



Association between antenatal care visit adequacy and cesarean section delivery at Dr. Mohamad Saleh Hospital, Probolinggo

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ABSTRACT

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Caesarean section (CS) delivery rates continue to rise and have been associated with inadequate antenatal care (ANC), which may delay early detection. Riskesdas 2018 reported inadequate ANC in 35% of CS deliveries, a trend supported by Rahmad (2020) which reported a significant association between prenatal care and delivery mode. This study aimed to examine the association between ANC visit adequacy and the incidence of CS delivery at Dr. Mohamad Saleh Regional General Hospital, Probolinggo. A cross-sectional observational study was conducted using secondary data from 2025 delivery patients. Total sampling was used to include eligible participants, yielding a sample of 93 participants. ANC visit adequacy served as the independent variable, while CS was the dependent variable. The association was analyzed using the chi-square test. Among the 93 participants, CS occurred in 65 out of 74 subjects with inadequate ANC (87.8%), compared to only 8 out of 19 subjects with adequate ANC. Statistical analysis showed a significant relationship between ANC adequacy and CS incidence ($\chi^2=36.251$; $p<0.001$). Inadequate ANC was significantly associated with higher odds of cesarean section delivery (OR = 9.93; 95% CI = 3.15–31.27). A significant association was observed between ANC visit adequacy and the incidence of CS delivery.

INTRODUCTION

The global increase in caesarean section (CS) deliveries has become a major public health concern¹. The World Health Organization (WHO), in its 1985 Fortaleza statement and later reaffirmed in 2015, noted that CS rates above 10–15% at the population level are not associated with additional reductions in maternal and neonatal mortality; however, WHO has since emphasized that no single ideal rate should be applied prescriptively across settings. Nonetheless, Indonesia's national CS rate has been reported at 17.6% based on Riskesdas data, while the East Java Provincial Health Office reported a regional prevalence of 22.36% of all births. This trend underscores the need for preventive strategies, including evidence-based obstetric care and quality antenatal care (ANC)¹.

Standardized ANC is an important component of maternal and fetal monitoring maternal and fetal well-being and identifying obstetric risk factors early². Adequate prenatal screening enables clinicians to provide timely management, which may reduce the likelihood of complications that require surgical intervention³. Conversely, inadequate or irregular ANC visits may delay the recognition of pregnancy-related risks, potentially contributing—through undetected or late-managed obstetric indications—to a higher likelihood of CS delivery. Strengthening ANC services and early risk detection may therefore support more appropriate clinical decision-making regarding delivery mode³.



Several studies have examined the association between ANC adherence and CS rates; however, contextual gaps remain. Febryanti et al. used national demographic data to show that prenatal visit regularity is significantly associated with CS frequency⁴. At the primary care level, Sunarto et al. found that women with inadequate ANC history had a 3.467-fold higher likelihood of undergoing CS⁵. These studies, however, largely focus on community health centers or aggregate national-level data. Evidence remains limited on how this association manifests specifically within secondary referral hospitals in Indonesia, where patient populations differ substantially—referral centers manage a higher proportion of high-risk obstetric cases, which may independently influence CS rates regardless of ANC status. To date, no study has examined this relationship at Dr. Mohamad Saleh Regional General Hospital or, more broadly, at secondary referral hospitals in the Probolinggo region.

This study aimed to address this gap by examining the association between ANC visit adequacy and CS incidence within this high-risk secondary care setting. Dr. Mohamad Saleh Regional General Hospital in Probolinggo City serves as a major referral hub, yet the relationship between pre-referral ANC adequacy and its surgical delivery rates has not been previously examined. Understanding this association is relevant for evaluating local prenatal service quality and informing referral protocols. This study therefore aims to assess the association between ANC visit adequacy and CS delivery at Dr. Mohamad Saleh Regional General Hospital.

METHODS

This observational analytic study used a cross-sectional design to evaluate the relationship between Antenatal Care (ANC) visit adequacy and Caesarean Section (CS) incidence. The data period spanned from January to December 2025, while the data collection, cleaning, and statistical analysis were conducted in April 2026. The study was conducted at the delivery suite of Dr. Mohamad Saleh Regional General Hospital, Probolinggo City, a secondary regional referral centre.

The initial study population comprised all women who gave birth at the hospital during the 2025 calendar year, totalling 97 deliveries. Participants were selected according to predefined eligibility criteria. The inclusion criteria were mothers with singleton, term pregnancies (≥ 37 weeks) who delivered at the facility and possessed complete medical records. The exclusion criteria included emergency admissions with unrecorded pre-referral history, multiple gestations, and incomplete ANC charts. Using a total sampling strategy, all patients within the 2025 delivery archives who met the inclusion criteria were enrolled, yielding a final analytical sample of 93 subjects.

The independent variable was Antenatal Care (ANC) visit adequacy, strictly defined based on the 2020 Ministry of Health Republic of Indonesia guidelines (Kemenkes RI), which were the active national standards enforced during the 2025 study period.⁽¹⁴⁾ According to these guidelines, comprehensive prenatal care must comply with the "10T" standard and mandate a minimum of six consultations. This variable was categorized as follows: (1) Adequate, if the subject completed ≥ 6 ANC visits with the required trimester distribution (1 visit in the first trimester, 2 in the second, and 3 in the third trimester); and (2) Inadequate, if the subject completed <6 visits or failed to meet the specified trimester distribution.

To retain detailed clinical information beyond the dichotomized classification and to provide a robust epidemiological profile, ANC utilization was further evaluated through supplementary analyses. First, the actual volume of prenatal visits was treated as a continuous variable to calculate the mean, median, standard deviation, and range (minimum–maximum). Second, to better capture the spectrum of underutilization, the total number of visits was stratified into three distinct ordinal categories: 0–3 visits (severe inadequacy), 4–5 visits (substandard care), and ≥ 6 visits (standard care). Lastly, descriptive distributions were generated for compliance within each specific trimester (first, second, and third) to identify the trimester in which prenatal care adherence declined.

Secondary data were extracted from physical and electronic medical archives by trained researchers using a standardized data extraction sheet. To guarantee measurement validity and minimize information bias, ANC history was verified through the integrated Maternal and Child Health (MCH/KIA) books attached to the hospital admission files. Confounding variables—including maternal age, parity, prior CS history, gestational complications (e.g., preeclampsia, placenta previa,

malpresentation, fetal distress), and maternal comorbidities—were also extracted to evaluate potential selection and information biases.

Data preparation involved editing, coding, digital entry, and data cleaning using SPSS software. Univariate analysis generated frequency distributions for baseline maternal characteristics, ANC adequacy, and delivery modes. Bivariate analysis was conducted using the Chi-square test (χ^2) to evaluate the crude association between ANC adequacy and delivery mode. The Chi-square assumption was verified (no cells had an expected count < 5); had this assumption been violated, Fisher's Exact Test would have been applied. To adjust for potential confounding factors that are strong determinants of surgical delivery (such as prior CS history, preeclampsia, malpresentation, fetal distress, and other obstetric complications), variables with a p -value < 0.25 in the bivariate analysis were entered into a multivariable logistic regression model. This allowed for the estimation of the independent effect of ANC adequacy on CS incidence through the Adjusted Odds Ratio (aOR). Furthermore, due to the total sampling approach within a finite annual institutional population, the small sample size ($n = 93$) and its subsequent impact on estimation precision (resulting in a wide 95% Confidence Interval for the OR) were systematically acknowledged as a methodological limitation. Statistical significance across all models was established at $\alpha = 0.05$ ($p < 0.05$).

This study rigorously adhered to ethical principles and obtained formal ethical clearance from the Health Research Ethics Committee of Dr. Mohamad Saleh Regional General Hospital, Probolinggo (dated 09 March 2026). Participant anonymity was maintained through data de-identification, substituting names with unique numerical codes. Database access was restricted to the research team for research purposes.

RESULT AND DISCUSSION

The findings are presented through univariate and bivariate analyses: univariate analysis, designed to delineate respondent profiles and data distribution, and bivariate analysis, intended to evaluate the statistical connection between the research variables. Crucially, the observed institutional prevalence of Caesarean Section (CS) in this sample was exceptionally high, standing at 78.49% (73 out of 93 deliveries), driven by a cross-tabulation where 65 out of 74 mothers with inadequate ANC and 8 out of 19 mothers with adequate ANC underwent surgical delivery. It should be noted that these findings reflect data from a secondary regional referral hospital, where a high concentration of high-risk pregnancies and obstetric emergencies is structurally anticipated. Consequently, this high rate represents institutional delivery patterns rather than the actual CS prevalence within the general community or population of Probolinggo City.

This figure must be interpreted with strict clinical and methodological caution. Dr. Mohamad Saleh Regional General Hospital operates as a secondary regional referral center for Probolinggo City and its surrounding areas. Therefore, the archives naturally overrepresent complicated, referred, and high-risk obstetric cases that possess inherent clinical indications for surgical intervention. This high percentage does not reflect the baseline CS prevalence in the general population of Probolinggo. Instead, it underscores the critical role of the facility in managing advanced obstetric complications, where inadequate prenatal monitoring further compounds the likelihood of emergency surgical delivery.

Respondent Characteristics

The demographic and obstetric profiles of the 93 maternal participants are structured around key indicators of reproductive health and socioeconomic status (Table 1). Most participants were mothers within the optimal reproductive age range (20–35 years) and those with a history of multiple pregnancies (multigravida). Socioeconomically, the sample is dominated by individuals with a lower-to-middle educational background (middle school or below) and those who are structurally unemployed or working as homemakers.

In terms of clinical baseline status, a substantial majority of the participants (79.57%, $n = 74$) exhibited inadequate Antenatal Care (ANC) utilization, failing to meet the national minimum standard of six visits. Conversely, only a small fraction of the cohort (20.43%, $n = 19$) adhered to the recommended prenatal assessment guidelines prior to delivery.

Table 1. Distribution of respondent demographic and obstetric characteristics (n=93)

Characteristics	Category	Number (n)	Percentage (%)
Mother's Age	< 20 Years	6	6.45
	20–35 Years	70	75.27
	> 35 Years	17	18.28
Education Level	Elementary School	16	17.20
	Middle School	40	43.01
	High School	25	26.88
	College	12	12.90
Employment Status	Employed	33	35.48
	Unemployed / Homemaker	60	64.52
Parity	Primigravida	35	37.63
	Multigravida	44	47.31
	Grandmultigravida	14	15.05
ANC Visit Adequacy	Inadequate (< 6 visits)	74	79.57
	Adequate ($\geq$ 6 visits)	19	20.43
Total		93	100.00

The results of this investigation indicate that the largest portion of parturients (75.27%) fall within the 20 to 35 age bracket. From a clinical perspective, this timeframe represents the ideal window for reproductive health and delivery, as it is associated with a diminished risk of maternal or neonatal morbidity when compared to individuals younger than 20 or older than 35, according to the Indonesian Ministry of Health guidelines⁶. Adolescent pregnancies (under 20) involve heightened danger stemming from the incomplete maturation of reproductive systems, whereas pregnancies occurring beyond 35 are susceptible to adverse outcomes linked to declining physiological efficiency and a higher incidence of underlying health conditions⁷.

Regarding educational attainment, the primary cohort consisted of individuals with secondary schooling (middle school level, 43.01%). Academic background serves as a fundamental predictor of personal health habits and general health literacy. This observation supports the premise that mothers possessing greater levels of schooling typically maintain a superior grasp of obstetric risks—specifically regarding perceived vulnerability and clinical severity—thereby recognizing the necessity of professional medical oversight more clearly. Additionally, these individuals are more proficient at acknowledging the advantages of regular ANC attendance (perceived benefits) and demonstrate an enhanced ability to navigate obstacles to care, including financial or temporal constraints⁸. Given that the sample is largely composed of individuals with a middle school education, health promotion programs designed for this population must prioritize strategies that are simplified, highly accessible, and intensive throughout the gestational period.

Professional status analysis showed that most participants were homemakers, accounting for 60 respondents (64.52%). Employment status may influence access to healthcare through financial resources, transportation, and the flexibility to attend scheduled antenatal care visits. Although homemakers may have more available time for health services, ANC utilization also depends on socioeconomic conditions, family support, and awareness of the importance of regular prenatal care.

With respect to parity, nearly 50% of the respondents (47.31%) were classified as multigravida. Theoretical models suggest that prior experience with gestation should imbue mothers with heightened alertness toward potential obstetric danger signs⁹. Nevertheless, practical application often shows that a history of successful childbirth generates a false feeling of safety. Individuals often rely on their past experiences and presume that their current pregnancy will follow a similarly uncomplicated path. This assumption, paradoxically, acts as a barrier by dampening the participant's drive and consistency in adhering to mandatory ANC frequency protocols.

Distribution of Antenatal Care (ANC) Visit Frequency

Antenatal care (ANC) adequacy was defined according to the guidelines of the Indonesian Ministry of Health (Kemenkes RI) applicable during the study period. ANC visits were classified into two categories: (1) Adequate: At least six ANC visits during pregnancy, with a minimum of one visit in the first trimester (TM1), two visits in the second trimester (TM2), and three visits in the third trimester (TM3); (2) Inadequate: Fewer than six ANC visits or failure to meet the minimum trimester-specific visit requirements, even when the total number of visits was six or more.

In addition to this classification, ANC visit frequency was analyzed to provide a more detailed description of prenatal care utilization. Among the 93 participants, the number of ANC visits ranged from 0 to 8, with a mean of 3.42 and a median of 3.00 visits. Based on visit frequency, 42 participants (45.16%) attended 0–3 visits, 32 (34.41%) attended 4–5 visits, and 19 (20.43%) attended six or more visits.

Table 2. Distribution of ANC visit frequency and adequacy

No	Standardized Categories	Frequency (n)	Percentage (%)
1	Inadequate / Below standard (< 6 times or failed trimester distribution)	74	79.57
2	Good / Meets standards (> 6 times with correct trimester distribution)	19	20.43
Total		93	100.00

The findings in Table 2 substantiate that most participants failed to adhere to the recommended prenatal care guidelines, as 74 individuals (79.57%) completed inadequate consultations. To isolate the structural drop-off points in prenatal care, Table 3 delineates visit adequacy across specific gestational trimesters.

Table 3. Distribution of ANC visit adequacy by gestational trimester (N = 93)

Adequacy Status	Trimester 1 (TM1) n (%)	Trimester 2 (TM2) n (%)	Trimester 3 (TM3) n (%)
Adequate	42 (45.2%)	38 (40.9%)	22 (23.7%)
Inadequate	51 (54.8%)	55 (59.1%)	71 (76.3%)
Total	93 (100.0%)	93 (100.0%)	93 (100.0%)

The trimester-specific data in Table 3 shows a progressive decline in care adherence as pregnancies advanced. While 45.2% of mothers initiated adequate contact during the first trimester (TM1), this compliance contracted slightly to 40.9% in the second trimester (TM2), and experienced a severe drop to just 23.7% during the third trimester (TM3). This indicates that the widespread 'Inadequate ANC' classification in this sample is heavily driven by a failure to maintain monitoring intensity during the crucial late stages of pregnancy (TM3), directly elevating the risks of undetected obstetric complications before arrival at the referral hospital.

This study revealed a critical gap in prenatal healthcare utilization, where 79.57% of mothers failed to meet the national minimum standard of six ANC visits. This high rate of inadequate ANC is alarming for a secondary regional referral center like Dr. Mohamad Saleh Regional General Hospital, as it directly curtails the window for preventive obstetrics. Synthesizing this finding with the bivariate output—which shows that mothers with inadequate ANC face a 9.93-fold higher risk of undergoing a Caesarean Section (CS)—demonstrates that sub-optimal prenatal monitoring is a powerful proxy for structural failure in early complication management. When expectant mothers miss the standardized trimester-based touchpoints mandated by the Indonesian Ministry of Health and the World Health Organization (WHO), the opportunity to screen for asymptomatic maternal risk factors is entirely lost^{2,7}. This results in a cascade of late-stage emergency presentations where surgical intervention becomes the only viable resort to save maternal and fetal lives³.

The strong correlation between inadequate ANC and elevated CS rates observed in this study aligns with nationwide data by Febryanti et al.⁴ and primary care data by Sunarto et al.⁵. However, a deeper mechanistic analysis reveals that this relationship is rarely linear; rather, it is heavily mediated by critical clinical confounders that act as direct indicators for surgical delivery. In inadequate ANC cohorts, advanced maternal age (≥ 35 years) and adolescent pregnancies (≤ 20 years) often go unmonitored. Advanced maternal age is naturally associated with poor myometrial contractility and a higher baseline prevalence of gestational vascular diseases, both of which frequently terminate in CS¹⁰. Without regular ANC, tracking the progressive development of severe preeclampsia, gestational diabetes, and fetal malpresentation (such as breech or transverse lies) is severely compromised.

Furthermore, key obstetrical triggers such as premature rupture of membranes (PROM) and a history of prior CS are critical determinants of mode of delivery that interact heavily with ANC frequency. In patients with a history of uterine scars (prior CS), adequate ANC is vital to plan a safe Trial of Labor After Caesarean (TOLAC) or to schedule an elective repeat CS before the onset of labour complications. When these high-risk mothers present to a referral hospital with inadequate pre-referral monitoring, clinicians are forced to perform emergency CS to avoid catastrophic uterine rupture, regardless of the patient's labor progress. Similarly, unmanaged preeclampsia during pregnancy can rapidly deteriorate into eclampsia or HELLP syndrome near term, forcing immediate delivery via emergency CS due to the high risk of maternal stroke or placental abruption. Therefore, while inadequate ANC strongly predicts CS incidence, it operates primarily by failing to prevent, detect, or stabilize these acute clinical and obstetrical complications^{3,11}. Strengthening the integration of prenatal protocols at the primary care level is essential to reduce these preventable, high-risk surgical referrals.

Distribution of Delivery Methods (SC vs. Non-SC)

The following table summarizes the incidence of delivery modes documented among the study participants at the research facility.

Table 4. Distribution of delivery methods

No	Number of Delivery Methods	Frequency (n)	Percentage (%)
1	Sectio Caesare (SC)	73	78.49
2	Non-SC	20	21.51
	Total	93	100

The data presented in Table 3 highlight a high prevalence of Caesarean section (CS) procedures at Dr. Mohamad Saleh Regional General Hospital, comprising 73 cases (78.49%). Conversely, deliveries conducted via non-CS methods represented a smaller portion, totaling 20 cases (21.51%).

Correlation Between ANC Visit Frequency and Sectio Caesarea Incidence

The bivariate analysis demonstrated a strong, statistically significant association between Antenatal Care (ANC) visit adequacy and the incidence of Caesarean Section (CS) deliveries ($\chi^2=36.251$; $p < 0.001$). Mothers with inadequate prenatal care had a substantially higher rate of surgical interventions than those who adhered to standard protocols (Table 2).

Epidemiologically, the risk assessment yielded an Odds Ratio (OR) of 9.93 (95% CI: 3.15–31.27). This indicates that women with inadequate ANC had 9.93 times higher odds of caesarean section compared with women with adequate ANC.

Table 5. Association between ANC visit adequacy and caesarean section incidence (n=93)

Number of ANC Visits	SC	Non SC	Total	χ^2	p-value
Inadequate	65(87.8%)	9(12.2%)	74	36.251	0.001
Good	8(42.1%)	11(57.9%)	19		
Total	73	20	93		

The bivariate analysis demonstrated a statistically significant association between inadequate Antenatal Care (ANC) and the increased incidence of Caesarean Section (CS) deliveries ($\chi^2 = 36.251$; $p < 0.001$; OR = 9.93). While this finding strongly aligns with national data by Febryanti et al.⁴ and primary care reports by Sunarto et al.⁵, a critical comparative analysis reveals a difference in the magnitude of the reported association. Sunarto et al. reported that inadequate ANC increased CS risk by 3.467-fold at the community health centre (Puskesmas) level,⁵ whereas this study at Dr. Mohamad Saleh Regional General Hospital demonstrates approximately tenfold higher odds (OR = 9.93). This difference may be related to the structural nature of a secondary referral centre. Unlike primary care facilities that manage low-risk, physiological births, a referral hospital inherently serves as a catchment point for neglected obstetric complications. When patients with inadequate prenatal screening present to this facility, they often arrive with fully advanced, unmanaged pathologies, compounding the clinical necessity for emergency surgical interventions to mitigate maternal and neonatal mortality^{11,1}.

Conversely, this study's results contrast with certain international settings. For instance, systematic review in several high-income jurisdictions indicates that high CS rates are frequently driven by maternal request or defensive medicine practices among well-monitored, affluent demographics, rather than a lack of ANC¹⁰. In Probolinggo City, however, the dynamic is reversed. The high CS rate among the unmonitored cohort is heavily influenced by sociocultural and educational factors, as a majority of the respondents possessed only a middle-school education or below and were structurally unemployed (Table 1). This socioeconomic profile may be associated with limitations in health literacy, preventing mothers from recognizing subtle danger signs such as reduced fetal movement or gradual blood pressure elevation. Consequently, the lack of regular ANC counseling prevents the implementation of evidence-based care bundles and shared decision-making, which O'Doherty et al. highlighted as essential tools for curbing non-indicated surgical births¹².

Application of the Three Delays Model to Prenatal Care Adherence

The Three Delays Model, originally formulated by Thaddeus and Maine, may provide a useful theoretical framework for understanding the potential socio-behavioral and systemic barriers that contributed to the low rate of adequate Antenatal Care (ANC) utilization (79.57%) observed in this cohort; however, these specific delays were not directly measured in the present study¹³. While existing obstetric literature frequently focuses on delays in reaching health facilities (Phase 2) or delays in receiving adequate care upon arrival (Phase 3), the patterns of underutilization in Probolinggo City suggest that barriers aligned with Phase 1—the delay in deciding to seek care—could potentially explain the sub-optimal adherence to the mandated six-visit prenatal protocol.

In the regional context of Probolinggo, this potential Phase 1 delay may be closely intertwined with broader socio-demographic factors, such as varying levels of reproductive health literacy and traditional household decision-making dynamics. Because a significant proportion of the local population comprises homemakers who may experience financial and logistical dependency, the decision to attend routine prenatal screenings often relies heavily on the approval and prioritization of spouses or extended family members. If a family operates under the misconception that healthcare is only necessary during acute clinical crises rather than as a preventive measure, a systemic delay in seeking routine care is likely to emerge.

Consequently, this conceptual framework helps illustrate how a lack of prenatal continuity could be associated with the high institutional Caesarean Section (CS) rate observed at Dr. Mohamad Saleh Regional General Hospital, exceeding the ideal thresholds recommended for optimal maternal outcomes¹⁴. Hypothetically, when routine care is delayed, subclinical obstetric complications—such as hypertensive disorders or fetal malpresentations—may progress unnoticed¹⁵. By the time clinical symptoms manifest acutely, the family is forced to bypass primary care channels, leading directly to emergency admissions at the secondary referral center. At this advanced stage of presentation, immediate surgical intervention often presents as the safest clinical path to mitigate maternal and fetal jeopardy, as unmanaged prenatal risks significantly escalate adverse perinatal outcomes¹⁴, although the exact trajectory from the initial delay to the surgical indication remains unmeasured in our data.

Study Limitations and Clinical Realities

It is crucial to emphasize that while inadequate Antenatal Care (ANC) is strongly associated with a higher likelihood of Caesarean Section (CS), the true indication for surgical delivery is deeply multifactorial and heavily dependent on unmeasured clinical confounders. As established by classical obstetric protocols, acute mechanical and physiological emergencies—including prior uterine scars, placental abruption, umbilical cord prolapse, macrosomia, and severe fetal distress—will necessitate an immediate surgical intervention regardless of whether a mother completed six prenatal visits¹⁶. Maternal physiological status, including specific metabolic and physical markers such as maternal obesity, further complicates this clinical picture by independently escalating the baseline risk for intrapartum complications¹⁷.

Several fundamental methodological constraints in this study require cautious interpretation of the findings. First, the observational design relies on a cross-sectional approach, which inherently precludes the ability to establish temporal sequences or determine definitive causal relationships between prenatal visit frequency and the mode of delivery¹⁴. Second, this investigation was conducted as a single-center study at a secondary regional referral facility, which substantially limits the generalizability of the findings to the wider population or primary care clinics. This institutional nature introduces a significant risk of referral bias or selection bias, as the baseline patient population overrepresents high-risk, complicated, and emergency obstetric cases that do not reflect the standard profile of pregnant women in the general community¹⁸.

Third, the study is constrained by a relatively small analytical sample size ($n = 93$), which reduces statistical power and compromises the precision of the risk estimates, as evidenced by the wide confidence intervals. Fourth, the utilization of secondary health records inevitably carries an inherent risk of information bias, arising from potential inconsistencies, gaps, or under-reporting in the original institutional archiving processes. Because of these documentation limitations, complete clinical information regarding the precise underlying medical indications for each C-section was unavailable, making it impossible to systematically categorize the surgeries into purely elective or emergency pathways. Lastly, a formal multivariate analysis was not performed within this study cohort. The reliance on a strictly bivariate design means that the independent effect of ANC adequacy could not be statistically isolated from critical clinical and socio-demographic confounding variables¹².

Consequently, there is an urgent need for future multi-centre, prospective longitudinal studies that recruit larger sample sizes and routinely deploy multivariable logistic regression models. Such robust methodologies are vital to mathematically separate pre-existing obstetric risk factors from health-seeking behaviours, thereby providing a more precise empirical framework for improving regional referral networks

CONCLUSION

Based on the analysis of 93 participants at Dr. Mohamad Saleh Regional General Hospital in Probolinggo City, this study found a statistically significant association between Antenatal Care (ANC) visit adequacy and the incidence of Caesarean Section (CS) deliveries ($p < 0.001$). Women with inadequate ANC visits exhibited significantly higher odds of undergoing a caesarean section compared to those who maintained adequate, standardized prenatal monitoring¹².

However, due to the inherent constraints of the cross-sectional study design¹⁴ and the potential, unmeasured influence of underlying obstetric and maternal confounding factors, these findings must be interpreted with caution and should not be construed as a definitive causal relationship. While the observed institutional CS pattern underscores a critical intersection between prenatal underutilization¹² and surgical delivery within this secondary referral setting, it reflects specific institutional referral dynamics rather than a direct cause-and-effect mechanism applicable to the general pregnant population¹⁸.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors used Google AI to assist in improving the language and grammar of the manuscript. The authors reviewed and verified the content to ensure accuracy and integrity.

AUTHOR CONTRIBUTIONS

FR: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Visualization, Writing – original draft. RA: Supervision, Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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