean	57(15.0)	324(85.0)	2.352(1.134-4.877)	0.022

Source: Primary Data (2025)

Multivariable Analysis associated with the risk of Preeclampsia among Expectants Mothers

In the multivariable analysis, variables with a p-value ≤ 0.2 in the bivariate analysis were included. After adjusting for potential confounders, several factors remained significantly associated with preeclampsia ($p < 0.05$). Unmarried women were nearly twice as likely to develop preeclampsia compared to married women (AOR = 1.733; 95% CI: 1.057–2.503; $p = 0.014$). Similarly, those who consumed three meals a day had higher odds of developing preeclampsia compared to those who ate once daily (AOR = 1.719; 95% CI: 1.435–3.196; $p = 0.046$). Women with a history of pregnancy-related complications also showed increased risk (AOR = 1.448; 95% CI: 1.056–2.771; $p = 0.017$). Those whose most recent delivery was by caesarean section had more than twice the odds of developing preeclampsia compared to those with a history of normal delivery (AOR = 2.341; 95% CI: 1.098–4.988; $p = 0.028$).

Table 4: Showing the multivariate analysis of factors contribute to the risk of preeclampsia among expectants

Variables	COR (95% CI)	p-value	AOR (95% CI)	p-value
Current Marital Status				
Married	1.0		1.0	
Unmarried	2.478(1.736-3.971)	0.022	1.733(1.057-2.503)	0.014
Number of meals in a day				
Once	1.0		1.0	
Twice	0.662(0.226-1.973)	0.451	0.629(0.211-1.874)	0.405
Thrice	1.818(1.495-3.509)	0.008	1.719(1.435-3.196)	0.046
More	0.562(0.236-1.338)	0.193	0.555(0.228-1.353)	0.080
Type of pregnancy carried				
Single	1.0		1.0	
Multiple pregnancy	0.490(0.232-0.832)	0.006	0.505(0.235-1.086)	0.264
Ever experienced pregnancy complications				
No	1.0		1.0	
Yes	1.714(1.253-2.257)	0. 041	1.448(1.056-2.771)	0.017
Most recent mode of delivery				
Normal	1.0		1.0	
Caesarean	2.352(1.134-4.877)	0. 022	2.341(1.098-4.988)	0.028

Source: Primary Data (2025)

Discussions

Prevalence of Preeclampsia among Expectant Mothers

The study found a preeclampsia prevalence of 16.4% among Expectant Mothers in Imvepi Refugee Settlement, highlighting a significant health burden in this vulnerable group. Several individual and

pregnancy-related factors influenced the risk of developing preeclampsia. Unmarried women faced a higher risk, potentially due to less emotional and financial support, while those living in nuclear families had a lower risk compared to women in extended households, possibly because of reduced stress or greater autonomy in health decisions. Higher monthly income was associated with reduced risk. Interestingly, women consuming three meals per day had an increased risk, indicating that meal quality may be more important than quantity. More so, women with previous pregnancy complications and caesarean section mothers were more likely to develop preeclampsia, reflecting the complex and sometimes unpredictable nature of risk factors in refugee populations.

The study found that the prevalence of preeclampsia was 16.4% among pregnant women in Imvepi Refugee Settlement. This is probably because preeclampsia is a common hypertensive disorder of pregnancy, particularly in low-resource settings where access to quality antenatal care, early screening, and timely management is limited. This finding is consistent with studies conducted in Ethiopia and Nigeria, where the prevalence was reported to range between 10% and 18% (38, 9, 1). Similarly, research from India and Vietnam also reported comparable prevalence rates, affirming that preeclampsia remains a major public health concern in underserved populations (36, 17). Further, studies from rural China and Tanzania show that limited maternal health literacy, inadequate nutrition, and delayed health-seeking behavior contribute to the persistence of hypertensive disorders during pregnancy (24, 20). However, some studies in high-income countries such as Sweden and Canada have reported lower prevalence rates, often below 5%, likely due to stronger prenatal screening systems, better maternal nutrition, and early risk factor identification (44, 53). The difference in prevalence could be attributed to disparities in health infrastructure, socio-economic status, and availability of early diagnostic interventions. This implies that to reduce the burden of preeclampsia, particularly in refugee and other marginalized settings, health systems should prioritize access to early and routine antenatal care, community-level education on danger signs, and nutrition programs targeting pregnant women.

Individual Factors that may contribute to the Risk of Preeclampsia among Expectants

The study found that respondents who were unmarried had significantly higher odds of developing preeclampsia compared to those who were married. This is probably because married women often receive greater emotional, social, and financial support from their spouses, which helps buffer stress and facilitates timely and consistent antenatal care both of which are protective against hypertensive disorders in pregnancy. This finding is consistent with studies from Kenya and Nigeria, where social and spousal support was linked to better maternal health outcomes, including reduced incidence of preeclampsia and other complications (5, 34). Similarly, a study in Ethiopia found that unmarried pregnant women experienced higher psychosocial stress and reduced utilization of maternal health services, increasing their vulnerability to preeclampsia (27). Further, research in high-income countries such as Australia and the United States also supports the association between relationship status and pregnancy outcomes, where unmarried women were more likely to experience adverse outcomes due to lower support systems (47). However, some studies in Scandinavian countries with universal access to antenatal care services and strong welfare systems report no significant differences in preeclampsia risk between married and unmarried women. This difference in findings may be attributed to variations in healthcare access, social safety nets, and cultural expectations surrounding pregnancy and support systems. This implies that targeted support mechanisms

such as community-based maternal support groups, counseling services, and tailored antenatal care outreach are necessary to address the specific vulnerabilities of unmarried pregnant women in resource-limited settings like Uganda to mitigate the risk of preeclampsia.

The study found that respondents who had three meals per day were more likely to develop preeclampsia compared to those who ate only once daily. This is probably because the nutritional quality and composition of meals, rather than the frequency alone, play a more critical role in determining maternal health outcomes. Diets rich in calories but poor in essential nutrients can lead to maternal overweight or obesity, which is a major risk factor for preeclampsia (33, 22). Similarly, studies from Tanzania and Nigeria have shown that high-calorie, low-micronutrient diets during pregnancy are associated with increased maternal complications, including preeclampsia and gestational diabetes (3, 37). Further, (40)., demonstrated that frequent consumption of unhealthy foods can contribute to inflammation, oxidative stress, and insulin resistance pathways that are biologically linked to preeclampsia. However, some studies from high-income settings such as the United Kingdom and Sweden have reported no significant association between meal frequency and preeclampsia risk, possibly due to differences in food quality, dietary regulation, and public health nutrition programs (29, 10). The difference in findings could stem from varying levels of dietary education, food security, and access to balanced meals across settings. This implies that nutrition education for pregnant women should emphasize not only meal timing and frequency but also the quality, diversity, and nutrient density of foods consumed during pregnancy to reduce the risk of preeclampsia.

Maternal-Related Factors to Preeclampsia among Expectant Mothers

The study found that respondents who had experienced pregnancy complications had significantly higher odds of developing preeclampsia compared to those who had not. This is probably because previous complications may indicate underlying physiological vulnerabilities or chronic conditions such as hypertension or diabetes, which increase the risk of preeclampsia in subsequent pregnancies. This is consistent with studies which found that women with prior pregnancy complications are more likely to develop hypertensive disorders due to persistent endothelial dysfunction and immune maladaptation during pregnancy (2, 48). Similarly, a study in Ghana reported that women with a history of miscarriage or stillbirth had higher chances of developing preeclampsia in later pregnancies, possibly due to residual systemic inflammation or poor placental development (31).

However, studies have found different results that suggest previous pregnancy complications do not always predict preeclampsia, especially in populations with access to advanced maternal healthcare and consistent prenatal screening (18, 28). The difference could be because of variations in healthcare quality, socioeconomic status, and availability of preconception counseling services across settings. This implies that antenatal care programs should not only focus on women with known risks but also strengthen early screening and intervention strategies for all pregnant women, regardless of their obstetric history, to prevent the onset and progression of preeclampsia.

The study found that respondents whose most recent delivery was by caesarean section had significantly higher odds of experiencing preeclampsia compared to those who had normal deliveries. This is probably

because caesarean section deliveries are often associated with complications in previous pregnancies, which may indicate an underlying risk profile for hypertensive disorders such as preeclampsia. This is consistent with studies conducted in Ethiopia and India, which found that women who previously underwent caesarean sections were more likely to experience hypertensive complications in subsequent pregnancies due to uterine scarring, placental abnormalities, and altered immune responses (46, 43). Similarly, a study in Brazil observed that caesarean delivery was a predictor of recurrent obstetric complications, including preeclampsia, especially in women with short interpregnancy intervals (45).

However, studies from some high-income countries such as Sweden and the United States have found different results, indicating that caesarean delivery was not significantly associated with increased preeclampsia risk when adjusted for maternal age, BMI, and pre-existing conditions (25, 11). The difference could be because of the availability of comprehensive perinatal care, better surgical follow-up, and closer monitoring of high-risk pregnancies in those settings, which may mitigate the adverse outcomes typically associated with caesarean deliveries. This implies that in settings with limited maternal health resources, women with a history of caesarean section should be closely monitored for signs of preeclampsia during subsequent pregnancies. Tailored antenatal care protocols should be developed to ensure timely intervention and reduce maternal morbidity.

Strength and Limitation of the Study

This study provides valuable context-specific data on the prevalence and risk factors of preeclampsia among expectant mothers in Imvepi Refugee Settlement, a typically underrepresented population in maternal health research. Using primary data from mothers attending antenatal care enhances the reliability and local relevance of the findings. The inclusion of various socio-demographic and obstetric factors offers a comprehensive understanding of preeclampsia risks in low-resource, humanitarian settings.

However, the cross-sectional design limits the ability to establish causal relationships, restricting the findings to associations. The study's geographic focus on Terego District, specifically Imvepi, may limit its generalizability to other regions, especially non-refugee areas. Additionally, reliance on self-reported data may introduce recall or reporting bias. Despite these limitations, the study provides critical insights into maternal health in a high-risk, underserved population.

Conclusions

The study found that the prevalence of preeclampsia was significant as this relate to other similar studies conducted. Factors linked to an increased risk of preeclampsia included not being married, number of meals taken in a day, past complications an Expectant Mother has had before, and mode of delivery being a caesarean, and a family history of diabetes mellitus. Promoting health-seeking behavior among Expectant Mothers can help ensure early detection and timely management of preeclampsia.

Recommendations

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

To the Ministry of Health (MOH) and Health Workers:

The study recommends that, the Ministry of Health (MOH) should strengthen antenatal care by training health workers to routinely screen all pregnant women for preeclampsia risk, including those without prior complications, early detection is key to preventing severe outcomes (32).

Health facilities and districts, especially in rural and underserved areas, should intensify community outreach to raise awareness about the risks, signs, and prevention of preeclampsia.

Given the significant association between marital status and preeclampsia, targeted support for unmarried and socially disadvantaged women is critical. The MOH, in collaboration with the Ministry of Gender, Labour and Social Development, should ensure affordable or free antenatal care for low-income and unmarried women through subsidies or universal health coverage policies.

To Public Health Policy and Practice

Special attention should be given to women who have experienced pregnancy-related complications or previously delivered via caesarean section, as these were shown to be high-risk factors in this study.

Finally, maternal nutrition and psychosocial support should be integrated into national antenatal care guidelines. Addressing these gaps will improve early diagnosis, promote equitable access to care, and reduce the burden of preeclampsia across all populations.

Declarations

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Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Faculty of Health Sciences Research Ethics Committee (FRC) of the Islamic University in Uganda (IUIU). Administrative clearance was granted by the District Health Officer of Terego District and the administrations of the selected health facilities in Imvepi Refugee Settlement.

Written informed consent was obtained from all participants before data collection, either by signature or thumbprint. Participation was voluntary, and respondents were free to withdraw at any time without any consequences. Confidentiality and anonymity were maintained by not collecting personal identifiers, and all data were used strictly for academic and research purposes.

Plan for Dissemination of Findings

A duplicate of the comprehensive report was provided to the University, district health office, and office of Chief administrative officer Terego District. Aims to develop a manuscript for publication is underway for a prominent health journal with significant visibility.

Authors' Contributions

AA, DR, ZS, MK, AMB, OM: Participated in the conception and design of the study, proposal development, data collection, data analysis, interpretation of the results, and manuscript drafting and write-up. AA, DR, ZS: Conducted the formal analysis and critically reviewed and edited the manuscript. All authors read and approved the final manuscript.

Disclosure Statement

The authors declare that they have no financial or non-financial conflicts of interest related to the preparation of this manuscript.

Data Availability Statement

The data supporting the findings of this study are publicly available and can be accessed through an open-access repository at Islamic University in Uganda.

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Figures

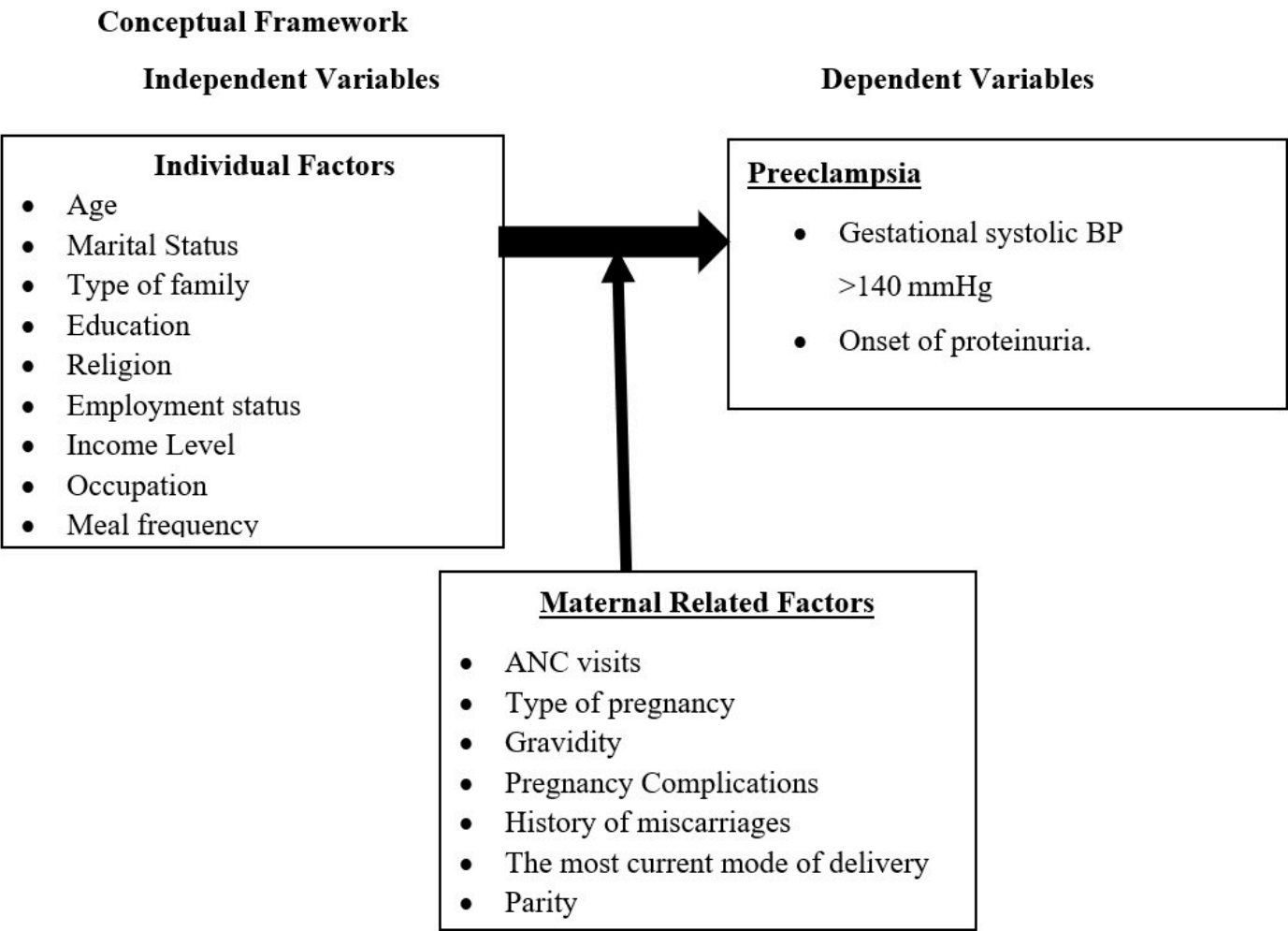


Figure 1

Conceptual Framework of the Study

Source: Primary Data (2025)

Source: adapted from Anderson's Behavioral Model of Health Services Use by Anderson Ronald of 1978 and modified by the researcher (2025).

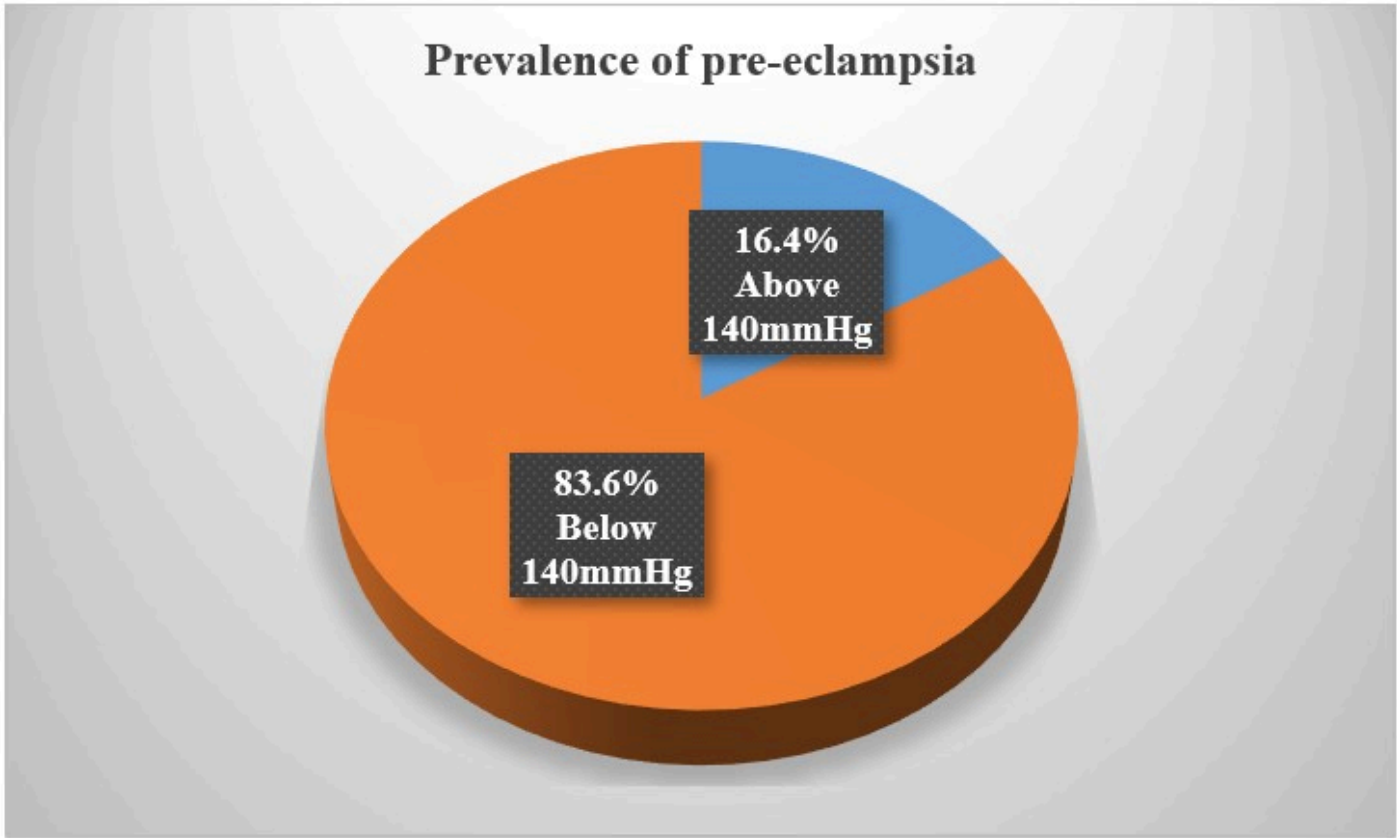


Figure 2

Showing the prevalence of pre-eclampsia (blood pressure of above 140mmHg)

Source: Primary Data (2025)

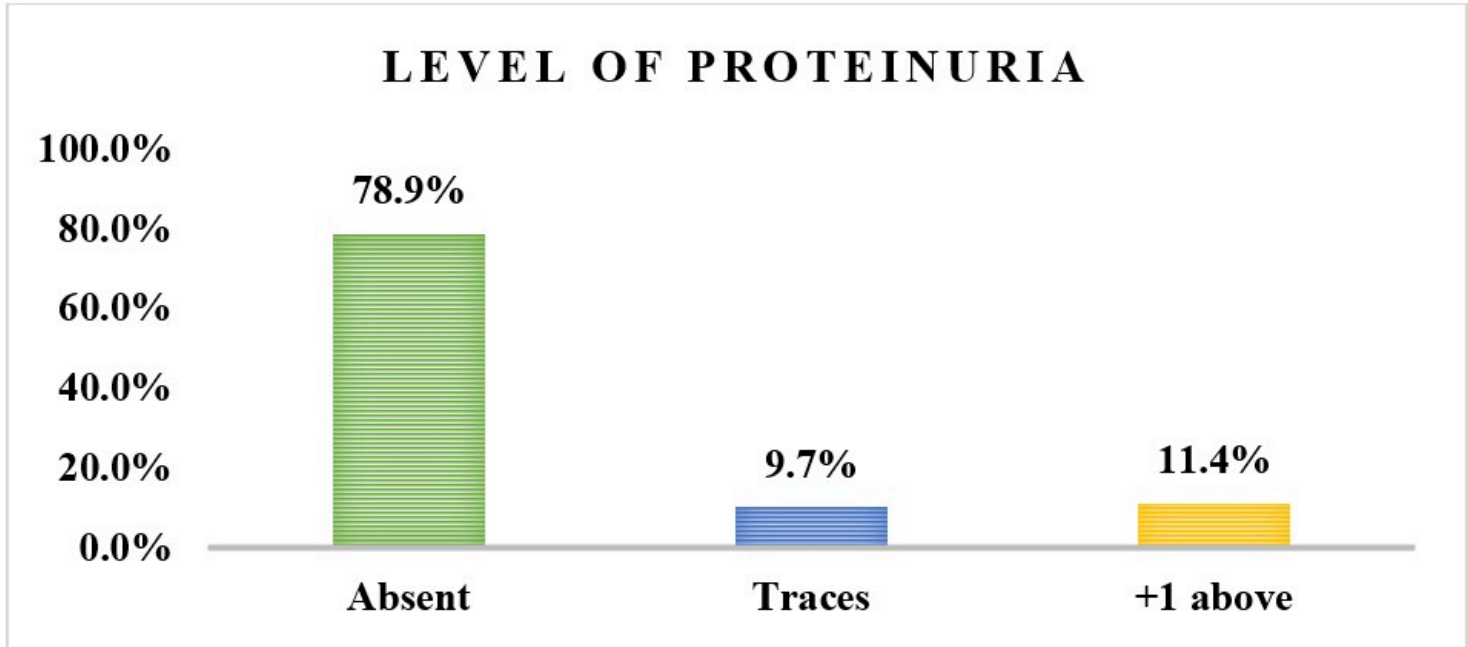


Figure 3

Showing the level of proteinuria

Source: Primary Data (2025)