

BMJ Open Paternal postpartum depression and its associated factors among partners of postpartum women at Dessie Town, Northeast Ethiopia, 2023: a community-based cross-sectional study

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To cite: Assefa A, Workie A, Assefaw M, *et al.* Paternal postpartum depression and its associated factors among partners of postpartum women at Dessie Town, Northeast Ethiopia, 2023: a community-based cross-sectional study. *BMJ Open* 2026;**16**:e100947. doi:10.1136/bmjopen-2025-100947

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2025-100947>).

Received 29 March 2025
Accepted 07 January 2026



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ABSTRACT

Background Paternal postpartum depression among fathers of newborns is a new concept in Ethiopia. It is an emerging public health concern because it produces insidious effects on the well-being of newborns as well as on the whole family. However, there is limited evidence on the prevalence of paternal postpartum depression and its associated factors among partners of postpartum women in Ethiopia.

Design A community-based cross-sectional study was conducted.

Setting This study was conducted in Dessie town, Amhara Regional State, Northeast Ethiopia.

Participants 634 partners of postpartum women participated in the study between 10 January and 10 February 2023. The study included fathers whose spouses had given birth in the last 12 months and who had been of the randomly selected kebeles for at least 6 months. Fathers aged <18 years at the time of data collection were excluded from the study. Data were collected through the structured and pretested Amharic questionnaire through face-to-face interviews.

Primary and secondary outcome measures A standardised and validated depression-screening instrument (Edinburgh Postnatal Depression Scale) was used to assess paternal postpartum depression. Variables with a P value<0.25 in the bivariable analyses were used as the cut point for eligibility in the multivariable binary logistic regression model. Finally, statistically significant associated factors or secondary outcomes were declared at a p value<0.05 and were reserved in the final model with 95% CI.

Results 610 fathers were interviewed, with a response rate of 96.2%, and the prevalence of paternal postpartum depression was 19% (95% CI 16.0 to 22.3). This study showed that not being comfortable with income (adjusted OR (AOR)=2.32 (95% CI 1.16 to 4.66)), substance use (AOR=2.48 (95% CI 1.22 to 5.05)), prior parenting experience (AOR=1.89 (95% CI 1.02 to 3.50)), unplanned pregnancy (AOR=2.81 (95% CI 1.50 to 5.25)) and infant sleep problems (AOR=4.59 (95% CI 1.80 to 7.18)) were significantly associated with paternal depression.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ It was a cross-sectional study, so it does not show a cause-and-effect relationship
- ⇒ Comparative analysis of the prevalence and factors associated with paternal postpartum depression is challenging owing to the limited number of studies on related topics, especially in Ethiopia.
- ⇒ Furthermore, the assessment of depression symptoms was based on self-report measures, so under-reporting of depressive symptoms is highly likely because of social desirability and recall bias.

Conclusion and recommendations This study revealed that nearly one-fifth of fathers had paternal depression. Factors significantly associated with PPD were not being comfortable with family income, substance use, experience of childbirth, unplanned pregnancy and infant sleeping problems. This suggests the need to provide health education to decrease substance use and counselling on the utilisation of family planning to minimise unplanned pregnancy and support offered to multiparous fathers.

INTRODUCTION

Paternal postpartum depression (PPD) is a clinically significant mental health problem for male partners. Conversely, depression among fathers of newborns is also termed as PPPD or 'sad dads'.¹ Most studies have used the definition for maternal postnatal depression to define PPD.^{1,2}

It is widely overlooked despite being the most common mental health problem among fathers, and it affects all aspects of family life.^{3,4} Approximately 10% of fathers develop postpartum depression, typically beginning in the first 12 months after a baby's birth, with the highest number between 3 and 6 months after birth, which is later than when women develop postpartum depression.^{5–7}

The prevalence of PPPD ranges from 1.2% to 25.5%.⁸ A study in Finland synthesised the evidence on new mothers' and fathers' experiences of PPPD; the findings showed that 10% of fathers experienced depressive symptoms.⁹ In another study, 28.3% of fathers in Pakistan¹⁰ and 13.6% of fathers in Saudi Arabia had postpartum depression.¹¹ In Nigeria, the prevalence was 8.9%, which is an important finding in this study.¹²

PPPD-associated symptoms include insomnia or hypersomnia, eating disorders, fatigue, sadness, crying, anxiety and feelings of guilt related to caring for their infant. While many postpartum depression symptoms are similar for fathers and mothers, some symptoms are unique to men.⁷ The known factors are ecological factors and changes in the levels of testosterone, oestrogen, cortisol, vasopressin and prolactin as biological factors.⁵

Studies from developing countries, where men have huge environmental and sociocultural vulnerability, are limited. As far as the literature search is concerned, no studies in Ethiopia have focused on PPPD. Depression in fathers during the first year of child life can have a negative impact on fathers, such as developing chronic depression, suicidal behaviour, substance abuse disorder and socioeconomic problems. It also affects families, increasing social, behavioural, cognitive and emotional developmental problems in their children, poor parenting behaviours and increasing conflicts in the marital relationship.^{12 13}

Children who live with fathers with depression or other mental illness have a 33%–70% increased risk of developing emotional and behavioural problems.¹⁴

In developing countries, guidelines for assessing paternal mental health are not established, even in areas where midwives are directly involved with pregnancy and postpartum care.¹⁵ Although the WHO has emphasised providing integrated maternal and child health services, new fathers' mental health has not yet been embedded in these programmes. Additionally, there is different literature on the role of fathers, benefits of paternal involvement in child care and their functioning within families.¹⁶

Several countries have designed and implemented paternity leave policies to help fathers adapt to new fatherhood and have positive effects on parental mental health. However, it is a very short period, which is insufficient, particularly in private sectors, and it is important to note socially accepted norms that designate mothers as primary caregivers and fathers as income providers or secondary caregivers in the family, which results in negative social outcomes.¹⁷ Therefore, this study aimed to assess the prevalence of PPPD and its associated factors.

Specific objectives

1. To assess the prevalence of PPD among partners of women who gave birth in the last 12 months in Dessie town, Northeast Ethiopia, 2023.
2. To identify factors of PPD among partners of women who gave birth in the last 12 months in Dessie town, Northeast Ethiopia, 2023.

METHODS AND MATERIALS

Study area, period and design

A community-based cross-sectional study was conducted in Dessie town, Amhara Regional State, Northeast Ethiopia. It is one of the city administrations in the Amhara Region, which is geographically located 480 km from the regional town (Bahir Dar) and 401 km from Addis Ababa, the capital city of Ethiopia.

Dessie town has 26 kebeles, the lowest administrative level in Ethiopia (18 are urban kebeles and eight are rural kebeles). 9660 wives gave birth in the last year in Dessie Town (Dessie Town Health Office, 2021)³⁷. The study was conducted from 10 January to 10 February 2023.

Population

Source population

All fathers whose wives gave birth in the last 12 months in Dessie town.

Study population

The study population included all fathers whose wives gave birth in the last 12 months and who are residents in randomly selected kebeles of Dessie town during the data collection period.

Eligibility criteria

Inclusion criteria

All fathers whose wives gave birth in the last 12 months and who have been residents for at least 6 months in randomly selected kebeles.

Exclusion criteria

Fathers who lived in the area for <6 months and were <18 years old during the data collection were excluded.

Sample size determination and sampling procedure

The required sample size was determined by using a single population proportion formula:

$n = (Z\alpha/2)^2 P (1P) / d^2$, where n is the desired sample size

$Z\alpha/2$ is the standardised normal distribution value for 95% CI of 1.96.

d was the margin of error to be tolerated (5%).

p =by considering 50%, since the prevalence of PPPD in Ethiopia is not known.

$n = (1.96)^2 0.5 (1-0.5) / (0.05)^2$

$n = 384$

A design effect of 1.5 was applied; given that a multi-stage stratified sampling procedure was used, the sample size becomes 576, and a non-response rate of 10% was added.

Therefore, the final sample size for this study is 634.

A multi-stage stratified sampling technique was used. The first 26 kebeles were stratified into rural and urban. Then, 3 random kebeles were selected from 8 rural kebeles and 8 kebeles from 18 urban kebeles by using the lottery method.

As a figure legend **description**, a total of 11 kebeles were included in the study. We used the formula **ni**

$x n/N$, where n_i indicated the total fathers during the postpartum period in each of the selected rural or urban kebeles, and N is the total number of fathers during the postpartum period in both urban and rural kebeles.

752 fathers lived in eight selected urban kebeles, and 506 fathers lived in three selected rural kebeles. From 11 kebeles, the total number of fathers was 1258. The sample sizes were determined by using this formula; 379 fathers were selected from eight urban kebeles, and the remaining 255 fathers were selected from three rural kebeles.

The total population from each urban kebele was as follows: Seferesalam (47), Megenagna (53), Tequam (146), Nefsuager (105), Kelem Meda (165), M/tsehayi (74), Robi (88), Salayish (74), and from rural kebeles; Borusilase (157), Borumeda (256) and Kurkur (93).

Hence, the study participants proportionally allocated and selected by a systematic sampling technique were as follows: Seferesalam (24), Megenagna (27), Tequam (74), Nefsuager (53), Kelem Meda (83), M/tsehayi (37), Robi (44) and Salayish (37) from urban kebeles and Borusilase (79), Borumeda (129) and Kurkur (47) from rural kebeles.

Finally, a systematic sampling technique was used to select each father during the postpartum period from each kebele in every K^{th} interval by taking $K=N/n$, K_1 (Seferesalam)= $47/24=1.96 \approx 2$, K_2 (Nefsuager)= $105/53=1.98 \approx 2$, K_3 (Kukur)= $93/47=1.98 \approx 2$ and almost all kebeles K^{th} interval ≈ 2 .

The first sample was selected randomly, and samples were then taken every K^{th} interval, where N is the total

number of fathers from selected kebeles and n is the sample size for selected kebeles (figure 1).

Dependent variable

PPD

Independent variables

Paternal factors: age, religion, residence, educational status, employment status, number of newborns, family income, comfort with family income, substance use, history of depression and experience of childbirth.

Relationship factors: Relationship with parents, marital status, marital relation, number of wives, relative mental illness, friend support, family support and professional support.

Infant and environment factors: residence of wife after delivery, housing status, planned/unplanned pregnancy, duration of the postpartum period, attended Antenatal Care (ANC), mode of delivery, presence/absence of a male partner during the delivery of a baby, gestational age of the pregnancy, congenital birth problems, place of delivery, infant sleeping problem and history of losing a child.

Operational definition

PPD: in this study, paternal depression during the postpartum period was defined as when the cumulative score of the Edinburgh Postpartum Depression Scale (EPDS) was ≥ 10 (10, 18, 19). The onset limitation of 4 weeks has been criticised in different studies, as it does not reflect the epidemiological evidence. In both clinical practice and research, the term 'postpartum depression' refers to depressive episodes occurring in the first-year postpartum period. The 12-month timeframe was chosen because the most significant change and readjustment in family and work life occurred in this period.²

Comfortable with family income: this means that the male partner is not worrying much about money and has a sense of satisfaction with the situation. It is not defined by the amount of money but relative to personal value and other factors, such as overall well-being and happiness, with response options 'Yes/No'.¹⁸

Substance use: male partners were considered substance users if they reported using one or more substances, such as commercial or locally produced alcohol, khat (chewing), cigarette or tobacco (smoking) and other addictive substances. This was measured by at least one 'yes' response before the interview irrespective of the dose and frequency.^{19–21}

Infant sleeping problems were defined based on parents' response to infant sleep duration as irregular or not sufficient.¹⁹

Patient and public involvement statement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

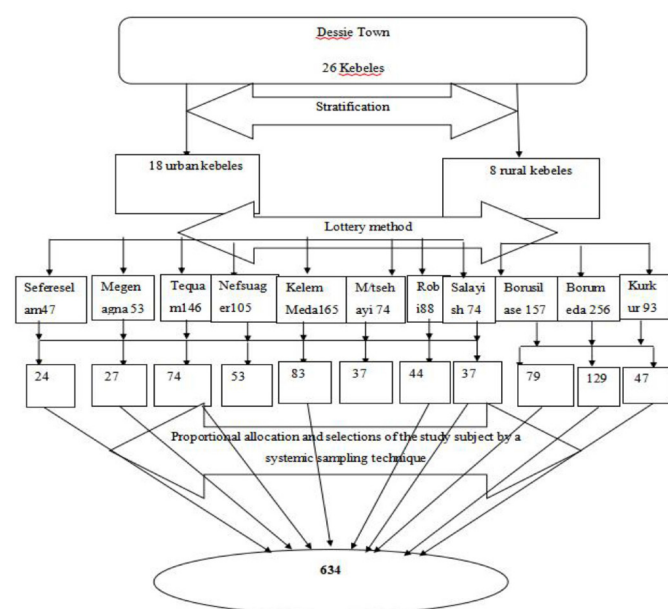


Figure 1 Schematic representation of the sampling procedure for paternal postpartum depression and associated factors among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, 2023.

Data collection tools and procedures

Data were collected through the structured and pre-tested Amharic questionnaire. The questionnaire was prepared by reviewing different published studies and modified to the objective of this study.^{11 20 21} The questionnaire included paternal factors, relationship factors, infant and environment factors and EPDS screening tools. A systematic sampling technique was used to select each father.

Data quality control

The questionnaire was initially prepared in English. The English version was translated to the local Amharic language and re-translated back to English by a language translator expert to ensure internal consistency. The outcome variable (PPD) was assessed using the EPDS with a Cronbach's alpha reliability of 0.87. The questionnaire was pre-tested on 5%, which was on 32 partners of postpartum women of the sample outside Dessie Town, before 15 days of the actual data collection time to ensure clarity, wording and logical sequence of the questions.

Data processing and analysis

Data were cleaned, coded and entered using Piñata version 4.6.0.0 and cross-checked for completeness before analysis. The entered data were exported and analysed with SPSS version 26. Logistic regression was used to analyse the associations between the independent variables and the PPD outcome. The final model goodness-of-fit was checked by Hosmer and Lemeshow's test, and the model was fit, with a p-value of 0.82. Variables were assessed for multicollinearity, and the data met the assumption of collinearity with a variance inflation factor of 1.11–4.97 and a tolerance test of 0.20–0.89. Variables with a p value of 0.25 in the bivariable analyses were used as the cut point for eligibility in the multivariable binary logistic regression model. Finally, statistically significant variables were declared at a p-value of 0.05 and were reserved in the final model with 95% CI.

RESULTS

610 fathers were interviewed, with a response rate of 96.2%. The mean age $\pm$ SD of the participants was 35.13 $\pm$ 6.24 years, and 323 respondents (53%) were between 25 and 34 years old.

About half of the participants (309; 50.7%) identified as Muslim. Most participants lived in urban areas (372; 61%), and approximately one-third (206; 33.8%) had completed higher education or above (table 1).

597 (97.9%) respondents were married, 555 (91%) responded that they had a good marital relationship and 78 (12.8%) had relatives diagnosed with mental illness and received family support and friend support (85.1% and 75.1%, respectively) (table 2).

522 (85.6%) of respondents' infants were delivered at governmental health institutions. Among all respondents, 487 (79.8%) reported that their wives' pregnancies were planned. In addition, 438 (71.8%) and 517 (84.8%)

Table 1 Paternal factors of paternal postpartum depression among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, 2023

Variables	Frequency (n=610)	Percent (%)
Paternal age		
≤25	12	2
25–34	323	53
35–44	228	37.4
≥45	47	7.7
Religion		
Orthodox	285	46.7
Protestant	13	2.1
Muslim	309	50.7
Catholic	3	0.5
Residence		
Rural	238	39
Urban	372	61
Educational status		
Not read and write	49	8
Read and write	86	14.1
Primary education	130	21.3
Secondary education	139	22.8
Higher education and above	206	33.8
Employment status		
Employed	444	72.8
Unemployed	166	27.2
Family income		
≤1500	46	7.5
1501–3000	266	43.6
3001–5000	161	26.4
≥ 5001	137	22.5
Comfortable with family income		
Yes	167	27.4
No	443	72.6
Substance use		
Yes	80	13.1
No	530	86.9
History of depression		
Yes	74	12.1
No	536	87.6
Experience of childbirth		
Yes	341	55.9
No	269	44.1
Number of newborn		
One	589	96.6
Twin	21	3.4

fathers were present during antenatal check-ups and at the time of delivery, respectively (table 3).

Overall, 116 participants (19.0%; 95% CI 16.0 to 22.3) scored above the cut-off point for PPD (≥ 10).

Table 2 Relationship factors of paternal postpartum depression among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, 2023

Variables	Frequency (n=610)	Percent (%)
Marital status		
Married	597	97.9
Single	5	0.8
Divorced	5	0.8
Widowed	3	0.5
Number of wife		
1	605	99.2
>1	5	0.8
Good marital relationship		
Yes	547	89.7
No	63	10.3
Good parental relationship		
Yes	568	93.1
No	42	6.9
Relatives diagnosed with mental illness		
Yes	78	12.8
No	532	87.2
Family support		
Yes	519	85.1
No	91	14.9
Friend support		
Yes	458	75.1
No	152	24.9
Professional support		
Yes	446	73.1
No	164	26.9

In addition to prevalence, this study aimed to identify PPD-associated factors. After adjusting for confounding variables, the finding showed that fathers who were not comfortable with their family income were 2.32 times more likely to have postpartum depression than fathers who were comfortable with their family income (AOR=2.32 (95% CI 1.16 to 4.66)).

Fathers who were currently using one or more substances had 2.48 times higher odds of postpartum depression than those who were non-users (AOR=2.48 (95% CI 1.22 to 5.05)).

In addition, fathers who had experience of childbirth had nearly two times higher odds of postpartum depression than those who had no experience of childbirth (AOR=1.89 (95% CI 1.02 to 3.50)).

Furthermore, fathers whose wives had unplanned pregnancies had 2.81 times higher odds of postpartum depression than those whose wives' pregnancies were planned (AOR=2.81 (95% CI 1.50 to 5.25)).

Additionally, fathers whose infants had sleeping problems had 3.59 times higher odds of postpartum depression than those whose infants had no sleeping problems (AOR 3.59 (95% CI 1.80 to 7.18)) (table 4).

DISCUSSION

The findings of this study showed the prevalence of PPD and its associated factors among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, in 2023.

In this study, 116 (19%) (95% CI 16.0 to 22.3) partners had postpartum depression. This finding is in line with the results of studies conducted in Saudi Arabia, Sweden, China and Japan, with PPD prevalence of 16.6%,¹¹ 21%,²² 20.4%²³ and 17%,²⁴ respectively.

Conversely, this PPD prevalence was lower than those reported in studies conducted in Pakistan in 2020 and 2022 and in Ireland and Italy, with prevalence of 28.3%,¹⁰ 23.5%,²⁰ 28%²⁵ and 28%,²⁶ respectively. The possible explanation for this discrepancy in prevalence is sociodemographic differences; particularly, their cultural norms around fatherhood and access to healthcare affect the mood status of the fathers and further drive depression development during the postpartum period.¹⁵

However, the prevalence of PPPD in the present study was higher than those in other studies conducted in Nigeria, Iran, Japan, Poland, Ireland, the UK, Germany, Hong Kong, China and Japan, with 8.9%,¹² 11.7%,¹⁵ 13.6%,¹⁷ 13%,²⁷ 12%,²¹ 3.6%,²⁸ 5%,²⁹ 5.2%³⁰ and 8.8%,³¹ respectively. Possible explanations for this discrepancy include sociodemographic differences, use of different methodological approaches and economic instability and poor access to healthcare in the study area that affect the mood status of the fathers, intensify negative emotion and further drive depression development during the postpartum period.

In this study, among paternal factors, fathers who were not comfortable with their family income had higher odds of PPPD than those who were comfortable with it (AOR=2.32 (95% CI 1.16 to 4.66)), and fathers who had unplanned pregnancies had higher odds of PPD than those who had planned pregnancies (AOR=2.81 (95% CI 1.50 to 5.25)). The presence of variables such as socioeconomic stressors, anxiety and worry about the outcome of unplanned pregnancies and dissatisfaction with family income is assumed to contribute to depression development after childbirth.

Fathers who reported that they were struggling to survive financially and living in poor economic circumstances had a greater risk of PPPD than those who were financially comfortable. This finding was consistent with the results of studies conducted in Ireland,²¹ Japan¹⁷ and Poland.^{27 28}

A possible reason for the above finding is that becoming a parent increases the need to fulfil the material needs of the family, including the newborn's basic needs or facilities. This economic difficulty may further affect the mood

Table 3 Infant and environment-related factors of paternal postpartum depression among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, 2023

Variables	Frequency (n=610)	Percent (%)
Your housing condition		
Your own	313	51.3
Rental	297	48.7
Did your wives go to her mother or family house		
Yes	134	22
No	476	78
Was the pregnancy planned		
Yes	487	79.8
No	123	20.2
Attend antenatal check-up		
Yes	438	71.8
No	172	28.2
Attend delivery of your child		
Yes	517	84.8
No	93	15.2
Time of father interviewed (months)		
<3	342	56.1
4–7	171	28
8–12	97	15.9
Mode of delivery		
Vaginal delivery	514	84.3
Caesarean section	96	15.7
Place of healthcare		
Government	522	85.6
Private	84	13.8
Home	4	0.7
Gestational age of the pregnancy		
Term	545	89.3
Preterm	41	6.7
Post term	24	3.9
Congenital birth problems		
Yes	28	4.6
No	582	95.4
Infant sleeping problem		
Yes	93	15.2
No	517	84.8
Loss of child before this pregnancy		
Yes	68	11.1
No	542	88.9

status of the fathers and increase their risk of developing depression during this period.

In this study, fathers who were current substance users had higher odds of PPD than fathers who were non-users (AOR=2.48 (95% CI 1.22 to 5.05)). This finding was in line with the results of studies conducted in Brazil³² and

Finland.¹⁸ This might be because taking any substances during the postpartum period might change the mood status of fathers, intensify negative emotions and further increase their risk for developing depression during the postpartum period.

Table 4 Bivariable and multivariable binary logistic regression analyses of paternal postpartum depression and associated factors among partners of women who gave birth in the last 12 months in Dessie Town, Northeast Ethiopia, 2023, (n=610)

Variables	Paternal postpartum depression			
	Yes, n (%)	No, n (%)	COR (95% CI)	AOR (95% CI)
Residence				
Rural	54 (22.7)	184 (77.3)	1.47 (0.98 to 2.21)	0.75 (0.43 to 1.32)
Urban	62 (16.7)	310 (83.3)	1	1
Employment status				
Employed	70 (15.8)	374 (84.2)	1	1
Unemployed	46 (27.7)	120 (72.3)	2.05 (11.34 to 3.13)	1.54 (0.86 to 2.75)
Comfortable with family income				
Yes	16 (9.6)	151 (90.4)	1	1
No	100 (22.6)	343 (77.4)	2.75 (1.57 to 4.82)	2.32 (1.16 to 4.66) *
Substance use				
Yes	46 (57.5)	34 (42.5)	8.89 (5.34 to 14.80)	2.48 (1.22 to 5.05)*
No	70 (13)	460 (87)	1	1
Known history of depression				
Yes	27 (36.5)	47 (63.5)	2.89 (1.71 to 4.88)	1.12 (0.48 to 2.63)
No	89 (16.6)	447 (83.4)	1	1
Number of new-borns				
Single	105 (17.8)	484 (81.3)	1	1
Twin	11 (52.4)	10 (47.6)	5.07 (2.10 to 12.25)	1.92 (0.54 to 6.82)
Experience of childbirth				
Yes	86 (25)	255 (75)	2.69 (1.71 to 4.22)	1.89 (1.02 to 3.50)*
No	30 (11)	239 (89)	1	1
Good relationship with your parents				
Yes	105 (18.5)	463 (81.5)	1	1
No	11 (26.2)	31 (73.8)	1.57 (0.76 to 3.21)	0.95 (0.35 to 2.56)
Marital status				
Married	110 (18.4)	487 (81.6)	1	1
Single	2 (40)	3 (60)	2.95 (0.49 to 17.88)	1.46 (0.08 to 27.50)
Divorced	3 (60)	2 (40)	6.64 (1.09 to 40.22)	2.47 (0.10 to 2.00)
Widowed	1 (33.3)	2 (66.7)	2.21 (0.20 to 24.63)	0.47 (0.13 to 17.11)
Good marital relationship				
Yes	91 (16.6)	456 (83.4)	1	1
No	25 (39.7)	38 (60.3)	3.30 (1.90 to 5.73)	1.71 (0.76 to 3.89)
Housing condition				
Owned	41 (13)	272 (87)	1	1
Rental	75 (25)	222 (75)	2.24 (1.47 to 3.41)	1.45 (0.84 to 2.50)
Planned pregnancy				
Yes	54 (11)	433 (89)	1	1
No	62 (50.4)	61 (49.6)	8.15 (5.18 to 12.82)	2.81 (1.50 to 5.25)*
Did you attend ANC				
Yes	49 (11)	389 (89)	1	1
No	67 (39)	105 (61)	5.07 (3.31 to 7.76)	1.55 (0.85 to 2.86)
Mod of delivery				
Vaginal delivery	83 (16)	431 (84)	1	1

Continued

Table 4 Continued

Variables	Paternal postpartum depression			
	Yes, n (%)	No, n (%)	COR (95% CI)	AOR (95% CI)
Caesarean section	33 (34)	63 (66)	2.72 (1.68 to 4.41)	1.52 (0.77 to 3.01)
Congenital birth problems				
Yes	21 (75)	7 (25)	15.38 (6.36 to 37.20)	2.58 (0.80 to 8.31)
No	95 (16)	487 (84)	1	1
Place of healthcare				
Government	91 (17)	431 (83)	1	1
Private	23 (27)	61 (73)	1.79 (1.05 to 3.04)	1.03 (0.49 to 2.15)
Home	2 (50)	2 (50)	4.74 (0.66 to 34.06)	5.10 (0.46 to 56.69)
Infant sleeping problems				
Yes	55 (59)	38 (41)	10.82 (6.61 to 17.70)	3.59 (1.80 to 7.18)*
No	61 (12)	456 (88)	1	1
Lost child before this child				
Yes	40 (58.8)	28 (41.2)	0.11 (0.07 to 0.20)	2.20 (0.99 to 4.89)
No	76(14)	466(86)	1	1

Key 1=reference.
 *statistically significant at 95% CI, $p < 0.05$ with paternal postpartum depression.
 AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio.

Furthermore, fathers who had experience of childbirth had higher odds of PPD than first-time fathers (AOR=1.89 (95% CI 1.02 to 3.50)). This result was in line with the findings of a study conducted in Finland in 2013.⁹ The reason may be that fathers' mental health deteriorates as they face the challenges of parenting, with money-related concerns contributing to their distress.³³

Fathers who had an infant with sleeping problems had higher odds of PPD than fathers who had no infant with sleeping problems (AOR 0.59 (95% CI 1.80 to 7.18)). This result was congruent with the finding of a study conducted in Ireland.²⁵ These results might be attributed to child health-related worries, stress and anxiety becoming the reason for the deteriorating mental health condition of fathers and increasing their risk for PPPD development.

In this study, having a full-term or preterm infant was not significantly associated with PPD. Conversely, in the study conducted in the southern region of Ireland in 2017, having a full-term infant was a significant protective factor, and PPD prevalence was higher among fathers of preterm infants than among fathers of term-born infants.²⁵

In Ethiopia, no guidelines have been established for assessing paternal mental health, even in areas where midwives are directly involved with pregnancy and postpartum care. However, according to the WHO, depression can be diagnosed and treated in primary healthcare centres, and midwives have a good opportunity to diagnose fathers' PPD because of their proximity to families.³² The American Academy of Paediatrics acknowledged PPD as a clinical problem yet called for paediatricians to screen fathers at the 6-month postpartum visit. The

National Perinatal Association encourages screening fathers for depression at least twice during the first postpartum year.³⁴ Currently, in Japan, midwives or public health nurses visit all families within 4 months after childbirth.

This study has several limitations. The cross-sectional design does not allow for causal inference, as exposures and outcomes were measured simultaneously. Although multivariable models were used, residual confounding from unmeasured factors cannot be excluded. The reliance on self-reported data introduces the possibility of recall and social desirability biases, particularly for sensitive mental health information.

Additionally, the lack of stratified analyses by age or marital status may have masked important differences between subgroups. The findings may also have limited generalisability beyond the study setting. Finally, depression was assessed using a screening tool rather than a diagnostic interview, which may have led to misclassification.

CONCLUSION AND RECOMMENDATION

In this study, almost one-fifth of fathers had PPD. Paternal factors such as not being comfortable with their family income, substance use, experience of childbirth, and environment-related and infant-related factors such as unplanned pregnancy and infant sleeping problems were significantly associated with PPD in the study area. Thus, providing the basic health needs of parents and child-care at affordable costs during the postpartum period is recommended. Additionally, further health education on the effects of substance use should be provided through

different mass media platforms, as well as placing greater attention on family planning utilisation to minimise unplanned pregnancy and offering better support to multiparous fathers.

Based on WHO recommendations, depression can be diagnosed and treated in primary healthcare centres, and midwives have a good opportunity to diagnose PPD among fathers given their proximity to families. Therefore, healthcare professionals are recommended to conduct mental health screening for fathers during the postpartum period. Significant predictors must be considered, especially among fathers who had economic problems, substance use, unplanned births, prior experience of birth and infant sleeping problems, and incorporated into the clinical assessment and intervention of PPPD. In addition, researchers are encouraged to conduct further research using diverse study designs (longitudinal and mixed-methods design) and identify further potentially important unmeasured associated factors of PPPD.

Acknowledgements The authors thank Wollo University for approving the ethical clearance and providing technical and financial support for this study. We also thank all study participants for their commitment to responding to our interviews and observations. Lastly, we are indebted to each health office for the assistance and permission to undertake the research.

Contributors AA conceived the study and undertook the statistical analysis. AA and AW supervised the study design and statistical analysis. AA, MA and AB contributed to the writing of the manuscript. All authors read and approved the submitted version of the manuscript. AA is the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s)

Ethics approval This study involves human participants and was approved by Wollo University, College of Medicine and Health Sciences, Ethical Review Committee (ERC) with the approval number (CMHS/840/20/15). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Paternal postpartum depression has public health importance which is neglected and under-recognised in Ethiopia.

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