

## ORIGINAL RESEARCH

# Place, provider and timing: Factors influencing the overuse of cesarean in low-risk primigravid women

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## Abstract

The purpose of this study was to examine the relationship between the type and timing of commonly used intrapartum clinical factors and their relationship to birth outcomes. The factors included in the analysis were type of provider (midwife or obstetrician), place of birth (home or hospital), cervical dilation on admission, and commonly used labor interventions, namely use of continuous electronic fetal monitoring, epidural anesthesia and oxytocin on the type of birth (cesarean or vaginal birth). The research question guiding the analysis was: what factors increase the likelihood of cesarean birth (CB)? The findings reported here are parts of a larger mixed methods study that used three data collection methods: a projective test, a focus group, and a semi-structured postpartum interview. The study took place in an urban area in the mid-Atlantic United States and the sample was comprised of 49 low-risk primigravid women recruited between 28-36 weeks gestation. The analysis reported here only used data from the postpartum interview. During the interview, each woman reported the events of their labor and birth that were then mapped along a timeline. The findings show that admission to hospital early in labor played a key role in increasing the number of interventions used and was associated with increased risk of CB. The small, homogenous sample limited the ability to conduct more comprehensive statistical analysis and to generalize to more diverse groups, however, the proportional differences are highly suggestive and warrant further investigation.

## Key words

Cesarean section, Cesarean birth, Surgical birth, Intrapartum care

## 1 Introduction

In the United States, cesarean birth (CB) is currently used at over twice the rate recommended by the World Health Organization<sup>[1]</sup>. Maternal and neonatal death and both short and long-term adverse outcomes are significantly higher in women that have CB than those that deliver vaginally, resulting in avoidable morbidity and mortality and cost to health systems<sup>[1,2]</sup>. Despite considerable research about this issue, the reasons for high utilization rate of surgical birth in the United States remain poorly understood.

Changes in maternal demographics and risk factors such as increased maternal age during the first pregnancy have been proposed as potential causal mechanisms to explain high CB utilization, but research has now shown that these are not root causes<sup>[3]</sup>. Alternately, more recently CB has been linked to the increased use of commonly used clinical interventions for

labor management such as continuous electronic fetal monitoring (CEFM), epidural analgesia, and oxytocin for induction or augmentation of labor. CEFM has been associated with increased rates of CB in multiple studies<sup>[4, 5]</sup>. In contrast, models of care that rely on intermittent auscultation to monitor fetal well-being during labor are consistently associated with low rates of oxytocin, epidural anesthesia, and CB use<sup>[6-9]</sup>. Although the optimal timing of epidural administration in labor remains a hotly debated topic within the perinatal community, research suggests that epidurals initiated early in labor (prior to 4 centimeters of cervical dilation) increase the rates of CB<sup>[8, 10, 11]</sup>. A Cochrane meta-analysis<sup>[12]</sup> on this topic reported no increase in the risk of CB when epidural was used in early labor, but the report has been widely criticized because it included two large trials where the inclusion criteria required subjects to be at least 4-5 centimeters dilated<sup>[13]</sup>. More recently, Nguyen and colleagues found that nulliparous women that had epidural anesthesia during labor had a 19.3% higher absolute risk of CB compared to women that did not have an epidural. Research associating oxytocin use and CB is inconsistent<sup>[10]</sup>. Early trials completed in the 1980s reported that intrapartum oxytocin used early in labor reduced the risk of CB<sup>[14, 15]</sup> but more recently studies have shown a strong association with uterine hyperstimulation and an increased risk of emergency cesarean<sup>[11, 16]</sup>. Main and colleagues<sup>[17]</sup> found that early use of oxytocin reduced the use of CB, although other studies have shown a significant association with increased surgical birth<sup>[11, 18]</sup>.

While the previously mentioned studies have shown that individual clinical interventions may lead to increased utilization of CB, interventions are rarely used in isolation during labor and a growing body of knowledge suggests that obstetrical interventions create a ‘cascade’ or cumulative effect associated with higher rates of surgical birth<sup>[11, 19-22]</sup>. In addition, moderate variation in CB rates across health systems have been reported for nulliparous women at term with singleton vertex presentations. This is attributed to differences in the use of clinical interventions among organizations, not to differences in patient populations or risk factors<sup>[17, 23]</sup>. Similarly, those studies found that clinical factors such as admission to hospital in early labor may increase the risk of CB.

The exploratory analysis reported here contributes to the understanding of the cumulative effect that clinical interventions have on use of CB. We used data from a cohort of 49 low risk primigravid women. The data were collected as part of a mixed methods study aimed at understanding what factors influence birth choices in low-risk primigravid women. The underlying assumption for the study was that the decisions women make about the management of their labor could influence the use of CS. The qualitative study findings about the preconceptions women have about their birth experience are published elsewhere<sup>[24, 25]</sup>. The focus of this paper is to report the association between the use of multiple clinical factors and interventions, namely type of provider (midwife or obstetrician), place of birth (home or hospital), cervical dilation on admission, use of continuous electronic fetal monitoring, epidural anesthesia, and oxytocin use and the type of birth (cesarean or vaginal birth). The research question guiding this analysis was: Are individual clinical factors, and the combination of those factors, associated with increased utilization of CB? The sample size for this study, while adequate for the qualitative analysis, was not sufficient to allow the use of advanced statistical techniques therefore the analysis is limited to descriptive statistics.

## 2 Methods

### 2.1 Design

The larger mixed-methods study used multiple data collection techniques including a prenatal projective test, a prenatal focus group, and a postpartum interview conducted in the first six weeks after birth. Details of the data collection and analytic methods as related to this analysis are described briefly below and the qualitative analysis is described in full elsewhere<sup>[24, 25]</sup>. The analysis reported here only used data from the postpartum interviews.

### 2.2 Conceptual framework

The Preference Sensitive Care framework was used to guide the analysis<sup>[26]</sup>. The framework states that when multiple options are available for care, variation in usage rates is a result of differences in professional preference as opposed to clinical necessity. Wennberg and Wennberg<sup>[27]</sup> showed that regional and inter-provider variation in the use of treatment

options, in particular discretionary surgery, is attributable to practitioners' preferred practices. They argue that patients delegate decision-making for the treatment options to the healthcare provider, thereby creating the conditions for providers to select their own preferred method of treatment regardless of clinical guidelines or evidence showing best practices for a particular option. In this study, the Preference Sensitive Care model provided a lens to explore variation in the use of intrapartum interventions that could explain differences in rates of CB.

### **2.3 Sample and setting**

The study used a convenience sample comprised of low-risk primigravid women between 28-36 weeks gestation that were recruited from advertisements in healthcare clinics, offices, on-line childbirth listserves, and prenatal classes. Women were also approached directly by the researchers in clinics, offices, and shopping malls, or were referred by word-of-mouth. The study was conducted at a large urban academic institution in the mid-Atlantic region where the recruitment catchment area consisted of an ethnically and socioeconomically diverse population, although the final sample did not reflect that diversity.

The inclusion criteria were designed to ensure that the sample consisted of primigravid women with the lowest possible risk for CB. The criteria required that the women be 21-36 years old, 28-36 weeks pregnant at the time of consent, had conceived without the use of reproductive assistive technologies, and had no pre-existing health conditions that could increase their risk of CB. In addition any women that reported abnormalities in their prenatal screening related to fetal health were excluded. A member of the research team used a standardized form containing the inclusion criteria to screen all participants by telephone. Once they established that criteria were met, the participant was invited to the institution for informed consent and the first data collection.

### **2.4 Data collection and analysis**

Data used for this analysis were collected from semi-structured telephone interviews that were conducted with each participant within the first six weeks postpartum. The goal of the interview was to collect data about the events that occurred during labor and birth, including dilation at admission, the use of epidural, the use of oxytocin for induction or augmentation, the use of intravenous fluids, infant feeding status, and the type of birth. The interviewer used a standard set of questions comprised of a comprehensive list of commonly used labor interventions. The birth intervention data were mapped along a timeline to represent the hour in labor when the events occurred and how the events correlated to cervical dilatation. Women were prompted to report the trajectory of labor and birth from the onset of labor through to the immediate postpartum period. A secondary aim of the interview was to explore how participants reconciled the expectations that they reported prior to birth and the reality of their labor and birth. The findings related to that aim are reported elsewhere <sup>[24, 25]</sup>.

The timeline data were coded and entered into variables created for each of the constructs of interest. These included the place of birth (hospital or home), type of provider (midwife or obstetrician), cervical dilatation at time of admission to the hospital, use of CEFM at any time during labor, use of oxytocin at any time during labor, epidural use during labor, and cervical dilatation at the time each intervention was started or occurred. Oxytocin use was sub-categorized to reflect induction of labor (started prior to uterine contractions) versus augmentation. The primary outcome of interest was type of birth, namely vaginal or cesarean birth. SPSS Version 18 was used to obtain descriptive statistics for all variables.

### **2.5 Ethical considerations**

The study received institutional review board approval from the participating university and all women completed an informed consent prior to participating in any of the three phases of data collection. Each participant that completed all phases of data collection received a total of \$150 as compensation for the time and effort involved with participation in the study. The stipend was paid in two phases: \$50 for completing the projective test and focus group, and \$100 for completion of the postpartum interview.

### 3 Results

In total, 72 women were screened and 52 were eligible to participate and were consented for inclusion. The data from two women were lost due to technical difficulty and one was lost to follow-up, therefore the final analysis included data from 49 women. The demographic characteristics of the sample are summarized in Table 1.

**Table 1.** Demographic characteristics and type of birth (N = 49)

Characteristic	Mean	SD
Age in years	28.8	3.9
Annual Income	\$104,364	\$58,181
	N	%
<b>Education</b>		
Bachelor's degree or less	19	38.8
Graduate degree	30	61.2
<b>Marital Status</b>		
Currently not married	14	28.6
Currently married	35	71.4
<b>Ethnicity</b>		
Non-caucasian	17	34.7
Caucasian	32	65.3
<b>Type of birth</b>		
Cesarean*	7	14.3
Vaginal	42	85.7

\* 2 cesareans were planned in advance of labor

The diverse socioeconomic characteristics of the geographic area was not reflected in the sample that was comprised of women reporting a higher than average income (mean = \$104,364) and more than half (61%) of whom were educated at the graduate degree level. About two-thirds of the women were Caucasian and 71% were married. Seven (14.3%) of the 49 women underwent a CB of which two were scheduled prior to the onset of labor. One of those women decided early in her pregnancy to have a CB without a clinical indication and the second had a CB because of breech presentation. The CB rate for the total sample including the home birthers was 14.3% (see Table 1), versus a rate of 16.3% for the subsample that delivered in the hospital.

Table 2 shows the clinical factors, the labor interventions, and type of birth for the entire sample and for the subset of women that delivered in the hospital. The data from the women who had home births or scheduled CB were not used to compute proportions for labor interventions shown in the lower portion of Table 2 since those women could not have experienced those interventions. Of the total cohort, 40.8% had a midwife as their primary care provider and six women elected to have home births. The CB rate for the total sample including the home birthers was 14.3% (see Table 1), versus a rate of 16.3% for the subsample that delivered in the hospital. Six (20.7%) of the 29 women cared for by physicians had CB as compared to 1 (5%) of the 20 women who were cared for by midwives. All of the women that had an unscheduled CB were admitted to the hospital in early labor (cervical dilatation of 3 centimeters or less). The individual uses of CEFM, oxytocin, and epidural show that of the women who birthed in the hospital, 33 (82.5%) received CEFM, 68.3% received an epidural, and 39% received oxytocin. All of the women who had CB also received CEFM and epidural and almost one-third (32.5%) received CEFM, oxytocin, and epidural.

Finally, the use of labor management strategies was examined by early admission status (see Table 3).

**Table 2.** Frequencies of clinical characteristics and labor interventions, overall and by type of birth in entire sample (N = 49) and subset of women that labored in the hospital (n = 41<sup>†</sup>)

Characteristic	Cesarean (n = 7)		Vaginal (n = 42)		Total (n = 49)	
	N	%	N	%	N	%
<b>Place of birth</b>						
Hospital	7	16.3	36	83.7	43	87.8
Home	0	0	6	100.0	6	12.2
<b>Care provider</b>						
Physician	6	20.7	23	79.3	29	59.2
Midwife	1	5.0	19	95.0	20	40.8
Labor Interventions	Cesarean (n = 5)		Vaginal (n = 36)		Total (n = 41)	
	N	%	N	%	N	%
<b>Admission dilatation<sup>††</sup></b>						
≤ 3 centimeters	5	100	15	42.9	20	50.0
> 3 centimeters	0	0	20	57.1	20	50.0
<b>Continuous Electronic Fetal Monitoring<sup>††</sup></b>						
Yes	5	100	28	80.0	33	82.5
No	0	0	7	20.0	7	17.5
<b>Oxytocin</b>						
Yes	2	40.0	14	38.9	16	39.0
No	3	60.0	22	61.1	25	61.0
<b>Epidural</b>						
Yes	5	100	23	63.9	28	68.3
No	0	0	13	36.1	13	31.7
<b>CEFM, oxytocin, and epidural<sup>††</sup></b>	2	15.4	11	84.6	13	32.5

<sup>†</sup> Women who had scheduled CBs and women who birthed at home were excluded from these analyses since there was no opportunity for them to receive the interventions; <sup>††</sup> Sample size decreased due to missing data

**Table 3.** Frequencies of Various Labor Management Strategies in Subset of Women that Labored in the Hospital, by Admission Status (Early<sup>#</sup> versus not Early Admit), n = 40<sup>§,‡</sup>

Labor management strategy	Admitted early (n = 20)		Not admitted early (n = 20)	
	N	%	N	%
CEFM <sup>‡</sup>	19	95.5	13	65.0
Oxytocin	10	50.0	5	25.0
Epidural	16	80.0	11	55.0
CEFM <sup>‡</sup> and oxytocin	10	50.0	5	25.0
CEFM <sup>‡</sup> and epidural	16	80.0	11	55.0
CEFM <sup>‡</sup> , oxytocin, and epidural	8	40.0	4	20.0

Note. CEFM - electronic fetal monitoring; <sup>#</sup> Early admission was defined as cervical dilatation of 3 centimeters or less on admission; <sup>§</sup> Women that had scheduled cesarean births or home births were excluded; <sup>‡</sup> smaller sample size due to missing data

Almost all (95%) of the women that were admitted early received CEFM, versus 65% of the women that were admitted later in labor. Half of the women admitted in early labor received oxytocin, versus 25% of the women admitted later and most women (80%) received an epidural, versus 55% of the women admitted later. Twice as many women (40% versus 20%) that were admitted early received all labor management strategies (CEFM, oxytocin, and epidural).

## 4 Discussion

The findings support previous research showing that women who birth in the hospital environment have an increased likelihood of cesarean <sup>[28]</sup>. Previously, this finding was attributed to increased clinical risk, however our study included only low-risk primigravid women and there were no significant differences in the demographic characteristics between the home and hospital birth groups. Therefore the differences in the CB rates between the groups in this study are not attributable to increased clinical risks or differences in the demographic characteristics associated with higher CB use. In this study there were no CBs among the home birth cohort and none of those women required transfer to the hospital or received CEFM, oxytocin, or epidural anesthesia. We cannot explain the differences in the CB rate or the need for clinical intervention between home versus hospital birthers, however this finding supports the tenets of the Preference Sensitive Care framework, and suggests that provider preference may have played a key role.

Our findings support previous research that has shown that early admission in labor is associated with increased risk of CB <sup>[21]</sup>. We propose that causal association is rooted in the increased likelihood that women who are admitted earlier in labor are more likely to require more interventions to manage the labor process. This was seen in this study where women admitted to the hospital before 4cms dilatation were much more likely to receive more clinical interventions, suggesting that the cumulative effect of the interventions themselves may create the clinical conditions that lead to CB. For the hospital birth group, admission before 4cms notably elevated the chance of early CEFM, oxytocin augmentation, and/or epidural anesthesia.

Based on the findings in this study, continuous fetal monitoring in early labor appears to play a major part in the utilization of CB. Many of the women in the hospital birth group who received CEFM also had multiple additional clinical interventions including oxytocin and epidural anesthesia. We propose that early application of CEFM is the starting point for the cascade effect that increases the likelihood that oxytocin and epidural anesthesia will be used and that the interaction of those interventions is associated with higher utilization of CB. This relationship may be rooted in the need for the woman to lie still in bed in order to get a continuous fetal heart tracing on the monitor <sup>[4]</sup>. Immobilizing women in labor limits their ability to move around in order to offset the intensity of the contractions or to use other comfort measures, such as hydrotherapy (sitting in a tub or taking a shower) that have been shown to be effective intrapartum pain management strategies. Therefore, women that receive CEFM early in the labor process may be more likely to require an epidural for pain management before active labor has begun, as it is often the only pain management option available to them.

The sample size in this study was a limitation and precluded the use of more sophisticated statistical techniques that would have allowed us to detect significance in some of the relationships between the variables of interest. However the proportional differences are highly suggestive and warrant additional study. Moreover, the sample was not demographically similar to the general U.S. primigravid population and that limits generalizability of the findings. However, highly educated and economically advantaged women are more likely to experience optimal birth outcomes and have the lowest risk for CB therefore it is surprising that the CB rate was as high as it was among this cohort. Finally, we relied on self-report for intervention use, timing, and actual birth outcomes, and were therefore unable to determine if the interventions received were clinically indicated. We were also unable to determine specific details related to the timing of interventions before CB, such as whether or not epidural use was initiated before the decision to proceed with CB was made. Despite these limitations, the findings provide a starting point for future research aimed at examining the timed use of clinical interventions and cesarean birth.

## 5 Conclusions

Reducing overuse of CB is a vital step in the goal to optimize childbirth outcomes and the findings of this study have implications for the role that perinatal nurses play in achieving that goal. Their contribution to utilization of CB is likely to

become more pronounced as organizations adopt the use of standardized practice guidelines and order sets that prescribe the care used to manage labor. Those approaches provide intrapartum nurses with a higher level of autonomy to decide what types of clinical interventions are used, and how and when they are used in the course of labor<sup>[29]</sup>. That increased autonomy necessitates a clear need to build understanding about the factors that influence the likelihood of primary cesarean, particularly in nulliparous women. Research is also critically needed to fill the gap in the knowledge about the interaction effect that commonly used interventions including early admission, CEFM, epidural, and oxytocin may have on the increased rate of CB. Studies focused on the granular aspects of intrapartum care, such as the timing, order, and duration of interventions, will help to fill that gap.

In previous research we found that the types of clinical interventions nurses report using vary widely within and across organizations but tend to remain relatively stable among nurses suggesting that they have practice preferences that shape the types of labor management strategies habitually used<sup>[30]</sup>. Those findings influenced the decision to frame this analysis using the Preference Sensitive Care conceptual model. Of particular relevance to intrapartum nursing in this study were the findings related to admitting women to hospital in early labor because nurses are most commonly the providers that advise women about the timing of their admission. Clear guidelines to regulate the factors that necessitate admission in early labor could have a significant impact on the CB rate. This is supported by the recently published American Congress of Obstetrics and Gynecology consensus statement that promotes certain strategies to decrease primary cesarean, including allowing women more time in early labor, defining active labor as 6 cm dilatation, and allowing women more time in the second stage of labor<sup>[31]</sup>. Despite clinical recommendations such as those, it is unlikely that CB rates will decrease without further research on the use of combinations of interventions as related to birth outcomes.

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