



Original Article

Impact of Early and Delayed Registration of Antenatal Cases on the Outcome of Pregnancy Among Postnatal Mothers in A Tertiary Care Hospital in Central Karnataka

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ABSTRACT

Introduction - Antenatal care is central to reducing maternal and perinatal morbidity and mortality. The WHO recommends registration of pregnancy within the first trimester, yet delayed registration remains common in India, potentially compromising early detection and management of complications.

Objectives: To assess outcome of pregnancy with the time of registration and to associate early and delayed antenatal registration with maternal and fetal outcome.

Methods: This hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Chitradurga, from October 2024 to March 2025. A total of 330 postnatal mothers aged 18–40 years were enrolled using systematic random sampling. Data on sociodemographic profile, antenatal registration timing, and pregnancy outcomes were collected using a pretested semi-structured questionnaire and hospital records. Participants were classified as early (≤ 12 weeks) or delayed (> 12 weeks) registrants. Chi-square test and logistic regression were used for analysis, with odds ratios (OR) and 95% confidence intervals (CI) reported.

Results: Of the 330 mothers, 42.4% registered early and 57.6% registered late. Delayed registration was significantly associated with higher rates of anemia (51.6% vs. 30.0%, OR 2.49), PIH/preeclampsia (17.9% vs. 8.6%, OR 2.32), preterm labor (21.1% vs. 10.0%, OR 2.40), and PROM (14.7% vs. 6.4%, OR 2.52) among maternal outcomes. Fetal/neonatal outcomes—low birth weight (44.2% vs. 21.4%, OR 2.91), preterm birth (24.2% vs. 11.4%, OR 2.48), NICU admission (30.5% vs. 14.3%, OR 2.64), IUGR (16.8% vs. 7.9%, OR 2.38), and low APGAR score (12.6% vs. 5.0%, OR 2.75)—were also significantly higher in the delayed group. Vaginal delivery was more common with early registration (60.0% vs. 48.4%).

Conclusion: Delayed antenatal registration is associated with a 2–3 fold higher risk of adverse maternal and fetal outcomes. Strengthening community awareness and promoting first-trimester registration through frontline health workers are essential to improve pregnancy outcomes.

Keywords: Antenatal registration, pregnancy outcome, anemia, low birth weight, preterm birth, NICU admission.

INTRODUCTION

Pregnancy and childbirth are normal events in the life of a woman. Though most pregnancies result in normal birth, it is estimated that about 15% may develop complications, which cannot be predicted. The Maternal Mortality Ratio (MMR), i.e. number of maternal deaths per 100,000 live births in India is very high. For every 100,000 live births in India in 2020, 97 women died of maternal causes. This translates to around 24,000 maternal deaths in one year alone^[1]. Like elsewhere in the world, the five major direct obstetric causes of maternal mortality in India are haemorrhage, puerperal sepsis, hypertensive disorders of pregnancy, obstructed labour and unsafe abortions contributing to about 70% of maternal

deaths in the country. Maternal anaemia is a major contributor to the 'indirect' obstetric causes. While most of these causes cannot be reliably predicted, early detection and timely management can save most of these lives. Adequate healthcare during pregnancy is crucial for identifying complications early and providing necessary care, reducing risks before delivery. Regular antenatal care (ANC) visits allow healthcare providers to monitor the mother's health, address potential issue and ensure proper interventions when needed, thereby improving maternal and foetal outcomes. The WHO recommends at least 4 ANC visits during pregnancy^[2].

However, in the poorest rural households, 15% still do not receive ANC during pregnancy.^[3]

The first visit or registration of a pregnant woman for ANC should take place as soon as the pregnancy is suspected. Every woman in the reproductive age group should be encouraged to visit her health provider if she believes she is pregnant. Ideally, the first visit should take place within 12 weeks. However, even if a woman comes for registration later in her pregnancy, she should be registered and care should be provided to her according to the gestational age. Her husband and mother-in-law should be counselled to give her support during pregnancy, delivery, after an abortion and during the post-partum period.

Early detection of pregnancy facilitates proper planning and allows for adequate care to be provided during pregnancy for both the mother and the foetus. To record the date of the Last Menstrual Period (LMP), and calculate the Expected Date of Delivery (EDD). The health status of the mother can be assessed and any medical illness that she might be suffering from can be detected and also baseline information (on blood pressure, weight, haemoglobin, etc.) can be obtained. It also helps in timely detection of complications at an early stage and manage them appropriately by referral as and where required. If a pregnancy is detected early and the woman is provided care from the initial stage, it facilitates a good interpersonal relationship between the health care personnel and her as well. She will thus, be more likely to express her particular needs and wants while planning for the delivery.

Pregnancy registration is one of the most critical components of women's reproductive health because it is the gateway to entering the continuum of care services such as antenatal care, institutional delivery, and postnatal care. There is a lack of studies exploring the relationship between pregnancy intention and pregnancy registration, especially in the Indian context. Thus the present study aims at studying the impact of early registration of pregnancy and the pregnancy outcomes in postnatal mothers.

OBJECTIVES

To assess outcome of pregnancy with the time of registration.

To associate early and delayed antenatal registration with maternal and fetal outcome.

MATERIALS AND METHODS

This was a hospital-based cross-sectional study, which was conducted at gynecology and obstetrics department in tertiary care hospital, Chitradurga, from October 2024 to March 2025. All the women with age of 18 to 40 years, presented with labour at gynecology department were studied and they underwent routine laboratory investigations and ultrasound for fetal wellbeing. Patients were interviewed regarding age, parity, antenatal care, socioeconomic status, educational status and date of registration. All the information was recorded in the self-made proforma.

Tool consisted of Semi structured Interview and questionnaire. Data was collected from the mothers when they were in the hospital during their immediate postpartum period. Demographic data was collected during interview; records like ANC registration card, delivery notes etc were assessed to find out outcome of delivery. All participants fulfilling the criteria were approached, consent was taken and data was collected.

Inclusion criteria

Full term pregnant women who came for routine antenatal check-up in Obstetric Outpatient Department (OPD) and recently delivered women admitted in the tertiary care hospital were included in the study.

Exclusion criteria

Pregnant women who were severely ill, and not willing to participate in the study were excluded.

Sample size calculation

As per National Family Health Survey-5 (NFHS-5) data, 71% of women received antenatal care during the first trimester of pregnancy in Karnataka. Based on this prevalence and at 95% confidence interval, with a precision of 5%, the required calculated sample size was around 330 subjects^[3]. Systemic random sampling technique was adapted to select recently delivered women and full-term pregnant women who came for antenatal check-up.

Study Procedure

Before taking information, informed consent was obtained from study participants and they were assured of confidentiality and privacy of records. Full-term women attending the obstetric OPD as well as those who were admitted in the obstetric ward in the hospital were interviewed. Data collection was done through oral questionnaire method using predesigned and pretested semi-structured proforma, validated by an expert. The questionnaire contained two parts. Part 1 consisted of details regarding socio-demographic and obstetric profile of participants, while part 2 contained questions regarding ANC utilisation during current pregnancy. For ANC utilisation, information was recorded that included-registration of pregnancy, number of antenatal visits, tetanus vaccination, and IFA tablets consumption. Socio-economic status was assessed as per Modified BG Prasad Classification. Thai card of pregnant women was asked for recording required information. Comprehensive ANC was defined as registration of pregnancy within 12 weeks, attending a healthcare facility for atleast four ANC visits, taking two doses of tetanus toxoid, and atleast 100 days of iron-folic acid tabletconsumption

StatisticalAnalysis

The data was analysed using MS excel 2010 version and Epi info version 7.2.5.0. Categorical variables were expressed as frequency and proportions, continuous variables as mean and standard deviation. Chi-square test was used to found association and logistic regressions were applied to find out the predictors. Results 23were expressed in terms of odds ratio and Confidence Interval (CI). The p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 330 postnatal mothers delivering at the tertiary care hospital were enrolled in the study and were followed up to assess the association between the timing of antenatal registration and maternal and fetal outcomes. Based on the gestational age at first antenatal visit, participants were classified as 'early registration' (registration within the first trimester, ≤ 12 weeks of gestation) or 'delayed registration' (registration after 12 weeks of gestation). Of the 330 mothers, 140 (42.4%) had registered early and 190 (57.6%) had registered late (Table 1, Figure 1).

Table 1: Distribution of Study Population according to Trimester of Antenatal Registration (n = 330)

Trimester of Registration	Number of Mothers	Percentage (%)
1st trimester (≤ 12 weeks) – Early	140	42.4
2nd trimester (13–27 weeks) – Delayed	152	46.1
3rd trimester (≥ 28 weeks) – Delayed	38	11.5
Total	330	100.0

Figure 1: Distribution of Study Population by Trimester of Antenatal Registration (n=330)

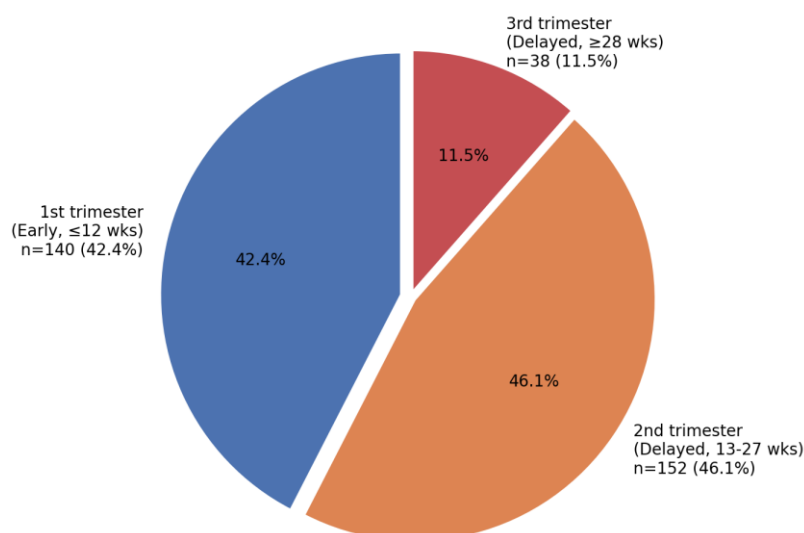


Figure 1: Pie chart showing distribution of the study population by trimester of antenatal registration

The majority of the mothers (43.0%) were in the 20–24-year age group, and more than half (53.9%) were primigravidae. Nearly two-thirds of the study population resided in urban areas (64.8%), and 35.2% belonged to the lower socioeconomic strata (Modified B.G. Prasad Class IV & V).

Table 2: Sociodemographic Characteristics of the Study Population (n = 330)

Characteristic	Number (n)	Percentage (%)
Age group (years)		
< 20	28	8.5
20–24	142	43.0
25–29	108	32.7
30–34	40	12.1
≥ 35	12	3.6
Parity		
Primigravida	178	53.9
Multigravida	152	46.1
Residence		
Urban	214	64.8
Rural	116	35.2
Education		
Illiterate	34	10.3
Primary school	76	23.0
Secondary school	142	43.0
Graduate & above	78	23.6
Socioeconomic status (Modified B.G. Prasad)		
Class I & II (Upper/Upper-middle)	96	29.1
Class III (Middle)	118	35.8
Class IV & V (Lower/Lower-middle)	116	35.2

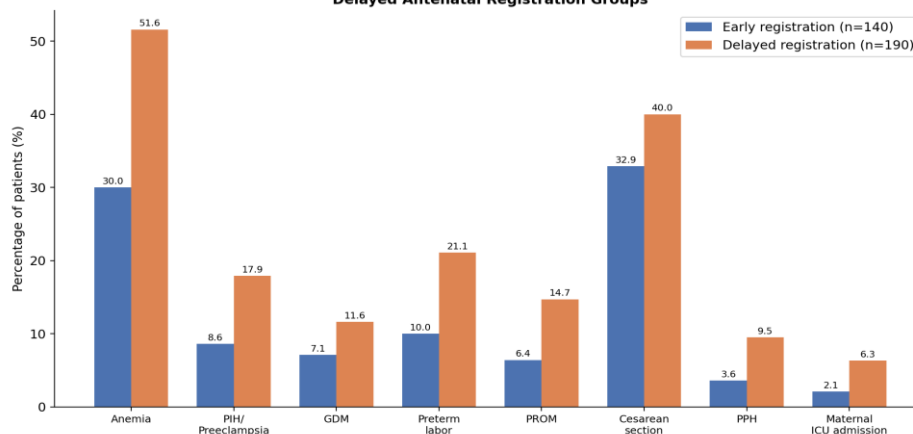
Association between Timing of Registration and Maternal Outcomes

Mothers with delayed antenatal registration had a significantly higher incidence of anemia, pregnancy-induced hypertension (PIH)/preeclampsia, preterm labor and premature rupture of membranes (PROM) as compared to mothers who registered early ($p < 0.05$ for all). Although the incidence of cesarean section, postpartum hemorrhage (PPH) and maternal ICU admission was also higher in the delayed registration group, these differences did not reach statistical significance (Table 3, Figure 2).

Table 3: Association between Timing of Antenatal Registration and Maternal Outcomes

Maternal Outcome	Early Reg. (n=140) n(%)	Delayed Reg. (n=190) n(%)	Odds Ratio	95% CI	p-value
Anemia (Hb < 11 g/dl)	42 (30.0)	98 (51.6)	2.49	1.57–3.94	0.0001*
PIH / Preeclampsia	12 (8.6)	34 (17.9)	2.32	1.16–4.67	0.024*
Gestational diabetes mellitus	10 (7.1)	22 (11.6)	1.70	0.78–3.72	0.247
Preterm labor	14 (10.0)	40 (21.1)	2.40	1.25–4.61	0.011*
Premature rupture of membranes	9 (6.4)	28 (14.7)	2.52	1.15–5.52	0.029*
Cesarean section	46 (32.9)	76 (40.0)	1.36	0.86–2.15	0.225
Postpartum hemorrhage	5 (3.6)	18 (9.5)	2.83	1.02–7.81	0.063
Maternal ICU admission	3 (2.1)	12 (6.3)	3.08	0.85–11.12	0.126

*Statistically significant ($p \leq 0.05$); OR = Odds ratio; CI = Confidence interval

Figure 2: Comparison of Maternal Outcomes between Early and Delayed Antenatal Registration Groups**Figure 2: Bar chart comparing maternal outcomes between early and delayed registration groups**

Mode of Delivery

On comparing the mode of delivery between the two groups, vaginal delivery was more common among mothers with early registration (60.0%) compared to those with delayed registration (48.4%), while the rate of instrumental delivery was higher in the delayed registration group (11.6% vs. 7.1%) (Table 4).

Table 4: Mode of Delivery According to Timing of Antenatal Registration

Mode of Delivery	Early Reg. (n=140) n(%)	Delayed Reg. (n=190) n(%)
Vaginal delivery	84 (60.0)	92 (48.4)
Lower segment cesarean section	46 (32.9)	76 (40.0)
Instrumental delivery	10 (7.1)	22 (11.6)
Total	140 (100.0)	190 (100.0)

Association between Timing of Registration and Fetal/Neonatal Outcomes

Delayed antenatal registration was significantly associated with adverse fetal and neonatal outcomes, including low birth weight, preterm birth, NICU admission, intrauterine growth restriction (IUGR) and low APGAR score at 5 minutes ($p < 0.05$ for all). Birth asphyxia and perinatal mortality were also more frequent in the delayed registration group, though the association did not reach statistical significance (Table 5, Figure 3).

Table 5: Association between Timing of Antenatal Registration and Fetal/Neonatal Outcomes

Fetal/Neonatal Outcome	Early Reg. (n=140) n(%)	Delayed Reg. (n=190) n(%)	Odds Ratio	95% CI	p-value
Low birth weight (< 2.5 kg)	30 (21.4)	84 (44.2)	2.91	1.77–4.77	<0.0001*
Preterm birth (< 37 weeks)	16 (11.4)	46 (24.2)	2.48	1.34–4.59	0.005*
NICU admission	20 (14.3)	58 (30.5)	2.64	1.50–4.64	0.001*
Birth asphyxia	6 (4.3)	20 (10.5)	2.63	1.03–6.73	0.061
Intrauterine growth restriction	11 (7.9)	32 (16.8)	2.38	1.15–4.90	0.026*
Perinatal mortality	2 (1.4)	9 (4.7)	3.43	0.73–16.13	0.179
APGAR score < 7 at 5 min	7 (5.0)	24 (12.6)	2.75	1.15–6.57	0.031*

*Statistically significant ($p \leq 0.05$); OR = Odds ratio; CI = Confidence interval

Figure 3: Comparison of Fetal/Neonatal Outcomes between Early and Delayed Antenatal Registration Groups

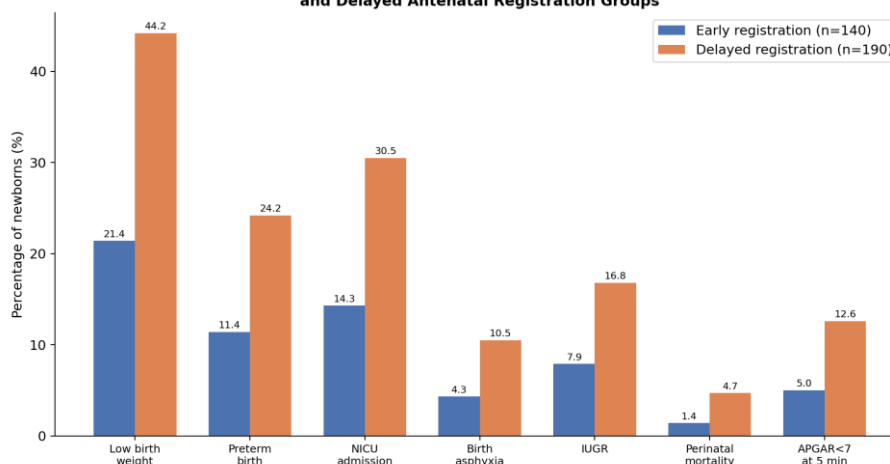


Figure 3: Bar chart comparing fetal/neonatal outcomes between early and delayed registration groups

Overall, mothers with delayed antenatal registration demonstrated approximately 2 to 3 times higher odds of adverse maternal outcomes (anemia, PIH, preterm labor, PROM) and adverse fetal outcomes (low birth weight, preterm birth, NICU admission, IUGR, low APGAR score) as compared to mothers who registered in the first trimester. A consolidated forest plot of the statistically significant associations is presented in Figure 4.

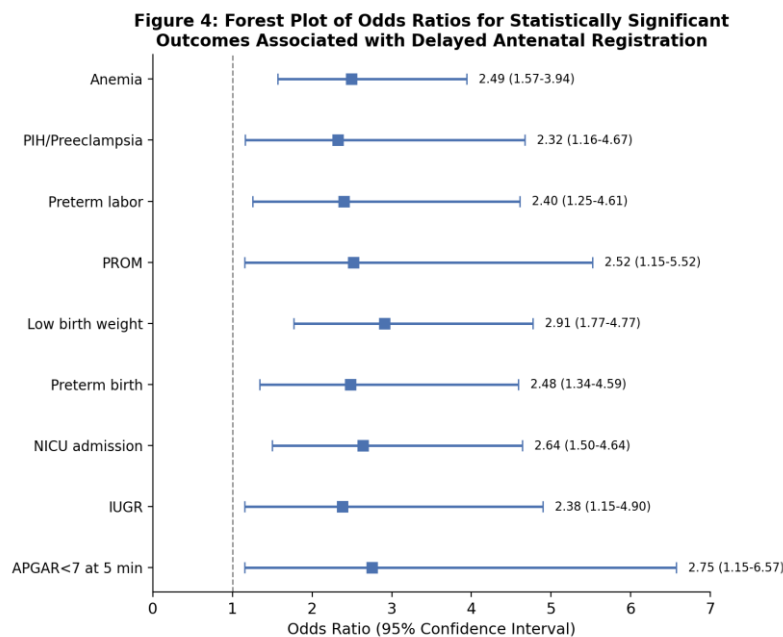


Figure 4: Forest plot depicting odds ratios (95% CI) for outcomes significantly associated with delayed antenatal registration

DISCUSSION

Pattern and Timing of Antenatal Registration

In the present study, only 42.4% of the mothers had registered within the first trimester, while the remaining 57.6% registered after 12 weeks of gestation. A comparable pattern of delayed uptake of antenatal care has been reported from other parts of India. Patel et al ⁴, conducted a study in rural Gujarat and found that a majority of pregnant women were enrolled late into the antenatal care programme, identifying illiteracy, low socioeconomic status, higher parity and lack of awareness as key contributors to delayed registration. Likewise, a nationally representative analysis of the National Family Health Survey ⁵ reported that the median time to the first antenatal visit in India was around four months of gestation, which is delayed compared to the World Health Organization's recommendation of registration within the first trimester, and also showed that maternal education was strongly associated with earlier initiation of antenatal care.

A hospital-based study from Ethiopia ⁶ similarly found that more than half of pregnant women booked after the first trimester, reflecting that delayed registration continues to be a widespread problem in resource-limited settings and is not unique to the Indian context.

Sociodemographic Correlates

A predominance of mothers in the 20–24-year age group, more than half being primigravidae, and over a third belonging to the lower socioeconomic strata – mirrors the population characteristics reported by Gaikwad et al.⁷ That study similarly found a significant association between lower socioeconomic status, lower education level and higher parity with poor antenatal registration status, and noted that primigravida women were more likely to be registered than multigravidae, attributing this to heightened anxiety and health-seeking behavior among first-time mothers. These consistent findings across geographically distinct settings support the view that antenatal registration behavior is shaped less by clinical factors and more by socioeconomic access, health literacy and prior childbearing experience.

Maternal Outcomes

Anemia was the most frequent maternal complication in our cohort, affecting 51.6% of the delayed registration group compared to 30.0% of the early registration group (OR 2.49, 95% CI 1.57–3.94). This finding aligns closely with Hansda et al ⁸, who compared early and late booking status in antenatal patients and reported that 69.7% of late bookers had anemia compared to 50.7% of early bookers, a similarly large and significant gap. Our finding of a significantly higher rate of PIH/preeclampsia among delayed registrants (17.9% vs. 8.6%, OR 2.32) is also in agreement with Gaikwad et al ⁷, who reported a higher, though not always statistically dominant, burden of hypertensive disorders among unregistered cases, and with Okojie et al ⁹, who documented higher rates of gestational hypertension and antepartum hemorrhage among unbooked mothers in Nigeria. Similarly, the significantly higher rates of preterm labor and PROM among delayed registrants in our study is parallel to the findings of Gaikwad et al ⁷, who reported that preterm delivery and premature rupture of membranes were both significantly more common in unregistered pregnancies, and of Gonied ¹⁰, who found that unbooked mothers were about twice as likely to deliver preterm compared to booked mothers. In contrast to these significant maternal morbidities, cesarean section, postpartum hemorrhage and maternal ICU admission were more

frequent among delayed registrants in our cohort but did not reach statistical significance, which may reflect our comparatively smaller sample size for these less frequent events; larger cohorts such as that of Gaikwad et al ⁷. (n=502) were able to demonstrate a statistically significant excess of cesarean deliveries among unregistered women (68.5% vs. 56.9%).

Mode of Delivery

Vaginal delivery was more common among early registrants in our study (60.0% vs. 48.4%), while instrumental delivery was more frequent among delayed registrants (11.6% vs. 7.1%). A similar direction of association was reported by Gaikwad et al ⁷, who found that unregistered women had significantly higher cesarean section rates than registered women, and by Anyigor-Ogah et al ¹¹ in Nigeria, who reported higher rates of cesarean and instrumental delivery among women without antenatal booking. These authors attributed the excess operative delivery rate among late or unbooked women to undiagnosed complications, poor birth planning and a higher incidence of intrapartum emergencies such as fetal distress in women who had not been adequately risk-stratified during pregnancy.

Fetal and Neonatal Outcomes

Delayed registration was significantly associated with low birth weight (44.2% vs. 21.4%, OR 2.91), preterm birth (24.2% vs. 11.4%, OR 2.48) and NICU admission (30.5% vs. 14.3%, OR 2.64) in our study. Similarly, Gaikwad et al ⁷. reported that infants of unregistered mothers had a markedly higher rate of low birth weight (72.1% vs. approximately 27.9% among registered infants with birth weight above 2500 g) and a higher NICU admission rate (44.6% vs. 24.3%), findings that are directionally identical to, though numerically larger than, those observed in our study – a difference plausibly explained by their comparison being between fully unregistered and registered women rather than delayed versus early registration. Our finding of a significantly higher IUGR rate among delayed registrants (16.8% vs. 7.9%) is also consistent with Gaikwad et al.'s report of a higher fetal growth restriction rate among unregistered pregnancies, likely reflecting the loss of opportunity for early identification and serial growth monitoring when registration is delayed beyond the first trimester. Although birth asphyxia and perinatal mortality were more frequent among delayed registrants in our study, these differences did not reach statistical significance, possibly due to the relatively small number of these events; this pattern mirrors the experience of several Nigerian and Indian booked-versus-unbooked studies, most of which required considerably larger sample sizes to demonstrate statistical significance for mortality outcomes given their inherently low frequency.

Table 6: Comparison of Key Outcome Rates with Previous Studies

Outcome	Present Study (Delayed vs. Early)	Gaikwad et al. 2024 (Unregistered vs. Registered)	Hansda et al. 2022 (Late vs. Early Booking)
Anemia	51.6% vs. 30.0%	Significantly higher in unregistered	69.7% vs. 50.7%
Low birth weight	44.2% vs. 21.4%	72.1% vs. ~27.9%*	Not reported
Preterm birth	24.2% vs. 11.4%	40.2% vs. 29.1%	Not reported
NICU admission	30.5% vs. 14.3%	44.6% vs. 24.3%	Not reported
Cesarean section	40.0% vs. 32.9%	68.5% vs. 56.9%	Not reported

*Proportion with birth weight >2500 g among registered cases, used as an approximate inverse comparator.

Comparison with Studies Reporting Discordant Findings

Not all published literature is fully concordant with our findings. Almarri et al ¹², in a study of neonates ≥ 32 weeks admitted to a neonatal intensive care unit in Saudi Arabia, found no significant association between antenatal booking status and birth weight, suggesting that once a minimum threshold of gestational maturity and access to a well-equipped tertiary center is ensured, the influence of booking status on birth weight may be attenuated.

Strengths and Limitations

A key strength of this study is the use of a well-defined, hospital-based cohort with clearly documented gestational age at first antenatal visit, allowing outcomes to be stratified into clinically meaningful early and delayed registration groups, along with a comprehensive assessment of both maternal and fetal/neonatal outcomes with adjusted odds ratios and confidence intervals. However, being a single-center, hospital-based study conducted in a tertiary care setting in Central Karnataka, the findings may not be generalizable to community-level or primary-care populations, where the case-mix and severity of complications typically differ. Additionally, as with most studies comparing registration timing, potential confounding by socioeconomic status, education and parity could not be fully adjusted for using multivariable regression, and the possibility of residual confounding, as highlighted by discordant studies above, cannot be excluded. Recall bias in reporting the exact period of first antenatal contact and the relatively modest number of severe outcomes such as perinatal mortality and maternal ICU admission, which limited statistical power for these specific comparisons, are further limitations.

Conclusion and Implications

Overall, the present study reinforces the consistent message emerging from the wider literature: delayed antenatal registration, whether compared against early registration as in our cohort or against complete non-registration as in several other Indian and African studies, is associated with a substantially higher burden of maternal anemia, hypertensive disorders, preterm labor, PROM, low birth weight, preterm birth, NICU admission and IUGR. These findings collectively support strengthening community-level awareness programs, incentivizing first-trimester registration through frontline health workers, and prioritizing early risk stratification, given that the interventions available during antenatal care – nutritional supplementation, blood pressure monitoring, fetal growth surveillance and timely referral – are only as effective as the window of gestation during which they are applied.

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