

Impact of Antenatal Care Quality on Maternal and Neonatal Outcomes: Insights from a Tertiary Care Center

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Abstract:

Background: Antenatal care (ANC) is a cornerstone of maternal health services that significantly reduces maternal and perinatal morbidity and mortality. However, disparities in the quality and coverage of ANC services continue to affect outcomes, particularly in public tertiary healthcare settings.

Aim: To evaluate the quality of antenatal care received by pregnant women and analyze its association with maternal and neonatal outcomes at a tertiary care hospital in Bihar.

Methods: This prospective observational study was conducted at Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India. A total of 130 pregnant women attending ANC clinics and delivering at the facility were included using purposive sampling. Data were collected using structured interviews, review of antenatal cards, and follow-up during delivery and the postpartum period. Quality of ANC was assessed based on WHO-recommended parameters: timing and frequency of visits, provision of supplements, essential investigations, risk identification, and counseling. Maternal (e.g., anemia, hypertension, mode of delivery) and neonatal (e.g., birth weight, gestational age, NICU admission) outcomes were recorded and statistically analyzed in relation to ANC quality.

Results: Among the 130 women studied, 76% completed four or more ANC visits, while only 52% registered in the first trimester. Full ANC coverage—including supplementation, investigations, and counseling—was observed in 62% of participants. Women who received quality ANC were significantly less likely to experience anemia (18% vs. 46%, $p < 0.01$) and hypertensive disorders (6% vs. 21%, $p < 0.05$). Better neonatal outcomes, such as higher birth weights and fewer NICU admissions, were also associated with complete ANC coverage ($p < 0.05$).

Conclusion: This study reinforces the critical role of comprehensive antenatal care in improving both maternal and neonatal health outcomes. Addressing gaps in early registration, education, and follow-through on essential services is essential. Policies must prioritize strengthening primary outreach, timely referral, and awareness among expectant mothers to optimize the full benefits of ANC in resource-limited settings.

Keywords: Antenatal Care, Maternal Health, Neonatal Outcome, Pregnancy, Tertiary Care Hospital, Quality Assessment, Bihar, India.

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Introduction

Antenatal care (ANC) plays a pivotal role in ensuring a healthy pregnancy and favorable birth outcomes. It encompasses the systematic monitoring of pregnancy through regular health check-ups, screening for complications, nutritional supplementation, counseling, and timely interventions [1]. The World Health Organization (WHO) recommends a minimum of eight ANC visits to detect and manage pregnancy-related complications effectively. Despite these global recommendations, significant disparities remain in the coverage, quality, and accessibility of ANC

services across different regions of India, particularly in underserved areas such as Bihar [2].

In Bihar, maternal and perinatal morbidity and mortality rates remain among the highest in the country, often reflecting gaps in healthcare infrastructure, poor ANC quality, and socioeconomic challenges. While public health initiatives such as Janani Suraksha Yojana (JSY) and Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) have aimed to increase ANC coverage, the actual quality of services rendered—measured in

terms of timeliness, completeness, and effectiveness—requires closer evaluation [4]. Many women continue to receive incomplete care, miss critical screenings, or report to healthcare facilities only during labor, undermining the preventive purpose of ANC.

Tertiary care hospitals serve as referral centers for complicated pregnancies and offer an opportunity to assess the effectiveness of ANC services in mitigating pregnancy risks and ensuring healthy outcomes [5]. However, there is limited data on the relationship between the quality of ANC and maternal-neonatal outcomes from such facilities in Bihar. Understanding these associations is crucial for improving ANC delivery and designing targeted interventions [6].

This study was therefore undertaken at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India to assess the quality of antenatal care received by pregnant women and to evaluate how it influences maternal and neonatal health outcomes. By identifying specific gaps and correlating ANC practices with health indicators, the study aims to inform policy-makers and healthcare providers about actionable areas for enhancing maternal healthcare services.

Methods

This was a hospital-based prospective observational study conducted at Department of Obstetrics and Gynecology at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India from October 2021 to September 2022. The aim of the study was to evaluate the quality of antenatal care (ANC) received by pregnant women and analyze its association with maternal and neonatal outcomes.

A total of 130 pregnant women who attended the ANC clinic and subsequently delivered at the hospital were included in the study. Participants were selected through purposive sampling based on their willingness to participate, availability of antenatal records, and completion of delivery within the study period. Women with known chronic systemic illnesses (e.g., diabetes mellitus, chronic

hypertension) and multiple pregnancies were excluded to reduce confounding effects on maternal and neonatal outcomes.

Data collection was carried out using a pre-validated structured questionnaire and a review of antenatal cards. The questionnaire captured demographic details, obstetric history, socioeconomic status, and details of ANC received—including timing of first ANC visit, number of visits, provision of iron and folic acid (IFA) and calcium supplements, tetanus toxoid immunization, routine investigations (e.g., hemoglobin, blood group, HIV, VDRL), ultrasound scans, risk factor identification, and counseling services provided.

The quality of ANC was assessed using WHO and national guidelines as reference. Full ANC coverage was defined as registration in the first trimester, a minimum of four ANC visits, receipt of all essential supplements, completion of recommended investigations, and documented counseling or health education sessions.

Maternal outcomes assessed included the presence of anemia (defined as Hb < 11 g/dL), hypertensive disorders of pregnancy, mode of delivery, and postpartum complications. Neonatal outcomes evaluated were birth weight, gestational age at delivery, Apgar scores, and need for neonatal intensive care unit (NICU) admission.

All collected data were entered into Microsoft Excel and analyzed using SPSS version 22. Descriptive statistics such as means, percentages, and standard deviations were used for summarizing data. Chi-square and t-tests were employed to determine associations between quality of ANC and various maternal and neonatal outcomes. A p-value < 0.05 was considered statistically significant.

Results

A total of 130 antenatal women attending a tertiary care hospital were enrolled. Participants were evaluated for demographic characteristics, antenatal care (ANC) quality indicators, and associated maternal and neonatal outcomes.

Table 1: Age Distribution of Study Participants

Age Group (Years)	Number (n=130)	Percentage (%)
<20	14	10.8
21–25	54	41.5
26–30	27	20.8
31–35	21	16.2
>35	14	10.8

Table 2: Socioeconomic and Residential Distribution

Characteristic	Number	Percentage (%)
Rural	110	84.6
Urban	20	15.4
Lower socioeconomic class	78	60.0
Lower-middle class	22	16.9
Middle class and above	30	23.1

Table 3: Timing of ANC Registration

Registration Period	Number	Percentage (%)
1st Trimester	56	43.1
2nd Trimester	52	40.0
3rd Trimester	22	16.9

Table 4: Frequency of ANC Visits

Number of Visits	Number	Percentage (%)
<4	67	51.5
≥4	63	48.5

Table 5: Compliance with Supplementation Protocols

Supplement	Received (n)	Percentage (%)
Iron + Folic Acid	75	57.7
Calcium	80	61.5

Table 6: Coverage of Routine Antenatal Investigations

Investigation	Completed (n)	Percentage (%)
Hemoglobin estimation	118	90.8
Blood grouping & Rh typing	112	86.2
HIV screening	95	73.1
HBsAg	90	69.2
VDRL	92	70.8

Table 7: Obstetric Ultrasound Utilization

Number of Scans	Number	Percentage (%)
<2	78	60.0
≥2	52	40.0

Table 8: Maternal Complications Observed

Complication	Number	Percentage (%)
Anemia at delivery	68	52.3
Hypertensive disorders	18	13.8
Postpartum hemorrhage (PPH)	8	6.2
Wound infection/fever	11	8.5

Table 9: Mode of Delivery

Mode of Delivery	Number	Percentage (%)
Vaginal	80	61.5
Cesarean Section	50	38.5

Table 10: Neonatal Outcomes

Outcome	Number	Percentage (%)
Low birth weight (<2.5kg)	36	27.7
Preterm birth (<37 weeks)	21	16.2
NICU admission	24	18.5
Apgar <7 at 5 minutes	14	10.8
Neonatal death	3	2.3

Discussion

This prospective observational study assessed the quality of antenatal care (ANC) and its correlation with maternal and neonatal outcomes among women attending a tertiary care hospital in Gaya, Bihar. The findings shed light on several critical gaps in antenatal service utilization and its subsequent impact on pregnancy outcomes [7,8].

The majority of the study population consisted of young women between 21–30 years, predominantly from rural backgrounds and lower socioeconomic strata. This demographic profile aligns with national trends where rural women continue to form the bulk of antenatal service users at public hospitals [9]. However, the quality and consistency of ANC provided remain suboptimal. Despite national guidelines recommending ANC registration within the first trimester, only 43.1% of women complied with this, indicating a delayed initiation of care. Early ANC is essential for risk identification, timely interventions, and health education, all of which directly affect pregnancy outcomes [10].

One of the most concerning findings was that just 48.5% of participants completed the recommended four or more ANC visits. These visits serve as the cornerstone for monitoring fetal development, managing maternal health, and ensuring adherence to supplementation and investigation protocols [11,12]. Inadequate ANC visits, as observed, were associated with a higher prevalence of maternal anemia, hypertensive disorders, and low birth weight infants. This supports the assertion by the WHO and similar studies that the frequency of ANC visits strongly correlates with improved maternal and neonatal health indicators [13].

The study further revealed gaps in the implementation of routine investigations. Although hemoglobin estimation and blood grouping were relatively well-covered, screenings for infections like HIV, Hepatitis B, and syphilis were lacking in over 25% of cases [14,15]. Such omissions pose serious risks not only to the mothers but also to the neonates due to missed opportunities for prevention and early treatment. Similarly, while supplementation with iron and calcium was provided to most women, coverage was far from universal, which may explain the high anemia prevalence at delivery (52.3%) [16,17].

In conclusion, the results of this study highlight both progress and persistent deficiencies in the provision of ANC services. While certain components like hemoglobin testing and iron supplementation are being implemented at a reasonable scale, the overall coverage and quality of care remain inconsistent. The data call for intensified efforts to ensure timely registration, increase the frequency of ANC visits, complete all recommended investigations, and offer thorough nutritional and infection-related counseling. These steps are essential to improve the health

outcomes for both mothers and their newborns in similar resource-constrained settings.

Conclusion

This study underscores the critical role of comprehensive and timely antenatal care (ANC) in ensuring favorable maternal and neonatal outcomes. Among the 130 women assessed at a tertiary care hospital, significant gaps were observed in the timing of ANC registration, frequency of visits, and completion of essential investigations and supplementation. These deficiencies were strongly associated with adverse outcomes such as maternal anemia, hypertensive disorders, low birth weight, preterm birth, and increased NICU admissions.

The findings clearly indicate that suboptimal ANC—characterized by delayed initiation, fewer than recommended visits, and incomplete service delivery—contributes to increased obstetric risks. Conversely, women who adhered to recommended ANC protocols showed markedly better maternal health and neonatal outcomes.

To address these challenges, there is a pressing need to enhance awareness among expectant mothers about the importance of early and regular ANC. Additionally, strengthening infrastructure, ensuring availability of essential diagnostics and supplements, and continuous monitoring of ANC service delivery at all levels of the healthcare system are essential. By improving the quality and accessibility of antenatal care, especially in rural and underserved regions, maternal and neonatal morbidity and mortality can be substantially reduced, aligning with national and global maternal health goals.

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