

# Postoperative Length of Stay Following Enhanced Recovery After Surgery Protocol Implementation for Scheduled Cesarean Deliveries

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## Background

Cesarean delivery is the most common major surgery worldwide.<sup>1</sup> In 2018, 1.2 million cesarean deliveries occurred in the United States, accounting for nearly 32% of all deliveries.<sup>2</sup> Research has shown enhanced recovery after surgery (ERAS) benefits include decreased length of stay, improved pain control, and improved patient satisfaction.<sup>2,3</sup> Despite high rates of occurrence, cesarean delivery has been late to join the ranks of ERAS specialties.<sup>2</sup> The ERAS Society released a three-part guideline specific to cesarean deliveries in 2018 and 2019,<sup>4,5,6</sup> yet few studies have assessed the impact of ERAS on cesarean post-operative outcomes.<sup>2</sup> An improved perioperative course would be particularly beneficial for mothers undergoing cesarean delivery as they require a quick recovery in order to care for their newborn, as well as potential healthcare cost savings.

The purpose of this retrospective, observational study was to determine how the recovery process following cesarean delivery may be improved by standardizing the perioperative care pathway, with the primary outcome of interest being postoperative length of stay (LOS).

## Methods

- Design: Retrospective, observational cohort study at Providence Sacred Heart Medical Center (PSHMC) in Spokane, WA.
- This project was approved by the PSHMC Clinical Innovation and Research Council and deemed exempt from human subjects research by Providence Health Care Institutional Review Board.
- Human subjects protection: Patient demographic and surgical data from electronic medical records were extracted, deidentified, and encrypted using a REDCap data collection tool.
- Inclusion Criteria: parturients 18 years of age or older who underwent scheduled cesarean delivery between June 1, 2017 to May 31, 2018 for pre-ERAS group and June 1, 2019 to February 29, 2020 for post-ERAS group, utilizing a year long run-in period between groups.
- Exclusion Criteria: urgent or emergent cesarean deliveries, cesarean deliveries occurring in the run-in time period of June 1, 2018 through May 31, 2019, and mothers under the age of 18 years.
- Outcome measurement: postoperative length of stay, defined as time of end of surgery to time of hospital discharge.
- Exposure measurement: defined as post-ERAS protocol implementation following April 1, 2019.
- Other variables considered included: age, weeks gestation, BMI, ASA, primary vs repeat cesarean, weeks gestation, and multiparty births.
- Statistical analysis: a-priori power analysis, univariate analysis, bivariate analysis, and multivariable and multivariate analysis.

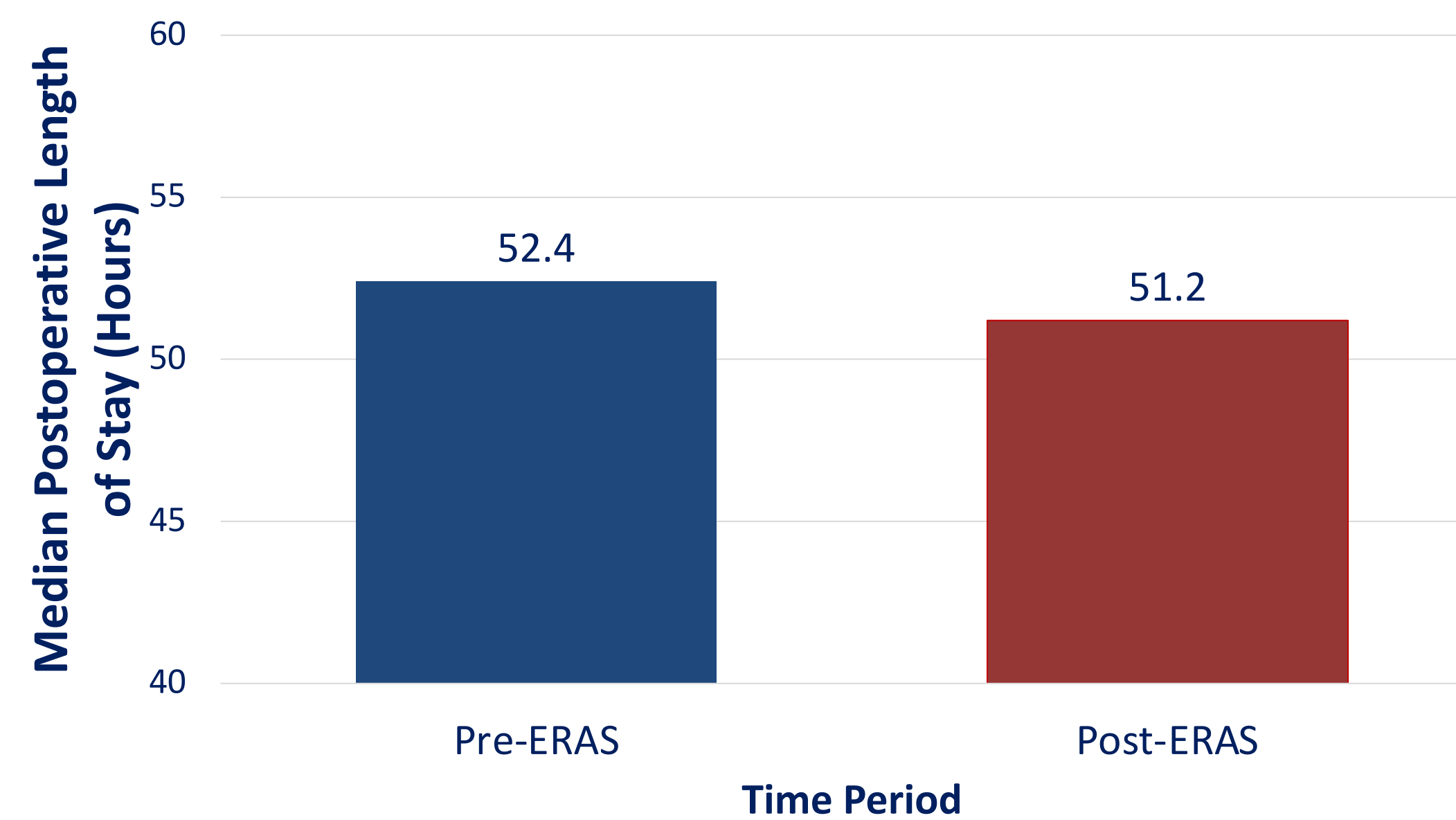
## Findings

**Table 1. Maternal Demographics and Case Characteristics (N=864)**

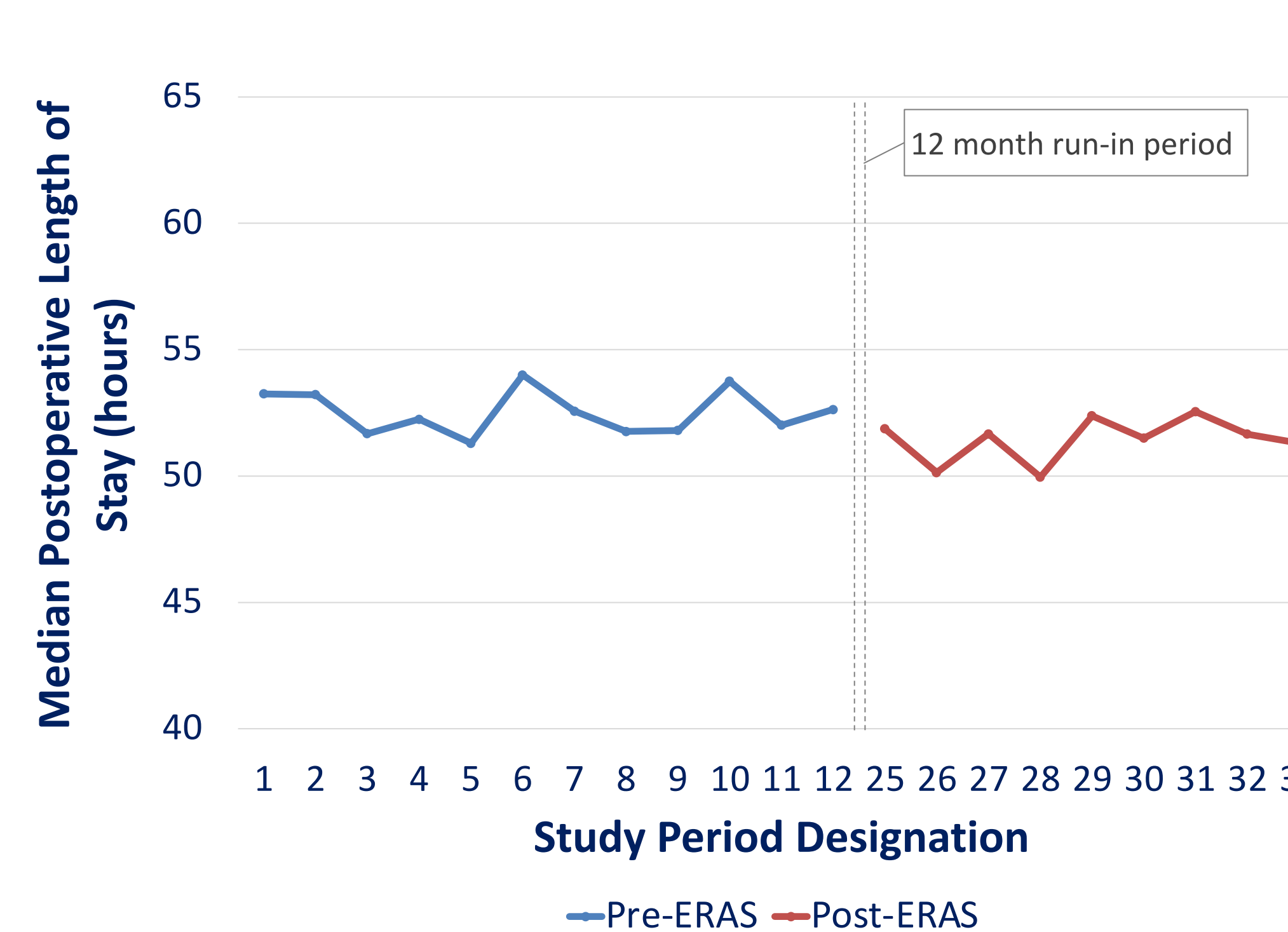
Characteristics	Pre-ERAS (n=480)	Post-ERAS (n=384)	P-value
Age (year)	31 ± 5	31 ± 6	0.44
BMI (kg/m <sup>2</sup> )	33 (29-38)	33 (29-39)	0.46
ASA, n (%)			
1 + 2	382 (80%)	315 (82%)	0.69
≥ 3	91 (19%)	63 (16%)	0.38
Missing	8 (1%)	6 (2%)	0.90
Weeks Gestation	38.6 ± 2.1	38.7 ± 1.8	0.32
Gravida, n (%)			
1	112 (23%)	99 (26%)	0.47
2+3	253 (53%)	194 (51%)	0.66
≥4	115 (23%)	91 (24%)	0.94
Parity, n (%)			
0+1	160 (33%)	137 (36%)	0.56
2+3	267 (56%)	211 (55%)	0.89
≥4	53 (11%)	36 (9%)	0.45
Multiple Births, n (%)	10 (2%)	6 (2%)	0.57
Cesarean Delivery Type			
Primary, n (%)	287 (60%)	206 (54%)	0.23
Repeat, n (%)	193 (40%)	178 (46%)	0.17

Data are presented as mean ± standard deviation, median (IQR) if distribution skewed, or number (%). BMI: Body mass index. ASA: American Society of Anesthesiologists physical status classification.

**Figure 2. Median Postoperative Length of Stay for Scheduled Cesarean Deliveries**



**Figure 3. Time Series of Median Postoperative Length of Stay for Scheduled Cesarean Deliveries**



**Table 2. Average Change in Postoperative Length of Stay follow ERAS Protocol Implementation with Varying Run-in Period Lengths\***

Run-In Period Length	Average Change in LOS (hours)	Standard Error	t Stat	P-value	Lower 95% (hrs)	Upper 95% (hrs)
2 months	0.19	0.73	0.26	<b>0.80</b>	-1.31	1.69
4 months	-0.60	0.80	-0.75	<b>0.46</b>	-2.24	1.04
6 months	-1.26	0.93	-1.35	<b>0.19</b>	-3.18	0.66
8 months	-1.81	1.08	-1.68	<b>0.11</b>	-4.05	0.42
10 months	-1.93	1.21	-1.60	<b>0.13</b>	-4.45	0.59
12 months	-1.40	1.48	-0.95	<b>0.36</b>	-4.50	1.71

\*Run-in period was defined as the period gap used between the pre-ERAS group and post-ERAS group. Multivariable analysis controlled for time. In all repeated models, the post-ERAS group was defined as June 1, 2019 through February 29, 2020.

## Discussion

In this retrospective observational study, this facility's postoperative LOS following cesarean delivery was found to be lower than that sited in the literature, with a median of 52.4 hours prior to ERAS protocol implementation. Following ERAS implementation, the median postoperative LOS decreased to 51.2 hours but was not found to be statistically significant in an adjusted model (p= 0.36). Cesarean deliveries comprised nearly 29% of all births at this facility, 58.5% of which were scheduled or elective cesarean deliveries. Characteristics of parturients were very similar among the pre- and post-ERAS patient groups; most patients were classified as ASA 2 and had a mean age of 31 years. With inconsistent run-in periods being reported in the literature, repeated multivariable analysis was utilized to model run-in periods of varying lengths and controlled for time. This analysis consistently showed no significant difference in postoperative LOS between the pre-ERAS and post-ERAS groups.

With PSHMC having had an already low postoperative LOS prior to protocol implementation, it is likely that other facilities with longer postoperative LOS may see a greater benefit of ERAS implementation. Additional work is still required to further the understanding of ERAS for cesarean deliveries and its impact on postoperative recovery. Future studies of interest includes determining 30-day readmission rates and emergency room visits following discharge. In order to determine the true effect ERAS may have on postoperative LOS and the recovery process following cesarean delivery, large prospective controlled trials are needed.

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