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# Distribution of Cesarean Deliveries Across the Robson 10-Group Classification Categories at a Tertiary Care Center in Eastern India: A Cross-Sectional Study

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## Abstract

Background and objective: Cesarean section rates have risen steadily worldwide, and the World Health Organization recommends the Robson 10-group classification system as the global standard for monitoring and comparing cesarean section rates. The objective was to describe the distribution of cesarean deliveries across the Robson groups at a tertiary care hospital in Jharkhand, India, over 12 months, and to identify the groups contributing most to the total. Group-specific cesarean section rates were not calculated, as only cesarean deliveries were included.

Materials and methods: This prospective, hospital-based, cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Bokaro General Hospital, Bokaro, Jharkhand, India, between April 2024 and March 2025. All 300 women delivered by cesarean section during the study period were included and assigned to Robson groups based on the available obstetric variables. Groups 2 and 4 were subdivided according to labor onset, and group 5 according to the number of previous cesarean sections. Because only women delivered by cesarean section were enrolled, the total number of women delivering in each Robson group was unavailable. The analysis therefore describes the distribution of cesarean deliveries across the Robson groups rather than group-specific cesarean section rates. Categorical variables were summarized using frequencies and percentages, without inferential statistical testing.

Results: Of 550 women who delivered during the study period, 300 underwent cesarean section, giving an overall cesarean section rate of 54.5%. Group 5 (women with a previous cesarean section) was the largest contributor, accounting for 84 of 300 cesarean deliveries (28.0%), followed by group 2 (nulliparous women with a term singleton cephalic pregnancy who underwent induction of labor or cesarean section before labor) with 79 (26.3%), group 1 with 48 (16.0%), and group 10 with 35 (11.7%). Groups 3 and 4 accounted for 17 (5.7%) and 19 (6.3%) cesarean deliveries, respectively. Groups 6 to 9 together accounted for 18 (6.0%) cesarean deliveries. Group 2A, comprising nulliparous women undergoing induction of labor, was the largest subgroup, accounting for 23.7% of all cesarean deliveries. Most procedures were performed as emergencies (223/300; 74.3%). All group percentages represent proportions of cesarean deliveries, not cesarean section rates within individual groups.

Conclusions: Groups 5 and 2 together accounted for 54.3% of all cesarean deliveries and were the largest numerical contributors at this center. These groups therefore represent important priorities for auditing cesarean section indications. However, their relative contributions do not establish that either group had an unusually high cesarean section rate. The overall rate of 54.5% warrants institutional review, with comparisons against population-level estimates interpreted in light of differences in case mix and referral patterns. Routine recording of the total number of women delivering in each Robson group is recommended to enable calculation of group-specific cesarean section rates and completion of the standard Robson report table.

**Categories:** Therapeutics, Obstetrics/Gynecology
**Keywords:** caesarean section, cross-sectional study, india, obstetric audit, robson ten-group classification system

## Introduction

Cesarean section is among the most frequently performed major surgical procedures in obstetric practice and may be planned in advance or undertaken as an emergency. Although the procedure is life-saving when medically indicated, it carries short- and long-term consequences for both mother and child. Maternal mortality and morbidity are higher after cesarean section than after vaginal birth, and cesarean delivery is associated with an increased risk of uterine rupture, abnormal placentation, ectopic pregnancy, stillbirth, and preterm birth in subsequent pregnancies, with risk rising in a dose-response manner with the number of previous procedures. Infants born by cesarean section show altered immune development, a greater likelihood of allergy, atopy, and asthma, and reduced intestinal microbiome diversity [1].

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Concern about the rising use of cesarean delivery is long-standing. A population-level cesarean section rate of between 10% and 15% was first proposed as appropriate in 1985 [2], and the World Health Organization (WHO) has since reaffirmed that cesarean section rates above approximately 10% at population level are not associated with further reductions in maternal or neonatal mortality [3]. The trend has nonetheless continued: nationally representative data from 154 countries covering 94.5% of world live births indicate that 21.1% of women now give birth by cesarean section, and projections suggest this will reach 28.5% by 2030 [4]. In India, the proportion of births delivered by cesarean section rose from 17.2% in the fourth round of the National Family Health Survey (NFHS-4, 2015-16) to 21.5% in the fifth round (NFHS-5, 2019-21) [5]. The increase has been driven predominantly by the private sector, where women have close to four times the odds of cesarean delivery compared with public facilities [6].

Because cesarean section rates vary widely with case-mix, comparing crude institutional rates is of limited value. A systematic appraisal of 27 published cesarean section classifications concluded that women-based systems, and the Robson classification in particular, were best placed to meet international and local monitoring needs [7]. The ten-group classification proposed by Robson assigns every woman who delivers to one of 10 mutually exclusive and totally inclusive groups, using six obstetric variables that are routinely recorded: parity, previous cesarean section, onset of labor, fetal presentation, number of fetuses, and gestational age [8]. The WHO has endorsed this system as the global standard for assessing, monitoring, and comparing cesarean section rates within and between facilities, and has issued an implementation manual that specifies the standard report table [3,8].

Robson-based audits have been reported from tertiary centers in several Indian states, including Bihar, eastern Uttar Pradesh, and Maharashtra [9-11], but published data from Jharkhand and the immediately surrounding region remain limited. The present study was therefore undertaken at a tertiary care hospital in Jharkhand. The objective was to describe the distribution of cesarean deliveries across the Robson 10-group classification categories over a 12-month period, that is, to determine the relative contribution of each group to the total number of cesarean deliveries. Because only women delivered by cesarean section were enrolled, the study does not calculate group-specific cesarean section rates, which require the total number of women delivering in each group.

# Materials And Methods

## Study design and setting

This was a prospective, hospital-based, cross-sectional observational study conducted in the Department of Obstetrics and Gynecology, Bokaro General Hospital, Bokaro, Jharkhand, India, a tertiary care referral institution, between April 2024 and March 2025. The study was approved by the Institutional Ethics Committee of Bokaro General Hospital, Steel Authority of India Limited, Bokaro Steel Plant, Bokaro, Jharkhand, India (Ethics Committee registration number NECRBHR, DHR-EC/NEW/INST/2021/1777), under approval number Ethical Committee BGH/2024/01, dated February 9, 2024. The protocol had previously been approved by the hospital's Scientific Research Committee on January 29, 2024 (reference MED/SRC/BGH/2024/1). Both approvals preceded the start of data collection in April 2024. The Committee reviewed the protocol, the participant information sheet, the informed consent form, and the case record form in English and Hindi before granting approval. Written informed consent was obtained from each participant on the Committee-approved consent form before enrolment.

*Participants*

All women delivered by cesarean section at the study institution during the 12-month study period were enrolled consecutively, giving a study population of 300 women. No woman delivered by cesarean section during the study period was excluded. The total number of deliveries during the same period, obtained from the departmental delivery register, was 550; this figure was used as the denominator for the overall cesarean section rate. The Robson classification variables were recorded only for women delivered by cesarean section and were not available for the remaining 250 women delivered vaginally; group-specific denominators were therefore not available. As all eligible women were included, no a priori sample size calculation was performed.

*Data Collection and Variables*

Data were recorded prospectively for each participant on a structured case record form approved by the Institutional Ethics Committee; the blank form is provided as Appendix A. The form captured demographic details (age, residence, education, and occupation), obstetric history (gravidity, parity, abortions, previous cesarean section, duration of marriage, and booking status), clinical findings on admission (height, weight, blood pressure, and general examination), laboratory and ultrasound findings, gestational age at delivery, fetal presentation, number of fetuses, urgency of the procedure with the indication for cesarean section, and maternal and neonatal outcomes. The completed forms were transcribed into a single line-listed master chart, one row per woman, from which every count reported in this study was derived.

*Definition of Classification Variables*

The six variables required for the Robson classification were defined as follows. Parity was the number of previous births, calculated from the recorded obstetric formula as gravidity minus the current pregnancy minus previous abortions; a woman with no previous birth was classed as nulliparous, so that a woman whose only previous pregnancy had ended in abortion was nulliparous. Previous cesarean section was taken from the obstetric history and recorded as none, one, two, or more. Where this field was blank in the master chart (179 records, 134 of them in nulliparous women), it was interpreted as no previous cesarean section; none of these women had been assigned to group 5. The number of fetuses was recorded as singleton or multiple. Fetal presentation and lie at delivery were recorded as cephalic, breech, or transverse or oblique. Gestational age at delivery was expressed in completed weeks, based on the last menstrual period where known and corrected against the earliest available ultrasound scan; values recorded in weeks and days were truncated to completed weeks, and delivery before 37 completed weeks was classed as preterm. Onset of labor was classed as spontaneous, induced, or no labor (cesarean section before the onset of labor). It was determined by the clinical team at the time of classification but was not retained as a separate column in the master chart; it is therefore represented only by the recorded group and subgroup (groups 1 and 3 for spontaneous labor, subgroups 2A and 4A for induced labor, and subgroups 2B and 4B for cesarean section before labor).

*Robson Classification Algorithm*

Each woman was assigned to one of the 10 Robson groups according to the WHO Robson Classification Implementation Manual [8], using the hierarchical sequence summarized in Appendix B. The number of fetuses was considered first: all multiple pregnancies were assigned to group 8. Singleton pregnancies in transverse or oblique lie were assigned to group 9, and singleton breech pregnancies to group 6 if nulliparous or group 7 if multiparous, including women with a previous cesarean section. Singleton cephalic pregnancies before 37 completed weeks were assigned to group 10, irrespective of parity or previous cesarean section. Singleton cephalic pregnancies at 37 weeks or more were assigned to group 5 if there had been at least one previous cesarean section; otherwise, nulliparous women were assigned to group 1 (spontaneous labor) or group 2 (induced labor or cesarean section before labor), and multiparous women to group 3 (spontaneous labor) or group 4 (induced labor or cesarean section before labor). Groups 2 and 4 were subdivided into 2A and 4A (labor induced) and 2B and 4B (cesarean section before labor), and group 5 into 5.1 (one previous cesarean section) and 5.2 (two or more). Subdivisions of this kind are among those most frequently adopted by users of the classification [12]. One woman with cord presentation recorded but no separately classifiable lie retained her recorded group assignment.

*Verification of Recorded Group Assignments*

Every recorded group assignment was checked against the classification variables in the master chart using the eligibility rules of each group: groups 1 to 5 require a singleton cephalic pregnancy at 37 weeks or more; groups 1, 2, and 6 require nulliparity; groups 3 and 4 require multiparity without a previous cesarean section; group 5 requires at least one previous cesarean section; groups 6 and 7 require breech presentation; and group 10 requires a singleton cephalic pregnancy before 37 weeks. Five records (1.7%) did not satisfy the rules of their recorded group and were reassigned to the group whose rules they met. Labor onset and singleton status could not be re-verified for these records, because labor onset was not held as a separate variable and the source clinical notes could not be re-examined.

*Data Availability*

An anonymized line-listed dataset of all 300 women is also provided. For each woman, it gives a study serial number, age group in five-year bands, parity, number of previous cesarean sections, gestational age in completed weeks, fetal presentation and number of fetuses, urgency of the procedure, the Robson group as recorded, the Robson group after verification, and a flag for reassigned records. Names, hospital numbers, dates, addresses, and free-text clinical notes have been removed.

### Statistical analysis

The analysis was entirely descriptive. Categorical variables are presented as frequencies and percentages. Percentages were calculated on a denominator of the total number of cesarean deliveries (n = 300) unless otherwise stated, and the overall cesarean section rate on a denominator of the total number of deliveries (n = 550). Percentages are reported to one decimal place. Counts were tabulated from the line-listed master chart, and the tabulation was cross-checked against the internal-consistency rules described above. No inferential statistical test (for example, chi-squared test, t-test, or analysis of variance) was applied, and no hypothesis was tested; accordingly, no p-values, test statistics, or confidence intervals are reported in the text, tables, or figure legends.

## Results

A total of 550 women delivered at the study institution during the 12-month study period, of whom 300 were delivered by cesarean section, giving an overall cesarean section rate of 54.5%.

## Characteristics of the study population

The characteristics of the 300 women are summarized in Table 1. The largest number of cesarean deliveries occurred in the 25-29 year age group (127 women, 42.3%), followed by the 30-34 year group (81 women, 27.0%) and the 20-24 year group (80 women, 26.7%). Cesarean section was least frequent at the extremes of reproductive age: two women (0.7%) were under 20 years, and none were aged 40 years or above. Of the 300 women, 149 (49.7%) were nulliparous and 151 (50.3%) were multiparous. Cephalic presentation was recorded in 281 cases (93.7%), breech in 10 (3.3%), multiple pregnancy in six (2.0%), and transverse or oblique lie in two (0.7%). One case (0.3%), in which cord presentation was recorded without a separately classifiable lie, could not be classified. Delivery occurred at or beyond 37 completed weeks in 262 women (87.3%) and before 37 weeks in 38 (12.7%). Emergency cesarean section accounted for 223 procedures (74.3%) and planned cesarean section for 77 (25.7%).

| Characteristic | n | % |
|---|---|---|
| Age (years) | | |
| <20 | 2 | 0.7 |
| 20-24 | 80 | 26.7 |
| 25-29 | 127 | 42.3 |
| 30-34 | 81 | 27.0 |
| 35-39 | 10 | 3.3 |
| ≥40 | 0 | 0.0 |
| Parity | | |
| Nulliparous | 149 | 49.7 |
| Multiparous | 151 | 50.3 |
| Fetal presentation | | |
| Cephalic | 281 | 93.7 |
| Breech | 10 | 3.3 |
| Multiple pregnancy | 6 | 2.0 |
| Transverse or oblique | 2 | 0.7 |
| Not classifiable | 1 | 0.3 |
| Gestational age | | |
| Term (≥37 weeks) | 262 | 87.3 |
| Preterm (<37 weeks) | 38 | 12.7 |
| Urgency of procedure | | |
| Emergency | 223 | 74.3 |
| Planned (elective) | 77 | 25.7 |

**TABLE 1: Characteristics of women delivered by cesarean section (n = 300)**

Percentages are calculated on a denominator of 300 cesarean deliveries. Categories are presented as recorded in the compiled dataset

## Distribution of cesarean deliveries across Robson groups

The distribution of the 300 cesarean deliveries across the Robson groups is presented in Table 2. Group 5 was the largest single contributor, with 84 cesarean deliveries (28.0%): 63 (21.0%) in women with one previous cesarean section (group 5.1) and 21 (7.0%) in women with two or more (group 5.2). Group 2 was the second largest, with 79 deliveries (26.3%): 71 in women whose labor was induced (group 2A, 23.7%) and eight delivered before the onset of labor (group 2B, 2.7%). Group 1 accounted for 48 deliveries (16.0%) and group 10 for 35 (11.7%). Groups 3 and 4 accounted for 17 (5.7%) and 19 (6.3%), respectively. Groups 6 to 9 together

contributed 18 deliveries (6.0%): group 6, 6 (2.0%); group 7, 4 (1.3%); group 8, 6 (2.0%); and group 9, 2 (0.7%). Groups 5 and 2 together accounted for 163 of the 300 deliveries (54.3%). All percentages are proportions of the 300 cesarean deliveries. They describe how cesarean deliveries were distributed across the groups and are not group-specific cesarean section rates, which could not be calculated because the number of women delivering in each group was not available.

| Robson group | n | Relative contribution (%) |
|---|---|---|
| Group 1 | 48 | 16.0 |
| Group 2A | 71 | 23.7 |
| Group 2B | 8 | 2.7 |
| Group 3 | 17 | 5.7 |
| Group 4A | 15 | 5.0 |
| Group 4B | 4 | 1.3 |
| Group 5.1 | 63 | 21.0 |
| Group 5.2 | 21 | 7.0 |
| Group 6 | 6 | 2.0 |
| Group 7 | 4 | 1.3 |
| Group 8 | 6 | 2.0 |
| Group 9 | 2 | 0.7 |
| Group 10 | 35 | 11.7 |
| Total | 300 | 100.0 |

**TABLE 2: Distribution of cesarean deliveries by Robson 10-group classification (n = 300)**

Relative contribution is the percentage of all cesarean deliveries contributed by each group. Subgroup percentages may not sum exactly to 100.0 because of rounding. 2A and 4A, induced labor; 2B and 4B, cesarean section before labor; 5.1, one previous cesarean section; 5.2, two or more previous cesarean sections

### Review and correction of Robson group assignment

The 300 recorded Robson assignments were reviewed against the parity, gestational age, and fetal presentation recorded in the dataset. Five records (1.7%) were inconsistent with these variables and were reassigned according to the WHO Robson Classification Implementation Manual. Two women who delivered at 36 completed weeks had been assigned to groups 5.1 and 5.2, which are restricted to term pregnancies; both were reassigned to group 10 because their gestation was preterm and presentation cephalic, although singleton status could not be verified from the dataset. One woman with a breech fetus at 34 weeks had been assigned to group 10 and was reassigned to group 7. One woman recorded as gravida 2 with one previous birth had been assigned to nulliparous group 2A and was reassigned to group 4A; the induction status implied by the original subgroup could not be confirmed, as labor onset was not recorded as a separate variable. One woman whose only previous pregnancy had ended in abortion was regarded as nulliparous and was reassigned from group 3 to group 1; the spontaneous onset of labor required for group 1 could not be verified for the same reason. These records could not be re-checked against the source clinical notes, so the revised assignments rest on the compiled dataset and residual misclassification cannot be excluded. Tables *1*, *2* and all percentages reflect the revised assignments.

The corrected distribution was then checked for consistency with the aggregate characteristics in Table *1*. These checks show internal consistency but do not independently validate every group. The 10 breech deliveries equal the combined size of groups 6 and 7, the two transverse or oblique lies equal group 9, and the six multiple pregnancies equal group 8. The 149 nulliparous women comprise 133 in the exclusively nulliparous groups 1, 2A, 2B, and 6, and 16 in groups 8, 9, and 10, which admit women of any parity. The 38 preterm deliveries exceed the size of group 10 (35) by 3, the number of preterm breech, multiple, or transverse presentations falling into groups 6 to 9.

## Discussion

The overall cesarean section rate of 54.5% warrants institutional review, although it cannot be compared directly with population-level figures. The 10%-15% range proposed in 1985 [2], the WHO statement that rates above approximately 10% are not associated with further reductions in mortality [3], and the NFHS-5 national figure of 21.5% [5] are all population-level observations, not targets for individual facilities. Comparable institutional rates have been reported from other Indian tertiary centers using the same classification, including 54.0% in Pune [11] and 61.1% in eastern Uttar Pradesh [10]. The gap between institutional and population rates is visible even within one state: in Bihar, the population-level NFHS-5 rate was 9.7% [5], whereas a tertiary center audit reported 38.2% [9]. Referral function contributes, because such centers concentrate complicated and previously operated cases: in a nationwide Robson study of 56 referral-level hospitals in Nigeria, 33% of women delivered by cesarean section and group 5 contributed 27.1% of all cesarean deliveries [13]. As a referral center, this institution would be expected to exceed the district average, but referral status, risk profile, and indication were not collected here, so the contribution of case-mix cannot be quantified.

Women with a previous cesarean section (group 5) formed the largest contributor, at 28.0%. This is characteristic of institutions with a high primary cesarean section rate, because each primary procedure creates a future group 5 woman. A meta-analysis of 6,641,615 births across Europe described this as a domino effect, with group 5 the largest contributor in every region [14]. Group 5 is therefore better understood as the accumulated consequence of earlier primary procedures, sustained by repeat operations where trial of labor is not offered or not taken up. Whether a trial of labor was offered was not recorded here, and the size of this group reflects the number of cesarean deliveries it contains, not an excess cesarean section rate within it.

Group 2 was the second largest contributor (26.3%), with induced labor (group 2A) accounting for 23.7% of all cesarean deliveries, the largest single subgroup. This does not by itself indicate avoidable cesarean delivery, because the appropriate comparator for induction is expectant management rather than spontaneous labor. In the ARRIVE trial, elective induction at 39 weeks in low-risk nulliparous women produced a lower cesarean rate than expectant management (18.6% versus 22.2%; relative risk 0.84, 95% confidence interval 0.76 to 0.93) [15]. The indications for induction, the gestational age at which it is offered, the regimens used, and the criteria for failed induction are therefore the most informative local audit targets.

The rank order seen here matches other Indian tertiary centers. A Bihar audit reported group 5 at 35.0%, group 2 at 26.4%, group 1 at 15.5%, and group 10 at 7.1% [9], and Pune and eastern Uttar Pradesh also found groups 5 and 2 or 1 leading [10,11]. The pattern is not universal: an Ethiopian university hospital found groups 3, 5, and 1 to lead [16]. Such differences reflect case-mix and referral function, which the Robson classification is designed to make visible. Finally, 74.3% of cesarean sections were performed as emergencies, which merits review of the indications, the timing of decision-making, and the opportunities for antenatal counseling and delivery planning. Emergency status was not cross-tabulated by Robson group, so whether women with a previous cesarean section were more likely to undergo emergency procedures cannot be determined; future audits should examine this by group.

### Limitations

This study has several limitations. It was conducted at a single tertiary referral center, and the findings may not be generalizable to community or secondary-level obstetric settings with different patient profiles. As only women who underwent cesarean section were included, and the total number of women delivering in each Robson group was not available, the analysis was limited to the relative contribution of each group to the cesarean cohort. Group sizes, group-specific cesarean section rates, and absolute contributions could not be calculated, limiting the identification of groups with disproportionately high cesarean section rates. The onset of labor was not recorded as a separate variable for groups 5 to 10, preventing an institution-wide analysis of spontaneous, induced, and pre-labor cesarean deliveries. In addition, indications for cesarean section were recorded as free text rather than coded using a standard classification, limiting systematic analysis of indications and the assessment of potentially avoidable procedures. The study covered only a single 12-month period, with no data from previous years to assess temporal trends. Furthermore, data were recorded by the clinical team during routine care rather than by an independent observer. Five records (1.7%) were identified as inconsistent with or potentially incompatible with the available obstetric variables and were reassigned following review. As the original clinical records were unavailable, certain classification criteria, particularly singleton status and onset of labor, could not be independently verified for all reassigned cases. The revised classifications were therefore based on the available compiled dataset, and residual misclassification cannot be excluded.

## Conclusions

The study identified women with a previous cesarean section and nulliparous women undergoing induction of labor or cesarean section before labor as the major contributors to the cesarean delivery cohort. These groups represent important priorities for reviewing clinical indications and institutional obstetric practices. However, their relative contributions reflect the distribution of cesarean deliveries rather than group-specific cesarean section rates, and do not establish that any group has an excessive rate. The Robson classification provided a useful framework for describing the cesarean case-mix, although independent

verification of certain criteria was limited for some reassigned cases. Future audits should record all deliveries by Robson group and systematically document the onset of labor to enable calculation of group-specific cesarean section rates and more reliable evaluation of interventions.

# Appendices

## Appendix A

Robson 10-Group Classification of Cesarean Sections

Study: A Study of the Efficacy and Practicability of Classification of Cesarean Section by Robson's Criteria

A. Study identification

Case serial number (dataset S.No.)

_____

Hospital record/study ID (coded)

_____

Date of delivery (DD/MM/YYYY)

_____

Age (completed years)

_____

B. Obstetric profile

Gravidity (G)

_____ (as recorded: _____)

Parity (P)

_____ Abortions (A): _____

Gestational age at delivery

_____ weeks + _____ days

Gestational-age entry as in source record

_____

Previous cesarean section(s)

☒ None ☒ One ☒ Two or more ☒ Not documented

Number of previous CS, if known

_____

Fetal presentation/lie

☒ Cephalic/vertex ☒ Breech ☒ Transverse/oblique ☒ Other: _____

Presentation as recorded (verbatim)

_____

C. Cesarean delivery details

Type of cesarean section

☒ Emergency ☒ Elective/planned

Procedure (from record)

_____

Indication(s) for cesarean (verbatim)

_____
_____

Additional clinical remarks, if documented

_____

Source-data note: This CRF reflects the uploaded 300-case spreadsheet. Unavailable or undocumented items should be marked “Not documented”; do not infer values from a Robson label.

D. Robson classification: required criteria/verification

Complete from original obstetric records where available. The uploaded spreadsheet does not contain all these criteria as independent fields.

Number of fetuses

☒ Singleton ☒ Multiple ☒ Not documented

Previous cesarean status verified

☒ No previous CS ☒ ≥1 previous CS ☒ Not documented

Onset of labor

☒ Spontaneous ☒ Induced ☒ Cesarean before labor ☒ Not documented

Fetal presentation verified

☒ Cephalic ☒ Breech ☒ Transverse/oblique ☒ Other/not documented

Gestational-age stratum

☒ <37 completed weeks ☒ ≥37 completed weeks ☒ Uncertain

Parity stratum

☒ Nulliparous ☒ Multiparous ☒ Uncertain

E. Robson group assignment

Tick one final group/subgroup (using the study spreadsheet nomenclature).

☒ 1 - Nulliparous, singleton cephalic, ≥37 weeks, spontaneous labor

☒ 2A - Nulliparous, singleton cephalic, ≥37 weeks, induced

☒ 2B - Nulliparous, singleton cephalic, ≥37 weeks, CS before labor

☒ 3 - Multiparous, no previous CS, singleton cephalic, ≥37 weeks, spontaneous

☒ 4A - Multiparous, no previous CS, singleton cephalic, ≥37 weeks, induced

☒ 4B - Multiparous, no previous CS, singleton cephalic, ≥37 weeks, CS before labor

☒ 5.1 - Previous one CS, singleton cephalic, ⩾37 weeks

☒ 5.2 - Previous two or more CS, singleton cephalic, ⩾37 weeks

☒ 6 - Nulliparous, singleton breech

☒ 7 - Multiparous, singleton breech (including previous CS)

☒ 8 - Multiple pregnancy (including previous CS)

☒ 9 - Singleton transverse/oblique lie (including previous CS)

☒ 10 - Singleton cephalic, <37 weeks (including previous CS)

F. Data quality/audit trail

Robson group as originally recorded

_____

Final Robson group after review

_____

Was case reclassified?

☒ No ☒ Yes

If reclassified, reason/source checked

_____

Missing or unverifiable criteria

☒ None ☒ Labor onset ☒ Singleton status ☒ Prior CS ☒ Other: _____

Completed by: _____ Date: _____ Reviewed by: _____

Confidential study document. Use a coded study ID; retain identifiable patient details separately under institutional procedures.

## Appendix 2

Robson classification algorithm used in this study

| Step | Criteria | Robson group |
|---|---|---|
| 1 | Multiple pregnancy (any parity, gestation, presentation, or previous cesarean section) | 8 |
| 2 | Singleton, transverse, or oblique lie (including previous cesarean section) | 9 |
| 3 | Singleton breech, nulliparous | 6 |
| 4 | Singleton breech, multiparous (including previous cesarean section) | 7 |
| 5 | Singleton cephalic, <37 completed weeks (including previous cesarean section) | 10 |
| 6 | Singleton cephalic, ≥37 weeks, one previous cesarean section | 5.1 |
| 7 | Singleton cephalic, ≥37 weeks, two or more previous cesarean sections | 5.2 |
| 8 | Singleton cephalic, ≥37 weeks, nulliparous, spontaneous labor | 1 |
| 9 | Singleton cephalic, ≥37 weeks, nulliparous, induced labor | 2A |
| 10 | Singleton cephalic, ≥37 weeks, nulliparous, cesarean section before labor | 2B |
| 11 | Singleton cephalic, ≥37 weeks, multiparous, no previous cesarean section, spontaneous labor | 3 |
| 12 | Singleton cephalic, ≥37 weeks, multiparous, no previous cesarean section, induced labor | 4A |
| 13 | Singleton cephalic, ≥37 weeks, multiparous, no previous cesarean section, cesarean section before labor | 4B |

**TABLE 3: Robson classification**

Variables are applied in the order shown; a woman is assigned at the first step whose criteria she meets.

# Additional Information

## Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

**Concept and design:** Katyani Sharma, Nishi Mishra, Bimalesh Ojha

**Acquisition, analysis, or interpretation of data:** Katyani Sharma

**Drafting of the manuscript:** Katyani Sharma, Bimalesh Ojha

**Critical review of the manuscript for important intellectual content:** Katyani Sharma, Nishi Mishra

**Supervision:** Nishi Mishra, Bimalesh Ojha

## Disclosures

**Human subjects:** Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Bokaro General Hospital issued approval BGH/2024/01. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

# References

1. Sandall J, Tribe RM, Avery L, et al.: Short-term and long-term effects of caesarean section on the health of women and children. Lancet. 2018, 392:1349-57. 10.1016/S0140-6736(18)31930-5
2. Appropriate technology for birth. Lancet. 1985, 326:436-7. 10.1016/S0140-6736(85)92750-3
3. WHO: WHO Statement on Caesarean Section Rates. World Health Organization, Geneva; 2015. https://www.who.int/publications/i/item/WHO-RHR-15.02.
4. Betran AP, Ye J, Moller AB, Souza JP, Zhang J: Trends and projections of caesarean section rates: global and

regional estimates. BMJ Glob Health. 2021, 6:e005671. 10.1136/bmjgh-2021-005671

5. Dutta R, Nathani P, Patil P, et al.: State-wise variation and inequalities in caesarean delivery rates in India: analysis of the National Family Health Survey-5 (2019-2021) data. Lancet Reg Health Southeast Asia. 2025, 32:100512. 10.1016/j.lansea.2024.100512
6. Neethi Mohan V, Shirisha P, Vaidyanathan G, Muraleedharan VR: Variations in the prevalence of caesarean section deliveries in India between 2016 and 2021-an analysis of Tamil Nadu and Chhattisgarh. BMC Pregnancy Childbirth. 2023, 23:622. 10.1186/s12884-023-05928-4
7. Torloni MR, Betran AP, Souza JP, Widmer M, Allen T, Gulmezoglu M, Merialdi M: Classifications for cesarean section: a systematic review. PLoS One. 2011, 6:e14566. 10.1371/journal.pone.0014566
8. Robson M: Classification of caesarean sections. Fetal Matern Med Rev. 2001, 12:23-39. 10.1017/S0965539501000122
9. Pravina P, Ranjana R, Goel N: Cesarean audit using Robson classification at a tertiary care center in Bihar: a retrospective study. Cureus. 2022, 14:e23133. 10.7759/cureus.23133
10. Kaithwas K, Khokale A, Gautam R, Bihari A: Cesarean section rates assessed using the Robson ten-group classification system: a retrospective observational study in a tertiary care hospital. Cureus. 2026, 18:e106095. 10.7759/cureus.106095
11. Nigam M, Gusain N, Upadhyay R: Patterns and indications of caesarean sections in a tertiary care hospital: a Robson ten-group classification analysis. Eur J Med Res. 2025, 31:158. 10.1186/s40001-025-03636-7
12. Betrán AP, Vindevoghel N, Souza JP, Gülmezoglu AM, Torloni MR: A systematic review of the Robson classification for caesarean section: what works, doesn't work and how to improve it. PLoS One. 2014, 9:e97769. 10.1371/journal.pone.0097769
13. Lavin T, Ocheke AN, Betran AP, et al.: Analyzing caesarean sections through the Robson classification in Nigeria: a prospective nationwide study in referral level facilities. EClinicalMedicine. 2025, 87:103427. 10.1016/j.eclinm.2025.103427
14. El Radaf V, Campos LN, Savona-Ventura C, Mahmood T, Zaigham M: Robson ten group classification system for caesarean sections across Europe: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol. 2025, 305:178-98. 10.1016/j.ejogrb.2024.11.052
15. Grobman WA, Rice MM, Reddy UM, et al.: Labor induction versus expectant management in low-risk nulliparous women. N Engl J Med. 2018, 379:513-23. 10.1056/NEJMoa1800566
16. Tura AK, Pijpers O, de Man M, Cleveringa M, Koopmans I, Gure T, Stekelenburg J: Analysis of caesarean sections using Robson 10-group classification system in a university hospital in eastern Ethiopia: a cross-sectional study. BMJ Open. 2018, 8:e020520. 10.1136/bmjopen-2017-020520