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Comparative analysis of partogram utility in monitoring labor progress among primigravida and multigravida women. A prospective observational study.

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Abstract

Background:
The partogram is a simple yet effective tool for monitoring labor, designed to detect deviations from normal progression and improve maternal and neonatal outcomes. Despite its proven benefits, routine utilization remains inconsistent in many low- and middle-income settings.

Objective:
To compare the effectiveness of partogram monitoring in primigravida and multigravida women by assessing labor progress, maternal interventions, and neonatal outcomes.

Methods:
Prospective observational study included 200 women (primigravida and multigravida) admitted in labor at a tertiary care hospital in West Bengal. Eligible participants were term singleton cephalic pregnancies in spontaneous or induced labor with cervical dilatation ≤7 cm. Exclusion criteria were multiple gestations, malpresentations, previous uterine surgery, and significant obstetric or medical complications. Labor progress was monitored using a standard partogram, and maternal, intrapartum, and neonatal outcomes were recorded and analyzed.

Results:
Primigravida women were significantly younger (23.8 ± 3.4 vs. 26.5 ± 3.9 years, $p = 0.002$), with a higher proportion of booked cases (72% vs. 65%, $p = 0.18$). The mean duration of the first stage of labor was longer in primigravida (7.07 ± 3.1 hrs) compared to multigravida (5.08 ± 3.1 hrs), and the second stage was also prolonged (30.3 ± 15.3 vs. 16.0 ± 15.1 min; both $p < 0.05$). Spontaneous vaginal delivery rates were higher in multigravida, while operative interventions were more common in primigravida. Neonatal outcomes were comparable, with no significant difference in Apgar scores (1-min: 7.5 ± 0.6 vs. 7.6 ± 0.5, $p = 0.42$; 5-min: 8.9 ± 0.4 vs. 9.0 ± 0.3, $p = 0.35$).

Conclusion:
Partogram use enabled early recognition of abnormal labor, improving intrapartum decision-making. Multigravida experienced shorter labor and fewer interventions.

Recommendations:
Routine partogram use should be emphasized, with closer monitoring of primigravida, regular staff training, integration into standard protocols, and further multicentric research to strengthen evidence.

Keywords: *Partogram, primigravida, multigravida, labor progress, maternal outcome, neonatal outcome.*
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Introduction
Maternal health continues to be a global public health priority, given its direct association with the quality of obstetric care and the overall well-being of societies. Despite significant progress in reducing maternal mortality over the past few decades, the global burden

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remains unacceptably high, particularly in low- and middle-income countries. According to the World Health Organization (WHO), approximately 295,000 women died during and following pregnancy and childbirth in 2017, with 94% of these deaths occurring in low-resource settings. Sub-Saharan Africa and South Asia together account for the majority of maternal deaths, where the maternal mortality ratio (MMR) remains several times higher than in high-income countries.1 A considerable proportion of these deaths is attributable to intrapartum complications such as obstructed or prolonged labor, postpartum hemorrhage, sepsis, and hypertensive disorders. Importantly, most of these causes are preventable through timely interventions, of which systematic intrapartum monitoring is a cornerstone.2

One of the simplest and most effective tools introduced to improve intrapartum care is the partogram (or partograph), a graphic representation of the progress of labor alongside maternal and fetal well-being. The utility of this tool lies in its ability to provide a continuous, pictorial overview of labor, enabling healthcare providers to detect deviations from the normal course at an early stage 3 Timely recognition of labor abnormalities allows for interventions such as augmentation, instrumental delivery, or referral to higher centers, thereby reducing maternal and perinatal morbidity and mortality. In settings where human resources are limited and timely decision-making is critical, the partogram serves as a low-cost, high-impact intervention.4

The concept of graphically monitoring labor was first introduced by Emanuel Friedman in 1954, who studied cervical dilatation and fetal descent in relation to time. Friedman's labor curve—often described as a sigmoid pattern—outlined the latent and active phases of the first stage of labor, and provided obstetricians with the first systematic method of distinguishing normal from abnormal progress. Although revolutionary, Friedman's curve had limitations, particularly in its inability to account for variability in latent phase duration and its sensitivity to patient population differences.5

Building on Friedman's work, Philpott and Castle in the 1970s developed a composite partograph tailored for use in African settings, where prolonged labor and obstructed deliveries were common contributors to maternal deaths. They introduced the concept of an "alert line" (representing a cervical dilatation rate of 1 cm per hour) and an "action line" drawn parallel and four hours to the right, which allowed clinicians to identify abnormal progress and decide when interventions were warranted. This modification greatly enhanced the partogram's utility in peripheral health centers with limited obstetric resources, serving as a practical decision-making aid for midwives and junior doctors.6

Recognizing its potential to standardize labor monitoring globally, the WHO in 1994 endorsed a modified partograph as part of the Safe Motherhood initiative. The WHO partograph excluded the latent phase, starting observations from 4 cm cervical dilatation, thus simplifying its use and minimizing unnecessary interventions. Large multicenter trials demonstrated that the WHO-modified partograph significantly reduced prolonged labor, operative interventions, and intrapartum stillbirths. More recently, adaptations such as the "paperless partogram," mobile applications, and electronic partographs have been developed to improve usability in overburdened healthcare systems. Nevertheless, the fundamental principles remain rooted in Friedman's and Philpott's contributions.7

A key consideration in the use of partogram is the distinction between primigravida and multigravida women. Physiological differences in labor progression between these groups are well established. Primigravida women generally experience longer first and second stages of labor, slower rates of cervical dilatation, and a higher likelihood of requiring operative interventions compared to their multigravida counterparts. Conversely, multigravida women often progress more rapidly but may face complications such as uterine rupture, particularly in scarred uteri. Monitoring these differences is crucial for individualized intrapartum management. A tool like the partogram enables clinicians to recognize whether deviations from expected progress are within the physiological range or indicative of pathology requiring intervention.8

In India, despite the inclusion of partogram in national guidelines and recommendations from the WHO, its use remains inconsistent. Studies have highlighted barriers such as inadequate training of healthcare providers, high patient load, lack of time, and the perception of partogram as a cumbersome tool. In rural and resource-limited settings, retrospective filling of partograms is not uncommon, which undermines its utility as a real-time monitoring instrument. Consequently, preventable complications like obstructed labor, postpartum hemorrhage, and neonatal asphyxia continue to contribute to maternal and perinatal mortality in the country. Addressing this gap requires renewed emphasis on training, simplified protocols, and highlighting the comparative advantages of partogram-guided management in different obstetric populations.9

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The present study was undertaken against this background to provide a comparative analysis of partogram utility among primigravida and multigravida women. By systematically monitoring labor progression and outcomes in both groups, the study seeks to answer critical questions: Does the partogram effectively capture differences in labor progress between primigravida and multigravida? Can it guide timely interventions to improve maternal outcomes, such as reduced rates of prolonged labor, instrumental deliveries, and cesarean sections? What is its impact on neonatal outcomes, including Apgar scores and NICU admissions?

Objectives

1. To compare labor progress in primigravida and multigravida women using the partogram.
2. To assess maternal outcomes, including mode of delivery and complications, in relation to partogram findings.
3. To evaluate neonatal outcomes, specifically Apgar scores and NICU admissions, in both groups.

Materials and Methods

Study design

This study was designed as a hospital-based prospective observational study.

Study setting

The study was conducted in the Department of Obstetrics and Gynecology, Suri Sadar Hospital, Birbhum, West Bengal, a tertiary care facility catering to a mixed population from both urban and rural areas. The study was carried out between July 2020 to march 2021

Participants

A total of 200 pregnant women, including both primigravida and multigravida, were recruited after fulfilling the eligibility criteria.

- **Inclusion criteria:** Women with term gestation (≥36 to ≤42 weeks), singleton pregnancy with cephalic presentation, and those admitted in spontaneous or induced labor with cervical dilatation ≤7 cm.
- **Exclusion criteria:** Women with suspected cephalopelvic disproportion, multiple gestations, malpresentations, antepartum hemorrhage, or significant medical/obstetric complications (e.g., hypertensive disorders, heart disease).

Study size

The sample size of 200 women was determined using the formula:

The sample size was calculated based on findings from previous studies evaluating labor progress with partograph use. In an Indian study, the mean duration of the first stage of labor was reported as 5.17 hours in primigravida and 4.33 hours in multigravida, with a standard deviation of approximately 2 hours and a mean difference of 0.84 hours between the groups. (As using the formula for comparing two means, with a 95% confidence level ($Z = 1.96$) and 80% power ($Z = 0.84$), the required sample size was estimated as 89 participants per group (178 in total). Allowing for a 10% contingency to account for incomplete records or loss to follow-up, the target size was rounded to 200 women.

Bias

To minimize bias, uniform inclusion and exclusion criteria were applied. Standardized case record forms were used to capture data prospectively. All clinical assessments followed institutional obstetric protocols, and outcome measurement was blinded to gravida status during analysis to reduce observer bias.

Data collection

For each eligible participant, a partogram was initiated at admission in the active phase of labor (cervical dilatation ≥4 cm). Baseline socio-demographic and obstetric details were recorded in structured case record forms. Maternal monitoring included assessment of pulse, blood pressure, and temperature at recommended intervals, while uterine contractions were documented on the partogram in terms of frequency and duration. Fetal well-being was evaluated by auscultation of fetal heart rate every 30 minutes in the first stage and every 15 minutes in the second stage, along with observation of membrane status and liquor characteristics. The progress of labor was plotted on the partogram through regular vaginal examinations, noting cervical dilatation and fetal head descent. Intrapartum interventions such as artificial rupture of membranes, oxytocin augmentation, and administration of analgesics were recorded. All maternal and neonatal outcomes, including mode of delivery, complications, Apgar scores, and NICU admissions, were documented prospectively and transferred to a computerized database for analysis.

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Assessment

Maternal outcomes assessed included duration of the first and second stages of labor, mode of delivery (spontaneous vaginal, instrumental, or cesarean), and complications such as postpartum hemorrhage, prolonged labor, fever, or sepsis. Neonatal outcomes included Apgar scores at 1 and 5 minutes, and need for NICU admission for asphyxia or complications.

Statistical analysis

Data were analyzed using SPSS (version 26.0). Continuous variables were expressed as mean ± SD or median (IQR) and compared with t-test or Mann–Whitney U. Categorical variables were presented as percentages and analyzed with Chi-square or Fisher's exact test. Multivariable regression was used to adjust for confounders, and results were reported with 95% confidence intervals. A $p < 0.05$ was considered statistically significant.

Ethical considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision). Approval was obtained from the Institutional Ethics Committee of Suri Sadar Hospital, Birbhum, before commencement of the study. Written informed consent was obtained from all participants after explaining the purpose, procedures, and potential risks and benefits of the study in a language they understood

Results

Table 1. Sociodemographic and Clinical Profile of Participants

Variable	Primigravida (n=100)	Multigravida (n=100)	p-value
Mean Age (years)	23.8 ± 3.4	26.5 ± 3.9	0.002
Booked cases (%)	72	65	0.18
Induced labor (%)	32	25	0.24

Table 1 presents the sociodemographic and clinical profiles of the study participants. The mean age of multigravida women (26.5 ± 3.9 years) was significantly higher compared to primigravida women (23.8 ± 3.4 years), reflecting the natural age progression with increasing parity (p=0.002). A higher proportion of primigravida women were booked cases (72%) compared to multigravida (65%), though the difference was not statistically significant (p=0.18). Similarly, induction of labor was slightly more frequent among primigravida (32%) than multigravida (25%), but this difference was also not significant (p=0.24). Overall, apart from age distribution, no significant variation was observed in the clinical background of the two groups.

Table 2. Labor Characteristics and Duration

Parameter	Primigravida	Multigravida	p-value
Mean 1st stage (hrs)	7.07 ± 3.1	5.08 ± 3.1	<0.001
Mean 2nd stage (min)	30.3 ± 15.3	16.0 ± 15.1	<0.001
Mean 3rd stage (min)	8.1 ± 3.5	7.8 ± 3.3	0.45

Table 2 compares the labor characteristics and duration between primigravida and multigravida women. The mean duration of the first stage of labor was significantly longer in primigravida (7.07 ± 3.1 hours) compared to multigravida (5.08 ± 3.1 hours) (p<0.001). Similarly, the second stage was prolonged in primigravida (30.3 ± 15.3 minutes) relative to multigravida (16.0 ± 15.1 minutes), and this difference was also highly significant (p<0.001). In contrast, the duration of the third stage of labor was comparable between the two groups (8.1 ± 3.5 minutes vs. 7.8 ± 3.3 minutes), with no statistically significant difference (p=0.45). These findings highlight that primigravida women experience significantly longer labor in the first and second stages compared to multigravida, while the third stage duration remains similar across groups.

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Table 3. Maternal Outcomes

Mode of Delivery	Primigravida (%)	Multigravida (%)	p-value
Spontaneous vaginal	64	82	0.01
Instrumental	12	8	0.38
LSCS	24	10	0.01
Maternal complications (PPH, fever, sepsis)	9	4	0.12

Table 3 shows the maternal outcomes among primigravida and multigravida women. Spontaneous vaginal delivery was significantly more common in multigravida (82%) compared to primigravida (64%) (p=0.01), while the rate of lower segment cesarean section (LSCS) was significantly higher in primigravida (24%) than in multigravida (10%) (p=0.01). Instrumental deliveries were slightly more frequent in primigravida (12%) than in multigravida (8%), but this difference was not statistically significant (p=0.38). Maternal complications such as postpartum hemorrhage, fever, or sepsis occurred in 9% of primigravida and 4% of multigravida, with no significant difference between the groups (p=0.12). Overall, primigravida women had a higher likelihood of requiring operative interventions, whereas multigravida women achieved more spontaneous vaginal deliveries with fewer complications.

Table 4. Neonatal Outcomes

Outcome	Primigravida (%)	Multigravida (%)	p-value
Apgar 7–8 (1 min)	94	95	0.76
Apgar 5–6 (1 min)	6	5	0.81
NICU admission	8	6	0.54

The neonatal outcomes analysis shows no statistically significant differences between primigravida and multigravida groups. The majority of newborns in both groups had favorable Apgar scores at 1 minute, with 94% of primigravida and 95% of multigravida infants scoring 7–8 (p=0.76). A small proportion recorded Apgar scores of 5–6 (6% vs. 5%, p=0.81). Similarly, NICU admission rates were low and comparable (8% in primigravida vs. 6% in multigravida, p=0.54). These findings suggest that parity did not significantly influence immediate neonatal outcomes.

Figure 1. Mean duration of labor stages between primigravida and multigravida

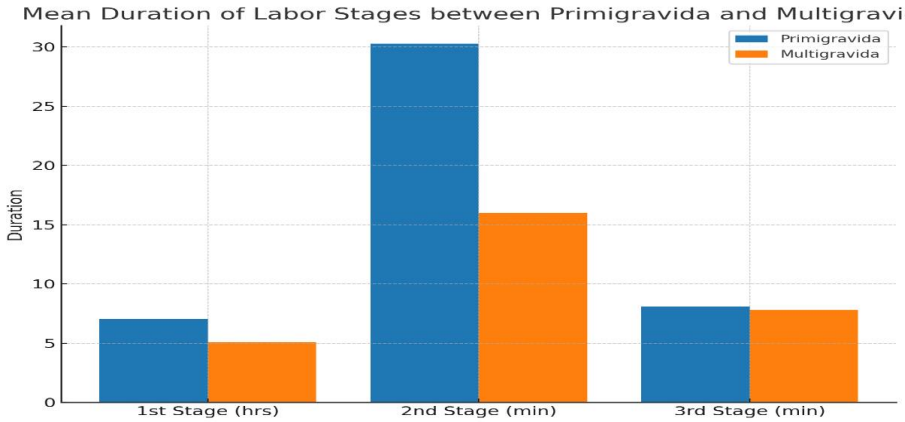

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Figure 1 illustrates the comparison of mean labor stage durations between primigravida and multigravida women. It clearly shows that primigravida experienced a longer first stage (7.07 hours vs. 5.08 hours) and second stage (30.3 minutes vs. 16.0 minutes) compared to multigravida. However, the third stage of labor was almost similar in both groups (8.1 minutes vs. 7.8 minutes). These findings reaffirm that primigravida women typically undergo more prolonged labor in the initial stages, whereas multigravida women progress more quickly.

Figure 2. Distribution of the mode of delivery in both groups

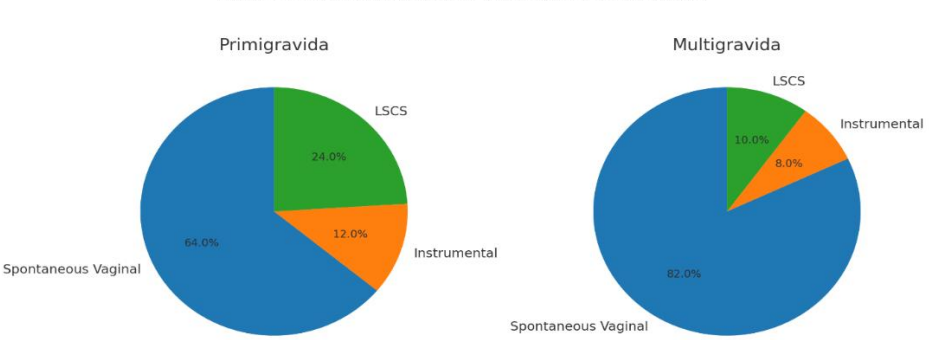
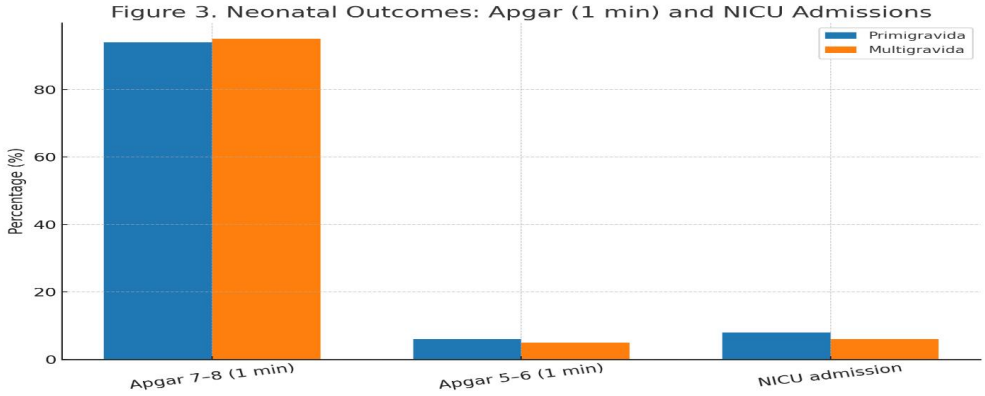


Figure 2 depicts the mode of delivery among primigravida and multigravida women. In primigravida, spontaneous vaginal delivery accounted for 64% of cases, while 24% required cesarean section and 12% had instrumental deliveries. In contrast, multigravida had a markedly higher proportion of spontaneous vaginal deliveries (82%) with fewer cesarean sections (10%) and instrumental interventions (8%). These findings indicate that multigravida women are more likely to achieve normal vaginal delivery, whereas primigravida women are at a higher risk of operative interventions, particularly cesarean section.

Figure 3. Neonatal outcome (Apgar 1 min and NICU admissions)



Discussion

The statistically significant difference in mean maternal age between multigravida (26.5 ± 3.9 years) and primigravida (23.8 ± 3.4 years) aligns with demographic expectations—and mirrors findings from Sowmya Krishna and Paladi (2023), 10, who reported similar age

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disparities among their two hundred study participants. The trend toward higher booking rates in primigravida, while not statistically significant, suggests increased antenatal care adherence among first-time mothers, a behavior pattern also noted in earlier investigations such as Penumadu and Hariharan (2014), 11. These baseline similarities—apart from age—lend credence to the comparative nature of the analyses.

Significant prolongation of the first and second stages of labor among primigravida women in this study echoes trends observed by Yadava et al. (2022), 12, where partogram monitoring in Ahmedabad revealed delayed cervical dilation and longer labor durations in primigravida versus multigravida groups. Sowmya Krishna & Paladi (2023)10 similarly reported that primigravida had substantially longer active and second stages than multigravida (approximately 2 hrs 12 minutes vs. 1 hr 35 minutes for active phase; 57 minutes vs. 35 minutes for second stage).

The third stage of labor did not differ significantly between parity groups in the present study, which aligns with physiologic labor behavior unaffected by parity and has also been observed in comparable investigations by Thobbi et al (2021), 13.

By effectively demonstrating these patterns through outcome data, the study reiterates that partogram monitoring remains a reliable tool for real-time assessment of labor progression—consistent with the WHO-endorsed model and earlier foundational research by Friedman14 (the sigmoid labor curve) and Philpott & Castle15 (alert & action lines).

This study revealed significantly higher rates of spontaneous vaginal delivery in multigravida (82% vs. 64%) and a greater incidence of cesarean section in primigravida (24% vs. 10%). Sowmya Krishna & Paladi's10 data reflect a similar trend (86% NVD vs. 68%; LSCS 6% vs. 18%). Similarly, Yadava et al.12 recorded higher cesarean rates in primigravida (3/26 vs. 1/34).

The disparity in operative deliveries is logically attributable to prolonged labor in primigravida, likely contributing to intervention for failure to progress or fetal compromise—echoing findings from Penumadu & Hariharan11, who emphasized that partogram patterns toward action line correlate with higher cesarean rates.

While primigravida faced more maternal complications (9% vs. 4%), this difference was not statistically significant, perhaps due to timely recognition and intervention guided by partogram plotting.

Neonatal data in the present study—Apgar scores and NICU admissions—showed no significant difference by parity. This mirrors results from Thobbi et al. (2021), 13 where favorable neonatal outcomes were observed in both primigravida and multigravida when partogram monitoring was used (good neonatal outcome in 91% vs. 92%).

Similarly, Yadava et al12) reported a low incidence of poor Apgar at 5 minutes (5 out of 60), underscoring the partogram's effectiveness in early detection of fetal distress and enabling timely intervention. These congruencies confirm that effective labor monitoring via partogram can neutralize potential parity-related neonatal risks.

Despite WHO recommendations for universal partogram usage, adoption remains inadequate in many Indian facilities due to factors like staff workload, training gaps, and documentation delays. However, this study's alignment with findings from multiple recent Indian studies (Ahmedabad series, Gulbarga series, Vijayapur, Wardha, etc.) reinforces partogram's enduring value in improving labor outcomes across settings. For instance, Penumadu & Hariharan11 emphasize that partogram zones—alert and action lines—serve as valuable triggers for operative decisions (prolonged labor, surgical referral). A study from Wardha similarly noted that deliveries progressing beyond alert lines correlated with more surgical interventions.

Furthermore, the paperless partogram concept studied in other contexts (e.g., a study showing paperless models matching WHO timelines in alert management) indicates potential opportunities for digitized labor monitoring, especially in resource-limited but higher-tech contexts.

A key strength of this study is its prospective, comparative design, specifically contrasting partogram utility in primigravida and multigravida. Its results are reinforced by consistent interpretation across several recent Indian studies.

Generalizability

The findings of this study are generalizable primarily to women delivering at tertiary care hospitals in similar low- and middle-income settings, where partogram use remains inconsistent and patient populations include both urban and rural backgrounds. Since the study was conducted at a single center with clearly defined inclusion and exclusion criteria, the results may not fully apply to women with high-risk pregnancies, multiple gestations, or non-cephalic presentations, who were excluded. Nevertheless, the sample size was adequate and representative of routine obstetric practice, supporting the external validity of the results for monitoring labor progress among low-risk primigravida

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and multigravida women. Broader multicentric studies across different healthcare levels would further strengthen generalizability.

Conclusion

The partogram continues to stand out as a valuable, low-cost, and practical tool for monitoring the progress of labor, particularly in resource-limited settings. Its structured approach enables healthcare providers to identify deviations from the normal course of labor at an early stage, thereby facilitating timely interventions. The findings of the present study reinforce that primigravida women, due to their higher risk of prolonged labor and operative interventions, require closer surveillance through partographic monitoring. By ensuring vigilant use of the partogram, clinicians can make informed decisions that reduce unnecessary delays, prevent maternal and neonatal complications, and promote safer delivery outcomes. Routine implementation of the partogram not only enhances clinical decision-making but also contributes to the standardization of labor monitoring practices, thereby strengthening the quality of obstetric care at both primary and tertiary levels.

Limitation

Limitations include its single-center setting, limiting generalizability, and the absence of long-term neonatal follow-up. Additional variables—socioeconomic factors, body mass index, and intrapartum analgesia—were not controlled.

Recommendations

Routine use of the partogram should be emphasized for all laboring women, with closer monitoring of primigravida who are at greater risk of prolonged labor and interventions. Regular staff training, integration into standard labor protocols, and antenatal counseling can enhance its effectiveness, while larger multicentric studies are needed to confirm and expand these findings.

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List of abbreviations

- LSCS: Lower Segment Cesarean Section
- NICU: Neonatal Intensive Care Unit
- PPH: Postpartum Hemorrhage
- SD: Standard Deviation
- SVD: Spontaneous Vaginal Delivery

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Conflict of interest

The authors declare that they have no conflict of interest related to this study.

Author contributions

Dr. Sonal Suryavanshi contributed to the conceptualization and design of the study, supervised data collection, and critically revised the manuscript. Dr. Nidhi was responsible for patient recruitment, data acquisition, and initial drafting of the manuscript. Dr. Ujjwal Sourav performed the statistical analysis, interpreted the results, drafted and edited the final version of the manuscript, and will act as the guarantor of the work. All authors read and approved the final manuscript.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. All patient information has been anonymized to ensure confidentiality.

Author biographies

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