Original Article

Perinatal Outcomes Among Booked and Unbooked Mothers: A Comparative Analysis from a Teaching Hospital in the Niger Delta Region of Nigeria

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ABSTRACT

Perinatal morbidity and mortality remain high in many low-resource settings, particularly among women without antenatal care. Understanding the impact of booking status on perinatal outcomes is crucial for improving feto-maternal health indices. We compared perinatal outcomes between booked and unbooked mothers who delivered at the Delta State University Teaching Hospital (DELSUTH). This was a retrospective comparative study that reviewed the case files of mothers who delivered at DELSUTH. Socio-demographic, obstetric, and perinatal data were extracted. Chi-square tests evaluated group differences, while logistic regression identified independent predictors of perinatal outcomes. Perinatal mortality rate (PMR) was calculated using stillbirths and early neonatal deaths per 1000 live births. Booked mothers were significantly younger, more educated, and most resided in urban areas ($p < 0.05$). Unbooked women had higher rates of labour complications. Unbooked mothers also recorded higher rates of stillbirth (8.5% vs. 2.2%), neonatal asphyxia (27.1% vs. 6.9%), NICU admission (30.5% vs. 11.2%), and early neonatal death (5.1% vs. 0.9%) (all $p < 0.01$). PMR was statistically significantly higher among unbooked mothers (148.1 vs. 30.9 per 1000 live births). Unbooked status was a strong independent predictor of adverse perinatal outcome (AOR = 8.12; 95% CI: 3.04–21.67) and Emergency caesarean section and assisted vaginal delivery also significantly increased risk. Unbooked pregnancies are associated with poorer perinatal outcomes, emphasizing the vital importance of improved antenatal care in our setting. Strengthening community awareness, improving access to care, and promoting early booking are essential in reducing adverse perinatal outcomes in the region.

Keywords: Booking status, DELSUTH, Nigeria, Perinatal mortality, Perinatal outcomes

INTRODUCTION

Adverse perinatal outcomes continue to be a public health challenge despite years of research aimed at identifying associated risk factors, and perinatal health remains an indicator of the quality of maternal and child healthcare services worldwide. [1-4] The perinatal period, defined as the time from the age of viability (28 completed weeks of gestation in Nigeria) to seven days after birth, is among the most critical periods in human life.[2] Perinatal morbidity and mortality are therefore major concerns, particularly in developing countries, where the majority of these deaths are preventable with timely and appropriate antenatal and intrapartum care.[5,6]

Adeoye et al. in Ibadan reported that adverse perinatal outcomes are defined as the occurrence of at least one of the following: preterm delivery, birth

asphyxia, low birth weight, neonatal intensive care unit admission, or perinatal death.[7] These adverse outcomes contribute to neonatal and infant morbidity and mortality and are associated with long-term complications.

Perinatal mortality (PM), which comprises still birth and early neonatal death, is the death of a foetus between 28 weeks of gestation and the first week following delivery.[2,8] In 2019, 4.3 million perinatal mortalities occurred globally. [9] Sub-Saharan Africa accounts for almost half of the global perinatal mortality, with an estimated PMR of 34.7 deaths per 1,000 total births, compared to less than 6 per 1,000 in most high-income countries.[10,11]

According to the Nigeria Demographic and Health Survey (NDHS), the county's perinatal mortality rate increased from 49 per 1,000 pregnancies in 2018 to 52 per 1000 in 2024.[2,8] There are regional differences in PMR, with rates as high as 43–68 per 1,000 in some northern states compared to 38–40 per 1,000 in the southern regions.[2] Nwokoro *et al*. in a study conducted in Abuja reported a PMR of 129.5 per 1000 births.[12] The Niger Delta region, despite being economically significant due to its oil resources, continues to experience poor perinatal outcomes attributable to limited access to skilled care, inadequate health infrastructure, and sociocultural barriers to health-seeking behaviour.[13] Delta State, located within the Niger Delta region, also experiences high burden of perinatal morbidity and mortality, particularly among unbooked parturients.[2]

Booking status refers to whether a pregnant woman has received supervised antenatal care at a standard health care centre prior to labour, and it is a determinant of perinatal outcome.[14] A booked mother is one who has received antenatal care under skilled supervision, while an unbooked mother is one who presents in labour or with obstetric complications without prior antenatal attendance. In recent decades, prenatal care has been recognized as an important public health intervention aimed at improving neonatal outcomes.[15,16]

Despite the availability of maternal health services at various levels of care, many women, especially those from rural communities, remain unbooked at the time of delivery leading to unfavourable maternal and perinatal consequences.[17] The non-utilization of the available maternal and perinatal health services is linked to poverty, poor female empowerment, low educational status, lack of awareness of benefit of ANC, and lack of access to health facilities. In the Niger Delta region, where inequities in healthcare access remain prominent, the non-utilization of maternal and perinatal healthcare services is particularly concerning. Osuji *et al.* carried out a study in a rural area in Delta State and reported that unbooked mothers had a significantly higher PNMR (224.2/1000) compared with booked mothers (21.6/1000), largely driven by preventable causes. However, there is lack of data from tertiary facilities in Delta State comparing perinatal outcomes between booked and unbooked mothers, especially with the improvements in obstetric care services at referral centres. The paucity of local data limits vital interventions. Understanding these differences is necessary to formulate effective strategies that will reduce adverse perinatal outcomes in Delta State. Therefore, this study aimed to compare perinatal outcomes between booked and unbooked parturients who delivered at DELSUTH, with a view to identifying the determinants of adverse perinatal outcomes and recommending strategies to improve perinatal health

MATERIALS AND METHODS

Definition of Terms:

1. Booked mothers were defined as those who had at least two antenatal clinics (ANC) visit and had their booking investigation results reviewed in DELSUTH prior to delivery.

2. Unbooked mothers were those who had no antenatal care in DELSUTH prior to delivery, and parturient referred from other facilities or traditional birth attendants.

3. Perinatal mortality referred to the death of a fetus between 28 weeks of gestation and the first week following delivery.

Study Design

This study was a retrospective comparative study to evaluate perinatal outcomes among booked and unbooked mothers who delivered at the Delta State University Teaching Hospital, Oghara, Delta State, Nigeria.

Study Setting

The study was conducted at the Department of Obstetrics and Gynaecology, DELSUTH, Oghara. DELSUTH is a teaching hospital in the Niger Delta region of Nigeria. It serves as a referral centre for surrounding private, primary and secondary healthcare facilities in Delta State and neighbouring states, including Edo and Bayelsa. The maternity unit is made up of antenatal and postnatal wards, a labour ward, a theatre for obstetric emergencies, and it is closely linked to the neonatal intensive care unit (NICU) that offers specialized care for newborns.

Study Population

The study population comprised all women who delivered at DELSUTH within the study period, as well as their newborns. Both booked and unbooked parturients were included in the analysis.

Study Period

The study covered deliveries over a two-year period between January 1, 2022, and December 31, 2023.

Eligibility Criteria

Inclusion criteria were all deliveries that occurred at DELSUTH within the study period; both booked and unbooked parturient with complete delivery records; and pregnancies of at least 28 completed weeks of gestation.

Exclusion criteria were deliveries with incomplete or missing essential data (e.g., unknown birth outcomes or unrecorded booking status) and neonates more than 7 days of delivery.

Sample Size

A total of 508 complete case records of women who delivered within the study period and met the inclusion criteria were reviewed. These included 331 booked and 177 unbooked mothers.

Data Collection

Data were extracted from patients' case notes, labour ward registers, and delivery records using a structured proforma. The proforma had four main sections: Socio-demographic characteristics (maternal age, marital status, educational level, parity, and place of residence), clinical characteristics (gestational age at presentation, onset of labour, and mode of delivery), perinatal outcomes (live birth, stillbirth, Apgar scores, neonatal asphyxia, NICU admission, and early neonatal death), and maternal booking status (booked or unbooked based on antenatal attendance at DELSUTH)

Study Variables

Independent variable was maternal booking status (Booked vs Unbooked), while the dependent variables were perinatal outcomes (live birth, stillbirth, neonatal asphyxia, NICU admission, and early neonatal death)

Data Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were computed for all variables. Results were presented as frequencies, percentages, means, and standard deviations. Comparative analyses between booked and unbooked mothers were performed using the Chi-square (χ^2) test for categorical variables and Student's t-test for continuous variables. Logistic regression analysis was used to identify predictors of adverse perinatal outcomes. Adjusted odds ratios (AORs) with 95% confidence intervals (CI) were calculated, and statistical significance was set at $p < 0.05$.

The Perinatal Mortality Rate (PMR) was calculated as:

$$\frac{\text{Number of stillbirths} + \text{early neonatal deaths}}{\text{Total live birth}} \times 1000$$

This was compared between booked and unbooked mothers.

Ethical Considerations

Ethical clearance for the study was obtained from the DELSUTH's Ethics and Research Committee (DELSUTH/HREC/PAN/2025/082/0776). Data were used only for research purposes.

RESULTS

A total of 508 parturient were included in the study, made up of 331 booked (65.2%) and 177 unbooked (34.8%) women.

Table 1 shows the socio-demographic

characteristics of study participants. The mean ages of the booked and unbooked women were 27.47 ± 7.49 and 29.48 ± 7.77 years, respectively, and the difference was statistically significant ($p = 0.005$). Also, age distribution was statistically significantly different between the two groups ($\chi^2 = 9.295$, $p = 0.026$), with more unbooked women aged 30–39 years (42.4% vs. 30.9%).

Educational attainment varied between groups ($\chi^2 = 128.641$, $p < 0.001$). While most booked women had secondary 214 (64.4%) or tertiary education 83 (25.1%), the unbooked group had a larger proportion with no formal education 26 (14.7%) or primary education 74 (41.9%).

Parity distribution also showed significant variation ($\chi^2 = 36.025$, $p < 0.001$). Grand multiparity was more common among unbooked women 73 (41.3%) compared with booked women 57 (17.3%). A significantly higher proportion of booked women lived in urban areas 203 (61.4%), whereas more than half of unbooked women resided in rural areas 91 (51.5%) ($p = 0.006$).

As shown in Table 2, unbooked women were significantly more likely to present preterm (<37 weeks) than booked women (31.1% vs. 10.0%, $p < 0.001$). The mean gestational age at presentation was also lower among unbooked mothers (37.24 ± 3.09 vs. 38.40 ± 2.37 weeks, $p < 0.001$). The onset of labour differed significantly between groups ($\chi^2 = 51.536$, $p < 0.001$). Induction of labour was more frequently performed among unbooked women 53 (29.9%) compared with booked women 30 (9.1%), whereas elective caesarean section was more common among booked women 83 (25.1%) vs. 12 (6.8%).

There was marked disparities in the Mode of delivery ($\chi^2 = 227.008$, $p < 0.001$). Booked women were more likely to have spontaneous vaginal delivery 146 (44.2%). In contrast, emergency caesarean section was more frequent among unbooked women 99 (56.0%) vs. 5 (1.6%).

Perinatal outcomes by booking status are presented in Table 3. Live birth rates were statistically significantly higher among booked mothers 324 (97.9%) compared with unbooked mothers 162 (91.6%, $p = 0.002$). Unbooked women recorded a markedly higher proportion of stillbirths (8.5% vs. 2.2%).

Adverse neonatal outcomes were significantly more common among unbooked mothers. These included: Neonatal asphyxia: 27.1% vs. 6.9% ($p < 0.001$), neonatal ICU admission: 30.5% vs. 11.2% ($p < 0.001$), and early neonatal death: 5.1% vs. 0.9% ($p = 0.003$).

Figure 1 demonstrates the marked disparity in PMR between booked and unbooked mothers, with unbooked pregnancies accounting for the vast majority of perinatal losses. Using stillbirths and early neonatal deaths, the calculated perinatal mortality rate (PMR) per 1000 live births was: Booked: 30.9 per 1000 and unbooked: 148.1 per 1000 births.

Table 4 presents the logistic regression analysis assessing predictors of perinatal outcomes. After adjusting for potential confounders, unbooked status emerged as a strong independent predictor of adverse fetal outcome (AOR = 8.12; 95% CI: 3.04–21.67; p = 0.001). Additionally, both assisted vaginal delivery (AOR = 2.55; 95% CI: 1.86–3.48; $p < 0.001$) and emergency caesarean section (AOR = 4.10; 95% CI: 2.52–6.68; $p < 0.001$) were statistically significantly associated with increased odds of adverse perinatal outcomes. Maternal age, parity, and onset of labour were not significant independent predictors in the adjusted model ($p > 0.05$).

Table 1: Patterns of Socio-demographic characteristics

Characteristics		Booked n (%)	Unbooked n (%)	Total n (%)	χ^2	p-value
Age (years)	<20	54 (16.4)	23 (13)	77 (15.2)	9.295	*0.026
	20-29	155 (46.9)	64 (36.2)	219 (43.2)		
	30-39	102 (30.9)	75 (42.4)	177 (34.9)		
	>40	20 (6.1)	15 (8.5)	35 (6.9)		
	Mean ± SD	27.47±7.49	29.48±7.77	28.17±7.64	-2.808	*0.005
Level of Education	None	15 (4.6)	26 (14.7)	41 (8.1)	128.641	*<0.001
	Primary	20 (6.1)	74 (41.9)	94 (18.6)		
	Secondary	213 (64.4)	50 (28.3)	263 (51.8)		
	Tertiary	83 (25.1)	27 (15.3)	110 (21.7)		
Parity	Nulliparous	99 (30)	44 (24.9)	143 (28.2)	36.025	*<0.001
	Multiparous	175 (52.9)	60 (33.9)	235 (46.3)		
	Grand multiparous	57 (17.3)	73 (41.3)	130 (25.6)		
Residence	Urban	203 (61.4)	86 (48.6)	289 (56.9)	7.634	*0.006
	Rural	128 (38.7)	91 (51.5)	219 (43.2)		

Age range = 16 – 45 years

Table 2: Patterns of Booking Status and Clinical Presentation at Admission

Characteristics		Booked n (%)	Unbooked n (%)	Total n (%)	χ^2	p-value
GA at Presentation	< 37weeks	33 (10)	55 (31.1)	88 (17.4)	35.863	*<0.001
	≥ 37weeks	298 (90.1)	122 (69)	420 (82.7)		
	Mean ± SD	38.40 ±2.37	37.24 ±3.09	38.00 ±2.70	4.381	*<0.001
Onset of Labour	Spontaneous	218 (65.8)	112 (63.3)	330 (64.9)	51.536	*<0.001
	Induced	30 (9.1)	53 (29.9)	83 (16.4)		
	Elective CS	83 (25.1)	12 (6.8)	95 (18.7)		
Mode of Delivery	Spontaneous VD	146 (44.2)	59 (33.4)	205 (40.4)	227.008	*<0.001
	Assisted VD	97 (29.4)	7 (4)	104 (20.5)		
	Emergency CS	5 (1.6)	99 (56)	104 (20.5)		
	Elective CS	83 (25.1)	12 (6.8)	95 (18.8)		

Gestational Age range = 30-41 weeks

Table 3: Patterns of Perinatal Outcomes by Booking Status

		Booked n (%)	Unbooked n (%)	Total n (%)	χ^2	p-value
Birth						
	Live birth	324 (97.9)	162 (91.6)	486 (95.7)	11.259	*0.002
	Still birth	7 (2.2)	15 (8.5)	22 (4.4)		
Neonatal asphyxia		23 (6.9)	48 (27.1)	71 (14.0)	43.949	*<0.001
Neonatal ICU admission		37 (11.2)	54 (30.5)	91 (17.9)	34.079	*<0.001
Early neonatal death		3 (0.9)	9 (5.1)	12 (2.4)	9.612	*0.003

Neonatal asphyxia (Apgar < 7 at 5 min)

Perinatal Mortality Rate (Numbers per 1000 Live Births)

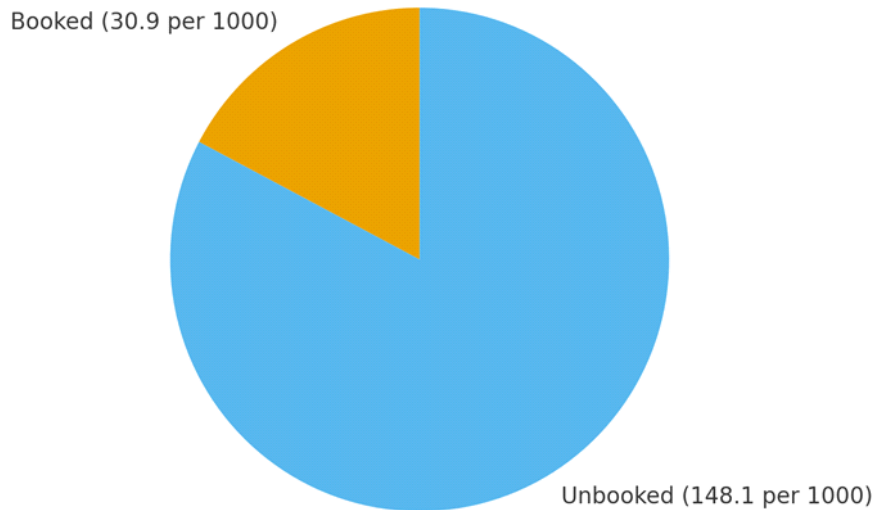Booked (30.9 per 1000)

Unbooked (148.1 per 1000)

Figure 1: Patterns of the perinatal mortality rate per 1000 live births for booked and unbooked pregnancies

Table 4: Regression analysis showing the predictors of adverse perinatal outcomes

| | B | S.E. | AOR | 95% C.I. for AOR | | P-value |
				Lower	Upper	
Unbooked	2.094	0.501	8.120	3.042	21.672	*0.001
Age group						
<20			1.000			0.541
20-29	-0.544	0.647	0.580	0.163	2.063	0.400
30-39	-0.750	0.534	0.472	0.166	1.345	0.160
>40	-0.743	0.554	0.476	0.161	1.410	0.180
Parity						
Nulliparous			1.000			0.770
Multiparous	0.265	0.408	1.303	0.585	2.901	0.517
Grand multiparous	0.231	0.383	1.260	0.595	2.671	0.546
Onset of labour						
Spontaneous			1.000			0.829
Induced	0.141	0.597	1.151	0.357	3.710	0.813
Elective CS	-0.132	0.637	0.876	0.252	3.052	0.835
Mode of Delivery						
Spontaneous VD			1.000			*<0.001
Assisted VD	0.934	0.159	2.545	1.863	3.477	*<0.001
Emergency CS	1.411	0.249	4.100	2.515	6.684	*<0.001
Elective CS	-0.27	0.205	0.764	0.511	1.141	0.188

CS – Caesarean Section; B-Regression Coefficient; S.E- Standard Error; AOR- Adjusted Odds Ratio; CI- Confidence Interval

DISCUSSION

This study examined the influence of booking status on perinatal outcomes among parturients who delivered at DELSUTH. Our results revealed significant socio-demographic, clinical, and perinatal discrepancies between booked and unbooked women, with unbooked status being the strongest predictor of adverse perinatal outcomes. These observations agree with established correlation between inadequate antenatal care and poor fetomaternal outcomes in low-resource settings such as Nigeria.

Our study revealed that booked mothers were statistically significantly younger, had higher education attainment, lower parity, and majority resided in urban areas compared with unbooked women. These findings are consistent with reports from recent Nigerian and International studies. [18-20]. In contrast, Omisakin *et al*. in Lagos, Chigbu *et al*. in Abia State, and Anyigor-Ogah *et al*. in Ebonyi State, reported that booked women were older compared with their unbooked counterparts. [14,21,22] The booked mothers in our study were more likely to seek prenatal care, whereas older and grand multiparous women often perceived less need for antenatal care based on their previous birth. Women with higher educational attainment are better empowered to appreciate the benefits of prenatal care due to improved economic opportunities and greater decision-making autonomy. The challenges in rural settings such as poor road networks, reliance on traditional birth attendants, and limited health facilities contribute to the reduced access to antenatal care among rural women. This disparity

may reflect differences in health-seeking behaviour in the study population. The socio-demographic findings in our study reinforces the structural and behavioural barriers to accessing ANC, particularly for uneducated, grand multiparous, and rural women, which ultimately lead to adverse pregnancy outcomes.

Unbooked women were significantly more likely to present preterm, and with a lower mean gestational age. Studies across Nigeria and sub-Saharan Africa similarly report higher preterm presentation among women without ANC, often related to untreated maternal conditions such as malaria, hypertensive disorders, genitourinary infections, and malnutrition.[19,22,23,24] Late detection and absence of preventive interventions increases the risk of preterm labour and its sequelae.

This study found significant differences in labour onset, with unbooked women more frequently requiring induction. This aligns with previous observations that unbooked women often present with obstructed labour, hypertensive emergencies, or fetal distress.[18] In this study, mode of delivery also showed disparities. More booked mothers had vaginal deliveries compared with unbooked parturients who mostly had caesarean deliveries. This is consistent with several other studies.[14, 22, 25]. The findings may be attributable to the absence of intrapartum monitoring prior to hospital arrival, delays in seeking care, and missed opportunities for risk classification among unbooked women. These findings demonstrate how lack of prenatal care directly contributes to obstetric emergencies requiring unplanned interventions with subsequent catastrophic perinatal outcomes.

This study showed that unbooked mothers were more likely to have adverse perinatal outcomes which included lower live birth, higher stillbirth rate, higher neonatal asphyxia, higher NICU admission and early neonatal death. Our findings are consistent with reports from many other studies.[14,18,19,22,26] Inadequate ANC limits early detection and management of complications and delayed interventions significantly worsen fetal hypoxia and markedly increase the risk of adverse perinatal outcomes. Inadequate use of healthcare resources,

primary delays in obtaining delivery care, increase interventional deliveries and hypoxia and preterm birth may have contributed to the poor perinatal outcomes in this study.

The perinatal mortality rate was almost five times higher among unbooked women (148.1 vs. 30.9 per 1000 live births). Similarly, researches from Nigeria, Pakistan and India have reported that perinatal mortality was higher among unbooked mothers.[18,19,26] This data differs from a community-based survey conducted in Ethiopia, which found that the unbooked pregnancies had a lower PMR of 110 per 1000 births.[27] Additionally, it was different from a Nepalese demographic and health survey that found a PMR of 42 per 1000 births.[28] This magnitude of discrepancy is consistent with findings from other reports in Nigeria,[12,22,29] where lack of ANC was found to be the main modifiable determinant of perinatal mortality. The findings were linked to poor healthcare systems, predominantly rural dwelling by majority of the unbooked participants, low educational attainment, and pregnancy complications. This reinforces the important role of ANC in reducing perinatal mortality

Unbooked status emerged as the strongest independent predictor of fetal complications, with an eightfold increase in odds. The findings of Dheresa *et al* in a study in Eastern Ethiopia corroborate this association, identifying unbooked status as a major predictor of adverse perinatal outcomes.[30] Other researchers reported similar findings of lack of ANC being a strong predictor of perinatal outcomes.[19,26,31] Mode of delivery also predicted perinatal outcomes, with assisted vaginal birth and emergency caesarean section increasing risk. This is in agreement with findings in Lagos.[14] It reflects the emergency nature of presentations among unbooked mothers, where fetal compromise has most times occurred before interventions. This study didn't show independent association between perinatal outcomes and maternal age, parity or labour onset after adjustment. This suggests that attending antenatal care may override the influence of these risk factors for adverse perinatal outcomes.

The strength of this study includes the elaborate comparative design and adequate sample size. The

detailed statistical analyses reinforced the validity of our findings, while the inclusion of socio-demographic and clinical variables provided insights relevant to improving antenatal care utilization and perinatal outcomes in our region.

Limitations of the Study

This study relied on the completeness and accuracy of hospital records. Missing data and documentation errors could have introduced bias. Additionally, the study was facility-based and may not fully represent the situation in the community. Nonetheless, the study provides valuable insights into the burden and determinants of poor perinatal outcomes in Delta State.

CONCLUSION

This study emphasizes how booking status at DELSUTH influenced perinatal outcomes. Unbooked Mothers had a higher burden of adverse perinatal outcomes, which highlights ongoing differences in access to and use of ANC services. The results highlight the importance of early and continuous maternal healthcare in improving newborn outcomes. It showed the relationship between inadequate ANC and increased risks of stillbirths, early neonatal deaths, and other poor indicators of perinatal life.

RECOMMENDATIONS

Reducing perinatal morbidity and mortality requires strengthening health education, female empowerment, increasing community involvement, improving the access to healthcare and reducing cost of prenatal services. There is a need to implement policies that encourage early booking and regular follow-up as key interventions for high-risk populations.

Furthermore, we recommend that future research should look into the socio-cultural, economic, and systemic barriers that prevent women from booking early or accessing antenatal care. Multicenter studies with larger sample sizes would provide greater insights into regional disparities and determinants of perinatal outcomes. Additionally, prospective studies could offer a detailed assessment of causality and help evaluate the effectiveness of interventions designed to improve utilization of antenatal services.

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Conflict of interest

The authors declare no conflict of interest