# A Comparative Analysis of Cesarean Section Prevalence and Associated Feto-Maternal Outcomes between Booked and Unbooked Patients at the Ekiti State University Teaching Hospital: A 5-Year Retrospective Study

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## ABSTRACT

Background: Antenatal care (ANC) booking status is a vital indicator of maternal healthcare engagement and is widely considered to significantly influence delivery outcomes. In low-resource settings like Nigeria, understanding how booking status influences cesarean section (CS) rates and associated feto-maternal morbidity and mortality is essential for designing effective public health strategies and hospital-level interventions.

Objective: This study aimed to compare the prevalence of cesarean section and associated fetomaternal outcomes between booked and unbooked patients who had childbirth at the Ekiti State University Teaching Hospital (EKSUTH) over a five-year period.

Methods: For this research, a retrospective analysis of 5,650 delivery records from April 2020 to March 2025 was conducted. Patients were classified as "booked" if they had at least two scheduled ANC visits at EKSUTH or "unbooked" if they had no prior ANC at EKSUTH. Data extracted included the mode of delivery (Spontaneous vaginal delivery or Cesarean section), maternal outcomes (Primary Postpartum Hemorrhage and mortality), and neonatal outcomes (APGAR scores and stillbirths). Statistical analyses included independent-samples t-tests and chi-square tests; p-values $< 0.05$ were considered significant.

Results: The overall prevalence of CS was 47.36% (2,676/5,650). Unbooked patients had a slightly higher CS rate (46.50%) than their booked counterparts (45.85%). Maternal mortality ($p=0.802$) and the incidence of Primary PPH ($p=0.602$) did not significantly differ statistically across both groups. On the other hand, unbooked patients had considerably poorer neonatal outcomes. The mean APGAR scores at one minute ($6.19 \pm 2.46$ vs. $7.30 \pm 1.33$, $p<0.0001$) and five minutes ($7.67 \pm 2.77$ vs. $8.83 \pm 1.33$, $p<0.0001$), for their newborns were considerably lower. Similarly, the group also had a significantly higher stillbirth rate (9.53% vs. 1.32%, $p<0.0001$).

Conclusion: While the CS rate at EKSUTH is high overall and slightly elevated among unbooked patients, the most critical finding is the severe disparity in neonatal outcomes. The most significant finding is the stark difference in neonatal outcomes, despite the high overall CS incidence at EKSUTH and a somewhat higher rate among unbooked patients. Poorer immediate newborn viability and much greater risks of stillbirth are closely linked to a lack of organized antenatal care. These results highlight the critical role of early and frequent antenatal

booking as a key strategy for increasing neonatal survival, and the urgent need for focused initiatives to close this care gap.

**Keywords**: Cesarean Section, Antenatal Care, Booked, Unbooked, Maternal Outcomes, Neonatal Outcomes, Apgar score, Stillbirth, Nigeria.

# INTRODUCTION

The cesarean section (CS) stands as one of the most common major surgical procedures performed globally [1]. It is a critical intervention to prevent maternal and perinatal mortality and morbidity in the presence of obstetric complications. The World Health Organization (WHO) suggests an ideal population CS rate of between 10-15%, noting that rates exceeding this threshold are not correlated with additional reductions in maternal and neonatal mortality [1, 2]. Despite this, a global trend of rising CS rates has been documented, particularly in middle- and high-income countries, with rates often surpassing 30% and even reaching 40% in many tertiary institutions [3, 4]. In Nigeria, the CS rate has seen a steady climb, with tertiary hospitals frequently reporting figures above 30%. This increase is driven by a complex interplay of factors, including rising patient demand for elective CS, heightened fear of litigation among practitioners, and a higher prevalence of complicated obstetric cases referred to these centers [5, 6].

In this regard, it is impossible to overemphasize the importance of antenatal care (ANC) as a pillar of mother and child health. ANC offers a vital platform for risk assessment, health education, treatment of pre-existing conditions, as well as birth preparedness and complication readiness. Patients in Nigeria's healthcare system are categorized practically as "booked" or "unbooked." A "booked" patient registers and adheres to a prescribed schedule of antenatal clinics at a specific healthcare facility. This allows for continuous monitoring and proactive management. Conversely, an "unbooked" patient presents for delivery with little or no prior antenatal care at that facility, often as an emergency case. This lack of engagement with the healthcare system prior to the onset of labor represents a significant and well-documented risk factor for adverse outcomes [7, 8].

Unbooked patients frequently present with more advanced labor, higher rates of obstetric emergencies such as ruptured uterus, severe pre-eclampsia, and obstructed labor.[9, 10] Due to these issues, there is a higher chance of emergency cesarean sections and poorer outcomes for both the mother and the baby.[10] Previous studies from various regions in Nigeria have consistently demonstrated that unbooked patients experience elevated rates of maternal mortality, perinatal mortality, and postpartum complications compared to their booked counterparts [11].

Even though there is proof that unbooked status is linked to unfavorable outcomes, more recent, institution-specific data are still required to measure the scope of this issue, especially with regard to CS outcomes. At Ekiti State University Teaching Hospital (EKSUTH), the analyzed CS rate was observed to be abnormally high. A detailed analysis of how this procedure and its associated outcomes differ by booking status is therefore crucial for internal audit, informed resource allocation, and strategic planning for maternal and neonatal health services.

This study, therefore, seeks to conduct a comparative analysis of cesarean section prevalence and associated feto-maternal outcomes between booked and unbooked patients at EKSUTH over a recent five-year period. The specific objectives are:

1. To determine and compare the prevalence of cesarean section between booked and unbooked patients.
2. To compare maternal outcomes (specifically Primary Postpartum Hemorrhage and mortality) following CS between the two groups.
3. To compare neonatal outcomes (APGAR scores and stillbirth rates) following CS between the two groups.

The findings from this research are intended to improve maternal and newborn health outcomes, offer insightful, evidence-based information that would support the significance of antenatal care, influence hospital policy and clinical practice, and direct focused actions in Ekiti State and similar settings.

# METHODS

## Study Design and Setting

A retrospective cross-sectional study was conducted at the Ekiti State University Teaching Hospital (EKSUTH). EKSUTH is a major tertiary healthcare facility serving the population of Ekiti State and its environs in South-West Nigeria. The hospital's Department of Obstetrics and Gynecology handles a broad range of both simple and complicated obstetric cases and runs a busy prenatal clinic and labor ward.

## Study Population and Period

The study population included all women who delivered at EKSUTH between April 1, 2020, and March 31, 2025. The primary inclusion criterion was the availability of a delivery record with a clearly documented mode of delivery (vaginal or cesarean). Over this five-year period, 5,650 deliveries met this criterion and constituted the final sample for analysis.

## Data Collection and Variables

Data were systematically extracted from the hospital's maternity registers and theatre records using a pre-designed, standardized data extraction form. The primary exposure variable was booking status, categorically defined as:

Booked: These are patients who had attended a minimum of two scheduled antenatal care visits, culminating in delivery at the facility.

Unbooked: Patients who had received no prior antenatal care and presented primarily for delivery, either as emergencies or through self-referral [31].

The primary outcome variable was the mode of delivery, classified as either Spontaneous Vaginal Delivery (SVD) or Cesarean Section (CS).

Secondary outcome variables, analyzed for CS deliveries only, included:

Maternal Outcomes:

Primary Postpartum Hemorrhage (PPH): Defined as an estimated blood loss of ≥1000ml following a CS delivery [12].

Maternal mortality is defined as the death of a woman either during pregnancy or within 42 days of pregnancy termination, from any cause related to or exacerbated by her pregnancy or its management and not from accidental or incidental causes [13].

Neonatal outcomes:

APGAR scores were obtained at the first and fifth minutes after birth. Both continuous variables (mean ± standard deviation) and categorical variables (low APGAR: <7 vs. normal APGAR: ≥7) were used to assess the scores.

Neonatal Survival Status: Categorized as "Good Outcome (Alive)" or "Poor Outcome (Dead)," the latter encompassing both Fresh Stillbirth (FSB) and Macerated Stillbirth (MSB).

## Data Management and Statistical Analysis

Extracted data were cleaned, coded, and analyzed using IBM SPSS Statistics for Windows, Version 28.0 [32]. For categorical variables, descriptive statistics were presented as frequencies and percentages, while for

continuous variables, they were displayed as means ± standard deviations. The prevalence of cesarean sections was calculated using the proportion of CS deliveries among all deliveries.

Inferential statistics were employed to test for associations:

The Chi-square ($\chi^2$) test was used to compare categorical outcomes (e.g., CS rate, PPH, mortality, APGAR categories) between the booked and unbooked groups. Fisher's exact test was also deemed suitable for maternal mortality, where event rates were extremely low.

The two groups' mean APGAR scores were compared using independent samples t-tests.

For every test, a p-value of less than 0.05 was deemed statistically significant.

**Ethical Consideration**

Ethical approval for this study was obtained from the EKSUTH Health Research Ethics Committee. Statutory informed consent from "participants" was not required because of the retrospective nature of the study. Patient confidentiality was strictly maintained throughout the whole research process; all identifying information was eliminated, and data were anonymized before analysis.

## RESULTS

Over the five-year study period, a total of 5,650 deliveries with a valid documented mode of delivery were recorded at EKSUTH. The following analysis shows the distribution of patients who booked and those who did not.

**Prevalence of Cesarean Section**

A total of 2,676 cesarean sections were performed, yielding an overall CS prevalence of 47.36% at EKSUTH during the study period.

A comparative analysis by booking status is presented in Table 1. Of the 3,505 booked patients, 1,607 (45.85%) delivered via CS. Among the 2,101 unbooked patients, 977 (46.50%) delivered via CS. This shows that unbooked patients had a slightly higher CS rate than booked ones.

Table 1: Prevalence of Caesarean Section Among Booked vs Unbooked Patients

| Booking Status | SVD (freq/%) | CS (freq/%) |
|---|---|---|
| Booked | 1,898 (54.15%) | 1,607 (45.85%) |
| Unbooked | 1,124 (53.50%) | 977 (46.50%) |

**Maternal Outcomes Following Cesarean Section**

**Primary Postpartum Hemorrhage (PPH)**

The occurrence of PPH among women who underwent CS is detailed in Table 2. Among the 1,605 booked women who had a CS, 12 (0.75%) experienced PPH. In the unbooked group, 10 out of 976 women (1.02%) who had a CS experienced PPH. The Chi-square test revealed no statistically significant difference in the incidence of PPH between the two groups ($\chi^2 = 0.272$, df = 1, p = 0.602).

Table 2: Primary PPH among CS Deliveries

| Booking Status | PPH (Yes) | PPH (No) | Total |
|---|---|---|---|
| Booked | 12 | 1,593 | 1605 |
| Unbooked | 10 | 966 | 976 |

Statistical Test | $\chi^2 = 0.272$, $p = 0.602$ |

**Maternal Mortality**

Maternal mortality following CS was a rare event, as shown in Table 3. There were no maternal deaths recorded among the 1,607 booked women who underwent CS. In the unbooked group, one maternal death occurred out of 976 CS deliveries (0.10%). Statistical analysis showed no significant difference in maternal mortality between the groups ($\chi^2 = 0.063$, df = 1, $p = 0.802$).

Table 3: Maternal Outcome among CS Deliveries

| Booking Status | Alive | Dead | Total |
|---|---|---|---|
| Booked | 1,607 | 0 | 1,607 |
| Unbooked | 975 | 1 | 976 |

Statistical Test | $\chi^2 = 0.063$, $p = 0.802$ |

**Neonatal Outcomes Following Cesarean Section**

**APGAR Scores**

A comparative analysis of APGAR scores revealed stark differences between the two groups, as summarized in Table 4. Booked patients had significantly higher mean APGAR scores at both 1 minute and 5 minutes post-delivery.

Table 4: Mean APGAR Scores (± SD) Among CS Deliveries

| Booking Status | 1-Minute APGAR (Mean ± SD) | 5-Minute APGAR (Mean ± SD) |
|---|---|---|
| Booked | 7.30 ± 1.33 | 8.83 ± 1.33 |
| Unbooked | 6.19 ± 2.46 | 7.67 ± 2.77 |

Independent-samples t-tests confirmed that these differences were highly statistically significant for both the 1-minute ($t = 18.51$, $p < 0.0001$) and 5-minute ($t = 17.40$, $p < 0.0001$) APGAR scores. This indicates a clinically relevant superior immediate neonatal condition among babies born to booked mothers.

When APGAR scores were categorized into low (<7) and normal (≥7), the disparity was even more pronounced. Chi-square analysis showed that booking status had a profound and statistically significant influence on the risk of a low APGAR score at both 1 minute ($\chi^2 = 289.81$, $p < 0.0001$) and 5 minutes ($\chi^2 = 242.78$, $p < 0.0001$). Unbooked mothers had a much higher proportion of neonates with low APGAR scores at both time points.

**Neonatal Survival (Stillbirths)**

The most dramatic difference in outcomes was observed in the rate of stillbirths, as detailed in Table 5. Among booked women undergoing CS, 14 out of 1,603 neonates (1.32%) were stillborn. In stark contrast, among unbooked women, 61 out of 970 neonates (9.53%) were stillborn. This represents a more than seven-fold increase in the risk of stillbirth for unbooked patients. This is similar to findings in studies done at tertiary facilities in Calabar and Port Harcourt [14, 15].

Table 5: Neonatal Outcome (Stillbirths) Among CS Deliveries

| Booking Status | Good Outcome (Alive) | Poor outcome (Dead) |
|---|---|---|
| Booked | 1,589 (98.68%) | 14 (1.32%) |
| Unbooked | 909 (90.47%) | 61 (9.53%) |

Statistical Test | $\chi^2 = 60.72$, $p < 0.0001$ |

The Chi-square test for this association was highly significant ($\chi^2 = 60.72$, df = 1, $p < 0.0001$), indicating a very big and statistically significant difference in neonatal survival rates between the two groups, with unbooked women having substantially higher stillbirth rates following CS.

**Summary of Statistical Findings**

A consolidated summary of the key inferential statistical results is provided in Table 6 for clarity.

Table 6: Summary of Statistical Findings for CS Deliveries

| Outcome | Significant? | $\chi^2$ / t-statistic | p-value | Interpretation |
|---|---|---|---|---|
| CS Prevalence | No | - | - | Marginal difference |
| PPH | No | 0.272 | 0.602 | Similar PPH risk |
| Maternal Mortality | No | 0.063 | 0.802 | Similar low mortality rate |
| Neonatal outcome | Yes | 60.72 | <0.0001 | More stillbirths in unbooked |
| 1-min APGAR (Mean) | Yes | t= 18.51 | <0.0001 | Significant difference (Booked > unbooked) |
| 5-min APGAR (Mean) | Yes | t= 17.40 | <0.0001 | Significant difference (Booked > unbooked) |
| 1-min APGAR (<7) | Yes | t= 289.81 | <0.0001 | Booking status significantly influences risk of low APGAR. |
| 5-min APGAR (<7) | Yes | t= 242.78 | <0.0001 | Persistent significant difference at 5 minutes. |

# DISCUSSION

This five-year retrospective study at EKSUTH offers a comprehensive analysis of the differential impact of antenatal booking status on cesarean section rates and associated feto-maternal outcomes. The findings paint a complex picture: while immediate, life-threatening maternal complications post-CS were comparable between groups, neonatal outcomes showed stark contrast, highlighting a critical and urgent area for public health and clinical intervention.

The overall CS prevalence of 47.36% documented in this study is remarkably high. This number is significantly higher than rates usually reported from other Nigerian tertiary facilities, which frequently range from 30% to 40% [3, 4]. It also greatly exceeds the WHO-recommended range of 10–15% [1]. There are probably several contributing factors behind this high prevalence. One important factor is EKSUTH's role as the main referral facility for complex obstetric patients from all throughout Ekiti State and the surrounding areas. The CS rate inevitably rises due to the surge of high-risk patients, especially unbooked women who tend to presentwith late-stage acute problems. The finding that the CS rate was marginally higher in unbooked patients (46.50%) than in booked patients (45.85%) aligns with existing literature that identifies a lack of antenatal care as a key risk factor for emergent operative delivery [16]. Unexpected emergencies such assevere fetal distress, prolonged obstructed labor, and abruptio placentae, which require promptand unscheduled surgical intervention, are common in unbooked patients. [17].

A notable finding of this study is the absence of a significant difference in the rates of Primary PPH and maternal mortality between booked and unbooked women undergoing CS[11, 18, 19]. The incidence of PPH was low in both groups (less than 1.1%), which may reflect a consistently high standard of intra-operative surgical technique, anesthesia, and postoperative care at EKSUTH that effectively mitigates this specific risk for all patients, irrespective of their booking history. Similarly, the extremely low maternal mortality rate (one death in 2,583 CS procedures) is commendable and testifies to the efficacy of the hospital's emergency obstetric care services in preventing maternal deaths, even when managing high-risk, unbooked cases [19]. This result must be interpreted cautiously, though. It might not fully account for the range of maternal morbidity that wasn't considered in this research, such as surgical site infections, sepsis, anesthesia problems, or whenan unscheduled hysterectomy is necessitated [20, 21]. Other research has reported higher overall maternal morbidity in unbooked patients, suggesting our analysis, while reassuring for the outcomes measured, might be limited in scope [22, 23].

The most compelling and alarming results of this study pertain to neonatal outcomes. The data unequivocally demonstrate that neonates delivered via CS to unbooked mothers fare significantly worse than those delivered to booked mothers, underscoring a tragic consequence of delayed care [8, 23].

Poorer initial physiological adaptation to extrauterine life is shown by the unbooked group's considerably lower mean APGAR scores at both the first and fifth minutes. More critically, the categorization analysis revealed that unbooked mothers were at a drastically higher risk of delivering a neonate with a low APGAR score, a well-established predictor of increased neonatal morbidity and the immediate need for resuscitation [24, 25, 26].

The most striking disparity was in the stillbirth rate. The unbooked group had a stillbirth risk that was more than seven times greater (9.53%) than the booked group (1.32%) following CS. This finding is the cornerstone of this research. It powerfully suggests that for a significant proportion of unbooked patients, the decision to perform a CS is often a last-resort intervention enacted too late, frequently after irreversible fetal compromise has already set in [27]. Conditions like prolonged obstructed labor, severe placental abruption, and intrauterine infections—which are more prevalent and undetected in women without antenatal surveillance—can lead to fetal death or terminal distress long before the mother reaches the hospital [28]. The CS is then performed on a fetus that is already deceased or in extremis. This highlights a critical failure in the pathway of care before hospital presentation, emphasizing that antenatal care is not merely about routine monitoring but is fundamentally about the timely identification of danger signs, facilitated referral, and proactive intervention to safeguard the fetus [29].

The findings of this study carry several important implications for healthcare delivery:

1. Promoting the Importance of Antenatal Care: More intensive, culturally appropriate community-level health education initiatives are crucial. These must move beyond generic messaging to emphatically communicate the life-saving importance of early and regular antenatal booking, specifically for fetal well-being and survival.

2. Strengthening Referral Systems: The high stillbirth rate among unbooked CS patients points to systemic weaknesses in the primary and secondary healthcare tiers. Strengthening integrated referral pathways to ensure the timely and efficient transfer of women with obstetric complications from peripheral health centers to better-equipped facilities, such as EKSUTH, is paramount.

3. Enhancing Hospital Preparedness: EKSUTH must continue to maintain its high-quality emergency obstetric care. However, the data on neonatal outcomes call for parallel enhancements of neonatal services. This includes ensuring the constant availability of skilled personnel for advanced neonatal resuscitation and bolstering the capacity of the Neonatal Intensive Care Unit (NICU) to manage the significant influx of compromised neonates from unbooked deliveries.

4. Guiding Further Research: Future studies should employ mixed-methods approaches. Quantitative research could control for potential confounders like gestational age and precise CS indications, while qualitative inquiry is needed to deeply explore the multifaceted barriers—financial, cultural, geographical, and educational—that prevent women from booking for antenatal care in this region.

## LIMITATIONS

This study has limitations inherent to its retrospective, record-based design. The analysis was reliant on the accuracy and completeness of routine hospital documentation. The interpretation of relationships may be affected by a number of possible confounding factors that were not examined in this dataset, including maternal age, parity, the precise gestational age at birth, and the specific clinical indications for each CS. Additionally, because this was a single-center study conducted at a tertiary referral hospital, the results may not be directly applicable to primary or secondary healthcare institutions, due to differences in patient demographics and case complexity [30].

## CONCLUSION

This study confirms an exceptionally high rate of cesarean section at EKSUTH, with a marginally higher prevalence observed among unbooked patients. While the hospital has demonstrated success in maintaining low and comparable rates of immediate, life-threatening maternal complications (PPH and mortality) post-CS for both booked and unbooked patients, the neonatal outcomes reveal a deeply concerning narrative. Devastatingly poor neonataloutcomes, such as markedly lower APGAR scores and a more than seven-fold greater chance of stillbirth after cesarean delivery, are directly linked to the lack of organized antenatal care.

Therefore, it follows that antenatal booking is an essential and potent protective factor for the baby. In the end, it saves newborn lives by facilitating the early diagnosis of complications and enabling prompt, planned medical or surgical intervention. Therefore, attempts to rationalize the high CS rate must be inextricably linked to, and possibly even preceded by, coordinated efforts to significantly improve the coverage, quality, and timeliness of prenatal care. The ultimate goal must be to shift the clinical paradigm away from performing emergency cesarean sections as a salvage procedure for moribund fetuses, towards providing proactive, planned, and high-quality obstetric care that ensures both mother and child not only survive but thrive.

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