

Prevalence and risk factors of postpartum depression among postnatal mothers with hypertensive disorders of pregnancy in a developing country

Women's Health

Volume 21: 1–11

© The Author(s) 2025

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/17455057251338938

journals.sagepub.com/home/whe



Wina Ivy Ofori Boadu¹ , Enoch Odame Anto^{1,2} , Edmund Mintah Wiafe¹,
Michael Nyantakyi¹ , Joseph Frimpong¹, Emmanuel Ekow Korsah¹,
Ezekiel Ansah¹, Afia Agyapomaa Kwayie¹, Elizabeth Aboagye¹,
Christian Obirikorang³ , Emmanuel Timmy Donkoh⁴
and Kwame Ofori Boadu⁵

Abstract

Background: Postpartum depression is a public health issue affecting both maternal well-being and child development. While it is the most common mental health disorder following childbirth, data on its prevalence and associated risk factors in developing countries, including Ghana, remains limited.

Objectives: This study determined the prevalence of postpartum depression and identified its associated risk factors among pregnant women who developed hypertensive disorders of pregnancy at the Adabraka Polyclinic in the Greater Accra Region of Ghana.

Design: This study was a hospital-based cross-sectional study.

Methods: This hospital-based cross-sectional study was conducted on 159 postnatal mothers who delivered between March 31, 2023 and May 31, 2023 at the Adabraka Polyclinic in the Greater Accra Region of Ghana. Participants were selected using purposive sampling. The data collection instrument were developed to gather information on sociodemographic, psychosocial, obstetric, and newborn characteristics. The Edinburgh Postnatal Depression Scale was used to investigate depressive symptoms in the mothers. Mothers with Edinburgh Postnatal Depression Scale scores above 12 or 13 were considered likely to be experiencing depression.

Results: Out of the 159 women followed to term, 74 were diagnosed with postpartum depression (Edinburgh Postnatal Depression Scale scores above 12 or 13), indicating a prevalence rate of 46.5%. The majority of these women were aged between 25 and 30 years (46.5%), engaged in informal occupations (52.2%), had multiple children (71.1%), pregnancies (69.2%), and normal blood pressure levels (62.3%). After adjusting for potential confounders in a multivariate logistic model, several factors were found to be independently associated with postpartum depression: informal occupation (adjusted odd ratio = 0.12, 95% confidence interval (0.02–0.62), $p = 0.012$), Ga ethnicity (adjusted odd ratio = 5.27, 95% confidence interval (1.25–22.11), $p = 0.023$), sub-optimal financial support from partner (adjusted odd ratio = 27.54, 95% confidence interval (4.63–164.00), $p < 0.001$), and experience of cesarean section (adjusted odd ratio = 22.10, 95% confidence interval (3.90–125.08), $p < 0.001$).

¹Department of Medical Diagnostics, Faculty of Allied Health Sciences, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

²School of Medical and Health Sciences, Edith Cowan University, Perth, WA, Australia

³Department of Molecular Medicine, School of Medicine and Dentistry, College of Health Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

⁴Department of Medical Laboratory Science, Center for Research in Applied Biology, University of Energy and Natural Resources, Sunyani, Ghana

⁵Department of Obstetrics and Gynaecology, Kumasi South Hospital, Kumasi, Ghana

Corresponding author:

Wina Ivy Ofori Boadu, Department of Medical Diagnostics, Faculty of Allied Health Sciences, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
Email: iboadu@yahoo.com



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

Conclusion: Pregnant women with hypertensive disorders may face a heightened risk of experiencing postpartum depression. Timely recognition and intervention are vital for enhancing the health and welfare of both mothers and their children.

Keywords

postpartum depression, pregnant women, hypertensive disorders

Received: 15 September 2024; revised: 26 March 2025; accepted: 14 April 2025

Introduction

Hypertensive disorders of pregnancy (HDP), including preeclampsia and chronic hypertension, are significant global causes of maternal and fetal morbidity and mortality.¹ Each year, HDP collectively result in ~30,000 maternal deaths and 500,000 perinatal deaths globally, making them the primary cause of maternal and neonatal morbidity and mortality worldwide.² HDP affect 3%–10% of pregnancies globally.³ Recent estimates show that maternal causes are the leading global cause of death among women aged 15–49, with sub-Saharan Africa bearing the brunt of these fatalities.⁴ Globally, 260 women die from every 100,000 live births, with sub-Saharan Africa accounting for the majority of these deaths.⁵ Despite efforts made worldwide to improve maternal health, maternal mortality remains a serious public health issue, particularly in low-income nations such as Ghana⁴ where it occurs three to four times more frequently than in high-income countries.⁶ HDP include preeclampsia, gestational hypertension, chronic hypertension, and preeclampsia superimposed on chronic hypertension.⁷

The severity of HDP, in combination with other perinatal factors like prematurity, newborn hospitalization in the neonatal intensive care unit, and fetal death, may also increase the risk of mothers developing postpartum depression (PPD) or anxiety.⁸ Due to the stress and challenges associated with HDP, mothers are more prone to developing PPD, which in turn may worsen the negative health consequences of these disorders. This combined burden can lead to adverse effects on the postnatal mother, such as difficulties with mother–infant bonding, breastfeeding challenges, and a decline in the mother's overall well-being.^{8–10} PPD is the most frequent psychological ailment following childbirth and can be detrimental to the social and cognitive development of mothers, partners, newborns, and children, particularly in areas like emotional regulation, communication skills, and parent–child bonding.¹¹ The incidence of PPD varies across and within countries, with rates being highest in regions with greater income disparity, maternal mortality, or infant mortality.¹²

Although the precise causes of PPD are unknown, it likely results from a complex interaction of physical, emotional, genetic, and social factors, such as lack of social support or financial strain.¹³ This limited understanding of the link between HDP and PPD makes it challenging to develop effective treatments.¹² PPD typically begins within 1–4 weeks

after delivery.¹⁴ While the core symptoms of sadness, hopelessness, and fatigue are common to both PPD and other forms of depression,¹⁵ some research suggests that PPD can also manifest through experiences unique to childbirth and motherhood, such as anxieties about infant care or difficulty bonding with the baby.¹⁶ Untreated PPD can have significant long-term consequences, potentially leading to chronic or recurring depression in mothers, and negatively impacting children's cognitive, emotional, and social development.^{17,18} Despite the lack of definitive knowledge regarding the link between HDP and PPD,¹⁹ research suggests that women diagnosed with HDP might experience PPD more frequently than those without HDP.¹⁹ Understanding the prevalence and associated risk factors of depression symptoms following HDP is crucial for improving postpartum care for women at risk. Therefore, this study aimed to determine the prevalence and associated risk factors of PPD among pregnant women who developed HDP.

Materials and methods

Study design and setting

This study employed a cross-sectional design to estimate the prevalence and factors associated with PPD among postnatal mothers who developed hypertensive disorders during gestation at the Adabraka Polyclinic, Accra-Adabraka between March 31, 2023 and May 31, 2023.

Survey instruments

Data collection involved face-to-face interviews using a structured questionnaire with pregnant women who developed hypertensive disorders during gestation. The questionnaire covered demographics, psychosocial characteristics,²⁰ pregnancy-related and newborn characteristics,⁸ and measures based on the Edinburgh Postnatal Depression Scale (EPDS).²¹ The principal investigator and trained assistant conducted the interviews. The questionnaire was written in English but was carefully translated into the local language to ensure clarity. It was pretested with 10 pregnant women who developed hypertensive disorders during gestation. Problems identified from the pretesting phase were corrected and the final draft was prepared for collection of data. The interviewer administered the questionnaires during the study period. All survey instruments can be found as the Supplemental Material.

Study population and participant selection

The study recruited 159 postnatal mothers who had developed HDP (including gestational hypertension, preeclampsia, chronic hypertension, and superimposed preeclampsia) between 4 and 12 weeks postpartum. The sample size was estimated using Charan and Biswas,²² formula, thus; $N = \frac{Z^2 \times p(1-p)}{e^2}$, where Z is the standard normal variate at a confidence interval (CI) of 95% = 1.96, p is the estimated prevalence of PPD (7%) from a similar work by Anokye et al.,²³ and e is the margin of error (0.05). To account for a 5% attrition rate, the sample size was adjusted to include 159 postnatal mothers. Similar studies by Strapasson et al.¹⁹ in Brazil and Mathisen et al.²⁴ in Argentina used sample sizes of 168 and 86, respectively.

Ethical approval

The study was approved by the Committee for Human Research, Publication, and Ethics (CHRPE/AP/632/23) of the School of Medicine and Dentistry (SMD), Kwame Nkrumah University of Science and Technology (KNUST). Additionally, approval was obtained from the authorities of Adabraka Polyclinic. Written informed consent was obtained from all prospective participants. In instances where participants were unable to provide consent themselves, their legally authorized representatives or literate guardians were approached for consent. The purpose of the study was explained to all participants, and written consent was obtained. The study adhered to the core principles outlined in the Declaration of Helsinki and its latter amendments.

Inclusion and exclusion criteria

This study included postnatal mothers (4–12 weeks postpartum) who had developed HDP (including gestational hypertension, preeclampsia, chronic hypertension, and superimposed preeclampsia). HDP is characterized by a systolic blood pressure of 140 mm Hg or higher and/or a diastolic blood pressure of 90 mm Hg or higher occurring after 20 weeks of pregnancy. Pregnant women and postnatal mothers without HDP were excluded from the study.

Data collection

A questionnaire was designed specifically to investigate the prevalence of PPD at 1–3 months postpartum among women who developed HDP during gestation. The questionnaire had five sections: sociodemographic section, pregnancy- and birth-related section, newborn characteristics section, psychosocial and psychological history, and EPDS,²¹ which was used to screen mothers for postnatal depressive symptoms indicative of PPD. The reporting of this study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional studies.²⁵

Statistical analyses

Data entry was done using Microsoft Excel 2016, and analysis was performed using SPSS version 26.0 (IBM SPSS Statistics for Windows, Version 26.0 Armonk, NY: IBM Corp.) and GraphPad Prism 8.0.1 (GraphPad Software Inc). Descriptive statistics were used to examine the distribution of the study variables. Categorical variables were presented as frequencies (N) and percentages (%). The association between various sociodemographic, psychosocial, and obstetric characteristics and mothers' EPDS categories was examined using the chi-square test and logistic regression models, respectively. Significant variables identified through the chi-square test were incorporated into the univariate model to evaluate their independent associations with PPD. The forward addition method was employed, iteratively removing non-significant variables until only statistically significant predictors remained, ensuring a more concise and interpretable model. The significant predictors identified through the forward addition method were then combined into a multivariate model to assess their combined effect on PPD. A $p < 0.05$ was considered statistically significant.

Results

Sociodemographic and obstetric characteristics of study participants

Table 1 shows that out of the 159 mothers with a history of hypertensive disorders, majority were aged 25–30 years ($n = 74$, 46.5%). Most of the women ($n = 88$, 55.3%) had received secondary education while a few ($n = 34$, 21.4%) had assessed tertiary education. The majority of women ($n = 8$, 52.2%) worked in the informal sector while a few ($n = 34$, 21.4%) were unemployed. Akans ($n = 85$, 53.5%) were the largest ethnic group. Majority of the women were married ($n = 94$, 59.1%). Most of them were multiparous ($n = 113$, 71.1%). More than half ($n = 110$, 69.2%) were multigravida, whereas 18 (11.3%) were primigravida. Normotensives had the largest proportion ($n = 99$, 62.3%), whereas 60 (37.7%) of them were hypertensives.

Prevalence of PPD amongst postnatal mothers

Figure 1 shows the distribution of postnatal mothers based on their PPD status. The prevalence of PPD among the study participants was 46.5%.

Association of sociodemographic characteristics with PPD among study participants

Table 2 demonstrates the association of sociodemographic characteristics with PPD among study participants. There were no significant association between participants age

Table 1. Sociodemographic and obstetric characteristics of the study participants.

Variable	Frequency (N=159)	Percentage (%)
Age (years)		
Median (IQR)	30.0 (27.0–34.0)	
Age category		
<25	25	15.7
25–30	74	46.5
31–36	38	23.9
≥37	22	13.8
Level of education		
Basic	37	23.3
Secondary	88	55.3
Tertiary	34	21.4
Occupation		
Unemployed	34	21.4
Informal	83	52.2
Formal	42	26.4
Ethnic group		
Akans	85	53.5
Ewe	20	12.6
Ga	28	17.6
Northerners	26	16.4
Marital status		
Single	33	20.8
Cohabitation	32	20.1
Married	94	59.1
Diagnosis		
Normotensive	99	62.3
Gestational hypertension	36	22.6
Preeclampsia	13	8.2
Eclampsia	4	2.5
Chronic hypertension	7	4.4
Parity		
Primiparous	46	28.9
Multiparous	113	71.1
Gravidity		
Primigravida	18	11.3
Multigravida	110	69.2
Grand multigravida	31	19.5

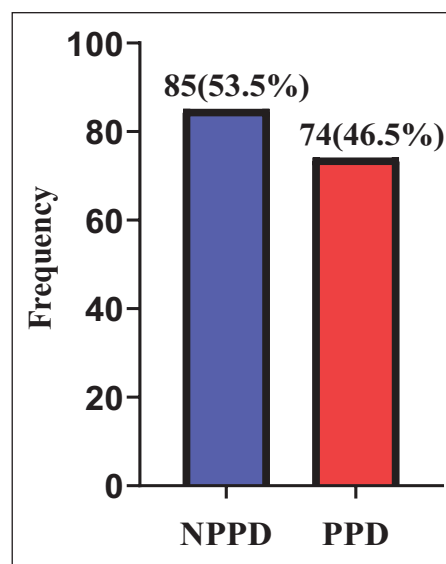
IQR: interquartile range.

Data are presented as frequency (N) and percentage (%).

category ($p=0.607$), level of education ($p=0.817$), and PPD. However, there were significant associations between occupation ($p=0.006$), ethnic group ($p=0.024$), marital status ($p=0.023$), and PPD.

Association of psychosocial characteristics with PPD among study participants

Table 3 shows the association of psychosocial characteristics with PPD among study participants. No significant association was found between financial support from family

**Figure 1.** Prevalence of postpartum depression among the study participants.

($p=0.170$) and PPD. Those receiving financial support from partners had significantly lower rates of PPD compared to those without support ($p<0.001$). Participants experiencing stressful life events were more likely to have PPD compared to those without such experiences ($p=0.002$). Moreover, planned pregnancies were associated with lower rates of PPD compared to unplanned pregnancies ($p=0.004$).

Association of obstetric/fetal characteristics and maternal complications with PPD among study participants

Table 4 shows the association of obstetric/fetal characteristics and maternal complications with PPD among study participants. The study found no significant association between birth weight category ($p=0.206$), gestational age category ($p=0.082$), parity ($p=0.862$), and gravidity ($p=0.424$) with PPD. However, the mode of delivery showed a significant association with PPD ($p=0.002$). Participants who underwent a cesarean section (CS) were more likely to experience PPD compared to those who had a normal delivery. The diagnosis categories, both specific and general, also demonstrated significant associations with PPD ($p<0.001$). Specifically, participants diagnosed with gestational hypertension, preeclampsia, chronic hypertension, or HDP were more likely to experience PPD compared to those with normotension.

Sociodemographic characteristics as predictors of PPD among study participants

In a univariate logistic regression model, occupation, ethnic group, and marital status were predictors of PPD.

Table 2. Association of sociodemographic characteristics with PPD among study participants.

Variable	Total (N= 159)	NPPD (N=85)	PPD (N=74)	p value
Age category				0.607
<25	25 (15.7)	13 (15.3)	12 (16.2)	
25–30	74 (46.5)	43 (50.6)	31 (41.9)	
31–36	38 (23.9)	17 (20.0)	21 (28.4)	
≥37	22 (13.8)	12 (14.1)	10 (13.5)	
Level of education				0.817
Basic	37 (23.3)	19 (22.4)	18 (24.3)	
Secondary	88 (55.3)	49 (57.6)	39 (52.7)	
Tertiary	34 (21.4)	17 (20.0)	17 (23.0)	
Occupation				0.006
Unemployed	34 (21.4)	12 (14.1)	22 (29.7)	
Informal	83 (52.2)	54 (63.5)	29 (39.2)	
Formal	42 (26.4)	19 (22.4)	23 (31.1)	
Ethnic group				0.024
Akans	85 (53.5)	53 (62.4)	32 (43.2)	
Ewe	20 (12.6)	8 (9.4)	12 (16.2)	
Ga	28 (17.6)	9 (10.6)	19 (25.7)	
Northerners	26 (16.4)	15 (17.6)	11 (14.9)	
Marital status				0.023
Single	33 (20.8)	16 (18.8)	17 (23.0)	
Cohabitation	32 (20.1)	11 (12.9)	21 (28.4)	
Married	94 (59.1)	58 (68.2)	36 (48.6)	

NPPD: no postpartum depression; PPD: postpartum depression.

Data are presented as frequency (%); chi square/Fisher's exact test, $p < 0.05$ was considered statistically significant for women with PPD and NPPD.**Table 3.** Association of psychosocial characteristics with PPD among study participants.

Variable	Total (N= 159)	NPPD (N=85)	PPD (N=74)	p value
Financial support from partner				<0.001
No	33 (20.8)	4 (4.7)	29 (39.2)	
Yes	126 (79.2)	81 (95.3)	45 (60.8)	
Financial support from family				0.170
No	49 (30.8)	22 (25.9)	27 (36.5)	
Yes	110 (69.2)	63 (74.1)	47 (63.5)	
Any stressful life activity				0.002
No	52 (32.7)	37 (43.5)	15 (20.3)	
Yes	107 (67.3)	48 (56.5)	59 (79.7)	
Planned pregnancy				0.004
No	77 (48.4)	32 (37.6)	45 (60.8)	
Yes	82 (51.6)	53 (62.4)	29 (39.2)	

NPPD: no postpartum depression; PPD: postpartum depression.

Data are presented as frequency (%); chi square/Fisher's exact test, $p < 0.05$ was considered statistically significant for women with PPD and NPPD.

Specifically, postnatal women in the informal sector (crude odds ratio (cOR)=0.44, 95% CI (0.21–0.95), $p=0.035$) had 56% lower odds of developing PPD when compared with postpartum women in the formal sector. Postnatal Ga mothers (cOR=3.50, 95% CI (1.41–8.66), $p=0.007$) had 3.5 times increased odds of developing PPD compared to Akan mothers. Also, mothers who were cohabiting (cOR=3.08, 95% CI (1.33–7.12), $p=0.009$) were significantly

associated with 3.1 times increased odds of having PPD compared to those who were married. After adjusting for maternal age and level of education in multivariate logistic regression model, having an informal occupation (adjusted odd ratio (aOR)=0.12, 95% CI (0.02–0.62), $p=0.012$), and being in the Ga ethnic group (aOR=5.27, 95% CI (1.25–22.11), $p=0.023$) were the independent sociodemographic characteristics of PPD (Table 5).

Table 4. Association of obstetric, fetal characteristics, and maternal complications with PPD among study participants.

Variable	Total (N=159)	NPPD (N=85)	PPD (N=74)	p value
Birth weight category				0.206
Low birth weight	5 (3.1)	1 (1.2)	4 (5.4)	
Normal	153 (96.2)	83 (97.6)	70 (94.6)	
Macrosomia	1 (0.6)	1 (1.2)	0 (0.0)	
Gestational age category (weeks)				0.082
<37	18 (11.3)	6 (7.1)	12 (16.2)	
37–42	141 (88.7)	79 (92.9)	62 (83.8)	
Parity				0.862
Primiparous	46 (28.9)	24 (28.2)	22 (29.7)	
Multiparous	113 (71.1)	61 (71.8)	52 (70.3)	
Gravidity				0.424
Primigravida	18 (11.3)	11 (12.9)	7 (9.5)	
Multigravida	110 (69.2)	55 (64.7)	55 (74.3)	
Grand multigravida	31 (19.5)	19 (22.4)	12 (16.2)	
Desired fetal gender				0.038
No	47 (29.6)	19 (22.4)	28 (37.8)	
Yes	112 (70.4)	66 (77.6)	46 (62.2)	
Mode of delivery				0.002
Normal	137 (86.2)	80 (94.1)	57 (77.0)	
CS	22 (13.8)	5 (5.9)	17 (23.0)	
Diagnosis category (specific)				<0.001
Normotensive	99 (62.3)	69 (81.2)	30 (40.5)	
Gestational hypertension	36 (22.6)	6 (7.1)	30 (40.5)	
Preeclampsia	13 (8.2)	6 (7.1)	7 (9.5)	
Eclampsia	4 (2.5)	2 (2.4)	2 (2.7)	
Chronic hypertension	7 (4.4)	2 (2.4)	5 (6.8)	
Diagnosis category (general)				<0.001
Normotensive	99 (62.3)	69 (81.2)	30 (40.5)	
HDP	60 (37.7)	16 (18.8)	44 (59.4)	

NPPD: no postpartum depression; PPD: postpartum depression; CS: Cesarean section; HDP: hypertensive disorders of pregnancy. Data are presented as frequency (%); chi square/Fisher's exact test, $p < 0.05$ was considered statistically significant for women with PPD and NPPD.

Psychosocial characteristics as predictors of PPD among study participants

Table 6 shows psychosocial characteristics as predictors of PPD among study participants. In a univariate logistic model, financial support from partner, stressful life activity, planned pregnancy, and desired fetal gender were predictors of PPD. Specifically, postpartum mothers who did not receive financial support from their partners ($cOR=13.05$, 95% CI (4.31–39.48), $p < 0.001$) were significantly associated with 13.05 times increased odds of developing PPD compared to those who received financial support from partners. Mothers who had stressful life activities ($cOR=3.03$, 95% CI (1.49–6.17), $p=0.002$) were significantly associated with 3 times higher odds of developing PPD compared with those who had no stressful life activity. Also, postpartum mothers who did not plan their pregnancies ($cOR=2.57$, 95% CI (1.35–4.88), $p=0.004$) were significantly associated with 2.6 times increased odds of developing PPD compared to those who

had planned their pregnancy. Postpartum mothers who did not get their desired fetal gender ($cOR=2.11$, 95% CI (1.06–4.23), $p=0.034$) were significantly associated with 2.1 times increased odds of PPD compared to those who had their desired fetal gender. After adjusting for maternal age and level of education in multivariate logistic regression model, no financial support from partner ($aOR=27.54$, 95% CI (4.63–164.00), $p < 0.0001$) was the independent psychosocial characteristic of PPD.

Obstetric characteristics and maternal complication as predictors of PPD among study participants

Table 7 shows obstetric characteristics and maternal complication as predictors of PPD among study participants. In a univariate logistic model, mode of delivery and diagnosis (complication) were predictors of PPD. CS ($cOR=4.77$, 95% CI (1.66–13.68), $p=0.004$) was

Table 5. Univariate and multivariate logistic regression model of sociodemographic factors as predictors of postpartum depression among study participants.

Variable	cOR (95% CI)	p value	aOR (95% CI)	p value
Age category				
25–30	1.00		1.00	-
<25	0.78 (0.31–1.94)	0.5950	-	-
31–36	1.34 (0.49–3.68)	0.5730	-	-
≥37	0.90 (0.29–2.85)	0.8610	-	-
Level of education				
Tertiary	1.00		1.00	
Basic	0.95 (0.37–2.41)	0.9090	-	-
Secondary	0.80 (0.36–1.76)	0.5730	-	-
Occupation				
Formal	1.00		1.00	
Unemployed	1.51 (0.60–3.84)	0.3810	0.91 (0.14–5.75)	0.918
Informal	0.44 (0.21–0.95)	0.0350	0.12 (0.02–0.62)	0.012
Ethnic group				
Akans	1.00		1.00	
Ewe	2.48 (0.92–9.73)	0.0730	1.07 (0.21–5.34)	0.937
Ga	3.50 (1.41–8.66)	0.0070	5.27 (1.25–22.11)	0.023
Northerners	1.22 (0.50–2.97)	0.6700	0.97 (0.22–4.23)	0.970
Marital status				
Married	1.00		1.00	
Single	1.71 (0.77–3.81)	0.1880	1.36 (0.31–5.85)	0.683
Cohabitation	3.08 (1.33–7.12)	0.0090	1.45 (0.35–5.96)	0.608

cOR: crude odd ratio; CI: confidence interval; aOR: adjusted odd ratio; 1.00: reference.

Data are presented as odd ratio (95% CI). Variables included in the multivariate model for adjustment were age, level of education, occupation, ethnic group, and marital status. Binary logistic regression analysis performed to obtain odd ratios. $p < 0.05$ was considered statistically significant.

Table 6. Univariate and multivariate logistic regression model of psychosocial characteristics as predictors of postpartum depression among study participants.

Variable	cOR (95% CI)	p value	aOR (95% CI)	p value
Financial support from partner				
Yes	1.00		1.00	
No	13.05 (4.31–39.48)	<0.0001	27.54 (4.63–164.00)	<0.001
Any stressful life activity				
No	1.00		1.00	
Yes	3.03 (1.49–6.17)	0.0020	1.63 (0.48–5.52)	0.429
Planned pregnancy				
Yes	1.00		1.00	
No	2.57 (1.35–4.88)	0.0040	1.91 (0.63–5.81)	0.257
Desired fetal gender				
Yes	1.00		1.00	
No	2.11 (1.06–4.23)	0.0340	2.69 (0.85–8.54)	0.093

cOR: crude odd ratio; CI: confidence interval; aOR: adjusted odd ratio; 1.00: reference.

Data are presented as odd ratio (95% CI). Variables included in the multivariate model for adjustment were Financial support from partner, Any stressful life activity, planned pregnancy, and desired fetal gender. Binary logistic regression analysis performed to obtain odd ratios. $p < 0.05$ was considered statistically significant.

significantly associated with 4.8 times increased odds of developing PPD compared with normal delivery. Moreover, all the HDP (cOR=6.33, 95% CI (3.09–12.93), $p < 0.0001$) were significantly associated with 6.3 times increased odds of having PPD compared with

normotensives. After adjusting for maternal age and level of education in multivariate logistic regression model, having CS (aOR=22.10, 95% CI (3.90–125.08), $p < 0.0001$) was the independent obstetric and maternal complication of PPD.

Table 7. Univariate and multivariate logistic regression model of obstetric characteristics and maternal complication as predictors of postpartum depression among study participants.

Variable	cOR (95% CI)	p value	aOR (95% CI)	p value
Mode of delivery				
Normal	1.00		1.00	
CS	4.77 (1.66–13.68)	0.0040	22.10 (3.90–125.08)	<0.001
Diagnosis				
Normotensive	1.00		1.00	
HDP	6.33 (3.09–12.93)	<0.0001	10.70 (0.97–118.10)	0.053

cOR: crude odd ratio; CI: confidence interval; aOR: adjusted odd ratio; 1.00: reference.

Data are presented as odd ratio (95% CI). Variables included in the multivariate model for adjustment were Mode of delivery and diagnosis. Binary logistic regression analysis performed to obtain odd ratios. $p < 0.05$ was considered statistically significant.

Discussion

The global prevalence of PPD ranges from 4% to 25%.¹² It is found to be 25% more prevalent in low- and middle-income nations than in developed countries.²⁶ Evidence suggests that PPD for women and their children may be more common and serious in low-income countries although mental health is frequently not prioritized as a problem in these settings.²⁷

To the best of our knowledge, this study is the first in Ghana to investigate the prevalence of PPD among women with recent history of pregnancy-related hypertensive disorders. Our findings reveal a significantly high prevalence of PPD at 46.5% in this population. While the scarcity of data on PPD specifically among hypertensive mothers limits direct comparisons, the prevalence reported in this study is markedly higher than rates observed among postpartum mothers in general. For instance, the prevalence in our study surpasses the rates reported by Anokye et al.²³ (7%) in Kumasi, Cadri et al.²⁸ (32.6%) in Hohoe, Saeed and Wemakor²⁹ (16.8%) in Bole District, and Buabeng³⁰ (22.3%) in Kumasi. Similarly, our study's prevalence surpasses rates reported in Nigeria (22.9%),³¹ and Ethiopia (33.82%),³² while prevalence in Bahrain (37.1%),³³ Saudi Arabia (38.5%),³⁴ and Brazil (10.8%)³⁵ were higher than that of our study. The increased prevalence in our study may be attributed to psychological and social factors, as noted by Yim et al.³⁶ and Liang et al.³⁷ in developing countries. Moreover, factors such as poverty, lack of social support, experiences of partner violence, a history of pregnancy loss, and unintended pregnancies have been found to be associated with PPD.³⁷ These findings underscore the need for targeted interventions and support systems to address the psychological well-being of postpartum women, particularly in resource-constrained settings.

In this study, informal occupation was independently associated with PPD. Thus, postpartum mothers with informal occupation had risk of PPD than postpartum mothers who had formal occupation. Experiencing job insecurity is believed to elevate the risk of depression in postpartum mothers with informal occupation.³⁸ Mothers who undergo childbirth may find it challenging to control this situation and are more likely to experience PPD. It was

also found in this study that the Ga ethnic postpartum mothers had increased risk of PPD. The findings found in this study could be as a result of a low socioeconomic living conditions among the Ga ethnic postpartum mothers.

In this study, we found that having no financial support from partners was independently associated with PPD. Thus, postpartum mothers who had no financial support from their partners had increased risk of PPD than those who had financial support from their partners. Overall findings from this study are in line with studies done in Saudi Arabia,³⁴ Brazil,³⁵ Egypt,³⁹ Ghana,⁴⁰ and Bahrain³³ which showed that not receiving financial support from partner have emotional, social and mental trauma on mothers, thereby increasing their risk of PPD. However, studies by Ayoub⁴¹ in Palestine and Almuqbil et al.⁴² in Saudi Arabia found no association between having no support from partner and PPD. The differences in findings could be due to the differences in the socioeconomic living conditions of the postpartum mothers in these settings.

To improve the quality of life for both mothers and newborns, male spouse or partners should financially support their female partners during pregnancy and also after childbirth.

Our study findings showed that undergoing a CS was independently associated with PPD. Thus, postpartum women who had undergone CS had increased risk of PPD than having normal vaginal delivery. Although the exact mechanism is not known, it is reported CS has adverse effects on psychosocial outcomes, especially concerning post-traumatic stress disorder which could lead to PPD.⁴³ Findings of this study is comparable to a study conducted by Al Nasr et al.³⁴ in Saudi Arabia and Benton et al.⁴³ in China which also found a significant association between having undergone CS and PPD. This finding could be as a result of the physical trauma postpartum mothers go through after childbirth which may have an effect on their psychological well-being.

Limitations

This study had several limitations that should be considered when interpreting the findings. First, data on body mass

index and physical activity levels were not collected. Since both factors could have influenced HDP and PPD, their omission may have introduced potential confounding effects. Future studies should account for these variables to improve the accuracy of findings. Second, the study did not include important mental health-related factors such as bipolar disorder, recent use of antidepressants, substance abuse, or lifetime treatment for depression. The exclusion of these variables may have limited a comprehensive understanding of PPD within the study population. Third, the reliance on self-reported questionnaires introduced the possibility of reporting bias or misinterpretation of questions, which may have affected response accuracy. Self-reported data were inherently subjective and could have been influenced by recall bias, stigma, or misunderstanding of survey items. Another major limitation was the cross-sectional design of the study, which prevented the establishment of causal relationships between HDP and PPD. Future research should consider longitudinal approaches to better assess the direction and strength of these associations.

Finally, the study sample was limited to a specific geographic region, which may have restricted the generalizability of the findings. Expanding data collection to multiple districts, municipalities, and metropolitan areas in future research would provide a broader and more representative perspective on PPD prevalence and its associated risk factors.

Conclusion

Pregnant women with hypertensive disorders may have an increased risk for PPD. Early identification and treatment of PPD are crucial for improving the health and well-being of both mothers and their children. We recommend that hospital authorities, in collaboration with the Ministry of Health and Ghana Health Service, partner with non-governmental organizations to implement routine screening programs for PPD. Additionally, the Ministry of Health through the Ghana Health Service should implement public education initiatives focused on raising awareness about PPD. These efforts are essential for early detection, support, and intervention to mitigate the impact of PPD on maternal and child well-being.

Acknowledgements

The author's express their gratitude to Mrs. Esther Opoku, the labor in-charge, along with all the midwives and laboratory staff at the Adabraka Polyclinic, for their invaluable support and guidance throughout this study.

ORCID iDs

Wina Ivy Ofori Boadu  <https://orcid.org/0000-0002-2660-1707>
 Enoch Odame Anto  <https://orcid.org/0000-0001-9023-6612>
 Michael Nyantakyi  <https://orcid.org/0000-0003-3864-0604>
 Christian Obirikorang  <https://orcid.org/0000-0002-6128-1358>

Ethical considerations

The study was approved by the Human Research, Publication, and Ethics (CHRPE/AP/632/23) of the School of Medicine and Dentistry (SMD), Kwame Nkrumah University of Science and Technology (KNUST). Additionally, approval was obtained from the authorities of Adabraka Polyclinic.

Consent to participate

Written informed consent was obtained from all prospective participants. In instances where participants were unable to provide consent themselves, their legally authorized representatives or literate guardians were approached for consent.

Consent for publication

Informed consent for publication was provided by the participants.

Author contributions

Wina Ivy Ofori Boadu: Conceptualization; Writing – original draft; Methodology; Supervision.

Enoch Odame Anto: Conceptualization; Writing – original draft; Supervision; Writing – review and editing.

Edmund Mintah Wiafe: Investigation; Writing – original draft; Methodology; Formal analysis.

Michael Nyantakyi: Writing – original draft; Visualization; Formal analysis; Writing – review and editing.

Joseph Frimpong: Investigation; Validation; Data curation.

Emmanuel Ekow Korsah: Investigation; Methodology; Data curation.

Ezekiel Ansah: Investigation; Writing – original draft; Formal analysis; Software.

Afia Agyapomaa Kwayie: Investigation; Writing – original draft; Validation; Software.

Elizabeth Aboagye: Investigation; Formal analysis; Validation.

Christian Obirikorang: Conceptualization; Writing – original draft; Supervision.

Emmanuel Timmy Donkoh: Investigation; Visualization; Formal analysis.

Kwame Ofori Boadu: Conceptualization; Methodology; Validation; Supervision.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability statement

All data and materials generated and analyzed during this study are included in the article and can be requested from the corresponding author.

Supplemental material

Supplemental material for this article is available online.

References

- Laine K, Murzakanova G, Sole KB, et al. Prevalence and risk of pre-eclampsia and gestational hypertension in twin pregnancies: a population-based register study. *BMJ Open* 2019; 9(7): e029908.
- Von Dadelszen P and Magee LA. Preventing deaths due to the hypertensive disorders of pregnancy. *Best Pract Res Clin Obstet Gynaecol* 2016; 36: 83–102.
- Magee LA, Pels A, Helewa M, et al. The hypertensive disorders of pregnancy (29.3). *Best Pract Res Clin Obstet Gynaecol* 2015; 29(5): 643–657.
- Neal S, Mahendra S, Bose K, et al. The causes of maternal mortality in adolescents in low and middle income countries: a systematic review of the literature. *BMC Pregnancy Childbirth* 2016; 16: 1–18.
- World Health Organization. Trends in maternal mortality: 1990–2015: estimates from WHO, UNICEF, UNFPA, world bank group and the United Nations population division. World Health Organization, 2015.
- Chaiworapongsa T, Chaemsaitong P, Yeo L, et al. Pre-eclampsia part 1: current understanding of its pathophysiology. *Nat Rev Nephrol* 2014; 10(8): 466–480.
- Sutton AL, Harper LM and Tita AT. Hypertensive disorders in pregnancy. *Obstet Gynecol Clin* 2018; 45(2): 333–347.
- Hoedjes M, Berks D, Vogel I, et al. Postpartum depression after mild and severe preeclampsia. *J Women's Health* 2011; 20(10): 1535–1542.
- Thombre MK, Talge NM and Holzman C. Association between pre-pregnancy depression/anxiety symptoms and hypertensive disorders of pregnancy. *J Women's Health* 2015; 24(3): 228–236.
- Lugobe HM, Muhindo R, Kayondo M, et al. Risks of adverse perinatal and maternal outcomes among women with hypertensive disorders of pregnancy in southwestern Uganda. *PLoS One* 2020; 15(10): e0241207.
- Wang Z, Liu J, Shuai H, et al. Mapping global prevalence of depression among postpartum women. *Transl Psychiatry* 2021; 11(1): 543.
- Frieder A, Ferst M, Hainline R, et al. Pharmacotherapy of postpartum depression: current approaches and novel drug development. *CNS Drugs* 2019; 33: 265–282.
- Alsulami A, Orabi A, Timraz S. Saudi women's perspectives on postpartum depression. *Front Glob Womens Health* 2024; 5: 1326130. doi: 10.3389/fgwh.2024.1326130.
- Kettunen P, Koistinen E and Hintikka J. Is postpartum depression a homogenous disorder: time of onset, severity, symptoms and hopelessness in relation to the course of depression. *BMC Pregnancy Childbirth* 2014; 14: 1–9.
- Biaggi A, Conroy S, Pawlby S, et al. Identifying the women at risk of antenatal anxiety and depression: a systematic review. *J Affect Disord* 2016; 191: 62–77.
- Howard LM, Molyneaux E, Dennis C-L, et al. Non-psychotic mental disorders in the perinatal period. *Lancet* 2014; 384(9956): 1775–1788.
- Mehta S and Mehta N. An overview of risk factors associated to post-partum depression in Asia. *Ment Illn* 2014; 6(1): 14–17.
- Patel M, Bailey RK, Jabeen S, et al. Postpartum depression: a review. *J Health Care Poor Underserved* 2012; 23(2): 534–542.
- Strapasson MR, Ferreira CF and Ramos JG. Associations between postpartum depression and hypertensive disorders of pregnancy. *Int J Gynecol Obstet* 2018; 143(3): 367–373.
- Mbarak B, Kilewo C, Kuganda S, et al. Postpartum depression among women with pre-eclampsia and eclampsia in Tanzania; a call for integrative intervention. *BMC Pregnancy Childbirth* 2019; 19: 1–8.
- Cox JL, Holden JM and Sagovsky R. Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 1987; 150(6): 782–786.
- Charan J and Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med* 2013; 35(2): 121–126.
- Anokye R, Acheampong E, Budu-Ainooson A, et al. Prevalence of postpartum depression and interventions utilized for its management. *Ann Gen Psychiatry* 2018; 17: 1–8.
- Mathisen SE, Glavin K, Lien L, et al. Prevalence and risk factors for postpartum depressive symptoms in Argentina: a cross-sectional study. *Int J Women's Health* 2013; 14: 787–793.
- Von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet* 2007; 370(9596): 1453–1457.
- Norhayati M, Hazlina NN, Asreneen A, et al. Magnitude and risk factors for postpartum symptoms: a literature review. *J Affect Disord* 2015; 175: 34–52.
- Fitelson E, Kim S, Baker AS, et al. Treatment of postpartum depression: clinical, psychological and pharmacological options. *Int J Women's Health* 2010; 15: 1–14.
- Cadri A, Bonyo AAN, Richard AG, et al. The effect of social health issues on postpartum depression: analysis from a community sample in Ghana. *Science Publishing Group* 2020; 6(2): 88–94.
- Saeed N and Wemakor A. Prevalence and determinants of depression in mothers of children under 5 years in Bole District, Ghana. *BMC Res Notes* 2019; 12: 1–6.
- Buabeng AA. *Risk factors influencing postpartum depression among women attending postnatal clinic at Komfo Anokye Teaching Hospital*. PhD Thesis, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, 2015.
- Chinawa JM, Odetunde OI, Ndu IK, et al. Postpartum depression among mothers as seen in hospitals in Enugu, South-East Nigeria: an undocumented issue. *Pan Afr Med J* 2016; 23(1): 42–54.
- Kerie S, Menberu M and Niguse W. Prevalence and associated factors of postpartum depression in Southwest, Ethiopia, 2017: a cross-sectional study. *BMC Res Notes* 2018; 11: 1–7.
- Al Dallal F and Grant I. Postnatal depression among Bahraini women: prevalence of symptoms and psychosocial risk factors. *East Mediterr Health J* 2012; 18(5): 439–445.
- Al Nasr RS, Altharwi K, Derbah MS, et al. Prevalence and predictors of postpartum depression in Riyadh, Saudi Arabia: a cross sectional study. *PLoS One* 2020; 15(2): e0228666.
- Melo EF Jr, Cecatti JG, Pacagnella RC, et al. The prevalence of perinatal depression and its associated factors in two different settings in Brazil. *J Affect Disord* 2012; 136(3): 1204–1208.

36. Yim IS, Tanner Stapleton LR, Guardino CM, et al. Biological and psychosocial predictors of postpartum depression: systematic review and call for integration. *Annu Rev Clin Psychol* 2015; 11(1): 99–137.
37. Liang P, Wang Y, Shi S, et al. Prevalence and factors associated with postpartum depression during the COVID-19 pandemic among women in Guangzhou, China: a cross-sectional study. *BMC Psychiatry* 2020; 20: 1–8.
38. Lee J, Lim J-E, Cho SH, et al. Association between work-family conflict and depressive symptoms in female workers: an exploration of potential moderators. *J Psychiatr Res* 2022; 151: 113–121.
39. Mohammed E, Mosalem F, Mahfouz E, et al. Predictors of postpartum depression among rural women in Minia, Egypt: an epidemiological study. *Public Health* 2014; 128(9): 817–824.
40. Peters F, Hormeku E, Peprah A, et al. Prevalence and correlates of postpartum depression among nursing mothers within the Kumasi metropolis: an analytical cross-sectional study. *J Sci Technol* 2024; 42(2): 19–34.
41. Ayoub KA. Prevalence of postpartum depression among recently delivering mothers in Nablus District and its associated factors. [Nablus]: Najah University; 2014. Available from: <https://repository.najah.edu/handle/20.500.11888/7829>
42. Almuqbil M, Kraidiye N, Alshaimri H, et al. Postpartum depression and health-related quality of life: a Saudi Arabian perspective. *PeerJ* 2022; 10: e14240.
43. Benton M, Salter A, Tape N, et al. Women's psychosocial outcomes following an emergency caesarean section: a systematic literature review. *BMC Pregnancy Childbirth* 2019; 19: 1–24.