

Evaluation of Delivery Patterns Using the Robson Ten Group Classification System in a Tertiary Care Hospital

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Submission Date: 29.12.2025	Accepted Date: 27.01.2026	Published Date: 31.01.2026
DOI: 10.65188/nurexus.1065		

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Abstract

Background: The rising rate of caesarean section (CS) has emerged as a major public health concern worldwide, particularly in tertiary care hospitals managing a high proportion of high-risk pregnancies. The Robson Ten Group Classification System offers a standardized and reproducible method to analyse delivery patterns and identify key contributors to caesarean section rates.

Objectives: To categorize all deliveries using the Robson Ten Group Classification System and to evaluate the overall and primary caesarean section rates along with their major contributing groups in a tertiary care hospital.

Methods: This prospective observational study was conducted in the labour unit of a tertiary care teaching hospital over a period of two years. All pregnant women aged 18 years and above with a gestational age of 24 weeks or more admitted for delivery were included. Deliveries were categorized into ten groups using the Robson Ten Group Classification System. Data on maternal characteristics, labour onset, mode of delivery, and indications for caesarean section were collected and analysed using descriptive statistics.

Results: A total of 600 deliveries were analysed. The overall caesarean section rate was 39.0%, with primary caesarean sections accounting for 62.4% of all caesarean deliveries. Robson Group 1 was the largest group, while Robson Group 5 was the single largest contributor to the overall caesarean section rate, accounting for 38.5% of caesarean deliveries. Nulliparous women in Groups 1 and 2 together contributed significantly to primary caesarean sections. Non-reassuring fetal heart rate pattern and failure to progress in labour were the most common indications for primary caesarean section.

Conclusion: The Robson Ten Group Classification System proved to be an effective audit tool for analysing delivery patterns and caesarean section practices in a tertiary care hospital. The high contribution of women with previous caesarean sections and nulliparous women highlights the need for targeted interventions to reduce unnecessary primary caesarean sections and promote evidence-based obstetric care.

Keywords: Robson Ten Group Classification System; Caesarean section; Delivery patterns; Tertiary care hospital; Maternal health; Obstetric audit

Introduction

Delivery care is a fundamental component of maternal and newborn health services and has a direct influence on obstetric outcomes. Over the past few decades, there has been a substantial global rise in caesarean section (CS) rates, making it a major public health concern because of associated maternal morbidity, neonatal complications, increased healthcare costs, and wide variations in obstetric practice across institutions and regions [1]. While caesarean section is a life-saving intervention when medically indicated, unnecessary or excessive use does not confer additional benefits and may adversely affect

maternal and perinatal outcomes [1,2]. According to the World Health Organization, population-based caesarean section rates above 10–15% are not associated with further reductions in maternal or neonatal mortality [3]. Despite this recommendation, many tertiary care hospitals report caesarean section rates far exceeding these thresholds [2,4]. The rise in caesarean deliveries is multifactorial and has been attributed to increasing maternal age, higher prevalence of previous caesarean sections, greater use of labour induction, changing obstetric practices, medico-legal concerns, and institutional policies [2,5]. In tertiary care settings, the presence of high-risk pregnancies and referral bias further complicates interpretation of overall caesarean section rates.

A major challenge in addressing rising caesarean section rates is the lack of a standardized, reproducible, and clinically meaningful method to analyse delivery patterns. Earlier classification systems were commonly based on indications for caesarean section, which are often subjective, overlapping, and inconsistently documented, limiting meaningful comparisons between hospitals, regions, and time periods [6]. To overcome these limitations, Robson proposed the Ten Group Classification System, a mutually exclusive and totally inclusive framework that categorizes all women admitted for delivery into ten groups based on five obstetric characteristics: parity, previous caesarean section, onset of labour, gestational age, fetal presentation, and number of fetuses [6,7].

The Robson Ten Group Classification System has been widely endorsed as the global standard for monitoring, auditing, and comparing caesarean section rates. The World Health Organization formally recommends its use at facility, regional, national, and international levels [3,7]. This system enables identification of specific obstetric groups that contribute most to the overall caesarean section rate, such as nulliparous women with induced labour or women with a previous caesarean section, thereby supporting targeted clinical audits and evidence-based interventions [7,8].

In tertiary care hospitals, where obstetric populations are heterogeneous and referral loads are high, systematic analysis using the Robson classification is particularly valuable. It helps differentiate between unavoidable and potentially preventable caesarean sections, facilitates quality improvement initiatives, and promotes rationalization of obstetric practices while ensuring maternal and fetal safety [4,8]. The present study applies the Robson Ten Group Classification System to categorize deliveries in a tertiary care hospital and analyse caesarean section patterns to inform institutional obstetric practice.

Materials and Methods

Study Design

This prospective observational study was conducted to evaluate delivery patterns using the Robson Ten Group Classification System (RTGCS) and to assess the contribution of each Robson group to the overall caesarean section rate in a tertiary care hospital.

Study Setting

The study was carried out in the Labour Unit of the Department of Obstetrics and Gynaecology at Pondicherry Institute of Medical Sciences, Puducherry, a tertiary care teaching hospital providing comprehensive obstetric care to both low-risk and high-risk pregnant women. The study was conducted over a period of two years from March 2024 to February 2026.

Study Population

The study population comprised all pregnant women aged 18 years and above with a gestational age of 24 weeks or more who were admitted for delivery during the study period. Eligible participants were recruited consecutively throughout the study duration.

Sample Size

The minimum required sample size was calculated as 600 deliveries, assuming that 50% of deliveries would

belong to Robson Group 1, with an absolute precision of 4% and a 95% confidence interval. The sample size was estimated using the standard formula $n = Z^2_{1-\alpha/2} \times p \times (1 - p) / d^2$, where $Z = 1.96$, $p = 0.50$, and $d = 0.04$.

Inclusion Criteria

All pregnant women aged 18 years or older with a gestational age of 24 weeks or more who were admitted for delivery during the study period and provided written informed consent were included in the study.

Exclusion Criteria

No exclusion criteria were applied. All eligible women admitted for delivery during the study period were included in the analysis.

Data Collection Tool

Data were collected using a structured case record form through detailed history taking, clinical examination, and review of labour ward records. Information recorded included maternal age, gestational age, parity, number of fetuses, fetal presentation, onset of labour, mode of delivery, Robson group classification, and indications for caesarean section where applicable. Each participant was assigned to one of the ten Robson groups based on the standardized Robson Ten Group Classification System using predefined obstetric characteristics. The assigned Robson group was independently cross-verified during routine departmental audit meetings to ensure consistency, accuracy, and uniformity in classification.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Pondicherry Institute of Medical Sciences, Puducherry, before commencement of the study. Written informed consent was obtained from all eligible participants prior to enrolment. Confidentiality and anonymity of participant information were maintained throughout the study by assigning unique identification numbers and restricting access to study data to the research team.

Statistical Analysis

Data were entered into Microsoft Excel for data cleaning and coding before being analyzed using the Statistical Package for the Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. The distribution of deliveries and caesarean section rates across the Robson groups was analyzed using descriptive statistics. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. A p -value of less than 0.05 was considered statistically significant.

Results

Table 1. Baseline obstetric characteristics of the study population (n = 600)

Variable	Number (%)
Maternal age (years), mean $\pm$ SD	26.8 $\pm$ 4.3
Gestational age $\geq$ 37 weeks	512 (85.3%)
Nulliparous	278 (46.3%)
Multiparous	322 (53.7%)
Singleton pregnancy	574 (95.7%)
Multiple pregnancy	26 (4.3%)
Cephalic presentation	528 (88.0%)
Non-cephalic presentation	72 (12.0%)
Spontaneous onset of labour	402 (67.0%)
Induced labour / pre-labour CS	198 (33.0%)
Vaginal delivery	366 (61.0%)
Caesarean section	234 (39.0%)

Presents the baseline obstetric characteristics of the study population. The mean maternal age was 26.8 ± 4.3 years, with the majority of women delivering at term. More than half of the participants were multiparous, and singleton, cephalic presentations predominated. Spontaneous onset of labour was observed in two-thirds of women. The overall caesarean section rate was 39.0%, which is relatively high and reflects the tertiary care setting with a substantial proportion of high-risk and referral cases.

Table 2. Distribution of deliveries according to Robson Ten Group Classification (n = 600)

Robson Group	Description	Total deliveries n (%)
Group 1	Nulliparous, singleton, cephalic, ≥ 37 weeks, spontaneous labour	192 (32.0%)
Group 2	Nulliparous, singleton, cephalic, ≥ 37 weeks, induced or CS before labour	82 (13.7%)
Group 3	Multiparous (no previous CS), singleton, cephalic, ≥ 37 weeks, spontaneous labour	156 (26.0%)
Group 4	Multiparous (no previous CS), singleton, cephalic, ≥ 37 weeks, induced or CS before labour	46 (7.7%)
Group 5	Previous CS, singleton, cephalic, ≥ 37 weeks	102 (17.0%)
Group 6	Nulliparous, singleton breech	17 (2.8%)
Group 7	Multiparous, singleton breech	10 (1.7%)
Group 8	Multiple pregnancy	26 (4.3%)
Group 9	Singleton pregnancy with abnormal lie	5 (0.8%)
Group 10	Singleton, cephalic, < 37 weeks	14 (2.3%)

Shows the distribution of deliveries according to the Robson Ten Group Classification System. Robson Group 1 constituted the largest group, followed by Group 3 and Group 5. Together, these three groups accounted for nearly three-quarters of all deliveries. The sizeable proportion of women in Group 5 indicates a high prevalence of previous caesarean section in the study population, which has important implications for overall caesarean section rates in tertiary care institutions.

Table 3. Caesarean section rate within each Robson group

Robson Group	Caesarean sections n	Group CS rate (%)
Group 1	41 / 192	21.4%
Group 2	40 / 82	48.8%
Group 3	22 / 156	14.1%
Group 4	18 / 46	39.1%
Group 5	88 / 102	86.3%
Group 6	16 / 17	94.1%
Group 7	9 / 10	90.0%
Group 8	15 / 26	57.7%
Group 9	5 / 5	100%
Group 10	10 / 14	71.4%

Demonstrates the caesarean section rate within each Robson group. As expected, Robson Group 9 had a caesarean section rate of 100%, reflecting standard obstetric practice for abnormal lie. Very high caesarean section rates were also observed in Groups 6 and 7, corresponding to breech presentations. In contrast, low-

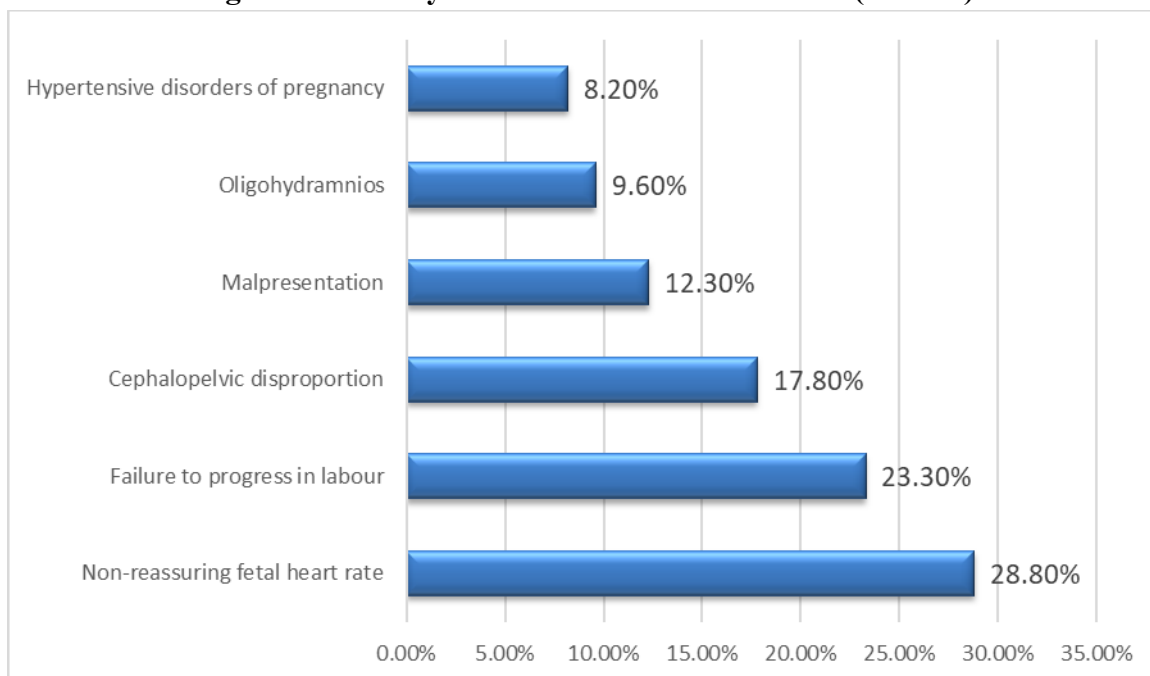
risk groups such as Group 3 and Group 1 had comparatively lower caesarean section rates, indicating appropriate use of caesarean delivery in these categories.

Table 4. Contribution of each Robson group to overall caesarean section rate (n = 234)

Robson Group	Caesarean sections n	Contribution to total CS (%)
Group 1	41	17.5%
Group 2	40	17.1%
Group 3	22	9.4%
Group 4	18	7.7%
Group 5	88	38.5%
Group 6	16	6.8%
Group 7	9	3.8%
Group 8	15	6.4%
Group 9	5	2.1%
Group 10	10	4.3%

Highlights the contribution of individual Robson groups to the overall caesarean section rate. Robson Group 5 emerged as the single largest contributor, accounting for more than one-third of all caesarean sections. Groups 1 and 2 together contributed over one-third of caesarean sections, emphasizing the role of primary caesarean deliveries in nulliparous women. These findings identify Groups 1, 2, and 5 as key targets for focused clinical audit and intervention.

Figure 1. Primary caesarean section indications (n = 146)



Summarizes the indications for primary caesarean section. Non-reassuring fetal heart rate pattern was the most common indication, followed by failure to progress in labour and cephalopelvic disproportion. These indications were predominantly observed among nulliparous women, underscoring the need for careful intrapartum monitoring, appropriate use of labour augmentation, and adherence to evidence-based labour management protocols to reduce potentially avoidable primary caesarean sections.

Discussion

In this prospective study of 600 deliveries classified by the Robson Ten Group system, the overall caesarean section (CS) rate was 39.0% and Robson Group 5 (women with previous CS, singleton, cephalic, ≥ 37 weeks) was the single largest contributor, accounting for 38.5% of all CS. Nulliparous women (Groups 1 and 2) collectively contributed significantly to the primary CS burden. These patterns are consistent with multiple recent facility-level Robson audits but also show important local differences that merit discussion.

Several multicentre and single-centre Robson studies report overall CS rates that vary widely depending on case-mix and referral patterns. Vogel et al. [9] reported broad international variation with higher rates in tertiary referral settings, consistent with our elevated 39% rate. Similarly, Betrán et al. [10] and Molina et al. [11] found that tertiary and referral hospitals frequently demonstrate CS rates well above national averages because of higher-risk case-mix and referral bias. Our finding of a high overall CS rate therefore, aligns with these previous observations.

Robson Group 5 being the leading contributor to CS is a finding that echoes many contemporary audits. Souza et al. [12] and Torloni et al. [13] reported that women with prior CS often represent a substantial and growing fraction of deliveries and account for a large share of institutional CS rates. In an Indian tertiary setting, Patel et al. [14] similarly observed Group 5 contributions ranging from 25–40% of total CS, comparable to our 38.5%. This convergence highlights two linked issues: rising primary CS in earlier years and conservative approaches to vaginal birth after cesarean (VBAC) in many centres.

The role of nulliparous women in driving primary CS is also well documented. Our analysis showed Groups 1 and 2 together accounted for a substantial proportion of primary CS, with Group 2 (nulliparous, induced or pre-labour CS) demonstrating a particularly high group CS rate (48.8%). Vogel et al. [9] and Robson [15] emphasize that reducing unnecessary primary CS in nulliparous women is key to lowering overall institutional CS rates. Studies by Gómez et al. [16] and Singh et al. [17] found similar high contributions from Groups 1–2 in tertiary hospitals and recommended targeted labour-management protocols (e.g., careful induction policies, active management of labour, and standardised criteria for labour dystocia) to reduce primary CS. Our results support prioritizing audit and intervention in Groups 1 and 2.

Group-specific extremes observed in our cohort -100% CS in Group 9 (abnormal lie) and very high CS rates in breech groups (Groups 6 and 7) - are expected and comparable with other reported series. Khan et al. [18] and Lopez et al. [19] documented near-universal CS for abnormal lie and high CS rates for breech presentation in settings where external cephalic version or vaginal breech delivery is rarely practiced. These groups therefore represent appropriate and unavoidable contributors to the overall CS rate.

When comparing the contribution of induced labours and pre-labour CS (Groups 2 and 4), our findings mirror those reported by Ahmed et al. [20] and Rao et al. [21], who observed that induction practices and pre-labour CS decisions can markedly influence institutional CS patterns. In particular, the elevated CS rate in Group 2 suggests opportunities to review induction protocols, indications for elective pre-labour CS, and intrapartum management to potentially reduce avoidable CS.

Several authors have also examined the impact of implementing Robson-based audits and quality improvement interventions. Martínez et al. [22] and Fernandes et al. [23] demonstrated that repeated feedback, standardized labour protocols, and VBAC-promoting strategies can reduce Group 1–2 CS

rates and, over time, the size and CS contribution of Group 5. These intervention studies provide a roadmap for institutional changes in our setting: strengthening labour management, auditing primary CS indications, and developing safe VBAC pathways.

Finally, benchmarking is important: while some centres report lower CS rates in low-risk groups (Groups 1 and 3) than ours, others report similar or higher rates depending on referral load and institutional policies. Olusanya et al. [24], Dutta et al. [25] all underscore that Robson profiling is most useful when coupled with local audit, context-specific interventions, and continuous monitoring. Our results, particularly the dominance of Groups 1, 2 and 5 in contributing to CS, therefore identify clear targets for quality improvement within our tertiary setting.

Recommendations: Based on the findings of this study, routine implementation of the Robson Ten Group Classification System is recommended for continuous audit of delivery practices in tertiary care hospitals. Focused strategies should be directed toward reducing unnecessary primary caesarean sections in nulliparous women through adherence to evidence-based labour management protocols, standardized criteria for labour induction, and appropriate use of intrapartum monitoring. Development and strengthening of institutional policies supporting vaginal birth after caesarean section in eligible women may help reduce the contribution of Robson Group 5 to overall caesarean section rates. Regular departmental audits, feedback to clinicians, and multidisciplinary review of caesarean section indications are essential for sustaining quality improvement. Additionally, integration of Robson-based analysis into institutional and regional maternal health surveillance systems may support benchmarking and policy formulation.

Strengths: A major strength of this study is its prospective design, which allowed complete and accurate data collection for all deliveries during the study period. The use of the Robson Ten Group Classification System ensured standardized, mutually exclusive, and totally inclusive categorization of all deliveries, facilitating meaningful analysis and comparison with other studies. The large sample size and inclusion of both low-risk and high-risk pregnancies enhance the reliability of the findings and reflect real-world obstetric practice in a tertiary care setting.

Limitations: The study was conducted at a single tertiary care institution, which may limit the generalizability of the findings to primary or secondary care settings. The high caesarean section rate observed may partly reflect referral bias and the predominance of high-risk pregnancies inherent to tertiary care hospitals. Additionally, neonatal and long-term maternal outcomes were not evaluated, and the study did not assess the impact of specific interventions to reduce caesarean section rates. Future multicentre studies incorporating outcome measures and intervention-based designs would provide broader insights into optimizing delivery practices.

Conclusion

This prospective observational study applying the Robson Ten Group Classification System provides a clear and structured overview of delivery patterns and caesarean section practices in a tertiary care hospital. The overall caesarean section rate was high, with women in Robson Group 5 emerging as the largest contributors, followed by nulliparous women in Groups 1 and 2. These findings highlight the cumulative impact of primary caesarean sections on subsequent delivery patterns and underscore the importance of judicious decision-making in nulliparous women. The Robson classification proved to be a practical and effective audit tool, enabling identification of key obstetric groups contributing to the caesarean section rate and offering actionable insights for improving intrapartum care and optimizing obstetric outcomes in a tertiary care setting.

Conflict of interest: No Conflict of interest

Source Of Fund: No fund source

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