Research Article

Evaluation Of Obstetric Determinants Of Postpartum, Maternal And Neonatal Outcomes In Urban And Rural Settings

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Abstract

Objective: The study addresses maternal and neonatal health disparities between urban and rural healthcare settings, focusing on obstetric determinants and their impact on postpartum maternal and neonatal outcomes.

Methods: Conducted over six months, this cross-sectional study involved 316 delivered mothers from selected urban and rural hospitals. Data collection encompassed socio-demographic details, obstetric history, delivery characteristics, postpartum complications, and neonatal outcomes. Statistical analysis included multivariable logistic regression and Chi-square tests, with significance set at $p < 0.05$.

Results: The prevalence of caesarean sections was higher in urban areas (65%) versus rural areas (59%). Postpartum complications were more frequent among urban mothers (31%) compared to rural mothers (25%). Breastfeeding difficulties were reported more in urban mothers (24%) than rural mothers (16%). Neonatal complications were similar across both settings, occurring in 24% of cases. Multivariable logistic regression showed that in the urban population, having more than eight antenatal care visits and was significantly associated with caesarean delivery (AOR = 3.91; $p = 0.020$). Body Mass Index was significantly linked to caesarean section and postpartum complications in both settings. Mode of delivery was significantly connected with perineal trauma and pelvic floor issues. However, place of residence alone was not significantly associated with most maternal and neonatal outcomes.

Conclusion: The study demonstrates that obstetric determinants significantly influence maternal and neonatal outcomes. Although caesarean sections were higher in urban settings, overall neonatal complications were comparable between urban and rural populations. Strengthening evidence-based obstetric practices, optimizing antenatal care utilization, and promoting appropriate mode of delivery may help reduce preventable maternal and neonatal morbidity in both healthcare settings.

Keywords: Obstetric determinants, Caesarean section, Postpartum complications, Neonatal outcomes, Urban–rural comparison, Antenatal care, Maternal health, Perinatal outcomes.

Introduction

Maternal and neonatal morbidity remains an important public health concern, particularly when obstetric complications are not identified and managed promptly. Postpartum complications such as excessive bleeding, postpartum haemorrhage, perineal and wound complications, infection and thromboembolic events may result in prolonged hospitalization, blood transfusion, intensive care admission and adverse maternal outcomes[1,2].

Maternal age, parity, previous obstetric history, antenatal risk factors, foetal condition and mode of delivery are among the important determinants that may influence maternal and neonatal outcomes[3,4].

The mode of delivery is a particularly important obstetric determinant. Although caesarean delivery can be lifesaving when medically indicated, increasing caesarean delivery rates have raised concerns regarding potentially avoidable maternal and neonatal morbidity[1,2].

In India, caesarean delivery has been reported more frequently in urban than rural areas and in private than public healthcare facilities. Analysis of DLHS-4 data reported caesarean delivery rates of 28.6% in urban areas and 19.5% in rural areas, while rates were 37.9% in private facilities and 13.7% in public facilities[3].

"The increasing use of caesarean delivery worldwide has generated concern regarding potential overuse and associated maternal and neonatal morbidity, particularly when the procedure is performed without a clear medical indication." [1,2]

Maternal age, socioeconomic status, education, antenatal care, pregnancy complications, and previous obstetric history have also been associated with caesarean delivery in Indian populations[3,4].

Healthcare setting may further influence maternal and neonatal outcomes because differences in healthcare accessibility, institutional capacity, and quality of maternal and newborn services can contribute to disparities in outcomes[6,7].

The existing Indian studies have largely examined determinants or prevalence of caesarean delivery, whereas comparatively

fewer studies have evaluated the combined association of obstetric determinants with multiple postpartum, maternal, and neonatal outcomes across urban and rural settings. Hence, the main objective of this study was to assess obstetric determinants and their association with postpartum, maternal and neonatal outcomes in urban and rural settings.

MATERIALS AND METHODS

Study Design and Setting

A hospital-based, cross-sectional comparative study was conducted over a period of six-month to evaluate obstetric determinants and their association with postpartum, maternal and neonatal outcomes in selected urban and rural settings providing obstetric and maternity care.

Participants and Selection Criteria

The study population comprised women who delivered in the participating hospitals during the study period. Women undergoing either vaginal or caesarean delivery, including those with singleton or multiple pregnancies and pre-existing or pregnancy-associated comorbidities, were eligible. Women who delivered outside the participating hospitals, declined participation, had incomplete clinical records that prevented assessment of study outcomes, or were referred cases without adequate delivery or outcome information were excluded. Eligible participants were identified from hospital delivery registers and enrolled using convenience sampling after obtaining informed consent.

Sample Size

The sample size was estimated using the Cochran formula for a single proportion, assuming a 95% confidence level, 5% margin of error and an expected prevalence of 50%. The final study population comprised of 316 participants, 189 participants from the urban and 127 from the rural setting.

Data Collection

Data were collected from hospital medical records, maternity case sheets, delivery registers, and brief participant interviews wherever additional information was required. A structured data collection form was used to record:

1. Sociodemographic characteristics;
2. Maternal obstetric history and antenatal characteristics;
3. Delivery characteristics and mode of delivery;
4. Postpartum maternal outcomes, complications, and breastfeeding status; and
5. Perinatal and neonatal outcomes.

Obstetric determinants assessed included maternal age, parity, previous obstetric history, antenatal risk factors, comorbidities and mode of delivery. Maternal outcomes included postpartum haemorrhage, infection, wound complications, blood transfusion, prolonged hospitalization and intensive care admission. Neonatal outcomes included clinically documented perinatal and neonatal complications.

The data collection form was developed in English and validated for content validity by two experts from the Department of Pharmacy Practice. Their recommendations were incorporated before data collection. The study was observational and participants received routine obstetric and neonatal care according to the clinical practices of the participating hospitals.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics for Windows, version 26.0. Categorical variables were summarized as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution.

Associations between categorical variables were assessed using the Pearson chi-square test or Fisher's exact test, as appropriate. Appropriate parametric or non-parametric tests were used for comparisons of continuous variables. Multivariable logistic regression analysis was performed to identify independent obstetric determinants associated with selected binary outcomes, including caesarean delivery, postpartum complications and neonatal complications. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. A two-sided p-value <.05 was considered statistically significant.

Ethical Considerations

The study protocol, informed consent form and data collection form were reviewed and approved by the Institutional Review Board (IRB), Geethanjali College of Pharmacy, under approval number GCPK/PD2/14, dated 29 August 2025. Written informed consent was obtained from all participants before enrolment. Participants confidentiality was maintained throughout the study and the collected data were used solely for research purposes.

RESULTS

Study population and sociodemographic characteristics

The sociodemographic characteristics are presented in Table 1. Most participants in both groups (N=189 from urban and N=127 from rural setting) were aged 18–30 years. The majority were married between 18 and 24 years. BMI was largely similar, although obesity was more common among urban, normal weight was a touch more among rural participants. Hindu participants constituted the largest proportion in both settings, followed by Muslim participants. Primary education was the most common educational level in both groups. Previous terminated pregnancy was reported by similar proportions among urban and rural participants. Most participants had attended more than eight ANC visits and public hospitals were the predominant place of delivery in both settings. Overall, the baseline characteristics were broadly comparable between the urban and rural groups, with some variation in BMI and religion distribution.

Comparison of Maternal and Neonatal Outcomes according to residential setting

Postpartum complications were reported more frequently among urban participants whereas, breastfeeding issues were slightly more frequent in the urban group and the association with residential settings were not statistically significant. Inadequate milk production, urinary incontinence or pelvic-floor problems, need for blood transfusion, perineal trauma, and wound infection also showed no statistical significance between urban and rural participants. For neonatal outcomes, stillbirth was uncommon and did not differ significantly between the two settings. Overall neonatal complications occurred in a similar proportion among both urban and rural groups, with no statistically significant association (Table 2).

Although some maternal outcomes showed numerical differences between urban and rural participants, none of the assessed maternal or neonatal outcomes demonstrated a statistically significant association.

Association between delivery mode, maternal and neonatal outcomes

The relationship between vaginal and cesarean delivery and postpartum and neonatal morbidity is presented in Table 3. Overall postpartum complications did not differ significantly between vaginal and cesarean deliveries. Breastfeeding issues and the need for blood transfusion also showed no significant association with mode of delivery. Wound infection was uncommon and was not significantly associated with delivery mode.

However, two maternal outcomes demonstrated statistically significant associations with mode of delivery. Urinary incontinence or pelvic-floor problems were more frequently associated with vaginal delivery rather than cesarean section, and were statistically significant. Perineal trauma was also significantly more common among participants with vaginal delivery. Among neonatal outcomes, neither stillbirth nor overall neonatal complications showed a statistically significant association with delivery mode. Neonatal asphyxia was also not significantly associated with either delivery. modes

Therefore, in this study, mode of delivery was significantly associated with selected maternal outcomes, particularly urinary/pelvic-floor problems and perineal trauma, but not with the overall postpartum or neonatal outcomes assessed.

Determinants of cesarean delivery

The multivariable logistic regression analysis was performed separately for urban and rural participants and included associated factors like maternal demographics, socioeconomics, obstetric, healthcare-utilization and gestational characteristics. Among urban participants, BMI and number of ANC visits were significantly associated with cesarean delivery. Compared with underweight participants, those with normal BMI had significantly lower adjusted odds of cesarean delivery (AOR 0.20, 95% CI 0.08–0.50; *p*=0.001). Overweight and obese participants did not show statistically significant associations with cesarean delivery.

Participants with more than eight ANC visits had significantly higher adjusted odds of cesarean delivery compared with those with 0–8 visits (AOR 3.91, 95% CI 1.24–12.35; *p*=0.020). The other evaluated factors, including age, religion, educational level, place of delivery, gravidity, previous terminated pregnancy and gestational age which did not show statistically significant associations with cesarean delivery. In the rural group, none of the evaluated variables demonstrated a statistically significant association with cesarean delivery. Although some categories showed higher or lower adjusted odds, the corresponding confidence intervals and *p*-values did not indicate statistical significance (Table 4).

Thus, the multivariable analysis identified higher ANC attendance and normal BMI as significant determinants of cesarean delivery in the urban group, while no statistically significant independent determinant was identified in the rural group.

Determinants of postpartum complications

The multivariable analysis of determinants associated with postpartum complications is presented in Table 5. In the urban group, maternal age showed a significant association with postpartum complications. Compared with participants aged <18 years, those aged 18–24 years had significantly lower adjusted odds of postpartum complications (AOR 0.10, 95% CI 0.02–0.47; *p*=0.003), as did those aged 25–30 years (AOR 0.12, 95% CI 0.03–0.50; *p*=0.003). BMI was also significantly associated with postpartum complications among urban participants. Compared with underweight participants, overweight participants had lower adjusted odds of postpartum complications (AOR 0.34, 95% CI 0.14–0.85; *p*=0.022), and obese participants also had lower adjusted odds (AOR 0.28, 95% CI 0.11–0.73; *p*=0.009). Normal BMI was not significantly associated with postpartum complications in the urban group.

Among rural participants, women aged 25–30 years had significantly lower adjusted odds of postpartum complications compared with those aged <18 years (AOR 0.12, 95% CI 0.01–0.92; *p*=0.041). BMI categories also demonstrated significant

associations. Normal-weight participants had lower adjusted odds compared with underweight participants (AOR 0.06, 95% CI 0.01–0.67; *p*=0.022), while overweight and obese participants also had significantly lower adjusted odds of postpartum complications. Other evaluated variables, including religion, educational level, place of delivery, gravidity, previous terminated pregnancy, ANC attendance, mode of delivery and gestational age, were not significantly associated with postpartum complications in either urban or rural participants (Table 5).

In particular, cesarean delivery did not demonstrate an independent association with postpartum complications after adjustment for the other variables.

Determinants of neonatal complications

The multivariable analysis of determinants associated with neonatal complications is presented in Table 6. Among urban participants, several factors demonstrated statistically significant associations with neonatal complications. Religion was significantly associated with neonatal complications. Compared with Hindu participants, Muslim participants had higher adjusted odds of neonatal complications (AOR 10.15, 95% CI 1.50–68.69; *p*=0.017). Gravidity was also significantly associated with neonatal complications in the urban group. Participants with gravidity of two had higher adjusted odds of neonatal complications compared with those with gravidity of one (AOR 4.49, 95% CI 1.18–17.13; *p*=0.028). The association for gravidity ≥3 was not statistically significant. ANC attendance was significantly associated with neonatal complications. Participants with more than eight ANC visits had lower adjusted odds of neonatal complications compared with those with 0–8 visits (AOR 0.19, 95% CI 0.04–0.78; *p*=0.022). Mode of delivery also demonstrated a significant association in the urban group, with cesarean delivery associated with lower adjusted odds of neonatal complications compared with vaginal delivery (AOR 0.41, 95% CI 0.17–0.97; *p*=0.043).

In the rural group, most evaluated determinants did not show statistically significant associations with neonatal complications. Age, religion, educational level, BMI, place of delivery, gravidity, previous terminated pregnancy, ANC attendance, mode of delivery, and gestational age were not statistically significant. However, postpartum complications showed an association with neonatal complications at the statistical threshold. Participants with postpartum complications had higher adjusted odds of neonatal complications compared with those without postpartum complications (AOR 4.20, 95% CI 1.00–17.61; *p*=0.050).

Overall, the factors associated with neonatal complications differed between either setting. Significant associations were identified with religion, gravidity, ANC attendance and mode of delivery among urban participants, whereas postpartum complications showed the relevant association among rural participants.

DISCUSSION

The present study included 316 participants, comprising 189 urban and 127 rural participants. Overall, maternal and neonatal outcomes did not differ significantly between urban and rural settings. Postpartum complications were reported in 31% of urban participants compared with 25% of rural participants (p=0.289), while neonatal complications occurred in approximately 24% of participants in both groups (p=0.884). These findings suggest that residential setting alone may not adequately explain maternal and neonatal morbidity when women have access to institutional maternity care. This is consistent with evidence from India indicating that institutional delivery alone may not improve maternal and neonatal outcomes unless accompanied by good-quality care. [8]

The proportion receiving more than eight ANC visits in this study was higher than nationally reported estimates, which may be explained by the hospital-based study population. The high ANC utilization is consistent with WHO recommendations for eight ANC contacts to improve maternal and foetal assessment and early detection of complications. [9] The strength of this study is the comparison of important sociodemographic and healthcare characteristics between urban and rural women. However, the hospital-based sample may limit generalizability.

Maternal and neonatal outcomes did not differ significantly between urban and rural participants. Postpartum complications were reported in 31% of urban and 25% of rural women (p=0.289), while neonatal complications occurred in 24% of both groups (p=0.884). Similarly, breastfeeding issues, inadequate milk production, urinary incontinence/pelvic-floor problems, blood transfusion, perineal trauma and wound infection showed no statistically significant urban–rural differences. These findings suggest that residential setting alone may not determine maternal and neonatal outcomes when women have access to institutional maternity care. Evidence from India similarly indicates that institutional delivery may not substantially improve outcomes unless accompanied by adequate quality of maternal and newborn care. [10]

The absence of significant differences is an important finding, although the relatively small sample and low frequency of some complications may have limited the statistical power to detect smaller differences. The strength is the assessment of multiple maternal and neonatal outcomes. Future studies with larger, multicenter samples should evaluate healthcare quality, referral delays, availability of emergency obstetric services and continuity of postnatal care to better explain urban–rural differences.[11]

A significant association was observed between mode of delivery and selected maternal outcomes. Urinary incontinence/pelvic-floor problems were more frequent following vaginal delivery than cesarean delivery (7% vs 1%; p=0.001), while perineal trauma was substantially higher following vaginal delivery (31% vs 2%; p<0.001). The higher frequency of urinary

incontinence/pelvic-floor problems and perineal trauma following vaginal delivery is consistent with previous research. [12] A systematic review and meta-analysis reported significantly higher odds of urinary incontinence and pelvic-organ prolapse following vaginal compared with caesarean delivery. [12] However, caesarean delivery should not be considered universally safer, as it is associated with surgical and neonatal risks. A systematic review found that elective caesarean delivery was associated with increased neonatal respiratory morbidity compared with spontaneous vaginal delivery. [13] The strength of this study is that it evaluates individual maternal and neonatal outcomes according to delivery mode. However, the relatively small number of women with uncommon outcomes, such as wound infection and stillbirth, may have limited the ability to detect significant differences. In addition, the analysis did not distinguish between elective and emergency caesarean deliveries or their clinical indications.

The multivariable analysis identified few significant determinants of caesarean delivery. In the urban group, more than eight ANC visits were significantly associated with higher odds of caesarean delivery (AOR 3.91, 95% CI 1.24–12.35; p=0.020), while normal BMI was associated with lower odds compared with underweight women (AOR 0.20, 95% CI 0.08–0.50; p=0.001). In the rural group, none of the evaluated determinants were statistically significant, although more than eight antenatal care visits showed a borderline association (AOR 4.27, 95% CI 0.97–18.78; p=0.055). The association between higher antenatal care attendance and caesarean delivery should be interpreted cautiously, as women with more antenatal care contacts may have increased detection of high-risk pregnancies or obstetric complications that subsequently require caesarean delivery. WHO recommends a minimum of eight antenatal care contacts to improve maternal and foetal assessment and facilitate early detection and management of complications.[14] The BMI finding in the present study differs from previous evidence. A systematic review and meta-analysis reported that overweight and obese women had higher odds of caesarean delivery compared with women of normal BMI. [15] Therefore, the lower odds observed among normal-weight women compared with underweight women in this study should be interpreted cautiously and may be related to the small number of underweight participants, differences in obstetric characteristics or residual confounding. A strength of this analysis is the use of multivariable logistic regression to evaluate several potential determinants simultaneously. However, the wide confidence intervals and relatively small subgroup sizes may have reduced the precision of the estimates.

The multivariable analysis showed significant associations between maternal age, BMI and postpartum complications. In the urban group, women aged 18–24 years and 25–30 years had significantly lower odds of postpartum complications than women aged <18 years (AOR 0.10 and 0.12; p=0.003). In the rural group, women aged 25–30 years also had lower odds (AOR 0.12, 95% CI 0.02–0.92; p=0.041). BMI was also significantly associated with postpartum complications, with overweight and obese women showing lower odds in the urban group and normal-weight, overweight and obese women showing lower odds in the rural group. The lower odds among older women should be interpreted cautiously because the <18-year reference group was small. Previous evidence indicates that adolescent pregnancy is associated with increased maternal and neonatal vulnerability and pregnancy-related complications.[16] The inverse association observed with BMI also differs from much of the published evidence, as systematic review data have reported higher risks of several adverse pregnancy outcomes, including caesarean delivery and postpartum hemorrhage, among the overweight and obese.[17] The strength of this analysis is the use of adjusted estimates for multiple potential determinants. However, the small subgroup sizes and wide confidence intervals may have affected the precision of the results. Therefore, the observed inverse associations should not be interpreted as protective effects.

The multivariable analysis showed that relatively few determinants were significantly associated with neonatal complications. In the urban group, Muslim women had higher odds of neonatal complications compared with Hindu women (AOR 10.15, 95% CI 1.50–68.69; p=0.017), while women with gravidity of two had higher odds compared with primigravida women (AOR 4.49, 95% CI 1.18–17.13; p=0.028). More than eight ANC visits were associated with lower odds of neonatal complications (AOR 0.19, 95% CI 0.04–0.78; p=0.022), and caesarean delivery was also associated with lower adjusted odds compared with vaginal delivery (AOR 0.41, 95% CI 0.17–0.97; p=0.043). In the rural group, most determinants were not statistically significant, although postpartum complications showed a borderline association with neonatal complications (AOR 4.20, 95% CI 1.00–17.61; p=0.050). The association between higher antenatal care attendance and lower neonatal complications is consistent with previous evidence. Previous studies found that ANC utilization was associated with a reduced risk of neonatal mortality, emphasizing the importance of adequate antenatal care for improving neonatal outcomes.[18] The lower odds of neonatal complications following caesarean delivery in the urban group should nevertheless be interpreted cautiously, as neonatal outcomes after caesarean delivery depend on factors such as indication, gestational age and whether the procedure is elective or emergency. Evidence has shown an increased risk of neonatal respiratory morbidity following elective caesarean delivery compared with spontaneous vaginal delivery. [19]

The significant association with religion should also be interpreted cautiously because religion may represent underlying social, cultural or healthcare-access differences rather than a direct biological determinant. The wide confidence interval indicates considerable uncertainty around this estimate. The strength of this analysis is the use of multivariable logistic regression to assess several potential determinants simultaneously. However, the relatively small sample and number of neonatal

complications may have resulted in unstable estimates.

Strengths and limitations

The strengths of the study include comparison of urban and rural populations, assessment of multiple maternal and neonatal outcomes, and use of multivariable analysis to identify setting-specific determinants. However, the relatively small sample size, observational design, uncommon outcomes wide confidence intervals and potential residual confounding limit causal interpretation. Some regression estimates were also affected by quasi-complete separation.

Clinical relevance and implications for practice

The findings emphasize the importance of quality antenatal care and appropriate decision-making regarding mode of delivery. The higher occurrence of perineal trauma and pelvic-floor problems following vaginal delivery highlights the need for systematic postpartum assessment and appropriate counselling and pelvic-floor rehabilitation when required. The variation in caesarean delivery between public and private hospitals also supports continued monitoring of caesarean rates and clinical indications.

Potential future research and implications

Future research should involve larger, prospective, multicentre studies to confirm these findings and should include detailed information on indications for caesarean delivery, previous caesarean section, maternal comorbidities, pregnancy complications, intrapartum interventions, birthweight, and neonatal outcomes. Longer postpartum follow-up is also needed to assess the persistence of pelvic-floor symptoms and to evaluate the effectiveness of postpartum rehabilitation. Further research should also examine whether differences in ANC quality, referral pathways, institutional practices, and socioeconomic factors contribute to urban-rural differences in maternal and neonatal outcomes.

CONCLUSION

The present study evaluated maternal and neonatal outcomes and their obstetric determinants in urban and rural settings. Overall, no statistically significant differences were observed in the assessed maternal and neonatal outcomes between urban and rural participants, suggesting that residential setting alone was not a major determinant of these outcomes. However, mode of delivery was significantly associated with selected maternal outcomes, particularly perineal trauma and urinary incontinence/pelvic-floor problems, which were more frequent following vaginal delivery. Among urban participants, higher ANC attendance was associated with increased odds of cesarean delivery, while higher ANC attendance was associated with lower odds of neonatal complications. These findings highlight the importance of quality antenatal care, appropriate individualized decision-making regarding mode of delivery, and adequate postpartum assessment and management.

Author contributions

H. Nagalaxmi, J. Swetha, M. Nissi and V. Darshan contributed to the study like preparing the proposal, data collection, statistical analysis and manuscript preparation under the guidance and supervision of Dr. Abdul Nazer Ali.

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Data availability

The original contributions presented in the study are included in the article/supplementary material, and further inquiries can be directed to the corresponding author.

Declarations

Competing interests

The authors declare that there is no competing interests.

Ethics approval and consent to participate

The proposal and informed consent and case collection documents were examined and authorized by the Geethanjali College of Pharmacy, Institutional Review Board (IRB), participation was voluntary and confidentiality was maintained.

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Table 1: Sociodemographic characteristics of study Participants Urban and Rural

Variable	Category	Urban (N=189) N (%)	Rural (N=127) N (%)
Age category (years)	<18	1 (1%)	3 (2%)
	18–24	84 (44%)	60 (47%)
	25–30	85 (45%)	54 (43%)
	>30	19 (10%)	10 (8%)
Age at marriage (years)	<18	42 (22%)	31 (24%)
	18–24	114 (60%)	69 (54%)
	25–30	31 (16%)	26 (21%)
	>30	2 (1%)	1 (1%)
Woman BMI	Underweight	9 (5%)	10 (8%)
	Normal weight	76 (40%)	53 (42%)
	Overweight	52 (28%)	38 (30%)
	Obesity	52 (28%)	26 (21%)
Religion	Hindu	99 (52%)	75 (59%)
	Christian	7 (4%)	10 (8%)
	Muslim	83 (44%)	42 (33%)
Level of education	Illiterate	37 (20%)	25 (20%)
	Primary	85 (45%)	65 (51%)
	Secondary	47 (25%)	23 (18%)
	Higher	20 (11%)	14 (11%)
Any terminated pregnancy	Yes	42 (22%)	31 (24%)
	No	147 (78%)	96 (76%)
Number of terminated pregnancies	None	147 (78%)	96 (76%)
	One	29 (15%)	24 (19%)
	Two	11 (6%)	5 (4%)
	Three	2 (1%)	2 (2%)
Number of ANC visits	0–8 visits	29 (15%)	16 (13%)
	>8 visits	160 (85%)	111 (87%)
Place of delivery	Public hospital	109 (58%)	71 (56%)
	Private hospital	80 (42%)	56 (44%)

Table 2: Urban vs Rural Maternal and Neonatal Outcomes

Variable	Urban (N=189) N (%)	Rural (N=127) N (%)	χ^2	P-value
Maternal Outcomes				
Any postpartum complications (Yes)	58 (31)	32 (25)	1.124	0.289
Breastfeeding issues (Yes)	45 (24)	20 (16)	3.021	0.082
Milk production not adequate (No)	43 (23)	26 (20)	0.231	0.631
Urinary incontinence / Pelvic floor problems (Yes)	4 (2)	5 (4)	0.910	0.340
Need for blood transfusion (Yes)	9 (5)	4 (3)	0.501	0.479
Perineal trauma (Yes)	21 (11)	18 (14)	0.658	0.417
Wound infection (Yes)	1 (1)	0 (0)	0.674	0.412
Neonatal Outcomes				
Type of birth (Still birth)	1 (1)	0 (0)	0.674	0.412
Any neonatal complications (Yes)	46 (24)	30 (24)	0.021	0.884

*Chi square Test, $p < .05$ is statistically significant.

Table 3: Delivery Mode vs Postpartum and Neonatal Morbidity

Outcome category	Variables	Vaginal delivery N (%)	Caesarean section N (%)	χ^2 value	p-value
Maternal outcomes	Postpartum complications	32 (27)	58 (29)	0.172	0.679
	Breastfeeding issues	22 (19)	43 (22)	0.427	0.513
	Urinary incontinence / pelvic floor problems	8 (7)	1 (1)	10.520	0.001*
	Need for blood transfusion	5 (4)	9 (5)	0.017	0.898
	Perineal trauma	36 (31)	3 (2)	57.449	0.001*
	Wound infection	0 (0)	1 (1)	0.598	0.439
Neonatal outcomes	Stillbirth	0 (0)	1 (1)	0.598	0.439
	Neonatal complications	26 (22)	50 (25)	0.419	0.517
	Neonatal asphyxia	8 (7)	16 (8)	0.178	0.673

Table 4: Determinants of Cesarean Delivery

Variables	Urban (N=189)			Rural (N=127)		
	AOR	95% CI	p-value	AOR	95% CI	p-value
Age at delivery						
<18 years	1 (Reference)			1 (Reference)		
18–24 years	1.16	0.25–5.48	0.850	4.13	0.51–33.26	0.183
25–30 years	0.96	0.23–4.05	0.959	4.68	0.76–28.69	0.095
>30 years	—	—	—	11.09	0.36–343.26	0.169
Religion						
Hindu	1 (Reference)			1 (Reference)		
Christian	0.92	0.45–1.91	0.830	0.74	0.25–2.20	0.583
Muslim	2.69	0.36–19.88	0.332	0.58	0.10–3.39	0.546
Level of study						
Illiterate	1 (Reference)			1 (Reference)		
Primary	1.20	0.29–5.00	0.803	1.39	0.25–7.62	0.706
Secondary	0.57	0.16–2.07	0.394	1.20	0.27–5.40	0.817
Higher	0.70	0.19–2.57	0.588	0.99	0.18–5.38	0.996
BMI category						
Underweight	1 (Reference)			1 (Reference)		
Normal weight	0.20**	0.08–0.50	0.001***	0.92	0.29–2.91	0.883
Overweight	0.51	0.19–1.36	0.178	0.65	0.19–2.21	0.485
Obese	0.23	0.04–1.33	0.102	0.74	0.12–4.47	0.742
Place of delivery						
Public	1 (Reference)			1 (Reference)		
Private	0.51	0.26–1.01	0.054	0.71	0.28–1.80	0.473
Gravidity						
1	1 (Reference)			1 (Reference)		
2	0.38	0.13–1.06	0.064	0.35	0.09–1.42	0.141
≥3	0.95	0.36–2.49	0.908	0.58	0.15–2.21	0.423
Any terminated pregnancy						
No	1 (Reference)			1 (Reference)		
Yes	1.27	0.52–3.11	0.598	0.51	0.17–1.55	0.235
ANC visits						
0–8 visits	1 (Reference)			1 (Reference)		
>8 visits	3.91*	1.24–12.35	0.020*	4.27	0.97–18.78	0.055
Gestational age at delivery						
Preterm	1 (Reference)			1 (Reference)		
Term	0.49	0.03–8.74	0.626	11.92	0.74–193.03	0.081
Post-term	0.28	0.02–4.78	0.381	9.86	0.82–118.75	0.071

AOR = Adjusted Odds Ratio; CI = Confidence Interval; ***p < 0.001, ***p < 0.01, *p < 0.05.*

Reference categories are shown as 1 (Ref); "—" indicates estimates not computed due to quasi-complete separation

*Chi square Test, p < .05 is statistically significant.

Table 5: Determinants of Postpartum Complications

Variables	Urban (N=189)			Rural (N=127)		
	AOR	**95% CI**	**p-value**	**AOR**	**95% CI**	**p-value**
Age at delivery						
<18 years	1 (Ref)			1 (Ref)		
18–24 years	0.10	0.02–0.47	0.003***	0.27	0.03–2.79	0.271
25–30 years	0.12	0.03–0.50	0.003***	0.12	0.01–0.92	0.041*
>30 years	—	—	—	—	—	—
Religion						
Hindu	1 (Ref)			1 (Ref)		
Christian	1.34	0.61–2.93	0.464	0.70	0.17–2.92	0.629
Muslim	0.95	0.14–6.39	0.961	2.15	0.29–15.90	0.453
Level of education						
Illiterate	1 (Ref)			1 (Ref)		
Primary	2.51	0.64–9.83	0.187	0.49	0.08–3.17	0.455
Secondary	0.59	0.17–2.08	0.413	1.00	0.22–4.61	0.997
Higher	0.79	0.23–2.79	0.719	0.33	0.05–2.34	0.265
BMI category						
Underweight	1 (Ref)			1 (Ref)		
Normal weight	0.15	0.01–1.62	0.117	0.06	0.01–0.67	0.022*
Overweight	0.34	0.14–0.85	0.022*	0.10	0.02–0.41	0.001***
Obese	0.28	0.11–0.73	0.009**	0.16	0.04–0.70	0.015*
Place of delivery						
Public	1 (Ref)			1 (Ref)		
Private	1.01	0.48–2.09	0.990	1.09	0.33–3.58	0.883
Gravidity						
1	1 (Ref)			1 (Ref)		
2	1.89	0.62–5.77	0.264	1.21	0.24–6.01	0.818
≥3	2.26	0.80–6.41	0.126	2.02	0.47–8.61	0.342
Any terminated pregnancy						
No	1 (Ref)			1 (Ref)		
Yes	0.62	0.24–1.61	0.327	1.75	0.46–6.70	0.413
ANC visits						
0–8 visits	1 (Ref)			1 (Ref)		
>8 visits	0.67	0.23–1.95	0.460	0.44	0.07–2.91	0.391
Mode of delivery						
Vaginal	1 (Ref)			1 (Ref)		
Caesarean	1.07	0.49–2.37	0.861	0.99	0.34–2.93	0.989
Gestational age at delivery						
Preterm	1 (Ref)			1 (Ref)		
Term	1.26	0.05–29.75	0.887	3.22	0.22–46.79	0.393
Post-term	1.30	0.06–29.26	0.869	0.24	0.02–2.45	0.230

AOR = Adjusted Odds Ratio; CI = Confidence Interval; ***p < 0.001, ***p < 0.01, *p < 0.05.*

Reference categories are shown as **1 (Ref);** "—" indicates estimates not computed due to quasi-complete separation.

Table 6: Determinants of Neonatal Complications

Variables	Category	Urban (N=189)		Rural (N=127)	
		AOR 95% CI	p-value	AOR 95% CI	p-value
Age at delivery	<18 years	1 (Ref)		1 (Ref)	
	18–24 years	0.45 (0.08–2.47)	0.360	3.86 (0.16–95.81)	0.410
	25–30 years	0.33 (0.07–1.59)	0.167	3.95 (0.22–70.56)	0.350
	>30 years	—	—	—	—
Age at marriage	<18 years	1 (Ref)		1 (Ref)	
	≥18 years	—	0.999	—	1.000
Religion	Hindu	1 (Ref)		1 (Ref)	—
	Christian	1.84 (0.78–4.33)	0.163	1.10 (0.32–3.75)	0.880
	Muslim	10.15 (1.50–68.69)	0.017*	2.92 (0.39–21.71)	0.296
Education level	Illiterate	1 (Ref)	—	1 (Ref)	—
	Primary	0.43 (0.10–1.90)	0.262	1.19 (0.17–8.42)	0.865
	Secondary	0.76 (0.21–2.80)	0.682	1.31 (0.22–7.99)	0.768
	Higher	0.48 (0.12–1.89)	0.292	1.25 (0.17–9.09)	0.824
BMI category	Underweight	1 (Ref)	—	1 (Ref)	—
	Normal weight	0.60 (0.07–5.22)	0.640	0.26 (0.02–2.95)	0.279
	Overweight	1.82 (0.65–5.10)	0.257	0.29 (0.07–1.26)	0.099
	Obese	0.84 (0.27–2.60)	0.756	1.03 (0.25–4.33)	0.967
Place of delivery	Public	1 (Ref)	—	1 (Ref)	—
	Private	0.65 (0.30–1.42)	0.279	1.28 (0.41–4.06)	0.671
Gravidity	1	1 (Ref)	—	1 (Ref)	—
	2	4.49 (1.18–17.13)	0.028*	0.51 (0.11–2.37)	0.393
	≥3	3.04 (0.84–10.98)	0.089	0.30 (0.06–1.38)	0.121
Any terminated pregnancy	No	1 (Ref)	—	1 (Ref)	—
	Yes	1.52 (0.50–4.60)	0.464	1.71 (0.47–6.26)	0.420
ANC visits	0–8 visits	1 (Ref)	—	1 (Ref)	—
	>8 visits	0.19 (0.04–0.78)	0.022*	0.58 (0.10–3.33)	0.542
Mode of delivery	Vaginal	1 (Ref)	—	1 (Ref)	—
	Caesarean	0.41 (0.17–0.97)	0.043*	1.60 (0.56–4.6)	0.382
Gestational age	Preterm	1 (Ref)	—	1 (Ref)	—
	Term	1.70 (0.11–26.81)	0.705	9.97 (0.57–173.90)	0.115
	Post-term	1.24 (0.08–18.29)	0.876	1.31 (0.10–16.5)	0.836
Postpartum complications	No	1 (Ref)	—	1 (Ref)	—
	Yes	0.58 (0.24–1.38)	0.217	4.20 (1.00–17.6)	0.050*

Adjusted Odds Ratio (AOR) and Confidence Interval (CI). ***p < 0.001, **p < 0.01, * p < 0.05.
Cells marked "—" indicate estimates not computed due to quasi-complete data separation.