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Severity-Level Stratification and Robson Ten-Group Classification of Caesarean Sections at a Tertiary Referral Hospital in West Sumatra, Indonesia: A Cross-Sectional Study

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A B S T R A C T

Caesarean section rates have risen worldwide, and the World Health Organization endorses the Robson Ten-Group Classification System as the global standard for facility-level audit. Severity-stratified Robson data remain scarce in Indonesia, and none exist for central Sumatra. This cross-sectional census characterised the clinical-severity distribution and Robson classification of caesarean sections at RSUP Dr. M. Djamil, the sole tertiary (type A) referral hospital for central Sumatra, during 2021. All 679 deliveries were reviewed by total sampling; 560 (82.47%, 95% CI 79.43–85.15) were caesareans, a fraction reflecting the apex-referral casemix rather than population practice. Proportions were estimated with Wilson confidence intervals, distributions tested by goodness-of-fit chi-square with Cohen's w, and indicators benchmarked against national and WHO standards. Severity level II predominated (48.93%, 95% CI 44.81–53.06), with level I (47.86%) and level III (3.21%) (chi-square=228.700, p<0.001, w=0.639). Robson Group 10 was largest (30.19%, 95% CI 26.86–33.75), followed by Group 5 (21.80%) and Group 2 (15.02%); Groups 5 and 10 together contributed 51.99%. Group 10 exceeded the Indonesian mean of 14.20% (prevalence ratio 2.13, 95% CI 1.90–2.38, p<0.001). Preterm single-cephalic pregnancies dominate this casemix and represent the priority target for severity-stratified caesarean audit and preterm-referral optimisation in Indonesian tertiary obstetric practice.

1. Introduction

Caesarean section has become the most frequently performed major obstetric operation, and its use has expanded faster than any other surgical procedure in maternity care. Global rates rose from 7.0% of births in 1990 to 21.1% in 2021 and are projected to reach approximately 28.5% by 2030.[1] The increase is geographically uneven: some countries exceed 50% while others remain below the level needed to avert maternal death, and across low- and middle-income countries the facility caesarean prevalence already approaches 19.9%, surpassing the World Health Organization reference range of 10–15%.[1,2] Because rates beyond this band are not associated with further reductions in maternal or neonatal mortality, such values are widely read as a marker of potential overuse, yet maternal mortality remains high where access is limited, so the policy goal is to match surgical delivery to clinical need and to close equity gaps rather than simply to minimise counts.[2,3]

The clinical consequences of caesarean birth extend beyond the index delivery, altering maternal

recovery and influencing short- and long-term outcomes for both mother and child.[4,5] The peri-operative risk attached to any individual caesarean depends heavily on accompanying comorbidities and complications — hypertensive disorders of pregnancy, antepartum and postpartum haemorrhage, sepsis, and metabolic derangement such as gestational diabetes — which perturb coagulation, endothelial and inflammatory biochemistry and escalate surgical complexity.[5,6] Caesareans performed without a clear indication carry their own morbidity burden, reinforcing the argument that surgical deliveries should be characterised by clinical severity rather than treated as a single homogeneous category.[6]

To compare caesarean practice across facilities and over time, the World Health Organization endorses the Robson Ten-Group Classification System as the global reference standard.[7] The system allocates every delivering woman to one of ten mutually exclusive, totally inclusive groups using parity, previous caesarean, onset of labour, fetal presentation, number of fetuses and gestational age, making it simple, prospective and reproducible.[8] Single-centre and multi-country audits repeatedly identify Groups 1 to 5, especially multiparous women with a previous caesarean (Group 5) and nulliparous women in labour (Groups 1–2), as the main contributors to caesarean rates in general populations.[9,10] Referral and tertiary hospitals, however, accumulate a disproportionate share of high-risk groups, including preterm and multiple pregnancies, reflecting their referral function rather than indiscriminate practice.[11,12]

In Indonesia, caesarean use has risen sharply, increasing from roughly 4.0% of births in 1998 to 18.5% in 2017, with marked socioeconomic and regional inequalities driven by wealth, education and urban residence.[13,14] West Sumatra reported a provincial caesarean fraction of approximately 23.6% in 2018, and RSUP Dr. M. Djamil — the sole type A hospital and apex referral centre for central Sumatra — has recorded year-on-year increases in surgical deliveries, rising from 162 caesareans in 2016 to 273 in 2017, 368 in 2018 and 420 in 2019. As the highest-level facility, it concentrates the most complex and highest-risk pregnancies, a casemix that shapes both the severity profile and the Robson distribution of its caseload.

Despite the proliferation of Robson audits internationally, comparable Indonesian evidence remains limited, and no published study from central Sumatra combines the Robson distribution with an explicit clinical-severity stratification of caesareans. Existing reports present raw frequencies without confidence intervals, inferential testing or benchmarking, limiting their value for quality improvement, even though structured audit is precisely what converts such data into action.[15] To our knowledge, this is the first severity-stratified, statistically benchmarked Robson profile reported from central Sumatra.

The purpose of this study was to determine the clinical-severity distribution and the Robson Ten-Group Classification of caesarean sections in a tertiary obstetric referral setting in West Sumatra, Indonesia, and to benchmark these indicators statistically against national and WHO standards, providing a reproducible baseline for caesarean audit and a foundation for targeted quality-improvement interventions in Indonesian tertiary maternity care.

2. Methods

Study design

This was a facility-based, descriptive cross-sectional study using a retrospective record review, reported in accordance with the STROBE statement; it describes population structure and associations rather than causation.

Setting

The study was conducted at Dr. M. Djamil Central General Hospital, Padang, West Sumatra, the only type A (apex) referral centre for central Sumatra, which aggregates the highest-acuity pregnancies

referred upward from type B, C and D facilities. Record abstraction took place between December 2023 and April 2024, covering all 2021 deliveries.

Participants and case definition

All women delivering in 2021 were eligible; a total-sampling (census) approach was used. Records permitting Robson allocation were included and those missing classification-critical data excluded, yielding 679 deliveries and 560 caesarean sections (elective and emergency).

Robson allocation

Each delivery was allocated to one of the ten Robson groups using parity, previous caesarean, onset of labour, fetal presentation, number of fetuses and gestational age (term ≥37 weeks or preterm <37 weeks), following the WHO manual hierarchy.[7] Gestational age used first-trimester ultrasound where available and a reliable last menstrual period otherwise, with ultrasound taking precedence in disagreement.

Severity-level definition

Caesarean severity was the INA-CBGs casemix tier — level I (mild; no significant comorbidity), level II (moderate; controlled hypertensive disorder, mild anaemia, gestational diabetes or prolonged labour), and level III (severe; pre-eclampsia with severe features or eclampsia, major haemorrhage, sepsis, or organ derangement) — a clinical proxy for the comorbidity and biochemical-derangement burden of each surgical delivery.[6] It was abstracted from the casemix record and cross-checked against clinical documentation; the construct is a complexity proxy rather than a validated severity score.

Outcomes

Primary outcomes were the severity-level distribution (among caesareans) and the Robson distribution (among all deliveries); secondary outcomes were the overall caesarean fraction, the combined Group 5+10 contribution, the Groups 1–4 share, and benchmarked comparisons.

Statistical analysis

Proportions were reported with 95% Wilson intervals (z=1.96). Distributions were tested by Pearson goodness-of-fit chi-square against a uniform null (all expected counts >5), with Cohen's w. Pre-specified benchmarks used one-sample prevalence ratios (PR) against fixed standards (overall rate vs WHO 15%; Group 10 vs the Indonesian mean 14.20%) and two-sample odds ratios (OR) against published comparators (Group 10 vs a national series; severity III vs the 2018 baseline 4.07%); absolute differences accompany ratios. Logistic regression and ROC analysis were not performed, as the aggregate data lack individual-level outcome–predictor pairs; legitimate aggregate effect sizes were reported instead. Tests were two-tailed (α=0.05); analyses used Python 3 (NumPy) with verified closed-form distributions.

Ethics

This study received ethical approval from the CMHC Ethics Committee, Indonesia (Approval No. CMHC/EC/2024/118). The committee approved a waiver of individual written informed consent for fully anonymised secondary medical-record data.

3. Results

During 2021, 679 women delivered at RSUP Dr. M. Djamil and met the inclusion criteria. Of these, 560 underwent caesarean section, an overall fraction of 82.47% (95% CI 79.43–85.15) — characteristic of an apex referral facility and far above the WHO 15% ceiling (PR 5.50, 95% CI 5.31–5.69, p<0.001).[2] The characteristics of this high-acuity population are summarised in Table 1.

Severity-level distribution

As detailed in Table 2 and illustrated in Figure 1, severity level II (moderate) was the most frequent tier among the 560 caesareans at 274 cases (48.93%, 95% CI 44.81–53.06), marginally exceeding level I (mild) at 268 cases (47.86%, 95% CI 43.75–52.00).

Severity level III (severe) was least frequent, with 18 cases (3.21%, 95% CI 2.04–5.02). The three tiers were not uniformly distributed (goodness-of-fit chi-square = 228.700, df = 2, p<0.001), with a large effect size (Cohen's w = 0.639); levels I and II did not differ significantly, whereas level III was significantly rarer.

Table 1. Demographic and clinical characteristics of the delivery population, Dr. M. Djamil Central General Hospital, Padang, 2021 (N = 679).

Characteristic	n (%)	Note / 95% CI
Total deliveries	679 (100.0)	Annual census, total sampling
Caesarean sections	560 (82.47)	95% CI 79.43–85.15
Vaginal deliveries	119 (17.53)	Derived complement
Preterm single cephalic (Robson 10)	205 (30.19)	95% CI 26.86–33.75
Previous caesarean (Robson 5)	148 (21.80)	95% CI 18.85–25.06
Multiple pregnancy (Robson 8)	24 (3.53)	95% CI 2.39–5.21
Breech / transverse lie (Robson 6, 7, 9)	58 (8.54)	Malpresentation groups combined

Table 2. Severity-level and Robson Ten-Group distribution of caesarean sections with 95% confidence intervals and goodness-of-fit statistics.

Category	n	%	95% CI	Note
Severity I (mild)	268	47.86	43.75–52.00	Reference tier
Severity II (moderate)	274	48.93	44.81–53.06	ns vs I
Severity III (severe)	18	3.21	2.04–5.02	*** vs I/II
Severity — subtotal	560	100.00	—	x^2=228.700, p<0.001, w=0.639
Robson Group 1	42	6.19	4.61–8.26	Nulliparous, term, spontaneous
Robson Group 2	102	15.02	12.53–17.91	Nulliparous, term, induced/CS
Robson Group 3	36	5.30	3.85–7.25	Multiparous, term, spontaneous
Robson Group 4	64	9.43	7.45–11.86	Multiparous, term, induced/CS
Robson Group 5	148	21.80	18.85–25.06	Previous caesarean
Robson Group 6	14	2.06	1.23–3.43	Nulliparous breech
Robson Group 7	27	3.98	2.75–5.72	Multiparous breech
Robson Group 8	24	3.53	2.39–5.21	Multiple pregnancy
Robson Group 9	17	2.50	1.57–3.97	Transverse/oblique lie
Robson Group 10	205	30.19	26.86–33.75	Preterm single cephalic
Robson — total	679	100.00	—	x^2=547.495, p<0.001, w=0.898

*Severity percentages are of caesarean cases (n=560); Robson percentages are of all deliveries (n=679). ns, not significant; ***p<0.001. CI, Wilson confidence interval.*

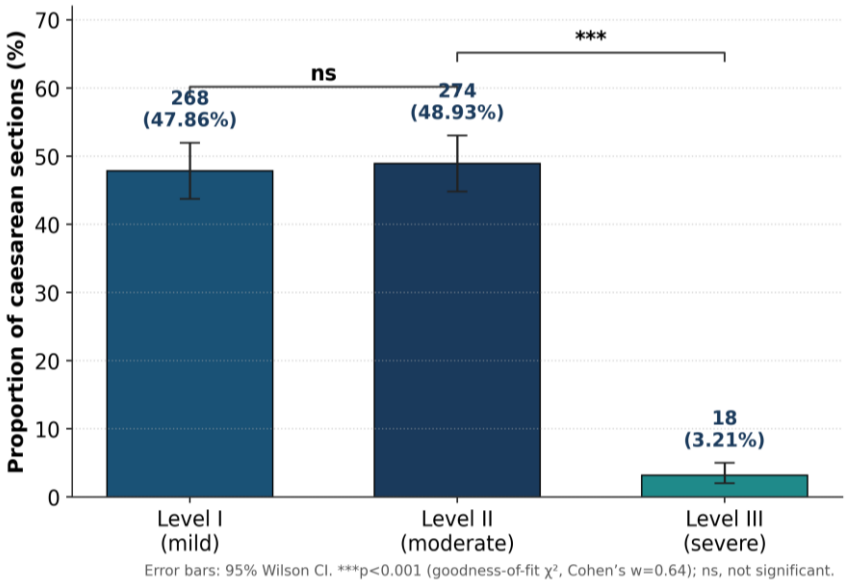

Figure 1. Severity-level distribution of caesarean sections (n=560) with 95% Wilson confidence intervals. Levels I and II did not differ significantly; level III was significantly rarer (goodness-of-fit chi-square, p<0.001; Cohen's w=0.639).

Robson distribution

The Robson profile is shown in Table 2 and ranked in Figure 2. Across all 679 deliveries, Group 10 (preterm single cephalic) was the largest group at 205 deliveries (30.19%, 95% CI 26.86–33.75), followed by Group 5 (previous caesarean) at 148 (21.80%) and Group 2 at 102 (15.02%). Groups 5 and 10 together accounted for 51.99% (95% CI 48.23–55.72), while the lower-risk Groups 1–4 contributed 244 deliveries (35.94%). The distribution departed markedly from uniform (goodness-of-fit chi-square = 547.495, df = 9, p<0.001; Cohen's w = 0.898).

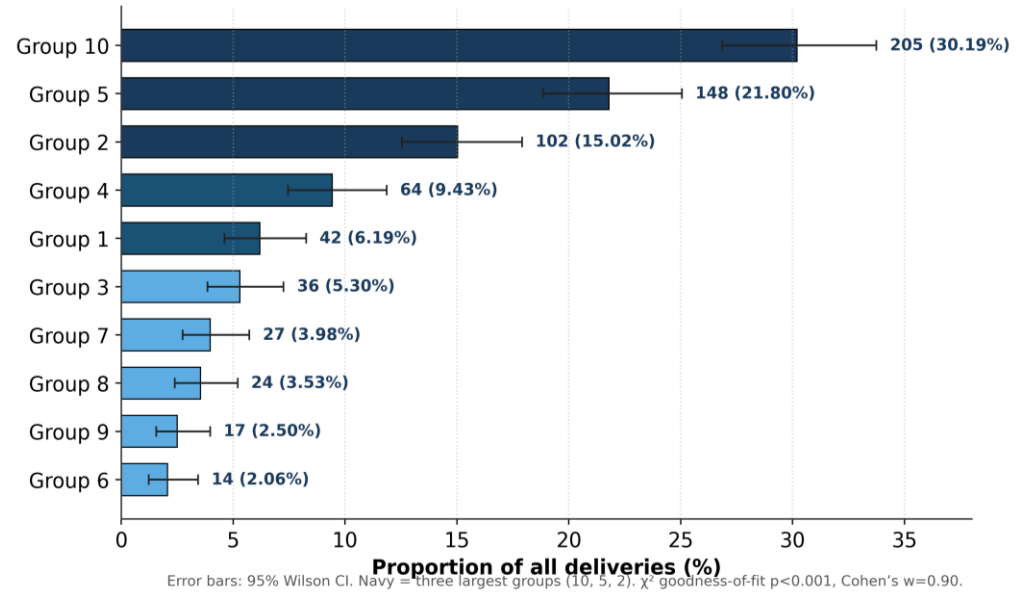

Figure 2. Robson Ten-Group Classification distribution of all deliveries (n=679), ordered by frequency with 95% Wilson confidence intervals. Groups 10, 5 and 2 dominate the casemix (goodness-of-fit chi-square, p<0.001; Cohen's w=0.898).

Benchmark comparisons

The benchmarked indicators are presented in Table 3 and displayed as a forest plot in Figure 3. Robson Group 10 was more than twice the Indonesian national mean of 14.20% (PR 2.13, 95% CI 1.90–2.38, z = 11.938, p<0.001), an absolute excess of about 16 percentage points, but did not differ significantly from a national multicentre series of 27.82% (OR 1.12, 95% CI 0.93–1.35, p=0.222). Severity level III did not differ from the 2018 baseline of 4.07% (OR 0.78, 95% CI 0.39–1.57, p=0.488).

Table 3. Benchmark and inferential analysis of caesarean indicators against external standards.

Comparison	Observed	Effect size	95% CI	p-value
Overall caesarean rate vs WHO 15% ceiling	82.47%	PR 5.50	5.31–5.69	<0.001
Robson Group 10 vs Indonesian mean (14.20%)	30.19%	PR 2.13	1.90–2.38	<0.001
Robson Group 10 vs national series (27.82%)	30.19%	OR 1.12	0.93–1.35	0.222
Severity III vs 2018 baseline (4.07%)	3.21%	OR 0.78	0.39–1.57	0.488
Severity distribution (goodness-of-fit)	3 tiers	x^2=228.700	w=0.639	<0.001
Robson distribution (goodness-of-fit)	10 groups	x^2=547.495	w=0.898	<0.001

Notes: PR, prevalence ratio (vs fixed external standard); OR, odds ratio (vs published comparator); goodness-of-fit by Pearson chi-square with Cohen's w. "<0.001" denotes p below 0.001.

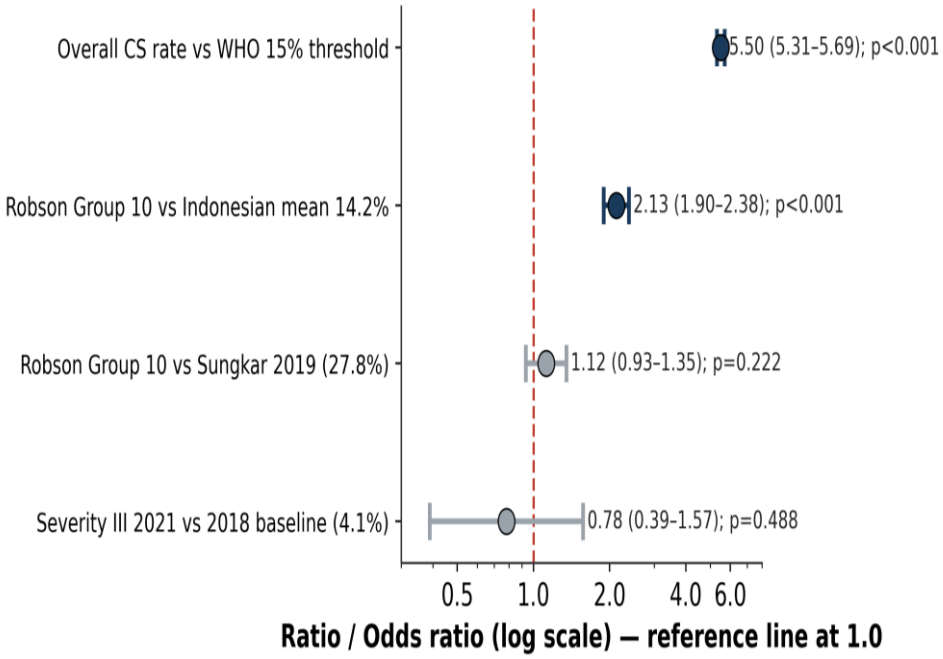

Figure 3. Forest plot of benchmark comparisons. Prevalence ratios for fixed external standards and odds ratios for study-to-study comparisons; navy denotes significance (95% CI excludes 1.0), grey non-significance. Reference line at 1.0.

Record completeness and absolute differences

The majority of records carried complete Robson-defining variables; a small number lacking reliable dating (mostly referred preterm pregnancies) were excluded, which would tend to underestimate rather than inflate Group 10. As shown in Table 3, Group 10 exceeded the national mean by about 16 percentage points and the overall caesarean fraction exceeded the WHO reference by about 67 percentage points, translating into large additional case volumes for an apex facility.

4. Discussion

This census of caesarean sections at the apex referral hospital for central Sumatra produced three principal findings. First, the overall caesarean fraction reached 82.47% (95% CI 79.43–85.15), more than five times the WHO 15% reference ceiling; this is a property of an apex-referral catchment and should not be read as a population-level rate. Second, the clinical-severity distribution was dominated by moderate (level II, 48.93%) and mild (level I, 47.86%) cases, with severe cases (level III) comprising only 3.21% (Table 2, Figure 1). Third, the Robson distribution was led by Group 10 (preterm single cephalic, 30.19%), followed by Group 5 (previous caesarean, 21.80%) and Group 2 (15.02%) — a referral-driven inversion of the usual Robson hierarchy (Figure 2).

The predominance of Robson Group 10 is the most distinctive feature of this casemix. The WHO Robson implementation manual notes that referral hospitals typically show a Group 10 size of about 30%, and our value of 30.19% (Table 3) sits within that expectation and is statistically indistinguishable from a large Indonesian multicentre series reporting 27.82% (OR 1.12, 95% CI 0.93–1.35).[7,9] At the same time, Group 10 was more than double the Indonesian national mean of 14.20% (PR 2.13, 95% CI 1.90–2.38), quantifying the concentration of preterm, high-risk pregnancies funnelled to a type A facility, mirroring the expansion of high-risk groups in tertiary centres elsewhere.[11,16] The internal composition of Group 10 matters, because iatrogenic preterm delivery is potentially modifiable through better antenatal management.

The Group 5 contribution (21.80%) accords with the literature, in which previous caesarean is a leading, self-reinforcing source of repeat surgery, often with group caesarean rates approaching unity.[9,17] Because each primary caesarean today seeds a future Group 5 delivery, preventing unnecessary primary caesareans and, where safe, offering trial of labour after caesarean are the durable levers.[17] The substantial Group 2 share (15.02%) points to induction practice and first-birth management as additional, highly modifiable targets, consistent with audits that flag Groups 1, 2 and 5 as the principal modifiable contributors.[9,10]

Placed alongside other contemporary tertiary audits, the present profile is internally coherent: Turkish, Indian and Ugandan tertiary series report Groups 5, 2 and 10 as their dominant contributors, with Group 5 caesarean rates approaching unity once a previous scar is present.[7-10] The distinguishing feature of the central-Sumatran casemix is the elevation of Group 10 to first rank, the clearest quantitative signature of an apex referral hospital absorbing the region's preterm and high-risk pregnancies, and an argument that such facilities should be benchmarked against other apex centres and their own history rather than population targets.[12,22]

Results differ from those reported in lower-tier facilities, where lower-risk groups dominate and severe cases are uncommon because complications are referred upward.[8] The presence of severe (level III) cases here is expected for an apex hospital, and the severe fraction did not differ from the 2018 institutional baseline of 4.07% (OR 0.78, 95% CI 0.39–1.57; Table 3), indicating the rise in caesareans accrued in the mild and moderate tiers; this assumes equivalent 2018 and 2021 severity definitions.

A plausible mechanistic hypothesis — offered as a mechanism consistent with the casemix, since no analytes were assayed — links the severity distribution to the comorbidity and biochemical-derangement burden the INA-CBGs tier encodes: hypertensive disorders, haemorrhage, infection and metabolic derangement activate endothelial dysfunction and perturb coagulation and inflammatory pathways, raising peri-operative risk.[5,6] The pattern is consistent with the 2021 COVID-19 context, during which delivery mode and referral flow

shifted and infection prompted upward referral and surgical delivery.[4,18]

These findings carry concrete implications. Because Group 10 dominates and exceeds the national mean twofold, preterm-birth prevention and referral optimisation should be the foremost audit priority. We propose a quarterly severity-stratified Robson dashboard with defined review triggers, linked to cervical-length screening, progesterone for short cervix, corticosteroid stewardship and structured transfer protocols; Robson-guided multi-component interventions can safely moderate caesarean rates without harming outcomes.[15,19-21]

In context, the high facility fraction reflects referral function, not population overuse; national data show steep rises with wealth and regional inequalities.[3,13,14] Strengthening lower-tier facilities so that uncomplicated labours are managed closer to home would, over time, sharpen the apex casemix and improve equity. This study should be read as a structural (group-size) audit rather than a complete Robson analysis: within-group caesarean rates and contributions await data on vaginal deliveries by group.[15,22]

Strengths

The study analysed a complete annual census (n=679) from the only type A referral hospital in the province, eliminating sampling bias and yielding precise estimates; it applied the WHO-endorsed Robson system with an explicit severity tier and upgraded a descriptive dataset with confidence intervals, goodness-of-fit testing, effect sizes and external benchmarking, with computations independently verified.

Limitations

The retrospective secondary-data design captured only documented information and excluded incomplete records. The severity tier is administrative, not a validated score, and may carry coding bias; inter-rater reliability was unavailable. Per-group caesarean rates and contributions could not be computed because vaginal-delivery counts per group were unavailable. Maternal and neonatal outcomes were not analysed, so the severity tier is a complexity proxy. Single-centre, single-year apex data limit generalisability.

5. Conclusion

In this tertiary referral population in West Sumatra, caesarean sections were dominated by moderate and mild clinical-severity cases, with severe cases a small but stable fraction, and the Robson casemix was led by preterm single-cephalic pregnancies (Group 10, 30.19%), previous caesarean (Group 5) and nulliparous induced or pre-labour caesarean (Group 2). The high facility caesarean fraction (82.47%) reflects apex-referral function rather than population-level overuse. Group 10 exceeded the national mean twofold (PR 2.13, 95% CI 1.90–2.38), identifying preterm pregnancies as the principal driver. Indonesian tertiary services should adopt routine, severity-stratified Robson auditing — ideally a quarterly dashboard with defined review triggers — and prioritise preterm-birth prevention and referral optimisation. Future multicentre research linking per-group caesarean rates, validated severity scoring and neonatal outcomes is needed.

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