Decreasing Decision-to-Incision Times for Unscheduled, Urgent Cesarean Deliveries

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OBJECTIVE: To standardize the preprocedure process for urgent, unscheduled cesarean deliveries to decrease the time from decision to skin incision to improve maternal and fetal outcomes.

METHODS: In our quality-improvement project, we selected indications that require urgent cesarean deliveries, created a standard algorithm, then implemented a multidisciplinary process intended to reduce decision-to-incision time. This initiative was conducted from May 2019 to May 2021, with a preimplementation period from May 2019 to November 2019 (n=199), implementation period from December 2019 to September 2020 (n=283), and postimplementation period from October 2020 to May 2021 (n=160). An interrupted time series calculation was performed, with stratification by patient race and ethnicity. The primary process measure was mean decision-to-incision time. The secondary outcomes were neonatal status as measured by 5-minute Apgar score and quantitative blood loss during the cesarean delivery.

RESULTS: We analyzed 642 urgent cesarean deliveries; 199 were preimplementation of the standard algorithm, and 160 were postimplementation. The mean decision-to-incision time improved from 88 minutes (95% CI 75–101 min) to 50 minutes (95% CI 47–53 min) from the preimplementation period to the postimplementation period. When stratified by race and ethnicity, the mean decision-to-incision time among Black non-Hispanic patients improved from 98 minutes (95% CI 73–123 min) to 50 minutes (95% CI 45–55 min) (t=3.27, $P<.01$); it improved from 84 minutes (95% CI 66–103 min) to 49 minutes (95% CI 44–55 min) among Hispanic patients (t=3.51, $P<.001$). There was no significant improvement in decision-to-incision time among patients in other racial and ethnic groups. When the cesarean delivery was performed for fetal indications, Apgar scores were significantly higher in the postimplementation period compared with the preimplementation period (8.5 vs 8.8 beta=0.29, $P<.01$).

CONCLUSION: Development and implementation of a standard algorithm to expedite decision-to-incision time for unscheduled, urgent cesarean deliveries led to a significant decrease in decision-to-incision time.

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There is presently no recommended decision-to-incision time for unscheduled, nonemergent cesarean deliveries. A target decision-to-incision time of 30 minutes is recommended for emergent cesarean deliveries,[1–3] but there is little guidance on how to achieve this goal.[4] The Royal College of Obstetricians and Gynaecologists classifies cesarean deliveries into four categories: 1) category 1, an immediate threat to the life of the woman or fetus; 2) category 2, maternal or fetal compromise that is not immediately life-threatening; 3) category 3, no maternal or fetal compromise but needs early delivery; and 4) category 4, birth timed to suit the woman or health care professional.[5] Chang et al and Lucas et al have reported similar categorizations to improve communication among multidisciplinary teams, prioritize specific cesarean delivery indications, and optimize data collection for comparison across cohorts. However, there are no data on the effects of such restructuring on improving decision-to-incision time or maternal or fetal outcomes.[6,7]

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Prompted by the observation of a wide variation in the decision-to-incision times for specific nonemergent indications at our institution, we created a new category of urgent cesarean delivery to promote a shared mental model for timely delivery. The aim of our quality-improvement (QI) project was to reduce decision-to-incision time for cesarean delivery designated as urgent but nonemergent. Our secondary aims were to evaluate whether a standard algorithm for urgent cesarean delivery was associated with improvement in clinical outcomes, including 5-minute Apgar scores and quantitative blood loss at the time of cesarean delivery. We stratified our data by race and ethnicity of the patient at all stages of assessment in the interest of integrating equity into our quality work, as described by Howell et al.[8]

METHODS

We conducted a QI project following SQUIRE (Standards for Quality Improvement Reporting Excellence) guidelines.[9] Our institution is an urban academic medical center and the largest safety-net hospital in New England. We have approximately 2,800 deliveries per year, with an average cesarean delivery rate of 32%. Our deliveries are staffed by midwives, family physicians, and obstetricians along with resident physicians in a collaborative practice.[10] We have one anesthesia attending dedicated to laboring patients at all times, with two anesthesia residents during the day and one anesthesia resident at night. We have five obstetric triage rooms, nine delivery rooms, and two operating rooms.

We calculated the primary process measure–decision-to-incision time–from data points abstracted from the electronic medical record (EMR). The decision time is documented for all cesarean deliveries in the EMR by the patient's nurse and corresponds to the time the surgical physician recommends that the patient undergo cesarean delivery. Incision time was the documented time of skin incision. Total calculated decision-to-incision time includes the time for consent.

Our department has collected decision-to-incision time for all unscheduled, nonemergent cesarean deliveries since 2014. We conducted department case reviews that revealed a wide variation in decision-to-incision time and noted that longer decision-to-incision times were associated with unexpected poor maternal and fetal outcomes. As a result, our QI team proposed a new category of cesarean delivery to improve timeliness by standardizing the triggers for more urgent cesarean deliveries and created a shared mental model for our prioritization and actions for these cases.

Beginning in May 2019, we implemented this QI initiative in four phases; key improvement areas and interventions are shown in Figure 1. For phase 1, we assembled a multidisciplinary team including nurse, obstetric, and obstetric anesthesia leaders, along with a perinatal safety specialist. The team collected baseline data on urgent cesarean delivery decision-to-incision time for all patients and included important covariates, including patient race and ethnicity, indication, and anesthesia type. Given that our population is, on average, 75% Black non-Hispanic and Hispanic combined and 15% White, we restricted our race categories to Black non-Hispanic, Hispanic, White non-Hispanic, and Other, which includes Asian, Pacific Islander, and Middle Eastern. We included race in our QI project evaluation to understand the effect of our interventions on all groups we serve.

Through data review and group consensus, we established which unscheduled cesarean delivery diagnoses warrant urgent categorization. We defined *urgent, unscheduled cesarean delivery* as cesarean delivery in patients with the following diagnoses: active phase arrest at 6 cm or greater,[11] category II fetal heart rate (FHR) tracing during labor requiring delivery per the Shields algorithm[12] but not meeting emergent category III criteria, any unscheduled cesarean delivery complicated by chorioamnionitis, and failed trial of labor after cesarean. We did not record whether there was more than one indication for urgent cesarean delivery. The QI team selected 40 minutes or less for decision-to-incision time as a goal after reviewing our baseline decision-to-incision time.

For phase 2, from December 2019 to January 2020, we focused on barrier identification and created feedback forms for nurses and physicians (Appendix 1, available online at http://links.lww.com/AOG/D175). We used a Pareto chart to describe barriers to timely cesarean delivery (Appendix 2, available online at http://links.lww.com/AOG/D175) and executed serial programmatic changes based on these findings.

During phase 3, from January 2020 to September 2020, a task force was established, including physicians who perform cesarean deliveries, anesthesiologists, nurses, and scrub technicians. The team met weekly for 1 month to revise and adapt through simulation our previously existing emergent cesarean delivery algorithm into an urgent cesarean delivery algorithm, which then was implemented for all urgent cesarean deliveries.

During phase 4, from October 2020 to May 2021, the urgent cesarean delivery task force reviewed all urgent cesarean deliveries with decision-to-incision

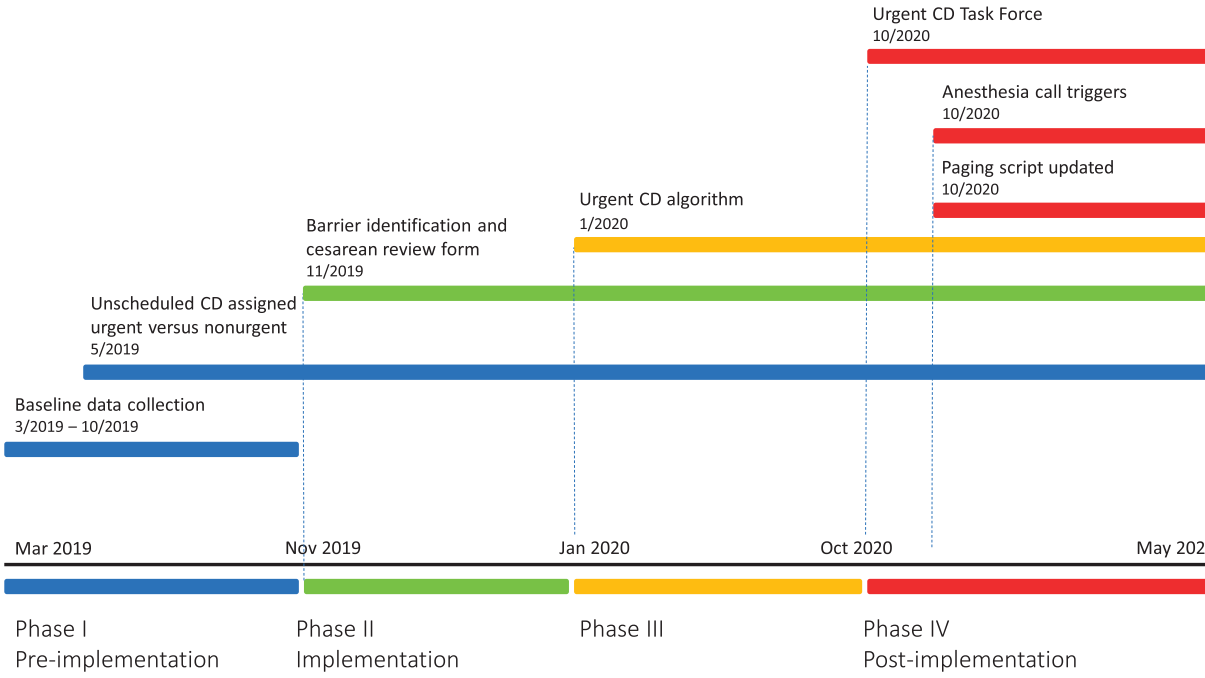

Fig. 1. Time of key interventions. CD, cesarean delivery.

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times longer than 60 minutes and addressed key barriers identified during the algorithm rollout. We developed a new paging script for urgent cesarean delivery and monitored adherence to the script and paging times. All cases, regardless of duration of delay or reason for delay, were included in the assessments.

The preimplementation period (phase 1) was May 2019 to November 2019 (n=199). The implementation period (phases 2 and 3) was December 2019 to September 2020 (n=283), including the introduction of barrier-identification meetings, cesarean delivery review form, and urgent cesarean delivery algorithm implementation. The postimplementation period (phase 4) was October 2020 to May 2021 (n=160) and included final improvements (Fig. 1).

Throughout the project, we completed process-measurement run charts within the PDSA (plan-do-study-act) cycles to ensure that our new processes were being carried out. We used Tableau to generate visual departmental data on our urgent cesarean delivery outcomes for physicians and nurses and provided reports to our surgeons regarding their decision-to-incision times for urgent cesarean delivery.

Data were collected throughout the QI project from our daily delivery logs; urgent cesarean deliveries were reviewed and team members queried by our clinical safety specialist on cesarean delivery indication, decision time, and cesarean delivery categorization to confirm accuracy. We stratified the data by patient self-reported race and ethnicity. Our primary outcome for this study was mean decision-to-incision time for urgent cesarean delivery. Our secondary outcomes were neonatal morbidity as measured by 5-minute Apgar score and quantitative blood loss at the time of cesarean delivery. We used the 5-minute Apgar score as a secondary outcome because this Apgar score has been shown to be associated with increased risk of neonatal and infant death, particularly with 5-minute Apgar scores less than 4.[13,14]

Statistical analyses for this report were performed using SAS 9.4. An interrupted time series analysis was used to assess the effect of implementation on the changes in level and slope of the average decision-to-incision time during implementation and postimplementation. To assess potential effect modification by race, we used dummy indicators for period (eg, during implementation, postimplementation) and race (eg, Black non-Hispanic, Hispanic, White non-Hispanic, and Other) and evaluated the period-by-race interaction terms in the full sample of 642 patients. The data were further evaluated with stratified regression by race. For secondary outcomes, we performed regression analyses with a two-sided statistical significance of $P<.05$. Lastly, we compared the decision-to-incision time among the three different anesthesia types during the phases and ran a two-way analysis

of variance test. A PubMed search using the terms "emergent cesarean," "urgent cesarean," "decision-to-incision time," "maternal outcomes," "neonatal outcomes" was conducted in January of 2021 as part of our literature review. This project was undertaken as a Quality Improvement Initiative at Boston Medical Center and, as such, was not formally supervised by the IRB, per their policies.

RESULTS

A total of 671 urgent cesarean deliveries were performed between May 2019 and May 2021. We excluded 29 cases due to unreliable decision-to-incision times, when the decision time was not recorded in the EMR at the time of delivery; 642 urgent cesarean deliveries were analyzed (Fig. 2). Patient characteristics for each time period (preimplementation, during implementation, and postimplementation of the QI project) are included in Table 1. Sixty percent (n=383) of all cesarean deliveries had an indication of category II FHR tracing, 26% (n=169) active phase arrest, 13% (n=83) failed trial of labor after cesarean, and 1% (n=7) chorioamnionitis. Our patients were 39.6% Black non-Hispanic, 34.0% Hispanic, 12.9% White non-Hispanic, and 13.6% Other; 55% of intrapartum patients spoke English as their primary language.

Phase 1 of the project resulted in the definition of urgent cesarean delivery based on indication for cesarean delivery and project planning. For phase 2, delay due to dietary status, reticence to use our second operating room for an urgent procedure, scrub availability, and "floor acuity" were identified as barriers. We removed dietary status as a reason to delay urgent cesarean delivery and encouraged the team to use the two operating rooms concomitantly for urgent cesarean delivery. We trained 43 nurses to scrub during this time. We increased communication, operating room use planning, scrub personnel availability, and use of a surgical back-up system to address the stress our team was experiencing from increased floor acuity.

Phase 3 resulted in a new algorithm for urgent cesarean delivery (Appendix 3, available online at http://links.lww.com/AOG/D175). Important highlights of the new algorithm include clarification of urgent cesarean delivery criteria and immediate paging to the delivery team when the decision is made.

During phase 4, the following barriers for cesarean delivery with decision-to-incision time longer than 60 minutes were identified: limited understanding of the reasons that the urgent cesarean delivery category was initiated; slow communication within the delivery team; and occasions with inadequate physician, nurse, and physical resource prioritization for urgent cesarean delivery. We sent out weekly emails highlighting data showing improved 5-minute Apgar scores to increase understanding among the staff regarding the importance of timely cesarean delivery. We developed obstetric anesthesia call triggers for when to call the other two anesthesia attendings available in the hospital to ensure adequate anesthesia staffing. Team communication was streamlined after introduction and monitoring of the new

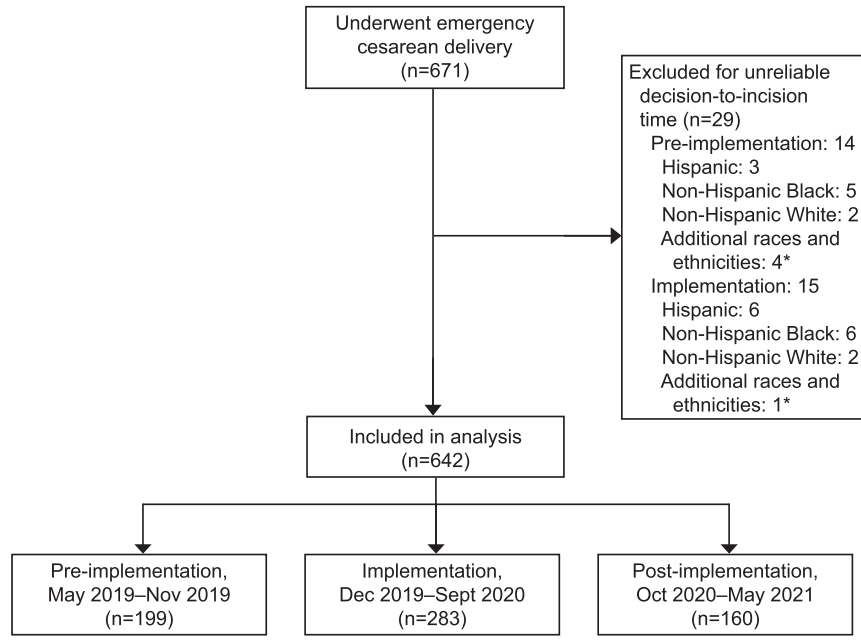

Fig. 2. Flow diagram of patient selection. *Includes Asian, Pacific Islander, and Middle Eastern. Note that the races and ethnicities in the Middle Eastern group could not be defined due to the way the data were collected.

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Table 1. Patient Characteristics

Characteristic	Time Period			P
	Preimplementation	Implementation	Postimplementation	
Race				.10
Black non-Hispanic	87 (43.7)	102 (36)	65 (40.6)	
Hispanic	62 (31.8)	99 (35)	57 (35.6)	
White non-Hispanic	17 (8.5)	47 (16.6)	19 (11.9)	
Other*	33 (16.6)	35 (12.4)	19 (11.9)	
Maternal age (y)	30.8±5.8	30.1±5.8	29.8±5.4	.22
Gestational age (wk)				.06
Preterm (less than 37)	31 (15.6)	21 (7.5)	17 (10.6)	
Term (37–40.6)	134 (67.3)	204 (72.6)	107 (66.9)	
Late term (41 or more)	34 (17.1)	58 (20.6)	36 (22.5)	
Indication for cesarean delivery				.01
Category II FHR tracing	123 (61.8)	136 (48.1)	78 (48.8)	
Active phase arrest	51 (25.6)	111 (39.2)	53 (33.1)	
Failed TOLAC	24 (12.1)	34 (12.0)	25 (9.6)	
Chorioamnionitis	1 (0.5)	2 (0.7)	4 (2.5)	
English as primary language	108 (54.3)	165 (58.3)	92 (57.2)	.67
Anesthesia				.002
Epidural	118 (59.3)	206 (72.8)	115 (71.9)	
Spinal	77 (38.7)	70 (24.7)	37 (23.1)	
General	4 (2.0)	7 (2.5)	8 (5.0)	

TOLAC, trial of labor after cesarean.
Data are n (%) or mean±SD unless otherwise specified.
* Includes Asian, Pacific Islander, and Middle Eastern race. Note that the races and ethnicities in the Middle Eastern group could not be defined due to data-collection method.

paging script (Appendix 4, available online at http://links.lww.com/AOG/D175) and paging times.

The primary process measure–the average decision-to-incision time–improved from 88 minutes to 67 minutes during the implementation period (phases 2 and phase 3) and to 50 minutes during the postimplementation period (phase 4) (Fig. 3). The interrupted time series analysis of the decision-to-incision time across the three periods demonstrated a significant reduction from preimplementation to implementation (beta=−31.2 min, 95% CI −50.3 to −12.1 min). Although not statistically significant in the interrupted time series analysis, decision-to-incision time continued to trend down during the postintervention phase. The mean decision-to-incision time among Black non-Hispanic patients improved from 98 minutes (95% CI 73–123 min) in the preimplementation period to 50 minutes (95% CI 46–55 min) in the postimplementation period (t=3.27, $P<.01$). Among Hispanic patients, the mean decision-to-incision time improved from 84 minutes (95% CI 66–103 min) in the preimplementation period to 49 minutes (95% CI 44–55 min) in the postimplementation period (t=3.51, $P<.001$) (Fig. 4). The pre–post comparison for patients in the White non-Hispanic (78 min [95% CI 51–105 min] vs 58 min [95% CI 45–71 min]) and Other groups (75 min [95% CI 49–100 min] vs 45 min [95% 40–51 min]) was not statistically significant (t=1.50, $P=.14$ and t=1.75, $P=.09$, respectively). These findings were consistent with the predicted mean in decision-to-incision time by period and racial group (Table 2). Evaluation of the period-by-race interaction terms in the full sample of 642 patients found that the directions of the associations were consistent with these findings, although no significant interactions were detected in the model (Appendix 5, available online at http://links.lww.com/AOG/D175).

Using stratified regression by race, we found that there was a significant reduction in decision-to-incision time during the implementation and postimplementation phases. Among Black non-Hispanic patients, decision-to-incision times both during implementation (beta=−25.2 min, 95% CI −47.4 to −2.97 min) and postimplementation (beta=−47.7 min, 95% CI −72.7 to −22.7 min) were significantly lower than preimplementation. Among Hispanic patients, decision-to-incision times were significantly lower both during implementation (beta=−21.9 min, 95% CI −39.12 to −4.82 min) and postimplementation (beta=−34.9 min, 95% CI −54.38 to −15.50 min) when compared with preimplementation.

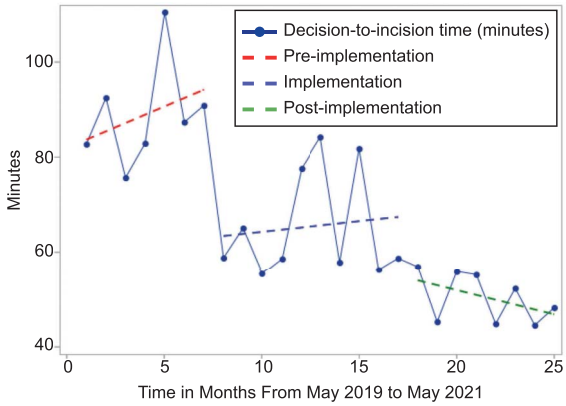

Fig. 3. Decision-to-incision time (in minutes) by preimplementation (May 2019–November 2019), implementation (December 2019–September 2020), and postimplementation period (October 2020–May 2021).

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When evaluating all patients who delivered by cesarean, 5-minute Apgar scores when the cesarean delivery was performed for FHR indications were associated with a statistically significant score improvement of 0.3 (8.5 vs 8.8, $P<.01$) in the postimplementation period compared with the preimplementation period. Stratification analysis by race showed that the Apgar score improvement in the postimplementation period was attributable to the score improvement of 0.4 (8.4 vs 8.8, $P<.01$) experienced by Black non-Hispanic patients. There was no significant association between maternal quantitative blood loss across these periods, either overall or by race (Table 3). An analysis of urgent cesarean delivery implementation period and secondary outcomes is summarized in Appendix 6, available online at http://links.lww.com/AOG/D175.

When comparing decision-to-incision time stratified by the three different anesthesia types, we found a significant decrease in decision-to-incision time for epidural from 69 minutes to 48 minutes ($P<.001$) and for spinal from 116 minutes to 57 minutes ($P=.008$). Although the average decision-to-incision time for general anesthesia decreased from 124 minutes to 51 minutes, this was not significant due to small sample size ($P=.08$).

DISCUSSION

Implementation of an urgent cesarean delivery process for specific indications reduced decision-to-incision times for these indications. We believe that the QI approach, including piloting changes with our teams and reporting our outcomes, improved our collaborative effort for system improvements. The improved decision-to-incision times were associated with a higher mean 5-minute Apgar score for patients with urgent cesarean delivery for fetal indications. We also showed a significant decrease in decision-to-incision times regardless of anesthesia type (epidural vs spinal).

Although previous studies have not demonstrated convincing evidence to suggest that a short decision-to-incision time in urgent cesarean delivery is associated with improved perinatal outcomes, we know that the duration of in utero fetal hypoxia is a potential contributor to hypoxic ischemic encephalopathy.[12,15] Indeed, in 2013, Clark et al suggested a 30-minute window of time to "initiate" delivery in the setting of specific category II FHR tracings, a recommendation we integrated into our priority focus on

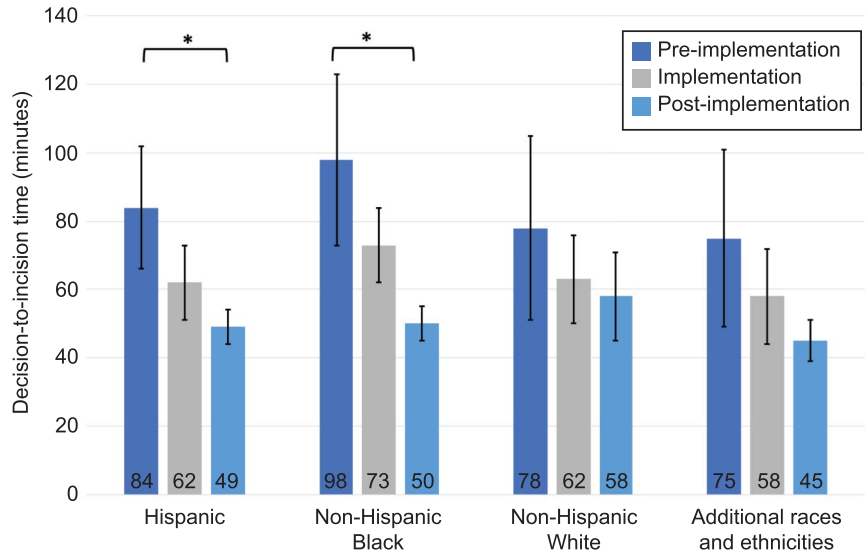

Fig. 4. Decision-to-incision time by race. Other includes Asian, Pacific Islander, and Middle Eastern. Note that the races and ethnicities in the Middle Eastern group could not be defined due to the way the data were collected. *Nonoverlapped 95% CIs for the point estimates.

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Table 2. Predicted Decision-to-Incision Time by Time Period and Racial Group

	Time Period		
	Preimplementation	Implementation	Postimplementation
Race			
Black non-Hispanic	**98.1 (85.0–111.3)**	72.9 (60.8–85.1)	**50.4 (35.2–65.6)**
Hispanic	**84.3 (68.7–99.8)**	62.3 (50.0–74.6)	**49.3 (33.1–65.6)**
White non-Hispanic	78.1 (48.4–107.9)	63.0 (45.1–80.9)	57.8 (29.7–85.9)
Other*	74.8 (53.4–96.1)	58.3 (37.6–79.0)	85.7 (43.8–127.6)

Data are mean (95% CI) in minutes.
Bold indicates statistical significance.
* Includes Asian, Pacific Islander, and Middle Eastern race. Note that the races and ethnicities in the Middle Eastern group could not be defined due to data-collection method.

40 minutes to actual skin incision.[15] The literature from emergent cesarean delivery is clear on the link between time and outcomes. For example, one prior study on emergent cesarean delivery shows that a decision-to-delivery interval of more than 75 minutes is associated with a higher proportion of 5-minute Apgar scores lower than 7.[16] We found an association with improved mean 5-minute Apgar score when we had a standardized process for the urgent indications and decreased decision-to-incision time overall. There are no prior studies regarding the effects of creation of an urgent category on decision-to-incision time or maternal or neonatal outcomes. As a result of improved outcomes and appreciation of a standardized approach, the urgent cesarean delivery designation has been incorporated into the labor unit workflow. We continue to monitor all cesarean deliveries for decision-to-incision time and follow-up on all urgent cesarean deliveries with decision-to-incision times longer than 60 minutes.

We found that stratification of patient data by race and ethnicity in the first phases of a QI project

Table 3. Predicted Means for 5-Minute Apgar Score and Quantitative Blood Loss by Time Period

	Time Period				
	Pre implementation	Implementation	*P* (Implementation vs Preimplementation)	Post implementation	*P* (Preimplementation vs Postimplementation
5-min Apgar score					
Overall sample	8.5 (ref)	8.6	0.58	8.8	**0.01**
Stratified sample					
Black non-Hispanic	8.4	8.6	0.19	8.8	**<0.01**
Hispanic	8.5	8.6	0.75	8.7	0.40
White non-Hispanic	8.4	8.4	0.94	8.7	0.45
Other*	8.7	8.6	0.53	8.9	0.41
Maternal QBL (8 mL)					
Overall sample	1,018.5 (ref)	1,155.5	0.04	1,160.8	0.07
Stratified sample					
Black non-Hispanic	1,055.6	1,031.3	0.75	1,134.6	0.36
Hispanic	1,068.2	1,251.0	0.15	1,320.5	0.08
White non-Hispanic	957.4	1,156.9	0.20	1,013.8	0.76
Other*	858.6	1,245.4	0.15	918.2	0.85

QBL, quantitative blood loss; ref, reference.
Bold indicates statistical significance.
* Includes Asian, Pacific Islander, and Middle Eastern race. Note that the races and ethnicities in the Middle Eastern group could not be defined due to data-collection method.

presented opportunities for more equitable care. Even though the initial difference in decision-to-incision time was not statistically different among racial groups, we showed our teams that using our standardized approach improved decision-to-incision time for Black non-Hispanic and Hispanic birthing people. These preliminary results provided an opportunity to leverage our staff's commitment to equitable care. Our data support that consistent review of racially stratified data in all phases of QI can result in standardization of care across subgroups.

Our report has several limitations. This is a retrospective description of data from a QI project; it does not address confounding by patient age, parity, body mass index, primary language, time of cesarean delivery, staffing, or labor floor acuity. This QI project was not meant to test a hypothesis regarding a 40-minute decision-to-incision time goal, but rather to improve the process measure for unscheduled cesarean deliveries for the urgent indications noted; the findings for fetal and maternal outcomes are associations, and we do not know whether they are causal.

Furthermore, we measured maternity morbidity only by quantitative blood loss and did not look at other severe morbidity outcomes such as complications from infection or intensive care unit admissions. Similarly, for neonatal morbidity, we did not measure umbilical cord gases because we do not collect cord gases for all deliveries. Although the mean 5-minute Apgar scores postimplementation were higher and statistically significant, this finding may not be clinically meaningful. Other major neonatal morbidities, such as hypoxic ischemic encephalopathy, need for resuscitation, and neonatal death, were not analyzed because there was not power to detect differences in these rare outcomes. Also, we did not analyze the influence of surgical time and intraoperative complications on maternal and neonatal outcomes. These data are dependent on appropriate ascertainment of decision-to-incision times; we addressed this through considerable training of our clinician and nursing teams before and throughout the project, along with follow-up of all cases to check decision times.

Our project was performed at one large, urban, academic medical center. Although implementation may be generalizable, other institutions may differ in resource availability, including the number of anesthesiologists, surgeons, nurses, operating room staff, and physical resources, which may affect their implementation process. Finally, we did not measure patient satisfaction and whether enforcing the quicker decision-to-incision time affected the patient experience.

Our project suggests that a phased QI approach to decreasing decision-to-incision time for urgent cesarean delivery will lead to improved decision-to-incision times and is associated with improved 5-minute Apgar scores. The next step in care improvement should focus not only on identifying which patients benefit from more rapid urgent cesarean delivery and what is the recommended decision-to-incision time, but what strategies will ensure patient-centered care during these transitions.

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Reporting Guidelines

Responsible reporting of research studies, which includes a complete, transparent, accurate, and timely account of what was done and what was found during a research study, is an integral part of good research and publication practice and not an optional extra. *Obstetrics & Gynecology* supports initiatives aimed at improving the reporting of health research. We ask authors to use the following guidelines when drafting their manuscripts:

1. CONSORT (Consolidated Standards of Reporting Trials) standards for reporting randomized trials
2. STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for the reporting of observational studies
3. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for meta-analyses and systematic reviews of randomized controlled trials
4. PRISMA for harms (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines reporting harms in systematic reviews, whether harms are a primary or secondary outcome
5. STARD (Standards for Reporting of Diagnostic Accuracy) standards for reporting studies of diagnostic accuracy
6. MOOSE (Meta-analysis of Observational Studies in Epidemiology) guidelines for meta-analyses and systematic reviews of observational studies
7. CHEERS (Consolidated Health Economic Evaluation Reporting Standards) guidelines for reporting economic evaluations of health interventions
8. SQUIRE 2.0 (Standards for Quality Improvement Reporting Excellence) guidelines for reporting on quality improvement in health care
9. CHERRIES (Checklist for Reporting Results of Internet E-Surveys) guidelines for web-based surveys
10. RECORD (Reporting of Studies Conducted Using Observational Routinely-Collected Health Data) guidelines for reporting International Classification of Diseases and Current Procedural Terminology codes
11. CONSERVE (CONSORT and SPIRIT Extension for RCTs Revised in Extenuating Circumstances) guidelines for reporting of trials and trial protocols that undergo important modifications in response to extenuating circumstances

Investigators should be thoroughly familiar with these sets of standards and follow these guidelines in articles submitted for publication.

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