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Maternal outcomes of pre-eclampsia with severe features and its determinants at Abebech Gobena Mothers and Childrens Health and Saint Peter's Specialized Hospital, Addis Ababa, Ethiopia: a cross-sectional study

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ABSTRACT

Objective The main objective of this study was to determine the prevalence and factors associated with unfavourable maternal outcomes among pregnant women with pre-eclampsia with severity features (PEWSF) at Abebech Gobena Maternal and Children's Health and St. Peter's Hospital, Addis Ababa, Ethiopia, 2023.

Design A hospital-based cross-sectional study was conducted from 1 January 2023 to July 2023. The data was collected using a structured and pre-tested questionnaire through face-to-face interviews and a review clinical chart. Data was entered using EpiData V.4.6 and analysed using SPSS V.26.0 statistical software. Binary logistic regression analysis was run to identify predictors of maternal outcome.

Setting Two hospitals in Addis Ababa, Ethiopia.

Participants 348 pregnant women with PEWSF were included.

Outcome measures Unfavourable maternal outcome was defined as mothers with PEWSF that develop at least one complication, that is, eclampsia, abruption placenta, Haemolysis, Elevated Liver Enzymes and Low Platelet Count (HELLP) syndrome, acute renal failure, disseminated intravascular coagulation, cardiac failure, stroke, postpartum haemorrhage, pulmonary oedema and death.

Results The overall prevalence of unfavourable maternal outcomes was 33.9% (N=118) (95% CI=28.7 to 38.8). Abruptio placenta (17.2%), HELLP syndrome (15.5%) and postpartum haemorrhage (13.8%) were common complications that occurred among mothers with PEWSF. Age above 35 years (adjusted OR (AOR) (95% CI)=2.70 (1.31 to 5.59)), rural residence (AOR (95% CI)=1.94 (1.07 to 3.53)), unemployment (AOR (95% CI)=0.35 (0.20 to 0.62)), severe blood pressure on admission (AOR (95% CI)=2.32 (1.03 to 5.19)) and complain of severe headache (AOR (95% CI)=1.91 (1.16 to 3.16)) were significant associates of unfavourable maternal outcomes.

Conclusions The prevalence of unfavourable maternal outcomes was high compared with other studies in Ethiopia. Maternal age, residence, occupation, blood pressure on admission and severe headache have shown a statistically significant association with unfavourable maternal outcomes. Socioeconomic development and early identification of severe signs and symptoms of pre-eclampsia are needed to reduce unfavourable outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Interviews and clinical chart reviews were conducted to collect data.
⇒ One drawback was that, because the research was conducted in a hospital setting, the maternal outcome of home births was not assessed.
⇒ Another limitation was that the study did not include unfavourable maternal outcomes after 24 hours of birth.

BACKGROUND

Pre-eclampsia is a multisystem progressive illness distinguished by the new development of hypertension and either proteinuria or end-organ failure after 20 weeks of gestation, during pregnancy, labour or post partum.[1] A combination of maternal and fetal/placental factors is most likely the reason. Relative placental hypoxia, ischaemia or under-perfusion can be brought on by abnormalities in the placental vasculature early in pregnancy.[2] This may then cause the mother's circulation to release antiangiogenic factors, altering the mother's systemic endothelium's function and causing hypertension in addition to other disease manifestations (haematological, neurological, cardiac, pulmonary, renal and hepatic dysfunction). However, the

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reason behind abnormal placental development and the subsequent sequence of events is still unknown.[3]

Pre-eclampsia complicates between 3% and 5% of pregnancies in high-income countries.[4] In Africa, hypertension disorders during pregnancy affect 10% of pregnancies.[5] A Zanzibar study found that pre-eclampsia with severe features (PEWSF) was prevalent in 26.3% of mothers.[6] Besides, 19.5% of PEWSF was reported in a prospective observational study done at Saint Paul's Hospital Millennium Medical College in Ethiopia.[7]

In the USA, unfavourable maternal outcomes occurred in 10% of women with PEWSF.[8] According to a prospective cohort study in the Sidama region of Ethiopia, women with PEWSF had a 43% higher risk of unfavourable maternal outcomes.[9] Similarly, it was shown that 37.7% of mothers with severe pre-eclampsia/eclampsia in referral hospitals in the Amhara region had unfavourable maternal outcomes.[10] Further, in Addis Ababa, Ethiopia, 36% of mothers with PEWSF reported having at least one maternal complication.[11]

Due to the progressive nature of the disease and the lack of known medical management, delivery is always the definitive treatment, however, there is debate on the best time to deliver for both preterm and term gestations. Extending pregnancy carries a risk of exacerbating endothelial dysfunction in the mother and perpetuating inadequate perfusion of target organs, potentially leading to serious damage to the brain, liver, kidneys, placenta/fetus, haematological and vascular systems.[1] Thus, there is an increased chance of induction failure and subsequent caesarean birth in pre-eclamptic women.[12] Other potential maternal sequelae include seizure, pulmonary oedema, cerebral haemorrhage, renal detachment or cortical blindness, stroke, hepatic failure, heart failure, renal failure, postpartum haemorrhage, disseminated intravascular coagulation, placental abruption and death.[1 13] There was also a reported lifetime risk of hypertension.[14] Furthermore, research published in the Lancet Regional Health revealed that pregnant women with hypertensive disorders have an increased risk of developing asthma and chronic obstructive pulmonary diseases.[15]

Moreover, pre-eclampsia and eclampsia made a substantial contribution to maternal deaths and severe morbidity.[4 16] 10% to 15% of all maternal deaths worldwide are attributed to pre-eclampsia and eclampsia.[11] In Ethiopia, the five primary direct causes of maternal death were haemorrhage, obstructed labour, pre-eclampsia/eclampsia, unsafe abortion and sepsis, accounting for 85% of maternal deaths. Pre-eclampsia/eclampsia makes up 11% of these five major causes of maternal mortality.[17]

A cross-sectional study in the Amhara region Referral Hospitals, Ethiopia, reported a significant association between residence, level of education, monthly income, parity, history of abortion, booking status, time of drug given and unfavourable maternal outcome.[10] Women admitted at <34 weeks, age 16–24 years, lower wealth quintiles and rural residence had also a positive association with unfavourable maternal outcomes.[9] Further, gestational age at admission,[18] onset of the disease and low haemoglobin level[19] were predictors of maternal complication.

Pre-eclampsia causes significant financial losses that affect not just the individual but also the next generation because of the expense of prescription drugs, medical treatment, lost productivity and hindered daily activities. According to a US study, pre-eclampsia during the first 12 months of life is expected to cost US$2.18 billion (US$1.03 billion for moms and US$1.15 billion for infants). The cost burden per infant varies with gestational age, starting at US$150 000 at 26 weeks and going up to US$1311 at 36 weeks.[20]

Limited studies to date have been done to address the unfavourable maternal outcomes among pregnant women with PEWSF in developing countries including Ethiopia. The findings could have its own contribution to the local Ethiopian Health Sector Transformation Plan-II targeted to lower maternal mortality ratio from 401 to 140 per 100 000 live births[21] and global Sustainable Development Goal target plans of less than 70 per 100 000 live births by 2030.[22] Hence, the study aimed to determine the prevalence and associated factors of unfavourable maternal outcomes among pregnant women with PEWSF in Ethiopia.

Research questions

1. What is the magnitude of unfavourable maternal outcomes among pregnant women admitted with PEWSF?
2. What are the factors associated with unfavourable maternal outcomes?

METHODS

Study design, period and area

This cross-sectional study was conducted at Abebech Gobena Mothers and Childrens Health (MCH) and St. Peter's Specialized Hospital from 1 January 2023 to 30 July 2023, in Addis Ababa, the capital city of Ethiopia. Abebech Gobena MCH Hospital is one of the tertiary referral hospitals directly under the Addis Ababa Health Bureau. Yekatit 12 Hospital Medical College uses it as a teaching hospital as well. The hospital gives service to more than 200 000 patients annually who were referred by about 18 catchment health centres in the Oromia regional state and Addis Ababa city, as well as one primary hospital. Whereas, St. Peter's Specialized Hospital is a government facility that served as the nation's first tuberculosis referral hospital. The hospital was founded in 1953. Currently providing care for over 100 000 people as a specialised hospital under the supervision of the Federal Ministry of Health. The MCH centre was established in 2006 Ethiopian Calendar and serves 15 catchment health centres and three primary hospitals from the Oromia region and Addis Ababa city.

Population and eligibility criteria

All pregnant mothers who were admitted with a diagnosis of PEWSF in the study area were the source population.

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Participants were randomly selected from this source population. All pregnant mothers who were diagnosed, admitted and managed for PEWSF were included. Pregnant mothers who were diagnosed with pre-eclampsia but not with severe features and who were not giving birth at the study hospitals with unknown maternal outcomes were excluded.

Sample size and sampling technique

The sample size was determined using OpenEpi V.3.03 statistical software with the assumption of 36% prevalence of unfavourable maternal outcomes in Addis Ababa, Ethiopia,[23] 95% CI, 5% marginal error and 5% non-response rate. Considering, that the final sample size was 372. A total population sampling method was used to select the eligible study participants.

Variables

Maternal outcome was the dependent variable. Independent variables included socio-demographic factors (age, residence, marital status, occupation, educational level and mode of admission), medical and reproductive history (gravidity, parity, history of abortion, antenatal care (ANC); history of gestational hypertension, family history of hypertension, anaemia, chronic hypertension, diabetes and renal disease); clinical features and investigations on admission (headache, dizziness, epigastric pain, visual disturbance, nausea and/or vomiting, convulsion, oedema, haematocrit, liver function test, urea, creatinine, urine protein); and obstetrical factors (onset of labour, mode of delivery, sex of the neonate and duration of hospitalisation).

Outcome measures

Pre-eclampsia with severe features

Is a pre-eclampsia with one of the severity features; including altered mental status, severe headache, altered cerebral or visual disturbance, hepatic abnormality, renal abnormality, severe blood pressure (≥160/110), thrombocytopenia (platelet count <100×10^9/L) and pulmonary oedema.[1 4]

Blood pressure at admission

Severe hypertension if blood pressure measurement was ≥160/110 and mild hypertension if 140-159/90-109.[4 11]

Severe headache

Incapacitating, 'the worst headache I have ever had' or headache that persists and progresses despite analgesic therapy.[1]

Hepatic abnormality

Severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by an alternative diagnosis or serum transaminase concentration ≥2 times the upper limit of the normal range, or both.[1]

Renal abnormality

Progressive renal insufficiency (serum creatinine >1.1 mg/dL (97.2 µmol/L) or a doubling of the serum creatinine concentration in the absence of other renal disease).[1]

Unfavourable maternal outcome

Mothers with PEWSF that develop at least one complication, that is, eclampsia, abruption placenta, haemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome, acute renal failure, disseminated intravascular coagulation, cardiac failure, stroke, postpartum haemorrhage, pulmonary oedema and death.[9 10]

Favourable maternal outcome

Mothers with PEWSF managed and improved without complications.[10]

Data collection tool, procedure, quality control

The data was collected using a well-constructed case record form and procedure. The questionnaire was adapted from similar studies.[7–10 13] The data collection team consisted of two supervisors and four data collectors. The principal investigators gave the supervisors and data collectors a 1-day training on the objectives, methods, procedures and data collection instrument. The questionnaire was translated back and forth from English to Amharic and vice versa to make sure the questions remained true to their original intent. Prior to the real data collection, a pre-test was done on 5% of the samples (19 mothers) at Debre Berhan Comprehensive Specialized Hospital and the necessary adjustments were taken into account in light of the test results. Over the course of the data collection process, the principal investigators and supervisors closely observed the clarity, consistency and completeness of the data.

Patient and public involvement

There was no patient and/or public involvement in the design and planning of this study.

Data management and analysis

Data was entered using EpiData V.4.6 and analysed using SPSS V.26.0 statistical software. The principal investigator randomly selected a questionnaire for quality control and cross-checked it with the correspondingly entered data and clinical chart. We employed descriptive statistics to describe the independent and dependent variables. The results were presented as number, frequency, percentage and comparison of maternal outcomes. Binary logistic regression analysis was run to identify independent predictors of unfavourable maternal outcomes. Variables with a p value of <0.25 in the bivariable regression analysis were included in the final multivariable logistic regression analysis model. Hosmer and Lemeshow's goodness-of-fit test was employed to evaluate the fitness of the model. The multicollinearity of the explanatory components was also investigated. With a two-sided 95% CI, adjusted ORs (AORs) were used to interpret the strength of the

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Table 1 Socio-demographic characteristics of participants admitted with PEWSF at Abebech Gobena Mothers and Childrens Health and St. Peter's Specialized Hospital, Ethiopia, 2023

Variables	Category	Frequency	Per cent (%)
Age in years	20–34	294	84.5
	<20	13	3.7
	≥35	41	11.8
Residence	Urban	272	78.2
	Rural	76	21.8
Level of education	No formal education	45	12.9
	Primary	97	27.9
	Secondary	134	38.5
	Higher education	72	20.7
Marital status	Married	324	93.1
	Others*	24	6.9
Occupation	Employed	204	58.6
	Unemployed	144	41.4
Mode of admission	Self	52	14.9
	Referral	296	85.1

*Single, divorced and widowed.
PEWSF, pre-eclampsia with severe features.

Table 2 Medical and obstetrical history of mothers admitted with pre-eclampsia with severe features at Abebech Gobena Mothers and Childrens Health and St. Peter's Specialized Hospital, Ethiopia, 2023

Variables	Category	Frequency	Per cent (%)
Gravidity	Primigravida	179	51.4
	Multigravida	162	46.6
	Grand multipara	7	2.0
Parity	Nulliparous	12	3.4
	1–3	322	92.5
	≥4	14	4.0
History of abortion	Null	279	80.2
	1	61	17.5
	≥2	8	2.3
Antenatal care (ANC) contact	Yes	342	98.3
	No	6	1.7
Number of ANC contact	1–3	74	21.3
	4–6	252	72.4
	≥7–8	22	6.3
Number of fetuses	Singleton	326	93.7
	Twin/multiple	22	6.3
History of gestational hypertension	Yes	34	9.8
	No	314	90.2
Family history of gestational hypertension	Yes	70	20.1
	No	278	79.9
Medical history	Yes	27	7.8
	No	321	92.2
Anaemia	Yes	8	2.3
	No	340	97.7
Chronic hypertension	Yes	12	3.4
	No	336	96.6
Diabetes mellitus	Yes	5	1.4
	No	343	98.6
Renal disease	Yes	2	0.6
	No	346	99.4

association. A p value of <0.05 was used to declare the level of significance.

RESULTS

Socio-demographic characteristics of participants

A total of 348 mothers participated, giving the survey a 93.5% response rate. The age range of the participants was 18–42 years old, with a mean (SD) of 27.55±5.18 years. Of these, 272 (78.2%) lived in urban, making up more than three-fourths. Furthermore, table 1 shows that 324 (93.1%) of the participants were married, and 134 (38.5%) had completed secondary school.

Medical and obstetrical history

More than half, 179 (51.4%) of mothers, were primigravida and 69 (19.8%) had previously experienced an abortion. Nearly all, 342 (98.3%), of the participants had ANC contact for the current pregnancy. However, only 22 (6.3%) of them had adequate ANC contact. Furthermore, 34 (9.8%) of mothers had a history of gestational hypertension. 27 (7.8%) of participants had a medical history. Of them, chronic hypertension and anaemia were reported in 12 (3.4%) and 8 (2.3%) of cases, respectively (table 2).

Clinical features and investigations on admission

In this study, 180 (51.7%), 119 (34.2%) and 87 (25.0%) of mothers were admitted with a chief issue of headache, epigastric pain and oedema, respectively. Whereas, on an investigation, 38 (10.9%) of the women had deranged liver function tests and 53 (15.2%) had protein 3+on admission. In addition, 196 (56.3%) of mothers had induction of labour and 213 (61.2%) of them spent more than 3 days in the hospital (table 3).

Maternal outcomes

Overall, 33.9% (N=118) (95% CI=28.7 to 38.8) of mothers had unfavourable maternal outcomes. Abruptio placenta (17.2%), HELLP syndrome (15.5%) and postpartum haemorrhage (13.8%) were the most prevalent complications that occurred among mothers admitted with a diagnosis of PEWSF (figure 1).

Factor of unfavourable outcomes

Variables having a p value of <0.25 in the bivariable analysis were chosen for the multivariable logistic regression analysis model. A crude OR is an OR of univariable

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Table 3 Clinical features of participants admitted with pre-eclampsia with severe features at Abebech Gobena Mothers and Childrens Health and St. Peter's Specialized Hospital, Ethiopia, 2023

Variables	Category	Frequency	Per cent (%)
Headache	Yes	180	51.7
	No	168	48.3
Dizziness	Yes	45	12.9
	No	303	87.1
Epigastric pain	Yes	119	34.2
	No	229	65.8
Visual disturbance	Yes	59	17.0
	No	289	83.0
Nausea and/or vomiting	Yes	15	4.3
	No	333	95.7
Convulsion	Yes	33	9.5
	No	315	90.5
Oedema	Yes	87	25.0
	No	261	75.0
Grade of oedema (n=87)	Grade 1	46	52.9
	Grade 2	38	43.7
	Grade 3	3	3.4
Blood pressure at admission	Severe range	297	85.3
	Mild range	51	14.7
Haematocrit	<33%	39	11.2
	≥33%	309	88.8
Liver function test	Normal	310	89.1
	Deranged	38	10.9
Urea	Normal	322	92.5
	Deranged	26	7.5
Creatinine	Normal	319	91.7
	Deranged	29	8.3
Urine protein (dipstick)	Negative	105	30.2
	1+	50	14.4
	2+	140	40.2
	3+	53	15.2
Onset of labour	Spontaneous	104	29.9
	Induction	244	70.1
Mode of delivery	Spontaneous vaginal delivery	186	53.4
	Instrumental	14	4.0
	Caesarean section	148	42.5
Sex of the neonate	Male	186	53.4
	Female	162	46.6
Duration of hospital stay	≤3 days	135	38.8
	≥4 days	213	61.2

analysis; one independent variable for predicting the dependent variable. Accordingly, age, residence, level of education, occupation, number of fetuses, sex of neonate, blood pressure on admission and headache issue were selected. In the final model, age, residence, occupation, blood pressure on admission and issues of headache were found to be statistically significantly associated with unfavourable maternal outcomes.

Mothers aged above 35 had approximately threefold increased risk of developing unfavourable outcomes compared with those aged between 20 and 34 (AOR (95% CI)=2.70 (1.31 to 5.59)). Rural residents had a 94% higher chance of experiencing unfavourable outcomes compared with their urban counterparts (AOR (95% CI)=1.94 (1.07 to 3.53)). Unemployed mothers bore a 65% lower risk of unfavourable outcomes in comparison to those who were employed (AOR (95% CI)=0.35 (0.20 to 0.62)). Severe blood pressure measurement on admission increased the risk of unfavourable outcomes by twofold (AOR (95% CI)=2.32 (1.03 to 5.19)). Furthermore, women who were admitted with a headache as their chief issue had a 91% higher likelihood of having unfavourable outcomes (AOR (95% CI)=1.91 (1.16 to 3.16)) (table 4).

DISCUSSION

In this study, the overall prevalence of unfavourable maternal outcomes was 33.9% (95% CI: 28.7% to 38.8%). Age, residence, occupation, blood pressure on admission and headache issues have shown a statistically significant association with unfavourable outcomes among women of PEWSF admitted at Abebech Gobena MCH and St. Peter's Specialized Hospital, Addis Ababa, Ethiopia.

Unfavourable maternal outcomes occurred in 33.9% of mothers with PEWSF. This is comparable with the study findings from Amhara region referral hospitals, where 37.7% of mothers with PEWSF developed unfavourable outcomes.[10] However, it was higher than 10% in the USA.[8] This discrepancy could be the result of variations in the study population, time, set-up, sample size and quality and standard of care provided by contemporary, well-equipped maternity hospitals, as well as good prenatal and obstetrical care. On the other hand, it was lower than 43% in the Sidama region of Ethiopia.[9] Variations in the incidence proportion of unfavourable outcomes between the studies might be attributed to the severity of the disease, differences in clinical features (severity signs and symptoms) on admission and gestational age at diagnosis.

Abruptio placenta (17.2%), HELLP syndrome (15.5%) and postpartum haemorrhage (13.8%) were the most prevalent complications. Similarly, in Thailand, postpartum haemorrhage, placental abruption and heart failure occurred in 9.4%, 1.4% and 0.4% of women with PEWSF, respectively.[13] Further, in the Sidama region, Ethiopia, a higher level of antepartum and postpartum haemorrhage was observed in the mothers of PEWSF.[9]

It was discovered that older mothers were linked to a higher likelihood of unfavourable outcomes. Mothers over 35 were almost three times more likely to experience an adverse outcome. In a similar vein, poor maternal outcome was more common in Indonesia among mothers with pre-eclampsia who were older than 35.[24] Because of increased endothelial injuries that lower

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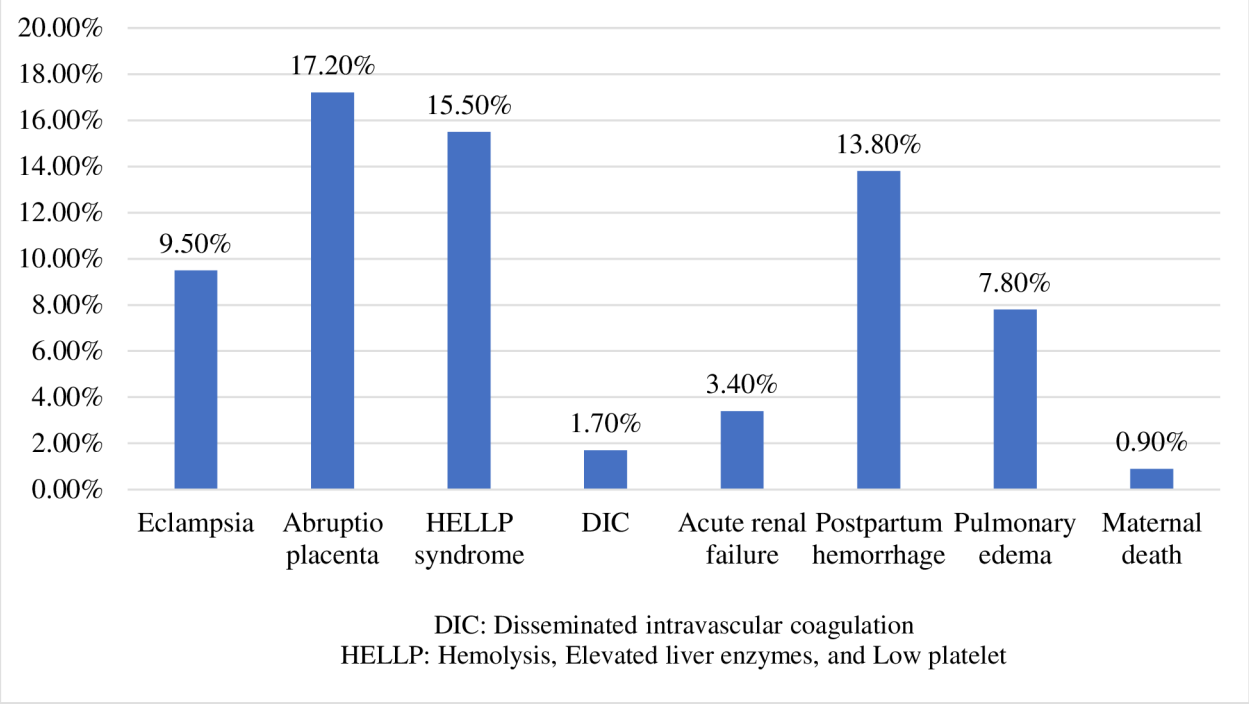


Figure 1 Outcomes of pregnant women admitted with pre-eclampsia with severe features at Abebech Gobena Mothers and Childrens Health and St. Peter's Specialized Hospital, Ethiopia, 2023.

renal reserves and the incapacity to adapt to physiological changes during pregnancy, older people may be more susceptible to developing renal insufficiency even if their pre-gestational kidney functions are normal.[25] It might also be connected to the extravascular space's increased fluid accumulation during pregnancy. Additionally, older people are more likely to have additional risk factors that increase their likelihood of developing pre-eclampsia, such as diabetes mellitus, obesity and chronic hypertension.[1]

The odds of unfavourable maternal outcomes were 94% higher among rural residents than their urban counterparts. Similarly, in Ethiopia's Sidama region, women who lived in rural regions were more likely to experience unfavourable maternal outcomes.[9] This could be because women in rural areas may have had a lower socioeconomic level, which may have resulted in a lesser tendency to seek medical attention. Pregnant women with low health-seeking behaviour are less likely to visit ANC clinics, which delays the diagnosis and treatment of pre-eclampsia. In addition, rural women faced significant challenges in getting to health facilities due to transportation issues, which caused delays in receiving medical care. It is improbable that they are aware of the risks and complications associated with pregnancy, labour and delivery. In addition, the cultural practices prevalent in rural areas greatly impact women's nutritional status by preventing them from consuming necessary foods and/or beverages.[26]

Unemployed mothers had less risk of unfavourable outcomes compared with those employed. In the Netherlands, when employed women worked longer hours (≥40 hours/week), the mean birth weight of kids decreased by 45 g.[27] Similarly, in South Korea,[28] higher risks of early abortive outcomes and stillbirths were more frequent in employed women. The possible explanation might be that unemployed mothers are more likely to have adequate time to care for themselves and listen to updated information regarding gestational hypertension via TV, radio or others. This might help them to have a lower risk of unfavourable outcomes.

A severe blood pressure measurement on admission doubled the likelihood of unfavourable maternal outcomes. Severe blood pressure was also revealed to be a significant predictor of an adverse outcome (eclampsia) among pre-eclamptic mothers in Morocco.[29] Hypertension is one of the hallmarks of pre-eclampsia and severe hypertension, defined as a blood pressure of more than 160/110 mm Hg, has been considered a warning indicator of the development of negative outcomes, such as eclampsia.[4] Thus, severe blood pressure is a symptom of a severe condition, rapid disease progression and a terrible prognosis.

Furthermore, women who were admitted with a chief issue of headache had a 91% increased risk of unfavourable outcomes. In a retrospective chart review of pre-eclamptic patients treated at Ayder Comprehensive Specialized Hospital, Ethiopia, headache and blurring were associated with poor maternal outcomes.[30] It has been noted that neurological symptoms indicate an impending negative consequence.[2]

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Table 4 Factors associated with unfavourable maternal outcome among mothers admitted with pre-eclampsia with severe features at Abebech Gobena Mothers and Childrens Health and St. Peter's Specialized Hospital, Ethiopia, 2023

Variables	Maternal outcomes		COR (95% CI)	AOR (95% CI)
	Favourable	Unfavourable		
Age in years	202 (87.8%)	92 (78.0%)	1	1
20–34	8 (3.5%)	5 (4.2%)	1.37 (0.44 to 4.31)	1.33 (0.39 to 4.52)
<20	20 (8.7%)	21 (17.8%)	2.31 (1.19 to 4.46)	2.70 (1.31 to 5.59)*
≥35				
Residence	188 (81.7%)	84 (71.2%)	1	1
Urban	42 (18.3%)	34 (28.8%)	1.81 (1.08 to 3.05)	1.94 (1.07 to 3.53)*
Rural				
Level of education	23 (10.0%)	22 (18.6%)	1.80 (0.84 to 3.84)	2.15 (0.89 to 5.17)
No formal education	62 (27.0%)	35 (29.7%)	1.06 (0.56 to 2.01)	1.73 (0.82 to 3.67)
Primary	98 (42.6%)	36 (30.5%)	0.69 (0.37 to 1.28)	1.00 (0.51 to 1.98)
Secondary	47 (20.4%)	25 (21.2%)	1	1
Higher education				
Occupation	123 (53.5%)	81 (68.6%)	1	1
Employed	107 (46.5%)	37 (31.4%)	0.53 (0.33 to 0.84)	0.35 (0.20 to 0.62)*
Unemployed				
Number of fetuses	220 (95.7%)	106 (89.8%)	1	1
Singleton	10 (4.3%)	12 (10.2%)	2.49 (1.04 to 5.95)	2.04 (0.79 to 5.24)
Twin/multiple				
Sex of the neonate	116 (50.4%)	70 (59.3%)	1.43 (0.92 to 2.25)	1.43 (0.88 to 2.33)
Male	114 (49.6%)	48 (40.7%)	1	1
Female				
Blood pressure on admission	188 (81.7%)	109 (92.4%)	2.71 (1.27 to 5.77)	2.32 (1.03 to 5.19)*
Severe range	42 (18.3%)	9 (7.6%)	1	1
Mild range				
Headache issue	106 (46.1%)	74 (62.7%)	1.97 (1.25 to 3.10)	1.91 (1.16 to 3.16)*
Yes	124 (53.9%)	44 (37.3%)	1	1
No				

P value≤0.25.
*Statistically significant at p value<0.05
AOR, adjusted OR; COR, crude OR.

Conclusion and recommendations

In this study, the prevalence of unfavourable maternal outcomes was high compared with other studies in Ethiopia. Maternal age, residence, occupation, blood pressure on admission and severe headache have shown a statistically significant association with unfavourable maternal outcomes. Socioeconomic development and early identification and treatment of severe signs and symptoms of pre-eclampsia are needed to reduce unfavourable outcomes. Prenatal screening and specialised care for women who are at high risk, such as older mothers, are also recommended. Further, longitudinal studies are recommended to investigate the outcome of mothers with PEWSF.

Limitations

It shares the limitation of a cross-sectional study to draw a causal relationship. Since this study was conducted in referral hospitals, we are unable to ascertain whether these women delayed visiting the primary health facilities or whether there were delays in referring them. In addition, as this was done in the hospital setting, the maternal outcome of women delivered at home was not assessed. Further, this study does not include adverse maternal outcomes after 24 hours of birth.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. All relevant data sets are incorporated in the article and supplementary files.

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