Antenatal Depression and Its Risk Factors Among Public Clinic Attendees: A Cross-Sectional Study in Urban and Rural Area of Limpopo, South Africa

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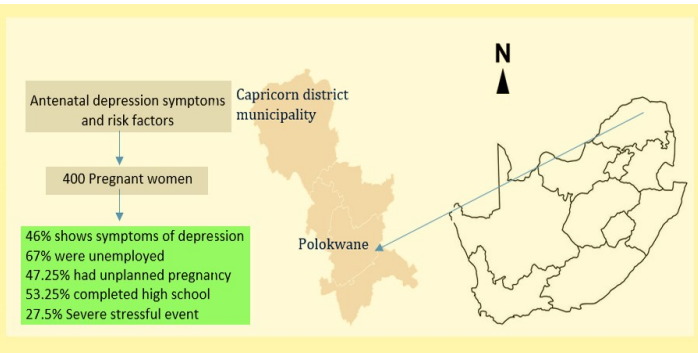
ABSTRACT

Antenatal depression is a common yet underdiagnosed mental health issue with serious implications for maternal and child well-being. While its prevalence is well-documented globally, limited research exists on its burden and contributing factors within primary health care settings in rural South Africa. The purpose of this study was to screen for symptoms of antenatal depression and explore associated factors among clinic attendees in primary health care facilities in the Capricorn Health District, Limpopo Province, South Africa. The Edinburgh Postnatal Depression Scale-10 (EPDS-10) was used to screen for symptoms of antenatal depression, and a quantitative questionnaire was used to collect socio-demographic data. The ages of the sample ranged from 18 to 44 years, with a mean age of 28 years. The greatest proportion, 46% (n = 186), were single, and the majority were unemployed, 67% (n = 270), with 53.25% (n = 243) having completed high school. Almost half, 47.25% (n = 189), had not planned their pregnancy. The prevalence of antenatal depression symptoms was high, at 46% (n = 184). Factors associated with antenatal depression symptoms included being unemployed, having a previous diagnosis of postnatal depression (PND), dissatisfaction with the relationship with one's partner, and lack of financial, social, and emotional support from the partner, as well as experiencing severe stress in the previous six weeks. The results highlight the need for routine antenatal screening for depression in primary health care facilities, where the majority of pregnant women access prenatal care.

ABSTRAK

Depresi antenatal adalah masalah kesehatan mental yang umum namun kurang terdiagnosis, dengan dampak serius terhadap kesejahteraan ibu dan anak. Meskipun prevalensinya telah banyak didokumentasikan secara global, penelitian yang membahas beban dan faktor-faktor penyebabnya di fasilitas pelayanan kesehatan primer di daerah pedesaan Afrika Selatan masih terbatas. Tujuan dari penelitian ini adalah untuk menyaring gejala depresi antenatal dan mengeksplorasi faktor-faktor yang terkait di antara pengunjung klinik di fasilitas pelayanan kesehatan primer di Distrik Kesehatan Capricorn, Provinsi Limpopo, Afrika Selatan. Edinburgh Postnatal Depression Scale-10 (EPDS-10) digunakan untuk menyaring gejala depresi antenatal, dan kuesioner kuantitatif digunakan untuk mengumpulkan data sosio-demografis. Usia sampel berkisar antara 18 hingga 44 tahun, dengan usia rata-rata 28 tahun. Proporsi terbesar, yaitu 46% (n = 186), berstatus lajang, dan mayoritas tidak bekerja, yaitu 67% (n = 270), dengan 53,25% (n = 243) telah menyelesaikan pendidikan tingkat SMA. Hampir setengah, yaitu 47,25% (n = 189), tidak merencanakan kehamilannya. Prevalensi gejala depresi antenatal tergolong tinggi, yaitu sebesar 46% (n = 184). Faktor-faktor yang terkait dengan gejala depresi antenatal mencakup status pengangguran, riwayat diagnosis depresi pascapersalinan (PND), ketidakpuasan dalam hubungan dengan pasangan, kurangnya dukungan finansial, sosial, dan emosional dari pasangan, serta pengalaman stres berat dalam enam minggu terakhir.

GRAPHICAL ABSTRACT



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INTRODUCTION

Maternal depression, which can occur during pregnancy, after delivery, or in both periods, presents a hidden health burden, especially in developing countries (Shidhaye & Giri, 2014), where it often remains undiagnosed. Maternal depression is the leading cause of disease-related disability in women, and it affects the health and well-being of both mothers and their children (Haithar et al., 2018). Maternal depression has been identified as a focus for efforts to improve maternal and child health outcomes. Mothers with depression tend to be less responsive to the needs of their children and are less likely to bond with their children, which may contribute to neglect of maternal nurturing roles (Treat et al., 2020).

The global prevalence of antenatal depression was reported to range from 15% to 65%, based on a review of 230 studies, and the following factors were identified to be associated with antenatal depression: exposure to different forms of abuse and violence, lack of social or partner support, and personal or family history of any common mental disorder (Dadi et al., 2020). Dadi et al. (2020) reported that the prevalence of antenatal depression in Africa is 26.3%, indicating that approximately one in four pregnant women experience depression.

A higher prevalence of maternal depression is reported in low- and middle-income countries, such as South Africa, where prevalence rates have been reported to range between 21% and 39% (Brittain et al., 2015; Redinger et al., 2018), compared to 7% in developed countries. High rates of both depression and anxiety during early and late pregnancy have been reported, with family stress identified as a significant contributor to early depression and anxiety (Redinger et al., 2020). Because depressive symptoms are significantly associated with adverse social factors (Pellowski et al., 2019), there is a need to conduct studies in understudied areas, such as the Limpopo Province.

Most public health facilities in South Africa do not screen for antenatal or postnatal depression, and affected mothers remain undiagnosed and untreated, despite attending antenatal and postnatal care services. As a result, even the nurses who provide services to these women may fail to identify this risk, due to structural factors related to policies, systems, and resources, as well as a lack of provider preparation and training, and overburdened clinics (Brown & Sprague, 2021). There is limited public health system expenditure on mental health facilities, but this differs by province, resulting in inequalities and inadequate service provision (Maphumulo & Bhengu, 2019). These inequalities and lack of resources restrict access to mental health services and place additional pressure on nurses, other healthcare professionals, and patients.

There are many risk factors affecting antenatal women, and many studies have identified them. It was reported that a systematic review found similar risk factors to those identified in other studies, with history of depression emerging as the strongest risk factor for antenatal depression. For example, lack of partner or social support, domestic violence, previous history of depression, unplanned pregnancy, and severe stressful events are significant predictors (Biaggi et al., 2016; Eastwood et al., 2017). Additional factors such as younger age, low levels of education, high number of children in the household, smoking, alcohol consumption, and lack of leisure time were also with antenatal depression (Coll et al., 2017).

The data was collected using face-to-face interviews, which may have influenced responses compared to anonymous questionnaires that allow participants to feel more comfortable sharing sensitive information. Even though the data were collected in a high-income country like Brazil, the risk factors remain relevant and can inform intervention strategies elsewhere. The Limpopo Province, including the Capricorn District, has been reported to provide suboptimal health services (Matlala et al., 2021). A study conducted in Bochum, within the Capricorn District, reported an antenatal

depression prevalence rate of 31%, which is high and concerning, suggesting that even higher rates of undiagnosed depression may exist in this population (Ramohlola et al., 2022). It is therefore essential to increase research efforts focused on screening for maternal depression within the province and, specifically, within the district. The purpose of this study was to screen for antenatal depression symptoms and to identify associated socio-demographic, clinical, and social support-related factors among clinic attendees in the Capricorn District, Limpopo Province, South Africa.

METHODS

Study design

The study used a quantitative cross-sectional design to collect data from pregnant clinic attendees in Capricorn district of Limpopo Province, South Africa. he data were collected over a period of four months, from April to July 2023.

Research Settings

The Polokwane Municipality, which is within the Capricorn District, has a total of 41 primary health care facilities, of which five were randomly selected for the study. All primary health care facilities offer a range of services, including antenatal and postnatal services.

Population and Recruitment of Participants

The population consisted of pregnant women who are in the third trimester of their pregnancy, i.e. from 28 weeks, who receive antenatal health care services at public primary health care clinics in Limpopo province, South Africa. The recruitment process started by obtaining permission letter to conduct the study from Limpopo Provincial office of health in Polokwane, which was used to negotiate for permission from the local municipality in Polokwane. The obtained permission letters were further used to negotiate for permission from the management of the identified primary health care facilities. Within the randomly selected primary health care facilities, the potential participants were individually recruited as they were waiting for antenatal health services. The women were recruited on any day of the week when the data collectors visited any of the five health facilities that participated in the study.

Inclusion and Exclusion

Women who were 18 years and older, in their third trimester, willing to participate in the study, and able to provide written informed consent were included. Women who were younger than 18 years, not in the third trimester, or who were unable to provide informed consent were excluded. The final sample of 400 was obtained, with 79 women from Buite clinic, 111 from Nobody clinic, 20 from Seshego zone 2 clinic, 90 from Seshego zone 4 clinic and 100 from Rethabile CHC. As it is difficult to obtain a random sample of mothers waiting in queues at the facilities, convenience sampling was employed.

Sampling and Sample Size Determination

Using the Raosoft sample size calculator for an unknown population of pregnant women in their third trimester, a 5% margin of error, a confidence level of 80% and response rate of 50%, a minimum of sample size of 350 was calculated.

Data Collection Tools

The Edinburgh Postnatal Depression Scale 10 (EPDS-10) was used to screen for antenatal depression scale. This is the most widely used instrument to screen for maternal depression, has been validated among diverse cultures and socioeconomic situations, and has been used in South Africa (Abrahams & Stellenberg., 2015; Mokwena & Masike., 2020). The acceptability of its sensitivity, specificity, and positive predictive value has also been confirmed (Serafini et al., 2017; Levis et al., 2020).

Table 1
The characteristics of the participants

Variable	Frequency	Percentage
Facility name		
Buite clinic	79	19.75
Nobody clinic	111	27.75
Seshego zone 2 clinic	20	5
Seshego zone 4 clinic	90	22.5
Rethabile CHC	100	25
Mother's age (years)		
18-20	41	10.25
21-25	102	25.5
26-30	141	35.25
31-25	84	21
36 and above	32	8
Level of education		
No formal education	5	1.25
Primary school	15	3.75
Secondary school	57	14.25
High school	213	53.25
Tertiary	110	27.5
Marital status		
Single	186	46.5
Staying with a partner	214	53.5
Employment status		
Unemployed	270	67
Employed	104	26
Self-employed	26	6
Occupants living with participants (<18 Years)		
None	92	23
1-2	213	53.25
≥3	95	23.75
Occupants living with participants (≥18 Years)		
None	3	0.75
1-2	255	63.75
≥3	142	35.50
Household Income		
R 0-1000	30	7.5
R 1001-2000	55	13.75
R 2001-5000	148	37
R 5000-8000	87	21.75
R >8000	80	20

Although the Edinburgh Postnatal Depression Scale was initially developed to screen for postnatal depression, it is being widely used to screen for antenatal depression (Meijer et al., 2014; Kozinszky & Dudas., 2015; Jairaj et al., 2019), where its psychometric accuracy continues to be validated. A quantitative questionnaire was used to collect socio-demographic data, such as age, highest level of education, marital status, and employment status, how many occupants living with participants who are under 18 and who 18 are and above and household income. The questionnaire also included information about the partner of the participant or father of the child, which included the partner's highest level of education, employment status, whether the woman was satisfied with the relationship with the father of the child, whether he was happy with the pregnancy, whether he provides financial support to the participant, whether he supports the participant during difficult times, whether in the previous twelve months the partner/father of the child had other sexual partners that she knows of, whether he drinks alcohol, and whether the partner threatened or actually hit her in the previous twelve

Table 2
Obstetric and clinical related information

Variable	Frequency	Percentage
Pregnancy(weeks)		
28-30 weeks	136	34
31-36 weeks	190	47.5
>37 weeks	74	18.5
Parity		
No baby	118	29.5
1-2 babies	237	59.25
>2 babies	45	11.25
Babies that are alive		
1-2 babies	247	88.21
>2 babies	33	11.79
Babies that died		
None	257	90.81
1-2 babies	25	8.83
>2 babies	1	0.35
Miscarriages		
None	323	80.75
1-2	75	18.75
>2	2	0.5
Pregnancy planned		
No	189	47.25
Yes	211	52.75
Previously Diagnosed with depression		
No	390	97.5
Yes	10	2.5
HIV status		
Negative	356	89
Positive	43	10.75
Unknown	1	0.25
When did you know about your HIV status?		
Already knew	76	19.05
Antenatal clinic	322	80.7
During delivery	1	0.25
Smoke cigarette		
Never	391	97.75
Everyday	4	1
Sometimes	5	1.25
Drink alcohol		
Never	388	97
Every weekend	1	1
Sometimes	11	2.75

months. Social support questions included whether the participant has a person that supports her in times of difficulties, and who supports her in times of difficulties. The last question was whether the participant experienced any severe stressful event in the previous six months, and if yes, to indicate the kind of stressful event from the list given.

Data collection

Data were collected by the principal investigator and trained research assistants. On the day of data collection, the purpose and processes of the study were explained to the group of clinic attendees as they were waiting to receive antenatal assessments, and they were requested to participate. Those who were interested were asked to go to a private room within the clinic, where further details of the study were given and they were given an opportunity to ask questions or seek clarifications. This was followed by the administration of the informed

Table 3
The participants' partner information

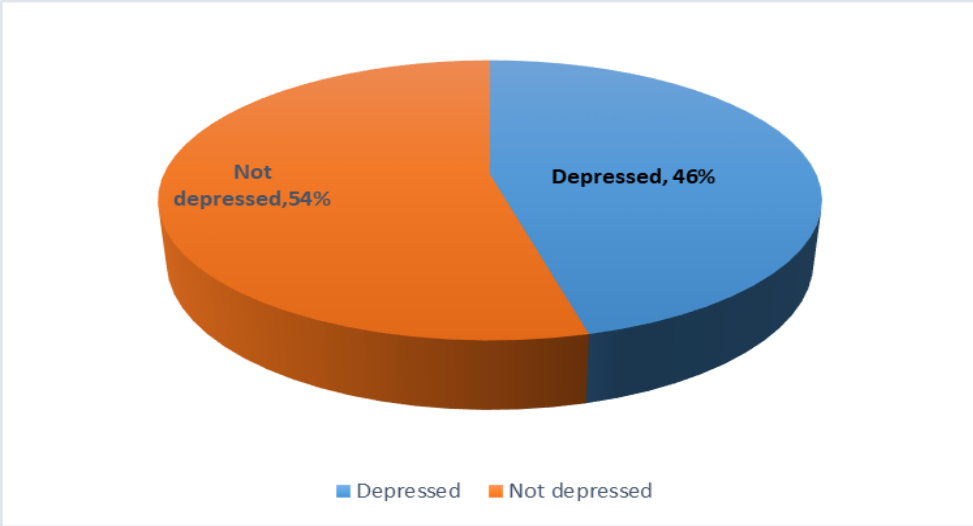
Variable	Frequency	Percentage
Highest level of education attained		
No formal education	3	0.75
Primary school	13	3.25
Secondary school	27	6.75
High school	204	51
Tertiary	113	28.25
I don't know	40	10
Employment status		
Employed	293	73.25
Unemployed	53	13.25
Self employed	54	13.5
Satisfied with relationship		
No	70	17.5
Yes	330	82.5
Partner happy with pregnancy		
No	52	13
Yes	333	83.25
Not sure	15	3.75
Partner financial support		
No	60	15
Yes	340	85
Partner social support		
No	69	17.25
Yes	331	82.75
Partner has other sexual partners you know		
No		
Yes	69	17.25
	331	82.75
Partner drinks alcohol		
No	167	41.75
Yes	233	58.25
Partner hits you		
No	360	90
Yes	40	10
Partner provides emotional support		
No	35	8.75
Yes	365	91.25
Severe stress		
No	290	72.68
Yes	110	27.32
Reason for severe stress		
Death of a close person	22	20
Family problems	10	9.09
Financial crisis	19	17.27
Pregnancy problems	10	9.09
Relationship Problem	25	22.73
Work related problem	10	9.09
Other	14	12.73

consent, the socio-demographic questionnaire and the Edinburg Postnatal Depression scale.

Ethical Considerations

An ethical clearance certificate to conduct a study was obtained from Sefako Makgatho Health Sciences University Research Ethics Committee (SMUREC/H/319/2021: PG). Permissions to conduct the study were obtained from the provincial department of health, the local municipality and the management of the health facilities. All participants provided in-

Figure 1
Pie chart showing the prevalence of depression symptoms



formed consent. All participants were given the information about the study pamphlet to keep, which has details about the South African Depression and Anxiety Group (SADAG), to be contacted for professional psychological assistance when necessary.

Data Analysis

The data were captured in Microsoft Excel, cleaned, coded, and exported to Stata version 14 for analysis. Socio-demographic data were analyzed descriptively and presented as means, medians, modes, proportions, percentages, and standard deviations. The prevalence of antenatal depression was determined using EPDS scores. A maximum score of 30 is possible; scores below 13 were categorized as not depressed, and scores of 13 or higher as depressed.

Pearson's chi-square test was used to explore associations between socio-demographic variables and depression symptoms, using a significance level of $p \leq 0.05$. Multivariate logistic regression analysis was performed on variables that were significantly associated with depression at the chi-square level ($p \leq 0.05$).

RESULTS

Table 1 shows the rest of the socio-demographic characteristics of the sample. A total of 400 respondents from five primary health care facilities participated in the study. The ages of the participants ranged from 18 to 44 years, with a mean of 28 years (±SD=5.46). The greatest proportion 53.50% (n=214) were living with a partner with included irrespective of whether they were married or not, and 46.50% (n=186) were single. The unemployment rate was high at 67% (n=270), and those who are self-employed 6% (n=26). The majority of participants completed high school 53.25% (n=243), while 27.50% (n=110) have tertiary qualifications.

Table 2 presents that the number of babies per participant ranged from 1 to 6, with the majority, 59.25% (n = 237), having one to two children, and 29.50% (n = 118) having no previous children. Almost half, 47.50% (n = 190), of the sample were between 31 and 36 weeks pregnant, while 34% (n = 136) were between 28 and 30 weeks, and 18.50% (n = 74) were more than 37 weeks pregnant. Nearly half of the participants, 47.25% (n = 189), reported that their pregnancy was unplanned. A small proportion, 2.50% (n = 10), of the participants had been previously diagnosed with postnatal depression related to earlier pregnancies.

Table 4
Factors associated with antenatal depression

Factor	Frequency (%)	Depressed (%)	Not depressed (%)	Chi^2	p-Value
Employment status					
Employed	104(26)	57(30.98)	47(21.76)	4.9667	*0.043
Self employed	26(6.50)	13(7.07)	13(6.02)		
Unemployed	270(67.50)	114(61.96)	156(72.22)		
Diagnosed with depression before					
No	390(97.50)	175(95.11)	215(99.54)	7.9937	*0.005
Yes	10(2.50)	9(4.89)	1(0.46)		
Participants satisfied with relationship					
No	70(17.00)	48(26.09)	22(10.19)	17.4025	*0.000
Yes	330(82.00)	136(73.91)	194(89.81)		
Partner happy with pregnancy					
No	52(13.00)	33(17.93)	19(8.80)	7.9605	*0.019
Yes	333(83.25)	143(77.72)	90(87.96)		
Not sure	15(3.75)	8(4.35)	7(3.24)		
Partner financial support					
No	60(15.00)	45(19.02)	25(11.57)	4.3226	*0.038
Yes	340(85.00)	149(80.92)	191(88.43)		
Partner emotional support					
No	69(17.25)	46(25.00)	23(10.65)	14.337	*0.000
Yes	331(82.75)	138(75.00)	193(89.35)		
Partner has other sexual partners					
No	330(82.50)	138(75.00)	192(88.89)	13.2756	*0.000
Yes	70(17.50)	46(25.00)	24(11.11)		
Who supports you in difficult times					
None	32(8.00)	19(10.33)	13(6.02)	10.9413	*0.012
Family	325(81.25)	138(75.00)	187(86.57)		
Extended family	26(6.50)	14(7.61)	12(5.56)		
Friends	17(4.25)	13(7.07)	4(1.85)		
Severe stressful event					
No	290(72.50)	110(59.78)	180(83.33)	27.6407	*0.000
Yes	110(27.50)	74(40.22)	36(16.67)		

Note: * Indicates significance association, Bivariate analysis using a Pearson chi-square test

Table 3 illustrates that the majority of the participants' partners have completed high school 51.0% (n=204), with 28.25% (n=113) having tertiary education, 73.25% (n=293) of the partners were employed and 82.50% (n=330) of the participants were satisfied with the relationship with their partners.

Table 4 presents the factors that were significantly associated with antenatal depression in the bivariate analysis. The Pearson chi-square test was used to assess statistical differences between women with antenatal depression and those without (p-value < 0.05).

The EPDS scores ranged from 0 to 27, with a mean score of 7.06 (SD = ±6.12). Among the 400 participants, 46% (n = 184) screened positive for depression symptoms, with 29.25% (n = 117) classified as mild, 12% (n = 48) as moderate, and a small proportion, 4.25% (n = 17), exhibiting severe symptoms (See Figure 1).

Table 5 presents that significant associations were found between depression symptoms and the following variables: employment status, previous diagnosis of postnatal depression (PND), satisfaction with relationship with partner, partner's attitude toward the pregnancy, partner's financial and emotional support, partner having other sexual partners, availability of social support, and experience of severe stress.

DISCUSSION

The current study reported a 46% prevalence of antenatal depression symptoms, which is among the highest reported in global litera-

Table 5
Multivariate logistic regression

Factor	Odds ratio	Std. Err.	z	p>|Z|	[95% conf. Interval]	
Employment status	1.324552	0.2949967	1.26	0.207	0.8560122	2.04945
Satisfied with their relationship	1.672305	0.6645953	1.29	0.196	0.7674274	3.64413
Diagnosed with depression before	0.0977359	0.1078624	2.11	*0.035	0.0112372	0.850058
Partner happy with pregnancy	0.6328611	0.2553291	1.13	0.257	0.287005	1.395492
Partner financial support	0.648984	0.2705839	1.04	0.3	0.2866412	1.469364
Partner emotional support	2.077666	0.8690218	1.75	*0.04	0.9152611	4.716353
Partner other sexual partner	0.429574	0.1266094	2.87	*0.004	0.2410807	0.765446
Social support	1.242153	0.3840073	0.7	0.483	0.677687	2.27678
Severe stressful event	0.3298978	0.080376	4.55	*0.000	0.2046414	0.53182

Note: * Indicates significance association, Multivariate logistic regression model P=level of significance; Z=z score, Std. Err. = Standard Error

ture (Curry et al., 2019; Dagher et al., 2021). However, this prevalence is consistent with findings from other African countries (Meijer et al., 2014; Stewart et al., 2014; Biratu & Haile, 2015), which reported high prevalence rates ranging between 30% and 49% (Redinger et al., 2018). This confirms the high burden of antenatal depression in developing countries, including several African nations and South Africa. The results also reflect geographic and community-level variations, as lower prevalence rates have been reported in other South African studies (Manikkam & Burns, 2012; Tomlinson et al., 2018), with the Eastern Cape reporting a much lower prevalence of 16% (Christodoulou et al., 2019).

The finding that a range of socioeconomic factors are associated with maternal depression has been previously confirmed (Getinet et al., 2018; Míguez & Vázquez, 2021), and this applies to both developed (Ogbo et al., 2018; Mukherjee et al., 2017; Cena et al., 2021) and developing countries (Dadi et al., 2020; Insan et al., 2022). Moreover, such low socioeconomic status magnifies the effects of negative life events on antenatal anxiety (Verbeek et al., 2019). The univariate analysis revealed that almost all variables related to the partner relationship were statistically significant, which may explain the high prevalence of depressive symptoms in this sample.

The current study found a statistically significant association between antenatal depression symptoms and several factors: previous diagnosis of postnatal depression, lack of partner emotional and financial support, a partner with other sexual partners, lack of social support, and recent experience of severe stress. Specifically, partner emotional support showed a significant association with depressive symptoms among pregnant women. Although employment status was associated with antenatal depression in the bivariate analysis, it was not significant in the multivariate model.

The study also confirmed that women lacking emotional support from their partners were twice as likely to experience antenatal depression compared to those with partner support. This finding aligns with other studies that have shown that social support lowers the risk of maternal depression (Sheeba et al., 2019). Lack of social support increases emotional insecurity (Dibaba et al., 2013; Bedaso et al., 2021), while the availability of support enhances emotional stability and reduces the risk of depression (Govender et al., 2020).

The association between a history of postnatal depression and antenatal depression has been validated by previous research, which has found that experiencing postnatal depression in a previous pregnancy is a risk factor for depression in subsequent pregnancies (Shakeel et al., 2015).

A major concern with antenatal depres-

sion is its tendency to persist into the postnatal period (Pampaka et al., 2019; Yasuma et al., 2020), compromising the mother's ability to care for her infant. Moreover, antenatal depression is associated with impaired neonatal brain development (Qiu et al., 2017) and, if left untreated, can negatively affect child development (Mokwena, 2021). All women identified with antenatal depressive symptoms are at risk for adverse outcomes, including the progression to postnatal depression with more severe and long-term consequences.

A strength of the study is that the majority of participants were willing to take part and, notably, many of those who screened positive for antenatal depression expressed a willingness to seek help. The researcher-administered questionnaire maintained participant anonymity, as no names were recorded, and interviews were conducted in private rooms. However, a limitation is that the data were collected primarily from urban, township, and semi-rural areas, which may have influenced the generalizability of the findings to more rural or remote populations. Since the questionnaires were administered by the researcher rather than self-completed, some participants may have hesitated to respond honestly, particularly to sensitive questions related to family violence and personal experiences, due to fear of judgment.

CONCLUSIONS

The study reported a high prevalence of antenatal depressive symptoms, many of which remain undiagnosed and untreated. This lack of screening and intervention can result in long-term adverse outcomes for both mother and child, as antenatal depression may progress to postnatal depression. Delays in screening compromise the quality of antenatal care. Prevention, early detection, and appropriate treatment can reduce complications and improve maternal health outcomes. Community outreach and educational programs need to be implemented to inform mothers about antenatal depression, its risks, available support services, and when to seek assistance. Health promotion should also target family members, partners, and relatives, encouraging them to provide emotional and practical support during the ante- and postnatal periods. Improving access to healthcare services such as counseling and depression screening at the community level can also reduce stigma. Longitudinal studies should be conducted to follow women from pregnancy through the postnatal period to assess the long-term impacts of maternal depression. This would enhance understanding of the effectiveness of antenatal depression intervention strategies and allow for timely and targeted support.

Although screening for maternal depression is not yet government policies, this does not prevent health facilities from implementing this necessary service to all mothers. It is recommended that an increasing number of clinics initiate this service, especially because the EPND scale is easy to use, and facilities can train a few of their staff to provide this essential service.

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AUTHORS' CONTRIBUTIONS
Mulalo Salane designed the study, formulated the concept, writing the original draft preparation, enrolled participants, collected data, analyzed data, and reviewed the manuscript. Kebogile Mokwena designed the study, formulated the concept, reviewed, editing the manuscript and supervision

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COMPETING INTERESTS
The authors confirm that all of the text, figures, and tables in the submitted manuscript work are original work created by the authors and that there are no competing professional, financial, or personal interests from other parties.

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