The Journal of Obstetrics and Gynecology of India (January–February 2023) 73(1):36–43
https://doi.org/10.1007/s13224-022-01710-2

ORIGINAL ARTICLE

# Leadership Driven Persistent Reduction in Cesarean Trends: An Interventional Study for Quality Improvement

**Arpita De[1,2] · Reva Tripathi[1] · Neha Gupta[1] · Aruna Nigam[1] · Arifa Anwar[1]**

Received: 9 April 2022 / Accepted: 24 August 2022 / Published online: 17 September 2022


## Abstract

**Background** This is a quality improvement study in North India undertaken to observe the efficacy and safety of a proposed set of interventions along Quality Improvement guidelines to reduce cesarean rates.

**Materials and Methods** It was a retrospective cross-sectional study conducted in New Delhi. Measures were iteratively introduced from 2017 and improved using multiple PDSA (Plan, Do, Study, Act) cycles to note the overall reduction in cesarean rates. Chi square tests were done with subanalysis based on the Robsons classification.

**Results** There was a significant reduction of annual cesarean rates from 36.35 to 22.87% over four years ($p < 0.01$) and in neonatal nursery admissions ($p < 0.01$). Covid outbreak saw a comparatively increased cesarean rate in 2020, for which it was excluded from the detailed study. The relative risk of cesarean delivery in the postintervention period was 0.62. Maximum reductions were seen in Robsons II, VI &VII.

**Conclusion** Devising multipronged interventions and their implementation through PDSA cycles are essential. Such measures in moderate resources are replicable elsewhere as well.

**Keywords** Robsons TGCS · Cesraean audit · Quality improvement in obstetrics

## Abbreviations

| | |
|---|---|
| CS | Cesarean section |
| QI | Quality improvement |
| PDSA | Plan-Do-Study-Act |
| CTG | Cardiotocogram |
| TOLAC | Trial of Labor after cesarean |

## Introduction

There has been a marked increase in cesarean rates in India in the last few decades which currently range between 14% in government hospitals to 38–70% in private hospitals. However, this has not been accompanied with any substantial improvement in maternal and neonatal outcomes [1, 2]. Keeping in mind this exponential increase, reduction in cesarean delivery rates has been lately identified as an unmet need and can therefore be considered an important indicator of quality of obstetric services delivered.

The authors had conducted an earlier study to analyze the trends of cesareans and Robsons groups V, I & II were identified as those which contribute maximum to the overall cesarean rates. Certain suggestions were proposed at the end of that study which were incorporated in routine clinical practice subsequently [3].

The aim of the present study was to use the principles of Quality Improvement (QI) in the SQUIRE (Standards for Quality Improvement Reporting Excellence) guidelines, to incorporate certain interventions as identified earlier and compare the cesarean rates before and after interventions [4].

Arpita De (MS, FMAS, Diploma- Urogynecology. Associate Professor, Department of Obstetrics and Gynecology, Hamdard Institute of Medical Sciences and Research (HIMSR), Jamia Hamdard, Hamdard Nagar, New Delhi. Reva Tripathi (MS. Professor and Head of Department, Department of Obstetrics and Gynecology, HIMSR), Neha Gupta (MD, FMAS. Associate Professor, Department of Obstetrics and Gynecology, HIMSR), Aruna Nigam (MD, FMAS, MNAMS. Professor, Department of Obstetrics and Gynecology, HIMSR), Arifa Anwar (MD, Associate Professor, Department of Obstetrics and Gynecology, HIMSR).

✉ Arpita De
arpitade07@gmail.com

[1] Department of Obstetrics and Gynecology, Hamdard Institute of Medical Sciences and Research (HIMSR), Jamia Hamdard, Hamdard Nagar, New Delhi, India

[2] New Delhi, India

## Material and Methods

This retrospective cross-sectional study was conducted in a medical college in New Delhi to evaluate the influences of targeted interventions on cesarean section (CS) rates.

Cesareans at gestational age of more than 32 weeks were included. The annual number of total deliveries and cesarean deliveries were taken from the Annual Census prepared from the Labor room register. The perinatal data were obtained from the Neonatal ICU. All data were entered on Google sheets for analysis. The data were anonymized and therefore individual informed consent was not required.

Quality improvement measures were iteratively introduced from 2017 and improved using multiple PDSA (Plan, Do, Study, Act) cycles. A pre- and post-process measure study design was used. A comparison by Chi-square test was done on the outcome measures, viz.,—the overall reduction in cesarean rates and neonatal ICU admissions in the subsequent years. A subanalysis according to the Robsons classification was undertaken, based on the available complete case records retrieved from the Medical Records department.

The changes that were introduced in 2017 are listed below:

1. Organizational: The Head of the department took an active initiative to organize the obstetrics team. A labor ward senior consultant was identified who would directly supervise compliance to standardized protocols.
2. Standardizing Obstetric Protocols as below:
    a. Elective cesareans for indications of bad obstetric history, suspicion of cephalopelvic disproportion (CPD) prior to labor, infertility and cesareans on demand were stopped.
    b. Identification of a senior consultant to monitor compliance to instructions and for planning the delivery protocol of individual patients.
    c. Admission in labor ward was delayed till active labor set in. For postdated pregnancies induction was not done before 41 weeks.
    d. Latent phase was extended up to 5cm dilatation in keeping with the new reference [5].
    e. Labor was allowed to proceed without intervention as far as possible. Amniotomy was avoided before 5–6 cm of dilatation. Opioid analgesia was used commonly in latent phase. Oxytocin augmentation was not done unless a specific indication was documented.
    f. Involvement of senior faculty for decisions on all inductions and cesareans was mandatory and not left to residents. Inductions were rationalized and stress was given on NICE and RCOG guidelines for induction and intrapartum care.
    g. Sequential inductions with Foleys catheter or prostaglandins were done for selected cases of inductions that were unsuccessful by a primary method. Selected cases of Robsons group V and VII were induced under supervision of senior obstetricians.
    h. The art of instrumental, breech and vaginal births after cesarean (VBAC) deliveries was reinforced.
    i. All suspicious Cardiotocograms were immediately shared with faculty for combined decision making. Intrapartum patients with meconium or fetal distress were not immediately taken up for cesarean. All fetal distress patterns were documented with CTG records along with identification and documentation of the type and duration of decelerations.
3. Counselling Protocols: The counselling process was started early during the antenatal visits to familiarize women about the process and time involved. Both patient and relatives were updated regularly during the intrapartum period, especially when the stay in the labor room was prolonged.
4. Regular Audits: Senior consultants were designated to conduct regular monthly audits on cesareans, accurate maintenance of case files and labor register records. Subsequently necessary changes were regularly suggested and implemented in keeping with the PDSA cycles. Repeated reinforcements were done to ensure implementation of changes.
5. Interdepartmental Meets: Involvement of Pediatricians and anesthetists in Quarterly Perinatal meets to discuss few previously identified high risk or critical cases. Regular discussions were also initiated to improve communication between on floor residents of different departments for optimizing management of emergencies.

In the process of implementing these changes, a few of them were focused interventions and were introduced through multiple Plan-Do- Study-Act (PDSA) cycles. These focused interventions have been detailed in Table 1 and the timeline of these changes has been shown in Fig. 1.

## Results

### Outcome Measures

The interventions were introduced in 2017 for effective reduction in cesareans. A run chart done from the years 2016–2019 is shown in Fig. 1. This shows the total cesarean rate and neonatal admissions over the years along with

**Table 1** Shows the focused interventions which were introduced through PDSA cycles along with the outcomes

| | |
|---|---|
| *Focused Change 1: Changes in 3 PDSA cycles over 6 months | *Outcomes of focused Change 1: |
| 1. Delay of admission till cervical dilatation is 5 cm in low risk cases | 1. Delay of admission in low risk cases was brought down to 4 cm cervical dilatation. The compliance increased from 45 to 80% |
| 2. Avoiding amniotomy before 5 cm unless clinically indicated or as part of induction | 2. Avoiding amniotomy before 5 cm unless clinically indicated or as part of induction |
| 3. Careful selection of patients for oxytocin augmentation in first stage of labor | 3. Routine oxytocin use in first stage reduced from: 95 to 55% |
| **Focused Change 2: Changes in 3 PDSA cycles over 3 months | ** Outcomes of Focused Change 2: |
| 1. Induction protocols were finalized. For uncomplicated pregnancies, induction for postdatism was not done before 41 weeks | 1. Number of women with uncomplicated pregnancies, induced for postdatism before 41 weeks reduced from 75 to 10% in 6 months and further to zero percent in 12 months |
| 2. Proper bedside handover of laboring women in presence of both – obstetrician and staff nurse | 2. Number of days when rounds included both doctors and concerned staff nurse increased from 45 to 95% |
| 3. All CTG with fetal distress patterns were discussed with senior faculty | 3. Discussions of fetal distress cases increased from 50 to 89% |
| 4. Women draining meconium stained liquor were allowed to progress if fetomaternal condition allowed | 4. Number of women with meconium stained liquor given trial of labor if fetomaternal condition allowed increased from 30 to 90% |
| ***Change 3: Changes over 2 PDSA cycles over 3 months | ***Outcomes of Focused Change 3: |
| 1. Supervision of all cesarean deliveries conducted by newly joined senior residents for a month | 1. Supervisions of all cesareans conducted by new senior residents, for a month increased from 45 to 90% of cesareans deliveries |
| 2. Number of primi breech deliveries supervised were monitored | 2. All primi breech deliveries were supervised |

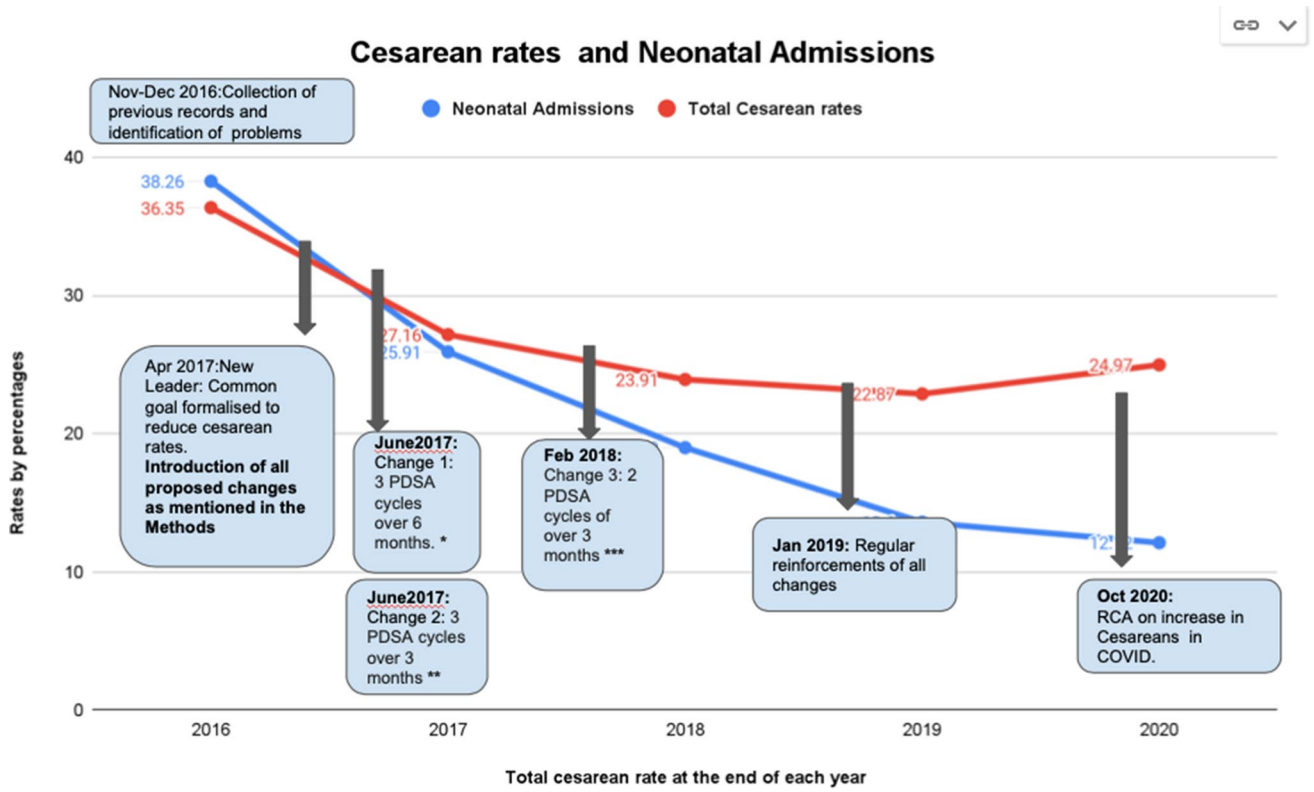


**Fig. 1** Shows the total cesarean rate and neonatal admissions over the years along with timelines of the PDSA cycles. Each year denotes the total cesarean rate at the end of the year

timelines of the PDSA cycles. Each year denotes the total cesarean rate at the end of the year.

The cesarean rates were 36.3% (587/1615) in 2016 and 27.16% (536/1973) in 2017. This reduced to 23.91% (576/2409) in 2018 and 22.87% (516/2256) in 2019. This was a significant reduction with $p < 0.01$. The *risk ratio (RR)* for cesareans after implementation of the interventions was calculated to be *0.67*. A substantial reduction in the Risk Ratio validated the reduction of cesareans. Table 1 shows the focused interventions which were introduced through PDSA cycles along with the outcomes.

The covid outbreak in 2020 resulted in multifold health care delivery problems, for which analysis was done till 2019. The timeline however has been extended till 2020 in the given figure (Fig. 1).

For the Robsons group wise study, 857 and 874 cesarean delivery records were analyzed in the years 2016–2017 (Group 1) and 2018–2019 (Group 2) respectively.

Table 2 shows that the main groups which contributed the most to the nonelective cesareans were Groups I, V, IIa and Group III in that order. There was definite reduction in the percentage contribution by some groups, though not statistically significant. This was partly because of the higher proportion of high risk patients in subsequent years in all the groups. Unfortunately, the high risk factors are not taken into account in Robsons classification, even though they are more commonly associated with cesarean deliveries. The increased number of high risk patients in turn increased the number of inductions.

Fetal distress, meconium stained liquor and non-progress of labor were the most common indications of cesareans in Groups I, III and spontaneous laboring Group V, X.

Failed induction was the most common indication of cesarean in the induced groups (IIA, IVA).

Table 3 shows the proportion of elective cesareans to total cesareans in different Robsons groups. Elective cesareans contributed to 33% of total cesareans under study in the preintervention period and this fell to 30.3% in the postintervention period. Despite this decrease, it must be highlighted that the most prominent change was seen in women with previous cesarean (Group V) which recorded an almost 20% *increase* in the contribution of women in Group V to the total elective cesareans from preintervention to postintervention period ($p < 0.01$), due to the larger number of women with previous two cesareans.

## Quality Improvement Parameters

Process measures are measures of whether an activity that was originally planned has actually been accomplished. It represents a health system's efforts to systematize its improvement.

Documentation in the individual patient case records was initially reviewed by designated faculty to ensure adherence to departmental protocols. Checks were made in different areas, viz., in the labor room, postoperative ward and finally the general wards. The process itself increased the sensitization of the residents to document all details correctly which also indirectly lead to a reduction in the cesareans as the residents were aware that they would be questioned for any lacunae. This improved the number of file checks from 75 to 90% ($p = 0.009$). The improved documentation not only enhances the quality of work currently but would also

**Table 2** The Robsons classification wise distribution in Nonelective cesareans (Total cesareans—Elective cesareans)

| Robsons group | Description | Preintervention % Nonelec Cesareans (571) | Postintervention % Nonelec cesareans (609) |
|---|---|---|---|
| I | Nulliparous, single cephalic, > 37 weeks in spontaneous labor | 35.03 | 31.03 |
| IIA | Nulliparous, single cephalic, > 37 weeks induced | 13.84 | 15.76 |
| III | Multiparous (excluding previous cs), single cephalic, > 37 weeks in spontaneous labor | 10.86 | 10.84 |
| IVA | Multiparous (excluding previous cs), single cephalic, > 37 weeks induced | 4.03 | 3.94 |
| V Spontaneous | Previous CS, single cephalic, > 37 weeks, spontaneous onset of labor | 18.21 | 17.41 |
| V Induced | Previous CS, single cephalic, > 37 weeks, induced labor | 3.15 | 4.93 |
| VI Spontaneous | All nulliparous breeches<br>In spontaneous labor | 0.70 | 3.94 |
| VII Spontaneous | All multiparous breeches in spontaneous labor (including previouscesarean) | 2.10 | 3.20 |
| VIII Spontaneous | All multiple pregnancies (including previous CS) | 1.23 | 1.48 |
| X Spontaneous | All single, cephalic, < 37 weeks (including previous CS). Spontaneous labor | 8.23 | 5.25 |
| X Induced | All single, cephalic, < 37 weeks (including previous CS)<br>Induced labor | 2.63 | 2.30 |
| Total | | 100 | 100 |

**Table 3** Robson classification wise distribution of elective cesareans in the pre and postintervention groups

| Robsons groups | Description of each group | Preintervention Elective cesareans = 286<br>% Elec CD | Postintervention Electivecesareans = 265<br>% Elec CD | *P* value |
|---|---|---|---|---|
| IIB | Primi, term, singleton preg with vertex presentation undergoing prelabor elective CS | 8.39 | 3.02 | ***p* = 0.007** |
| IVB | Multi, term, singleton preg with vertex presentation undergoing prelabor elective CS | 3.49 | 3.40 | $p > 0.05$ |
| V Elec | Term, singleton preg with vertex presentation with previous uterine scar undergoing prelabor elective CS | 47.90 | 68.68 | ***p* = 0.009** |
| VI Elec | Primi, term, singleton preg with breech presentation undergoing prelabor elective CS | 15.74 | 4.91 | ***p* = 0.003** |
| VII Elec | Multi, term, singleton preg with breech presentation, including previous cesarean undergoing prelabor elective CS | 10.14 | 4.15 | ***p* = 0.01** |
| VIII Elec | Multiple gestation pregnancy including previous cesarean | 4.54 | 4.15 | $p > 0.05$ |
| IX | Transverse or oblique lie including women with previous cesarean | 4.20 | 4.90 | $p > 0.05$ |

be useful for any future study apart from making it a good practice point for the long term benefit of residents.

The second process measure was the compliance to complete the documentation in the main cesarean register. Earlier in 2016–2017 there were separate registers in the labor room for cesareans and vaginal delivery entries. From 2018 a common register was maintained which improved the number of complete and correct entries from 91 to 99% ($p = 0.02$). Compliance was checked on a daily basis by the senior residents and the concerned faculty.

The third process measure was the conduct of Skill enhancing workshops and Perinatal meets. It increased from 1 workshop and no Perinatal meets in the 2016–2017 period to quarterly Perinatal meets and twice a year suturing workshops. Neonatal resuscitation, cardiotocogram (CTG) interpretations and suturing workshops like anal sphincter and bladder repairs were held at regular intervals. This improved the quality of overall obstetric surgical care over time and also helped to augment surgical skills of residents.

## Balancing Measures

Balancing measures are the unanticipated consequences which may happen with improvement in outcome and process measures.

Over the four years under study there was no change in maternal or perinatal morbidity and mortality. Maternal complications which were followed up, included prolonged hospital stay, Puerperal pyrexia, anal sphincter injuries and need for blood transfusion.

### In Perinatal Data

Neonatal complications which were followed up were nursery admissions beyond 24 h, neonatal sepsis and perinatal death. The perinatal mortality rates were similar in both periods. In the 2016–2017 period, there were no standard operating procedures (SOPs) and decisions were based on individual consultant opinions. With time SOPs were established and babies were shifted to mother side earlier. This significantly reduced the number of neonatal admissions for more than one and less than three days (Table 4) ($p < 0.05$). The first 24 h were excluded as all cesarean babies were kept in the Surgical ICU and during that duration the babies were kept in the neonatal ICU as part of routine hospital protocol.

### Root Cause Analysis

The covid pandemic caused a huge strain on manpower and quality maintenance. The cesarean rates in 2020 showed

**Table 4** Table compares the neonatal admissions in the Preintervention and Postintervention period

| % of Neonatal admissions between 24 and 72 h in preintervention period | % of Neonatal admissions between 24 and 72 h in postintervention period |
|---|---|
| 38.26% (2016) | 19.02% (2018) |
| 25.91% (2017) | 13.6% (2019) |

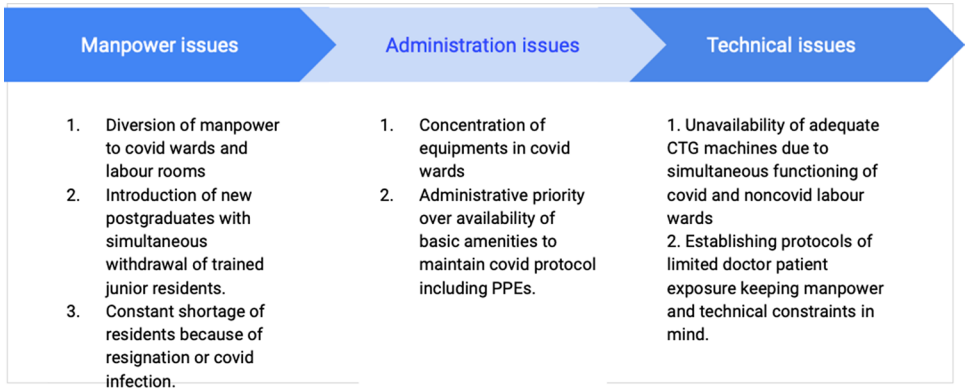


**Fig. 2** Root cause analysis of increased cesareans in 2020

an unavoidable increase. As a continuum of Quality improvement a fishbone diagram was done to do a Root cause analysis (Fig. 2). Even though immediate solutions were not found it helped in better management of resources to keep pushing for reduced cesarean rates.

## Discussion

Both WHO and FIGO have advised a reduction in the alarmingly high cesarean rates [6, 7]. In fact there is higher prevalence of long-term associated fetomaternal morbidity like placenta accreta and childhood comorbidities like obesity, asthma and diabetes though these are not generally considered and only a short-term view of the immediate perinatal period is taken into account [8]. Most studies have found cesareans to be higher in NTSV (Nulliparous, Term, Singleton and Vertex) and in women with previous cesareans [9, 10, 11, 12, 13].

Bolognani et al. identified three primary goals for reducing cesareans. First—to achieve maximum natural births, second was to avoid the first cesarean for better future obstetric implications and third was to motivate more number of TOLACs (Trial of labor after cesareans) [14].

Guidelines alone cannot bring about this change and implementation is critical. A strong leadership is not only required to implement guidelines and to change the attitudes of obstetricians but to rationalize the fear of unanticipated negative events in labor as well. A team effort is essential. Patient cooperation and active participation is also mandatory for achieving this goal.

With the QI interventions on the technical and organizational fronts, it was possible to reduce the cesarean rates by 13.5% (36.3% to 22.8%). Most of the interventions helped spontaneously laboring women (both primiparous and multiparous) to deliver vaginally. Longer periods of observation were advised for progress of labor. The reduction in the diagnosis of non-progress of labor was possible on using the Zhangs curve [15]. Now, the Labor care Guide (WHO 2018) shows further promise in correctly guiding the progress of labor [5]. The availability of CTG machines made it possible to give trial of labor even after passage of meconium, in high risk cases like preterm deliveries and growth restriction, in women undergoing repeat inductions or while escalating oxytocin drug dose. However, it was seen that the percentage contribution of fetal distress to total cesareans had increased. This was possibly because of overdiagnosis that happens with frequent use of CTG machines [16, 17]. Scalp pH or fetal blood sampling may not be possible and therefore scalp stimulation should be used in all such cases to further identify the safe patterns [18].

In Group V, there were more number of TOLAC (trial of labor after cesareans) and inductions, yet there was a 20% increase elective cesareans. At the outset this was very discouraging but an in-depth analysis however showed that this increase was primarily due to an increase in women with previous two cesareans from 27 to 38%.

Even though Robsons group V comprises of women with previous one as well as two cesareans, the implication is clinically very different. While women with previous one scar could be given a trial of labor and interventions could be devised to increase their success, women with two scars are conventionally not given a trial of labor and therefore contribute to increase the elective cesareans in Group V. Refusal for TOLAC, previous two cesareans and scar tenderness have been the most common indications for CS in this group. Elective cesareans done in view of unwillingness for TOLAC increased from 46 to 55% from the preinterventional to postinterventional period, respectively. Detailed analysis showed that most of these women were booked late in this hospital. They had already been seen by private practitioners and nursing homes and counselled against TOLAC. Thus, a substantial effort is required in the counselling of such women to increase the women who are willing for TOLAC and this sensitization must start early in pregnancy. It is equally important to

sensitize all health care providers to allow TOLAC in selected cases [19, 20].

A review of literature was done to compare these results with other similar studies which have attempted a reduction in cesareans.

A study done by Zahumensky et al. [21] undertook a QI study using similar multifaceted interventions to reduce cesarean rates. The cesarean rate reduced from 33.7 to 22.4% in 3 years. The main contributor to the reduction was a reduction in cesareans for non-progress of labor and an increase in vaginal births after cesareans. In the present study too there was a reduction in the contribution of cesareans due to non-progress of labor in the spontaneously laboring groups- Robsons group I, III, X.

In a study in Quebec, interventions were initiated to analyze the indications of cesareans, giving regular feedbacks and implementation of best practices. After one year there was a reduction from 22.5 to 21.8% in the test group while there was no change in the control group. Maximum benefit was seen in low risk mothers. Similarly Vadnais et al. reduced cesarean rates by introduction of QI initiatives like health care provider education and feedback along with evidence-based delivery policies [22, 23].

In the present study, one of the main uphill tasks was on giving feedback. The constant practice of evidence based feedback from seniors, a healthy discussion without fault finding, done over months built an environment of healthy feedbacks at all levels. Meetings were done for Root Cause Analysis in cases of untoward outcomes and appropriate changes were implemented.

A two stage study done in Ghonzou District of China was published in 2019. They were able to reduce the cesarean rate from 42 to 35% in two years with no increase in maternal or perinatal mortality. Analysis shows that the decline was more in NTSV mothers and the cesarean delivery rate was similar in the high risk mothers. Apart from medical interventions, public health education and perinatal health service improvement played a huge role in it [24].

This is one domain which requires involvement of both Community practitioners and leaders and government agencies. Keeping the Indian sociocultural scenario in mind, our department faculty held regular Public Health talks in the outpatient areas to educate the women and their accompanying attendants. This was very important as the seniors of the family play an overwhelming role in decision making in the Indian sociocultural scenario compared to the women themselves. All levels of health care workers need to be sensitized on this issue so that a common message goes out to the patient and her family.

All interventions that were done pertaining to manpower, resource allocation, etc., should be further analyzed under the headings of Accessibility, cost, complications, effectiveness, popularity and timing. These are popularly referred to by their acronym, the ACCEPT criteria [25]. Use of such criteria helps in uniform comparisons.

Trained manpower has been a constant problem. Residents trained in non-academic hospitals usually lacked the expertise to manage labor in difficult cases. In spite of repeated feedbacks, workshops and classes, a high attrition rate of trained residents negated the efforts. Another problem was to ensure accurate and complete documentation in all records. A daily check and feedback was required for the same. There was initial resistance from the patient as well as resident obstetricians when non-intervention and watchful expectancy was encouraged. Repeated reinforcements and regular counsellings were done to counter them prior to achieving some degree of success.

This study has been conducted in a medical college and hospital with moderate resource settings. It shows the trends over four years, thus negating any seasonal variations. It has covered an in-depth analysis of the indications of cesareans and inductions in the different Robsons groups enabling development of more group specific measures. Apart from the benefits of reducing organ injuries and future complications like placenta accreta, the cost reduction is an additional bonus to the patient.

One of the limitations of the study could be the retrospective nature of data analysis which is itself a weakness. Moreover, the reduction in CS rates has occurred when all interventions were applied in unison and individual components of the QI intervention could not be assessed in terms of their efficacy. Further detailed analysis is required to follow up babies delivering after prolonged labor and their clinical correlation with different CTG patterns.

## Conclusion

The strategies implemented over multiple PDSA cycles have significantly reduced the cesarean delivery rates from 39 to 23% over 4 years ($p$ value of $< 0.01$), without affecting the neonatal outcomes. This has been possible in spite of a high changeover of residents, increase in costs over time and limited resources. A committed team and leader is essential for this change to be constant. Women in spontaneous labor and women with previous cesarean (Groups I, III and V) should be the primary target population for the interventions. It is very realistically possible to replicate these actions in other institutions to achieve similar reductions in cesareans. Future research should focus on Robsons group specific cesarean section rates to enable comparison over different times and in different institutions and in identifying specific targeted interventions.

**Funding** None.

## Declarations

**Conflict of interest** None.

**Ethical Statement** Institutional Ethical clearance has been taken for the study.

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