

Research Article

Cesarean Section Patterns Based on the Robson Classification in a Regional General Hospital

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Abstract

Objectives: To quantify cesarean section use and identify the Robson groups contributing most to the institutional cesarean rate among all deliveries.

Methods: This retrospective cross-sectional study included all eligible and complete delivery records at Panembahan Senopati Regional General Hospital from January 1, 2022, through December 31, 2023. Delivery mode and Robson group were summarized using group size, group-specific cesarean section rate, absolute contribution, and relative contribution. Associations were assessed using chi-square tests and exploratory modified Poisson regression with robust standard errors.

Results: Among 1,178 deliveries, 763 (64.8%) were vaginal and 415 were cesarean, yielding a cesarean rate of 35.2% (95% confidence interval, 32.6-38.0%). Groups 2, 5, and 4 contributed 27.2%, 21.7%, and 17.3% of all cesareans, respectively, and together accounted for 66.3%. Group 5 had the highest group-specific rate (69.8%). Previous cesarean section showed the strongest adjusted association with cesarean delivery (adjusted prevalence ratio, 3.02; 95% confidence interval, 2.52-3.61).

Conclusion: Cesarean use was concentrated in Groups 2, 5, and 4. Future audits should distinguish induction from prelabor cesarean delivery, review primary cesarean pathways, and support individualized management after previous cesarean.

Keywords: cesarean section, clinical audit, delivery, Robson classification.

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INTRODUCTION

Cesarean section (CS) is an essential obstetric intervention when vaginal delivery would expose the woman or fetus to unacceptable risk. Its global use has risen substantially and is projected to account for 28.5% of births by 2030. However, CS remains major surgery, and the clinical benefit of each procedure must be balanced against short-term morbidity and risks that may affect later pregnancies, particularly after a uterine scar.^{1,2} A hospital's overall rate is influenced by access, case mix, referral pathways, and clinical practice, so it cannot by itself establish whether individual procedures were appropriate.

The Robson Ten-Group Classification System provides a standardized approach to institutional audit. It classifies all women admitted for delivery

into 10 mutually exclusive and collectively exhaustive groups using routinely recorded obstetric characteristics: parity, previous CS, onset of labor, number of fetuses, gestational age, and fetal presentation or lie.³ A complete Robson analysis uses all deliveries as the denominator and reports the size of each group, the group-specific CS rate, and each group's absolute and relative contribution. This denominator-based approach distinguishes a large contribution caused by a common obstetric population from one caused by a high probability of CS within a smaller group. Recent international analyses continue to show wide variation across facilities and regions, reinforcing the need for local data rather than universal assumptions.⁴

Evidence from Indonesian referral hospitals has described frequent indications for CS, variation between elective and emergency procedures, and associations with referral and financing patterns.⁵⁻⁷ Robson audits in other hospital settings have repeatedly identified Groups 2, 4, and 5 as major contributors, although their relative importance differs by population and clinical organization.^{8,9} These findings are informative but cannot substitute for an all-delivery audit at Panembahan Senopati Regional General Hospital, a district referral facility serving Bantul and surrounding areas. A facility-specific baseline can identify which care pathways merit closer review and provide a reproducible benchmark for future re-audit.

This study therefore aimed to conduct a denominator-based Robson audit of all available complete delivery records at Panembahan Senopati Regional General Hospital during the combined 2022–2023 period. The primary objectives were to estimate the overall CS rate, describe Robson group sizes and group-specific CS rates, calculate absolute and relative contributions, and identify the groups contributing most to CS use. Secondary objectives were to describe maternal and obstetric characteristics and explore adjusted associations with cesarean delivery.

METHODS

This retrospective cross-sectional study used routinely collected medical record data from Panembahan Senopati Regional General Hospital, Bantul, Special Region of Yogyakarta, Indonesia. The study period covered deliveries from January 1, 2022, through December 31, 2023. Records were analyzed as a pooled 2022–2023 cohort.

A total population sampling approach was used. Eligible records comprised all deliveries occurring at the hospital during the study period with a documented mode of delivery and sufficient information to assign the delivery to a Robson group and to assess the study variables. No restrictions were applied based on maternal or obstetric characteristics, referral status, or mode of delivery. Records were excluded if the woman delivered elsewhere and received only postpartum care at the hospital, if the record duplicated the same delivery episode, or if essential delivery-mode or classification data were missing or irreconcilable. The final analysis included 1,178 unique delivery records.

The primary outcome was delivery mode, categorized as vaginal delivery or CS. Vaginal delivery included spontaneous and assisted vaginal birth. Maternal and obstetric variables included maternal age, gravida, parity, abortion history, gestational age, previous CS, curettage history, number of fetuses, and assigned Robson group. Maternal age was categorized as younger than 35 years or 35 years and older; gestational age was categorized as term (37 weeks or more) or preterm (less than 37 weeks); and parity was categorized as nulliparous, primiparous, or multiparous. All required variables were extracted from the medical records and entered into a standardized Microsoft Excel worksheet. When a required variable was incomplete or unclear in the primary medical record, it was manually verified against the delivery-room patient register or operating-theater log. Records were excluded if an essential variable remained missing or irreconcilable after this verification.

Records were categorized into the 10 Robson groups according to the World Health Organization implementation manual.³ Four standard measures were calculated: group size, defined as deliveries in a group divided by all deliveries; group-specific CS rate, defined as cesarean deliveries in a group divided by all deliveries in that group; absolute contribution, defined as cesarean deliveries in a group divided by all deliveries; and relative contribution, defined as cesarean deliveries in a group divided by all cesarean deliveries.

Continuous variables were summarized using the median and interquartile range (IQR), and categorical variables were summarized using frequencies and percentages. The overall and group-specific CS rates were reported with 95% confidence intervals (CIs). Maternal and obstetric characteristics were compared by delivery mode using Pearson's chi-square test. The association between Robson group and delivery mode was evaluated using Pearson's chi-square test, with Cramer's V as an effect-size measure.

Exploratory adjusted associations with CS were estimated using modified Poisson regression with a log link and robust sandwich standard errors. Results are reported as adjusted prevalence ratios (aPRs) with 95% CIs. The model included maternal age group, parity, abortion history, preterm gestation, previous CS, curettage history, and multiple pregnancy. Gravida was omitted because of overlap with parity, and Robson group was omitted because it is constructed

from several obstetric characteristics included in the model. All tests were two-sided, and $p < 0.05$ was considered statistically significant.

ETHICAL CONSIDERATIONS

Hospital management authorized access to and use of the records for this study. The retrospective analysis involved no patient contact and no additional clinical risk. Direct personal identifiers were not included in the analytical dataset, access was limited to authorized research personnel, and only aggregate findings are reported. Individual informed consent was not sought because the study used coded or de-identified secondary record data and was considered minimal risk under the hospital's authorization and applicable institutional requirements.

RESULTS

A total of 1,178 unique delivery records were included. Median maternal age was 29 years (IQR, 25-34), and median gestational age was 38 weeks (IQR, 37-39). There were 763 vaginal deliveries (64.8%) and 415 cesarean deliveries, corresponding to an overall CS rate of 35.2% (95% CI, 32.6-38.0%). Most women were younger than 35 years (76.5%), had term pregnancies (87.4%), and had singleton pregnancies (98.6%). A previous CS was recorded in 174 women (14.8%). In unadjusted comparisons, maternal age group, previous CS, and curettage history were associated with delivery mode (Table 1).

Table 1. Maternal and Obstetric Characteristics According to Mode of Delivery

Characteristic	All deliveries, n (%)	Vaginal, n (row %)	Cesarean, n (row %)	P-value
Maternal age, (years)				
<35	901 (76.5)	609 (67.6)	292 (32.4)	<0.001
≥35	277 (23.5)	154 (55.6)	123 (44.4)	
Gravida				
Primigravida	443 (37.6)	293 (66.1)	150 (33.9)	0.445
Multigravida	735 (62.4)	470 (63.9)	265 (36.1)	
Parity				
Nulliparous	490 (41.6)	322 (65.7)	168 (34.3)	0.595
Primiparous	421 (35.7)	275 (65.3)	146 (34.7)	
Multiparous	267 (22.7)	166 (62.2)	101 (37.8)	
History of abortion				
No	983 (83.4)	646 (65.7)	337 (34.3)	0.127
Yes	195 (16.6)	117 (60.0)	78 (40.0)	
Gestational age, (weeks)				
≥37	1,030 (87.4)	675 (65.5)	355 (34.5)	0.148
<37	148 (12.6)	88 (59.5)	60 (40.5)	
History of cesarean section				
No	1,004 (85.2)	714 (71.1)	290 (28.9)	<0.001
Yes	174 (14.8)	49 (28.2)	125 (71.8)	
History of curettage				
No	1,035 (87.9)	683 (66.0)	352 (34.0)	0.018
Yes	143 (12.1)	80 (55.9)	63 (44.1)	
Number of fetuses				
Singleton	1,162 (98.6)	755 (65.0)	407 (35.0)	0.213
Multiple	16 (1.4)	8 (50.0)	8 (50.0)	

Note: Percentages in the all deliveries column are column percentages, whereas percentages in the Vaginal and Cesarean columns are row percentages. P-values were calculated using Pearson's chi-square test. CS = cesarean section.

Group 2 was the largest obstetric group (254/1,178, 21.6%), followed by Group 4 (236/1,178, 20.0%). Groups 2, 5, and 4 made the largest relative contributions to all cesarean deliveries, at 27.2%, 21.7%, and 17.3%, respectively. Together, they accounted for 66.3%

of cesareans. Group 5 had the highest observed group-specific CS rate (90/129, 69.8%), followed by Group 9 (40/62, 64.5%). Delivery mode differed across the 10 groups (Pearson chi-square[9] = 230.20, $p < 0.001$; Cramer's V = 0.442) (Table 2).

Table 2. Standard Robson report table for all deliveries

Robson group and obstetric population	Total n	Group size, %	Vaginal n	Cesarean n	Group-specific CS rate, % (95% CI)	Absolute contribution, %	Relative contribution %
Nulliparous, singleton cephalic, ≥37 weeks, spontaneous labor	131	11.1	124	7	5.3 (2.6-10.6)	0.6	1.7
Nulliparous, singleton cephalic, ≥37 weeks, induced or prelabor CS	254	21.6	141	113	44.5 (38.5-50.6)	9.6	27.2
Multiparous without prior CS, singleton cephalic, ≥37 weeks, spontaneous labor	162	13.8	155	7	4.3 (2.1-8.6)	0.6	1.7
Multiparous without prior CS, singleton cephalic, ≥37 weeks, induced or prelabor CS	236	20.0	164	72	30.5 (25.0-36.7)	6.1	17.3
Multiparous with prior CS, singleton cephalic, ≥37 weeks	129	11.0	39	90	69.8 (61.4-77.0)	7.6	21.7
Nulliparous, singleton breech	28	2.4	15	13	46.4 (29.5-64.2)	1.1	3.1
Multiparous, singleton breech, including prior CS	50	4.2	25	25	50.0 (36.6-63.4)	2.1	6.0
Multiple pregnancy, including prior CS	16	1.4	8	8	50.0 (28.0-72.0)	0.7	1.9
Singleton transverse or oblique lie, including prior CS	61	5.2	21	40	65.6 (53.0-76.3)	3.4	9.6
Singleton cephalic, <37 weeks, including prior CS	111	9.4	71	40	36.0 (27.7-45.3)	3.4	9.6
Total	1,178	100.0	763	415	35.2 (32.6-38.0)	35.2	100.0

Note: Absolute contribution = cesareans in the group/all deliveries. Relative contribution = cesareans in the group/all cesareans. Group size = deliveries in the group/all deliveries. Group-specific CS rate = cesareans in the group/deliveries in the group. Overall association: Pearson chi-square (9) = 230.20, $p < 0.001$; Cramer's V = 0.442. CS = cesarean section; CI = confidence interval.

Previous CS showed the strongest adjusted association with cesarean delivery (aPR, 3.02; 95% CI, 2.52–3.61; $p < 0.001$). Maternal age of 35 years or older (aPR, 1.39; 95% CI, 1.17–1.66), history of curettage (aPR, 1.61; 95% CI, 1.08–

2.41), and multiple pregnancy (aPR, 1.62; 95% CI, 1.01–2.59) were also associated with higher CS prevalence after adjustment. The multiple-pregnancy estimate was based on 16 women and was imprecise (Table 3).

Table 3. Crude and adjusted prevalence ratios for cesarean delivery

Factor	Comparison	Cesarean, N (%)	Crude PR (95% CI)	Adjusted PR (95% CI)	Adjusted P-value
Maternal age, years	≥35 vs <35	123/277 (44.4)	1.37 (1.17-1.61)	1.39 (1.17-1.66)	<0.001
Parity	Primiparous vs nulliparous	146/421 (34.7)	1.01 (0.85-1.21)	0.61 (0.49-0.76)	<0.001
Parity	Multiparous vs nulliparous	101/267 (37.8)	1.10 (0.91-1.34)	0.58 (0.45-0.74)	<0.001
History of abortion	Yes vs no	78/195 (40.0)	1.17 (0.96-1.41)	0.77 (0.53-1.13)	0.184
Gestational age, weeks	<37 vs ≥37	60/148 (40.5)	1.18 (0.95-1.45)	1.17 (0.96-1.43)	0.122
History of cesarean section	Yes vs no	125/174 (71.8)	2.49 (2.17-2.85)	3.02 (2.52-3.61)	<0.001
History of curettage	Yes vs no	63/143 (44.1)	1.30 (1.06-1.59)	1.61 (1.08-2.41)	0.020
Number of fetuses	Multiple vs singleton	8/16 (50.0)	1.43 (0.87-2.34)	1.62 (1.01-2.59)	0.047

Note: PR = prevalence ratio; CI = confidence interval. Adjusted estimates were obtained from a modified Poisson model with a log link and robust standard errors. The model simultaneously included maternal age group, parity, abortion history, preterm gestation, previous cesarean section, curettage history, and multiple pregnancy. Gravida and Robson group were not included.

DISCUSSION

This all-delivery audit found an overall CS rate of 35.2% during the combined 2022–2023 period. Groups 2, 5, and 4 were the leading contributors, together accounting for 66.3% of all cesareans. The significant association between Robson group and delivery mode, with a Cramer's V of

0.442, indicates that the institutional rate was concentrated in specific obstetric populations rather than evenly distributed across births. These findings provide a denominator-based baseline for focused review and future re-audit.

The observed rate should not be judged against a single facility target. Global and regional rates vary substantially, and hospital-level estimates are

shaped by referral role, access, and case mix.^{1,4} Indonesian studies from referral settings similarly show heterogeneous indications, emergency status, and patient characteristics.^{5,6} The hospital serves as a regional referral facility, but referral status was not retained in the analytical dataset; therefore, the contribution of referred cases to the observed CS rate could not be quantified.

Group 2, comprising nulliparous women with a term singleton cephalic pregnancy who underwent induction or prelabor CS, was the largest contributor at 27.2%. Group 4, the corresponding multiparous population without a previous CS, contributed 17.3%. Together, these groups accounted for 44.6% of all cesareans. Their prominence is consistent with audits in Indonesia and other hospital settings.^{7–10} The present dataset did not separate induction subgroups 2a and 4a from prelabor CS subgroups 2b and 4b. It therefore cannot determine whether these contributions reflected induction practices, unsuccessful induction, or planned prelabor procedures. A focused review should subdivide Groups 2 and 4 and capture indication for induction, cervical status, induction method, labor duration, fetal-status assessment, indication for CS, urgency, and decision-to-delivery interval.

Group 5 had the highest observed group-specific CS rate, 69.8%, and contributed 21.7% of all cesareans. Previous CS also had the strongest adjusted association with current cesarean delivery, with an aPR of 3.02. The recurring importance of Group 5 has been reported across diverse referral hospitals.^{8,11,12} This finding supports two complementary actions. First, primary CS decisions in women without a uterine scar should undergo structured indication review because they determine the future size of Group 5. Second, women with a prior CS should receive individualized counseling that considers preferences, prior obstetric history, scar characteristics, clinical resources, and anticipated maternal and neonatal risks. The study did not record eligibility for, attempted use of, or outcomes after trial of labor following cesarean, so it cannot identify avoidable repeat procedures or support a uniform trial-of-labor policy.²

Group 1 accounted for only 1.7% of all cesareans and had a group-specific rate of 5.3%, so it was not a leading driver in the expanded all-delivery analysis. Group 9 requires a different interpretation. It included 62 women and 22 recorded vaginal deliveries, producing a group-specific CS rate of 64.5%. Because Group 9 is

defined by singleton transverse or oblique lie, a rate below 100% warrants data-quality review.³ Possible explanations include miscoding of fetal presentation or failure to update the Robson classification after correction of the fetal lie before delivery. However, the underlying records should be reviewed to determine the cause.

The exploratory model also associated maternal age of 35 years or older, curettage history, and multiple pregnancy with a higher prevalence of CS. These results do not establish causality. Residual confounding is likely because the records lacked body mass index, detailed comorbidity, indication, referral status, labor management, and fetal-status variables. In addition, the multiple-pregnancy estimate was based on only 16 women. The regression is best viewed as a hypothesis-generating complement to the Robson audit, not as a clinical prediction model or a basis for operative indications.

The Robson system identifies where cesareans occur but does not establish whether an individual procedure was appropriate. Future audit cycles should link Robson group to standardized indication, urgency, maternal outcome, and neonatal outcome.

Recent multicenter and longitudinal studies suggest that Robson-based audit, feedback, and multifaceted interventions may reduce cesarean use in selected Robson groups without worsening measured maternal or perinatal outcomes, although effects vary by setting and implementation.^{12–14} The World Health Organization likewise recommends combining clinical practice review with appropriately selected nonclinical interventions such as education, audit and feedback, and organizational measures.¹⁵ At this hospital, the immediate priority is to improve the completeness and internal consistency of source variables before evaluating any reduction strategy. The principal strengths of this study are its inclusion of all available complete deliveries rather than a CS-only sample, use of unique records, and reporting of the four standard Robson measures. The principal limitations are the retrospective single-center design and incomplete granularity of the analytical file. Delivery year was absent, so 2022 and 2023 could not be compared. The analytical dataset also did not retain individual variables for induction versus prelabor CS, indication, urgency, referral status, fetal presentation or lie, body mass index, and maternal and neonatal outcomes. These limitations restrict causal and appropriateness

judgments but do not eliminate the value of the pooled baseline for data-quality improvement and re-audit.

CONCLUSION

Among 1,178 deliveries during the combined 2022–2023 period, 35.2% were delivered by cesarean section. Groups 2, 5, and 4 were the principal contributors and accounted for 66.3% of all cesareans. These findings highlight the need to review induction and prelabor CS pathways in term singleton cephalic pregnancies without a prior scar, together with individualized management after previous cesarean. Recurring Robson audits should be linked to indications, urgency, referral status, and maternal and neonatal outcomes, with future datasets retaining delivery year to permit temporal evaluation.

CONFLICT of INTEREST

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

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