

Changes in Cesarean Section Rates Following a Multifaceted Institutional Obstetric Quality Improvement Strategy: A Robson Ten-Group Classification Analysis

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Abstract

Objective: To evaluate changes in overall and Robson group-specific cesarean section (CS) rates following implementation of a multifaceted institutional obstetric quality improvement strategy in a tertiary referral center. **Methods:** This single-center, retrospective, quasi-experimental before-and-after study included 13,595 deliveries: 11,238 before intervention (October 2023–November 2025) and 2,357 after intervention (December 2025–June 2026). The intervention integrated national clinical guidance into routine practice through multidisciplinary education, standardized labor management, assessment of failed induction, reassessment of fetal heart rate monitoring before CS, review of CS indications, strengthened midwifery involvement, and expanded antenatal education. Deliveries were classified using the Robson Ten-Group Classification System. Overall and group-specific CS rates were compared, with risk differences (RDs), relative risks (RRs), and 95% confidence intervals calculated. **Results:** The overall CS rate decreased significantly from 68.4% to 62.4% after intervention (RD, -6.0 percentage points; 95% CI, -8.1 to -3.9; RR, 0.91; 95% CI, 0.88–0.94; $p<0.001$). Significant reductions were observed in Robson Groups 1, 2, 3, 8, and 10. The largest reduction occurred in Group 3 (31.5% vs. 19.6%; RD, -11.9 percentage points; RR, 0.62; $p<0.001$). Group 5 remained the largest contributor to total cesarean deliveries. **Conclusion:** A multifaceted institutional quality improvement strategy was associated with a significant reduction in the overall CS rate and reductions in selected Robson groups. Robson-based audit may provide a practical framework for identifying target populations, evaluating obstetric practice changes, and supporting continuous quality improvement.

Keywords: Cesarean Section; Quality Improvement; Labor, Obstetric; Pregnancy Outcome; Delivery, Obstetric

1. Introduction

Cesarean section (CS) is one of the most important interventions in modern obstetric care and can be life-saving for both the mother and the newborn when medically

indicated. However, its use has increased substantially worldwide during the past two decades, with rates exceeding those expected on the basis of obstetric necessity in many countries¹. Although inadequate access to CS remains a major concern in low-resource settings, excessive use without clear medical indication has become an equally important public health issue. Unnecessary CS has been associated with increased maternal morbidity, adverse outcomes in subsequent pregnancies, neonatal respiratory complications, and greater healthcare costs, highlighting the importance of optimizing rather than simply increasing or decreasing cesarean section rates¹⁻³.

Reliable evaluation of institutional cesarean section practices requires standardized methods that account for differences in obstetric case mix. To address this need, Robson proposed the Ten-Group Classification System (TGCS), which classifies every woman admitted for delivery into one of ten mutually exclusive and totally inclusive groups using six routinely collected obstetric variables⁴. Because of its simplicity, reproducibility, and clinical applicability, the World Health Organization (WHO) recommends the Robson classification as the international standard for monitoring, auditing, and comparing cesarean section rates across healthcare institutions⁵. Subsequent systematic reviews have confirmed that the Robson classification is a practical and robust tool for identifying the obstetric populations contributing most to overall CS rates and for evaluating changes in clinical practice⁶. More recently, a European systematic review and meta-analysis demonstrated considerable variation in Robson group distributions across Europe while consistently identifying women with a previous cesarean section (Robson Group 5) as the largest contributor to institutional cesarean section rates⁷.

Several clinical and non-clinical interventions have been proposed to reduce unnecessary cesarean deliveries, including implementation of evidence-based labor management protocols, standardized criteria for labor induction and labor arrest, audit and feedback systems, mandatory second opinions, and antenatal education programs^{8,9}. Evidence suggests that multifaceted quality improvement initiatives combining these strategies are more effective than isolated interventions in safely reducing unnecessary cesarean sections⁸. Furthermore, Topçu et al. demonstrated that implementation of institutional practice changes guided by the Robson classification was associated with a significant reduction in cesarean section rates in a tertiary obstetric center in Türkiye¹⁰. Nevertheless, evidence evaluating changes in both overall and Robson group-specific cesarean section rates following multifaceted institutional interventions remains comparatively limited. Therefore, the present study aimed to evaluate changes in overall and Robson group-specific cesarean section rates following implementation of a multifaceted institutional obstetric practice change in a tertiary referral center.

2. Materials and Methods

2.1. Study design

This single-center, retrospective, quasi-experimental before-and-after study compared cesarean section rates before and after implementation of institutional obstetric practice changes in December 2025. The pre-intervention period included deliveries from October 2023 through November 2025, whereas the post-intervention period included deliveries from December 2025 through June 2026.

2.2. Study population

All deliveries that occurred in our clinic during the study period were included. Deliveries were classified according to mode of birth as vaginal delivery or cesarean section. All cases were further categorized using the Robson Ten-Group Classification System.

A total of 11,238 deliveries were evaluated in the pre-intervention period and 2,357 deliveries in the post-intervention period. Overall, 13,595 deliveries were included in the analysis.

2.3. Definition of the intervention

Prior to formal implementation, a preparatory phase was undertaken during which national clinical recommendations were reviewed, multidisciplinary staff education was initiated, and the planned practice changes were progressively incorporated into local clinical workflows. Beginning in December 2025, a multifaceted institutional obstetric quality improvement strategy was implemented following structured integration of national clinical guidance into routine practice. The intervention was informed by the Turkish Ministry of Health Cesarean Section Clinical Protocol¹¹, the Clinical Protocol for Vaginal Birth After Cesarean Section¹², and the Clinical Guideline for Management of Labor for Midwives¹³. December 2025 was defined as the implementation milestone because, by this time, the relevant national recommendations had been incorporated into local clinical workflows, the planned educational and practice changes had been fully integrated into routine clinical practice, and multidisciplinary staff education involving obstetric specialists, residents, and midwives had been reinforced.

The intervention was implemented as a coordinated practice-change package rather than as a single isolated measure. Obstetric specialists and residents received structured departmental education and reinforcement regarding standardized labor management, appropriate indications for cesarean delivery, longer observation of labor when maternal and fetal conditions were reassuring, standardized assessment of labor progress and failed induction, and reassessment of fetal heart rate monitoring findings before proceeding to cesarean delivery when clinically appropriate. Cesarean indications were also reviewed within departmental quality improvement activities to promote consistency in clinical decision-making and reduce potentially avoidable variation in practice.

In parallel, midwifery practice was strengthened through education and greater integration of midwives into standardized intrapartum care. This component emphasized structured assessment of labor progress, maternal and fetal surveillance, supportive care during labor, timely recognition of deviations from normal labor, and multidisciplinary communication. Midwife-led outpatient services were used more actively to support antenatal counseling, preparation for labor, and promotion of vaginal birth when clinically appropriate.

The hospital-based antenatal education program ("Pregnancy School") was also expanded and used more actively. Pregnant women received structured education and counseling regarding the labor process, pain management options, expectations during vaginal birth, and the benefits and safety of vaginal delivery when no obstetric contraindication was present. Counseling regarding mode of birth was reinforced throughout antenatal care, including individualized discussion for women with a previous cesarean delivery when clinically appropriate.

Overall, the intervention aimed to translate national evidence-based recommendations into routine institutional practice through multidisciplinary education, standardized labor and cesarean decision-making, strengthened midwifery involvement, enhanced antenatal counseling, and continuous review of cesarean indications. No single component was considered the sole intervention; rather, the post-intervention period represented the phase after coordinated institutional integration of these measures into routine clinical practice.

2.4. Robson Ten-Group Classification

All deliveries were classified according to the Robson Ten-Group Classification System based on parity, previous cesarean section, gestational age, fetal presentation,

plurality, and onset of labor. The ten Robson groups used in this study are summarized in Table S1⁴. This classification was used to evaluate the distribution of the obstetric population, group-specific cesarean section rates, and the contribution of each group to the overall institutional cesarean section rate.

2.5. Outcomes

The primary outcome was the change in the overall cesarean section rate between the pre-intervention and post-intervention periods.

Secondary outcomes were determined according to Robson groups and included total number of deliveries, number of cesarean sections, number of vaginal deliveries, group-specific cesarean section rate, relative size, absolute contribution to the overall cesarean section rate, and relative contribution to total cesarean sections.

2.6. Statistical analysis

Categorical variables were presented as numbers and percentages. Since continuous variables were not available in the dataset, descriptive statistics for continuous variables were not calculated.

Overall cesarean section rates before and after the intervention were compared using the Pearson chi-square test. For Robson group-specific comparisons, 2×2 contingency tables were created for each group. Pearson chi-square test was used when expected cell counts were sufficient, and Fisher's exact test was used when expected cell counts were below 5.

Effect size was assessed by calculating risk difference, relative risk, and corresponding 95% confidence intervals, using the pre-intervention period as the reference category. Risk difference represented the absolute percentage-point difference between periods, while relative risk represented the ratio of cesarean section risk in the post-intervention period compared with the pre-intervention period.

All statistical tests were two-sided, and a p value <0.05 was considered statistically significant.

2.7. Ethical considerations

This retrospective study was conducted using routinely collected clinical data without patient identifiers. The study protocol was approved by the Institutional Ethics Committee of Izmir City Hospital (Approval No: 2026/38; Date: 17/08/2026). The study was conducted in accordance with the principles of the Declaration of Helsinki.

3. Results

3.1. Overall study population

A total of 13,595 deliveries were included in the analysis, comprising 11,238 deliveries during the pre-intervention period and 2,357 during the post-intervention period.

3.2. Overall cesarean section rate

During the pre-intervention period, 7,684 of 11,238 deliveries (68.4%) resulted in cesarean section, whereas 3,554 (31.6%) were vaginal births. Following implementation of the institutional intervention, the cesarean section rate decreased to 62.4% (1,470/2,357), while the proportion of vaginal deliveries increased to 37.6% (887/2,357).

This reduction in the overall cesarean section rate was statistically significant (Pearson χ^2 , $p < 0.001$). The absolute risk difference was -6.0 percentage points (95% CI, -8.1 to -3.9), and the relative risk was 0.91 (95% CI, 0.88–0.94), indicating an approximately 9% lower risk of cesarean delivery in the post-intervention period compared with the pre-intervention period (Table 1).

Table 1. Overall deliveries and cesarean section rates

Period	Total deliveries	Cesarean section, n	Vaginal delivery, n	Cesarean section rate (%)
Pre-intervention	11,238	7,684	3,554	68.4
Post-intervention	2,357	1,470	887	62.4

Pearson χ^2 test: $p < 0.001$

Risk difference (RD): -6.0 percentage points (95% CI, -8.1 to -3.9)

Relative risk (RR): 0.91 (95% CI, 0.88–0.94)

Abbreviations: CI, confidence interval; RD, risk difference; RR, relative risk.

3.3. Distribution of Robson groups

The distribution of deliveries across the Robson groups differed significantly between the pre- and post-intervention periods (overall Pearson χ^2 , $p < 0.001$). The relative proportion of Robson Group 2 increased from 11.0% to 16.6%, while Group 4 increased from 6.7% to 9.5%. In contrast, the proportions of Group 3 (13.9% vs. 8.7%) and Group 10 (17.6% vs. 14.0%) decreased. Robson Group 5 remained the largest obstetric population throughout the study, accounting for approximately one-quarter of all deliveries in both periods (24.2% vs. 24.0%) (Table 2).

Table 2. Distribution of deliveries according to the Robson Ten-Group Classification (Relative size)

Robson group	Pre-intervention, n (%)	Post-intervention, n (%)	Absolute change (percentage points)
1	2,109 (18.8)	396 (16.8)	-2.0
2	1,232 (11.0)	391 (16.6)	+5.6
3	1,567 (13.9)	204 (8.7)	-5.3
4	758 (6.7)	224 (9.5)	+2.8
5	2,724 (24.2)	566 (24.0)	-0.2
6	191 (1.7)	68 (2.9)	+1.2
7	182 (1.6)	50 (2.1)	+0.5
8	458 (4.1)	121 (5.1)	+1.1
9	40 (0.4)	7 (0.3)	-0.1
10	1,977 (17.6)	330 (14.0)	-3.6

Overall comparison: Pearson χ^2 test (2×10 contingency table), $p < 0.001$.

Footnote: Relative size was calculated as the proportion of deliveries in each Robson group among all deliveries within the corresponding study period.

Legend: The distribution of obstetric populations differed significantly between the pre-intervention and post-intervention periods, indicating changes in the relative size of several Robson groups following implementation of the institutional intervention.

3.4. Cesarean section rates according to Robson groups

Group-specific analysis demonstrated significant reductions in cesarean section rates in Robson Groups 1, 2, 3, 8, and 10 (Table 3).

The largest absolute reduction was observed in Robson Group 3, where the cesarean section rate decreased from 31.5% to 19.6% (RD -11.9 percentage points; 95% CI, -17.8 to -5.9; RR 0.62, 95% CI 0.47–0.83; $p < 0.001$). This group demonstrated the largest relative change between periods, corresponding to a 38% lower risk of cesarean delivery in the post-intervention period compared with the pre-intervention period.

Table 3. Cesarean section rates according to the Robson Ten-Group Classification

Robson group	Pre-intervention CS (%)	Post-intervention CS (%)	RD (95% CI)	RR (95% CI)	p value
1	63.7	55.6	−8.2 (−13.5 to −2.9)	0.87 (0.79–0.96)	0.002
2	39.8	33.0	−6.8 (−12.2 to −1.4)	0.83 (0.71–0.97)	0.016
3	31.5	19.6	−11.9 (−17.8 to −5.9)	0.62 (0.47–0.83)	<0.001
4	23.7	18.8	−5.0 (−10.9 to +0.9)	0.79 (0.58–1.07)	0.116
5	99.6	99.5	−0.1 (−0.8 to +0.5)	1.00 (0.99–1.01)	0.720
6	95.3	97.1	+1.8 (−3.2 to +6.8)	1.02 (0.97–1.07)	0.733
7	95.1	90.0	−5.1 (−13.9 to +3.8)	0.95 (0.86–1.04)	0.189
8	96.7	90.1	−6.6 (−12.2 to −1.1)	0.93 (0.88–0.99)	0.002
9	100.0	100.0	0.0	—	—
10	82.2	75.5	−6.8 (−11.7 to −1.9)	0.92 (0.86–0.98)	0.003

Risk difference (RD) was calculated as the absolute difference in cesarean section rates between the post-intervention and pre-intervention periods. Negative RD values indicate a reduction in the cesarean section rate following implementation of the intervention. Relative risk (RR) was calculated using the pre-intervention period as the reference.

Significant reductions in cesarean section rates were observed in Robson Groups 1, 2, 3, 8, and 10. Although a reduction was observed in Group 4, the difference did not reach statistical significance. No significant differences were identified in Groups 5, 6, or 7. Statistical comparison was not performed for Group 9 because all deliveries were by cesarean section in both study periods.

Abbreviations: CI, confidence interval; CS, cesarean section; RD, risk difference; RR, relative risk.

Significant reductions were also observed in Group 1 (63.7% vs. 55.6%; RD −8.2 percentage points; RR 0.87; $p=0.002$), Group 2 (39.8% vs. 33.0%; RD −6.8 percentage points; RR 0.83; $p=0.016$), Group 8 (96.7% vs. 90.1%; RD −6.6 percentage points; RR 0.93; $p=0.002$), and Group 10 (82.2% vs. 75.5%; RD −6.8 percentage points; RR 0.92; $p=0.003$).

Although the cesarean section rate declined in Robson Group 4 (23.7% vs. 18.8%), the difference did not reach statistical significance ($p=0.116$). No statistically significant differences were observed in Groups 5, 6, or 7. Statistical comparison was not informative for Group 9 because all deliveries in both periods were by cesarean section, resulting in no outcome variability (Table 3).

3.5. Contribution of Robson groups to the overall cesarean section rate

Changes in both the absolute and relative contributions of each Robson group are summarized in Table 4. The greatest reductions in absolute contribution to the institutional cesarean section rate were observed in Robson Groups 10 (14.5% vs. 10.6%), 3 (4.4% vs. 1.7%), and 1 (12.0% vs. 9.3%).

Despite virtually no change in its group-specific cesarean section rate, Robson Group 5 remained the largest contributor to all cesarean deliveries. Its relative contribution increased from 35.3% before the intervention to 38.3% after the intervention. Conversely, the relative contributions of Robson Groups 1, 3, and 10 declined substantially, reflecting a combination of reductions in group-specific cesarean rates and changes in the relative size of these obstetric populations (Table 4).

Table 4. Contribution of each Robson group to the overall cesarean section rate before and after the intervention

Robson group	Absolute contribution (%) Pre	Absolute contribution (%) Post	Δ	Relative contribution (%) Pre	Relative contribution (%) Post	Δ
1	12.0	9.3	−2.6	17.5	15.0	−2.5
2	4.4	5.5	+1.1	6.4	8.8	+2.4
3	4.4	1.7	−2.7	6.4	2.7	−3.7

4	1.6	1.8	+0.2	2.3	2.9	+0.5
5	24.1	23.9	−0.3	35.3	38.3	+3.0
6	1.6	2.8	+1.2	2.4	4.5	+2.1
7	1.5	1.9	+0.4	2.3	3.1	+0.8
8	3.9	4.6	+0.7	5.8	7.4	+1.6
9	0.4	0.3	−0.1	0.5	0.5	0.0
10	14.5	10.6	−3.9	21.2	16.9	−4.2

Absolute contribution was calculated as the proportion of all deliveries delivered by cesarean section within each Robson group relative to the total number of deliveries during the corresponding study period.

Relative contribution was calculated as the proportion of all cesarean sections attributable to each Robson group relative to the total number of cesarean deliveries during the corresponding study period.

Δ represents the change calculated as the post-intervention value minus the pre-intervention value (post-intervention – pre-intervention).

The largest reductions in the overall cesarean section rate were attributable to Robson Groups 10, 3, and 1. Despite an unchanged group-specific cesarean section rate, Robson Group 5 remained the largest contributor to the institutional cesarean section burden and accounted for 38.3% of all cesarean deliveries after the intervention. This increase in relative contribution reflects the decline in cesarean deliveries among other Robson groups rather than an increase in repeat cesarean sections.

4. Discussion

The present study found that implementation of a multifaceted institutional quality improvement program was associated with a statistically significant 6.0-percentage-point reduction in the overall cesarean section rate, corresponding to an approximately 9% lower risk of cesarean delivery in the post-intervention period. Significant reductions were observed in Robson Groups 1, 2, 3, 8, and 10, whereas women with a previous cesarean delivery (Robson Group 5) remained the largest contributors to institutional cesarean deliveries, consistent with international evidence⁷. These findings suggest that structured institutional practice changes may be associated with lower cesarean section rates in selected obstetric populations¹. By reporting risk differences and relative risks alongside conventional significance testing, the present study quantifies the magnitude of observed between-period changes and facilitates clinical interpretation^{6,10}. To our knowledge, this is one of the few before-and-after studies evaluating changes following implementation of a multifaceted institutional quality improvement program in both overall and Robson group-specific cesarean section rates using effect size measures, including risk difference and relative risk. Importantly, the distribution of deliveries across Robson groups differed significantly between the pre- and post-intervention periods. Therefore, the observed reduction in the overall cesarean section rate should be interpreted in the context of both changes in group-specific cesarean section rates and shifts in the distribution of the obstetric population, rather than being attributed solely to changes in cesarean delivery practice within individual Robson groups. However, given the relatively short post-intervention observation period compared with the pre-intervention period, the observed findings should primarily be interpreted as short-term post-implementation changes. Longer follow-up is required to determine whether these changes are sustained over time.

The intervention combined several evidence-based organizational and clinical measures, including prolonged observation of active labor, standardized criteria for failed induction, reassessment of fetal heart rate monitoring before cesarean delivery, promotion of vaginal birth, standardized labor management protocols, regular audit of cesarean indications, and expansion of structured antenatal education. Such a multifaceted approach reflects the interaction of clinical and organizational factors underlying cesarean use. Systematic reviews have shown that quality improvement initiatives integrating guideline

implementation, audit and feedback, professional education, and institutional policy changes may reduce unnecessary cesarean delivery^{8,14}. Recent evidence synthesizing systematic reviews has further emphasized the role of evidence-based medical procedures across the cesarean care pathway in optimizing maternal and neonatal outcomes¹⁵. This approach is consistent with WHO recommendations supporting evidence-based intrapartum care and avoidance of unnecessary obstetric interventions¹⁶, ACOG guidance emphasizing standardized labor management and multidisciplinary quality improvement^{17,18}, and FIGO recommendations promoting appropriate cesarean use through standardized clinical decision-making¹⁹. Because these measures were implemented concurrently as a coordinated, multifaceted strategy, the relative contribution of any individual component to the observed changes cannot be determined from the present study.

The greatest reductions were observed among women in Robson Groups 1, 2, and 3, representing women with singleton term cephalic pregnancies without a previous cesarean delivery. Group 3 showed the largest between-period change, with cesarean section risk approximately 38% lower in the post-intervention period. This finding is clinically plausible because decisions regarding labor progress, failed induction, and intrapartum assessment strongly influence cesarean delivery in otherwise low-risk pregnancies. Contemporary evidence indicates that normal labor may progress more slowly than previously recognized, particularly before active labor is established, and that premature diagnosis of labor arrest may increase primary cesarean delivery^{17,20}. Similarly, modern definitions of failed induction support allowing adequate time for cervical change when maternal and fetal conditions remain reassuring^{17,21}. The reductions observed in these low-risk Robson groups are consistent with the expected direction of change following greater adherence to contemporary labor management principles; however, adherence was not directly measured in this study.

A significant reduction was also observed in Robson Group 8. This finding should be interpreted cautiously given the clinical heterogeneity of multiple pregnancies and the absence of detailed information on fetal presentation, chorionicity, and indication-specific decision-making. Accordingly, the mechanisms underlying the observed between-period change in this group cannot be determined from the available data, and the reduction cannot be directly attributed to the institutional intervention.

Robson Group 10 likewise demonstrated a significant reduction in cesarean section rates. However, this between-period difference should not be directly attributed to the institutional intervention. The absence of detailed data on cesarean indications and fetal monitoring patterns precludes identification of the specific mechanisms underlying this finding. Current international recommendations emphasize that cardiotocographic findings should be interpreted within the overall clinical context rather than as isolated indications for cesarean delivery^{16,18}. Given the clinical heterogeneity of preterm birth, this finding requires cautious interpretation.

Despite the overall decline in cesarean section rates, Robson Group 5 remained the largest contributor to the institutional cesarean burden, consistent with international and European evidence⁷. Because the size of this group partly reflects the cumulative effect of primary cesarean delivery, efforts to achieve sustained reductions should include prevention of unnecessary primary cesarean deliveries among low-risk women, which may help limit the future size of Robson Group 5 and its contribution to the institutional cesarean burden¹. Further improvement may also require evidence-based management of women with previous cesarean delivery, including appropriate counseling regarding trial of labor after cesarean, careful patient selection, and standardized VBAC protocols in accordance with current RCOG recommendations²².

The present findings also reinforce the value of the Robson Ten-Group Classification System as a standardized framework for identifying obstetric populations contributing

most to institutional cesarean section rates and for longitudinally monitoring changes in cesarean delivery practice within the same institution^{4,6}. In this context, continuous Robson-based audit may support targeted quality improvement by distinguishing changes in group-specific cesarean rates from shifts in the underlying obstetric population structure.

4.1. Strengths

This study has several strengths. First, it included more than 13,000 consecutive deliveries from a high-volume tertiary referral center, providing a large real-world dataset reflecting routine obstetric practice. Second, all deliveries were classified using the internationally accepted Robson Ten-Group Classification System, enabling standardized evaluation of the obstetric populations contributing to institutional cesarean section rates and facilitating comparison with national and international studies^{4,6}. Third, the analysis reported risk differences, relative risks, and 95% confidence intervals alongside conventional hypothesis testing, allowing the magnitude and precision of observed between-period changes to be assessed rather than relying solely on statistical significance. Finally, the institutional strategy was pragmatic and incorporated organizational, educational, and clinical practice changes that may be feasible in other maternity settings without substantial additional infrastructure. This pragmatic approach may facilitate adaptation of similar quality improvement strategies in other maternity settings^{8,14}.

4.2. Limitations

Several limitations should be considered when interpreting these findings. First, this was a retrospective, single-center, uncontrolled before-and-after study. Consequently, the observed changes cannot be attributed solely to the intervention and may have been influenced by secular trends, changes in referral patterns, shifts in obstetric case mix, or other unmeasured contemporaneous factors. The unequal duration of the pre- and post-intervention periods further limits direct temporal comparability, and longer follow-up is needed to determine whether the observed changes are sustained over time. Furthermore, because the study was conducted in a single tertiary referral center with a relatively high baseline cesarean section rate, the generalizability of these findings to institutions with different patient populations, referral patterns, or baseline cesarean section rates may be limited.

Second, the intervention comprised multiple components implemented as part of a single institutional quality improvement strategy, including standardized labor management, revised failed induction criteria, reassessment of fetal monitoring before cesarean delivery, review of cesarean indications, promotion of vaginal birth, and expanded antenatal education. Therefore, the contribution of individual components to the observed changes cannot be determined. In addition, adherence to specific intervention components and implementation fidelity were not directly measured.

Third, detailed maternal baseline characteristics and maternal and neonatal outcome data were unavailable for adjusted analyses. Although the Robson classification accounts for several key obstetric characteristics by stratifying women according to parity, previous cesarean delivery, gestational age, fetal presentation, plurality, and onset of labor, residual confounding cannot be excluded^{4,6}. Moreover, the distribution of deliveries across Robson groups differed between periods, indicating changes in the underlying obstetric population structure that may have influenced the overall institutional cesarean section rate.

Fourth, maternal and neonatal safety outcomes were not evaluated. Therefore, the present study cannot determine whether the observed reduction in cesarean section rates was accompanied by changes in outcomes such as severe maternal morbidity, postpartum hemorrhage, neonatal intensive care unit admission, low Apgar scores, umbilical cord acidemia, or perinatal morbidity and mortality. This limitation is particularly important

when interpreting reductions in cesarean delivery among preterm or otherwise complex obstetric populations.

Finally, detailed data on cesarean indications, cardiotocographic patterns, and clinical decision pathways were unavailable. Consequently, the mechanisms underlying the observed reductions in specific Robson groups, particularly Group 8 and 10, cannot be established. Prospective multicenter studies incorporating maternal and neonatal outcomes, detailed indication-level data, implementation fidelity measures, and longer post-intervention follow-up are warranted to assess the sustainability, safety, and generalizability of these findings.

5. Conclusions

Implementation of a multifaceted institutional quality improvement strategy was associated with a statistically significant 6.0-percentage-point reduction in the overall cesarean section rate, with the largest changes observed in selected Robson groups, particularly Groups 1, 2, and 3. Significant reductions were also observed in Groups 8 and 10, although the mechanisms underlying these changes could not be determined from the available data. Women with a previous cesarean delivery remained the largest contributors to the institutional cesarean burden, underscoring the importance of both preventing unnecessary primary cesarean deliveries and promoting evidence-based management after previous cesarean birth where clinically appropriate.

These findings support the use of the Robson Ten-Group Classification System as a standardized framework for institutional audit, identification of target obstetric populations, and monitoring of changes in cesarean section practice over time. Given the uncontrolled before-and-after design, the observed reductions should be interpreted as post-implementation associations rather than definitive causal effects. Further prospective multicenter studies are needed to evaluate the sustainability, safety, and generalizability of similar quality improvement strategies.

Author Contributions

Eda GÜNER ÖZEN: Methodology, Investigation, Data Curation, Formal Analysis, Validation, Visualization, Writing – Original Draft, Writing – Review & Editing.

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Yaşam Kemal AKPAK: Supervision, Validation, Writing – Review & Editing.

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Informed Consent Statement: Patient consent was waived due to the retrospective design of the study and the use of anonymized clinical data, as approved by the Institutional Ethics Committee.

Data Availability Statement: The data presented in this study are available from the corresponding author upon reasonable request. The data are not publicly available because they contain information that could compromise the privacy of research participants.

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Supplementary Table S1. Robson Ten-Group Classification System

Group	Definition
1	Nulliparous, singleton, cephalic, ≥ 37 weeks, spontaneous labor
2	Nulliparous, singleton, cephalic, ≥ 37 weeks, induced labor or cesarean section before labor
3	Multiparous without previous cesarean section, singleton, cephalic, ≥ 37 weeks, spontaneous labor
4	Multiparous without previous cesarean section, singleton, cephalic, ≥ 37 weeks, induced labor or cesarean section before labor
5	Previous cesarean section, singleton, cephalic, ≥ 37 weeks
6	All nulliparous breech pregnancies
7	All multiparous breech pregnancies, including previous cesarean section
8	All multiple pregnancies, including previous cesarean section
9	All transverse or oblique lies, including previous cesarean section
10	Singleton, cephalic, ≤ 36 weeks, including previous cesarean section

Abbreviations: CS, cesarean section.