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Using linked data to explore medical complications associated with Robson classification of cesarean deliveries in Massachusetts, 2011 to 2018

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BACKGROUND: Cesarean delivery rates in the United States far exceed the World Health Organization (WHO)'s recommended population cesarean rate of 15%. This has resulted in calls from experts to reduce cesarean delivery rates. However, crude cesarean delivery rates are not necessarily comparable across populations since different birthing populations have different distributions of underlying cesarean delivery risk factors. WHO recommends using the Robson classification system to compare standardized cesarean delivery rates across populations, though it has been rarely used within the U.S.

OBJECTIVE: The objectives of this study were to understand the distribution of cesarean deliveries using the Robson Classification system and to identify associated conditions (and potential drivers) of cesarean delivery across Robson groups.

STUDY DESIGN: Our data comes from the Pregnancy and Early Life Longitudinal Data System from the Massachusetts Department of Health, which contains all birth certificate records for Massachusetts from 2011 to 2018. Using the WHO Robson Classification System Implementation guide, we categorized births into one of its 10 categories based on data from birth certificate records and ICD-9 and ICD-10 codes from billing records. Using the linked birth certificate records and hospital discharge records we went beyond the Robson classifications and examined patterns in maternal comorbidities and labor and delivery complications of cesarean deliveries across Robson groups.

RESULTS: Among the 25% of birthing people who had singleton, term, vertex births with spontaneous labor, the cesarean delivery rate was 15% for nulliparous and 3% for multiparous (with no prior cesarean). The prevalence of maternal risk factors was 28% in the former and 30% in the latter. Labor and delivery complications were present in 46% and 35% of births, respectively. Birthing people with breech or transverse fetal presentation had the highest cesarean delivery rates around 95%. Multiparous birthing people with a prior cesarean delivery and cephalic, singleton, term births were the largest contributor to the cesarean delivery rate (38% of all cesareans). Almost all births for malpresentation or malposition of fetus had at least one labor and delivery complication but much lower rates of risk factors (between 25% and 46%).

CONCLUSION: While cesarean delivery rates, maternal risk factors, and labor and delivery complications followed similar patterns across Robson groups, there were notable discrepancies, especially in births with noncephalic presentations where maternal comorbidity rates matched lower cesarean-risk groups like the nulliparous single-term cephalic births.

Key words: cesarean delivery, descriptive analysis, Robson classification system

Introduction

In the United States, cesarean delivery rates have hovered around 32% since 2007. In 2015, the World Health Organization released a statement that population-level cesarean delivery rates greater than 10% were not associated with a decrease in maternal or newborn mortality but provided no information on the impact of higher cesarean delivery rates and maternal and infant morbidities.[1] The current cesarean rate in the United States is 32%.[2] The Centers for Disease Control and Prevention (CDC) has suggested that this high cesarean rate could be linked to the high maternal mortality and morbidity rates across the United States.[3,4] However, comparing crude cesarean delivery rates across populations with differing distributions of important demographic and health characteristics may not be valid. Age of the birthing person, plurality, fetal presentation, and preexisting health conditions affect cesarean

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Why was this study conducted?

The World Health Organization recommends using the Robson classification system to compare standardized cesarean delivery rates across populations. The majority of cesarean delivery research in the United States does not use this classification system, and linked data allows for a more in-depth analysis of cesarean delivery.

Key findings

The prevalence of maternal comorbidities among nulliparous, term, singleton, vertex birthing people was 28%. Further, 46% of this population of birthing people experienced at least one labor and delivery complication. Breech births, accounting for 2% of all births and 6% of all cesarean deliveries, had prevalences of maternal comorbidities similar to those for low cesarean-risk births.

What does this add to what is known?

Maternal health researchers have focused on nulliparous, term, singleton, vertex primary cesarean deliveries as more potentially avoidable and these are typically the focus of interventions designed to reduce the cesarean delivery rate in the United States. We discovered that nearly half of these births (with no induction and no planned cesarean) had labor complications. Almost one-third of these low-risk deliveries had a documented maternal comorbidity.

delivery rates. In the United States in 2023, cesarean delivery rates varied by state, with some states like Alaska, Utah, and South Dakota hovering around 24% while others like Mississippi, Florida, and Louisiana have rates exceeding 35%.[2] Massachusetts has a cesarean delivery rate of 33.5%, ranking 15th out of the 50 states and the District of Columbia.

There are multiple classification systems for standardizing populations to better compare cesarean delivery rates. A 2011 systematic review identified 27 different classification systems, based primarily on indication, urgency, or maternal and fetal characteristics.[5] These classification systems were rated for inclusivity, exclusivity, clarity, and ease of use. The highest-rated system, and perhaps the most widely known, is the Robson classification system (or the 10-group classification), which groups pregnancies by parity, plurality, fetal position, gestational age, and prior cesarean delivery[6] (Table 1). This system is recommended by the World Health Organization for cesarean delivery rate comparisons across populations, in part because of its ease of use in countries with less developed vital statistics systems.[6]

While this system is very detailed with clearly defined exclusion and inclusion categories, it is solely based on current pregnancy characteristics. Using Robson we can distinguish, for example, between primary and repeat cesarean deliveries, which is a critical distinction since about 85% of birthing people in the U.S. with a prior cesarean have a repeat cesarean delivery.[7] However, the Robson classification system does not consider medical conditions or other clinical factors that could cause the seemingly homogeneous groups to be more heterogeneous.[5] There are a variety of reasons why someone may have a cesarean delivery and while we can distinguish between breech births, preterm births, and twin vs singleton births using the Robson classification system, we cannot identify indicated cesarean deliveries and nonindicated cesarean deliveries nor can we distinguish between all planned and emergent cesarean deliveries.

Understanding the factors that contribute to cesarean deliveries in the US can help inform research aimed at comparing outcomes between cesarean deliveries and vaginal deliveries (a common comparison made in perinatal research). The purpose of this study is to examine cesarean delivery rates and identify patterns in associated conditions across standardized groups using Robson classification.

Material and methods

This is a cross-sectional descriptive study. We aim to estimate the risk of cesarean delivery, calculated by dividing the number of cesarean deliveries by the number of birthing people, stratified by the 10-group classification system. The methods described below follow the descriptive framework proposed by Lesko et al[8] in 2022.

Data

Data for this study comes from The Pregnancy to Early Life Longitudinal Data System (PELL). PELL is a population-based linked-data system in Massachusetts in partnership with the Boston University School of Public Health, the Massachusetts Department of Health, and the federal Centers for Disease Control and Prevention. At its core, this data system contains data from Massachusetts birth certificates, fetal death records, and hospital discharge records. Data from 1989 to 2018 is included in this data system and currently includes over 1.7 million live births and fetal deaths. The data for this project contains the core PELL data (birth certificate data and hospital discharge records for each delivery) from 2011 to 2018.

In 2011, Massachusetts adopted the National Center for Health Statistics revised birth certificate form. The revision added several new variables, including detailed fetal presentation, trial of labor, induction of labor, and maternal BMI.[9] We therefore elected to limit our analytic dataset to 2011 onwards because fetal presentation, trial of labor, and induction are critical components of the Robson classification system.

Participants

As described above, the PELL data system includes all birth certificate information for births occurring in Massachusetts. Births that occurred between 2011 and 2018 (inclusive) were eligible for inclusion. Linked hospital discharge records for these births are also available. Individuals with no linkage of birth certificate and hospital discharge were excluded from the analysis, as were individuals with a reported age

of more than 50 years. Additionally, only births with known outcome status (cesarean or vaginal delivery) were included.

Outcome

The outcome of interest is cesarean delivery. This is measured from both birth certificate and hospital discharge records.

Robson groups

Robson groups are based on parity, plurality, fetal presentation, gestational age at delivery, induction, delivery method, trial of labor, and prior cesarean delivery (Table 1).[6] To create Robson groups, we used data come from birth certificate records and hospital discharge data. Hospital discharge extraction relies on versions 9 and 10 of International Statistical Classification of Diseases and Related Health Problems (ICD) codes.[10,11]

Pregnancy risk factors and labor/delivery complications

The birth includes specific fields for pregnancy risk factors (ie, maternal comorbidities) and labor and delivery complications. We extracted the data from these fields for each birthing person. Selection of comorbidities was based on clinical contributors for cesarean delivery as follows: For each included comorbidity and complication on the birth certificate, we searched the ICD-9 and ICD-10 databases and compiled a list of ICD codes for each condition.[10,11] Information on comorbidities and complications, included ICD codes and rationale for excluded items are available in Supplemental Table 1 and Supplemental Table 2. Comorbidities and complications that were part of the Robson classification system were excluded from the list. The dataset linked birth certificates to delivery hospital discharge records containing ICD-9 or ICD-10 codes. A condition identified on either the birth certificate or hospital discharge record was sufficient for inclusion in this analysis and included respiratory disease, cardiovascular disease, hypertensive disorders, cancer, diabetes, cancer, and other diseases (see Supplemental Table 1).

Analytic methods

First, all births were grouped into one of the 10 Robson groups. We calculated the rate of cesarean delivery within each group and the overall contribution of each group to the Massachusetts cesarean delivery rate. We described difference in the proportions of deliveries with any comorbidities or experiencing any complications across Robson group and as well as by delivery method. Additionally, we investigated patterns in the prevalence of each comorbidity and complication across Robson groups and by delivery method.

The Boston University IRB reviewed the research and made the determination that it was not human subjects research and therefore had no requirement to obtain consent.

Results

A total of 545,253 births were included in the analytic dataset. Most birthing people in Massachusetts between 2011 and 2018 were non-Hispanic white (60%) and almost 20% identified as Hispanic. About two-thirds of birthing people were born in the United States and half had private health insurance. The cesarean delivery rate in Massachusetts during the study period was 31.1% (Table 2).

Overall, about 45.5% of birthing people in Massachusetts had at least one of the maternal comorbidities. The prevalence of comorbidities among cesarean deliveries was 64.6% compared to 36.7% among vaginal deliveries (Table 2). A detailed breakdown of the included comorbidities in the population is available in Supplemental Figure 1. Eight of the comorbidities occurred in at least 1% of the birthing population. Gestational diabetes was the most common morbidity, with about 6% of the population documented as having the condition.

About 51% of birthing people in Massachusetts had at least one labor and delivery complication (80% of cesarean deliveries and 37% of vaginal deliveries) (Table 2). A detailed breakdown of labor and delivery complications in the population is available in Supplemental Figure 2. Thirteen complications were prevalent in at least 1% of the population. Moderate/heavy meconium staining was the most common, with 6% of birthing people documented as having the complication.

TABLE 1
Robson classification system

Robson group	Characteristics
1	Nulliparous[a], single[a] cephalic[a] pregnancy, term[a], spontaneous labor
2	Nulliparous, single cephalic pregnancy, term, induced OR no labor
3	Multiparous[a], no uterine scar, single cephalic pregnancy, term, spontaneous labor
4	Multiparous, no uterine scar, single cephalic pregnancy, term, induced labor OR prelabor cesarean delivery
5	Multiparous, at least one previous uterine scar, single cephalic pregnancy, term
6	Nulliparous, single breech[a] pregnancy
7	Multiparous, single breech pregnancy
8	Multiple pregnancy[a]
9	Single pregnancy with transverse or oblique lie[a]
10	Single cephalic pregnancy, preterm delivery

[a] See glossary for definition.

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TABLE 2
Distribution of demographic factors in Massachusetts birthing people, 2011 to 2018

Characteristic	N	%
Race		
Asian/Pacific Islander	49,652	9.1%
Hispanic	101,639	18.6%
Native American/Aleutian	3571	0.7%
Non-Hispanic Black	54,862	10.1%
Non-Hispanic White	326,667	59.9%
Missing	8890	1.6%
Mom age		
Mean, SD	30.3	5.67
Immigrant status		
Foreign	162,802	29.9%
Puerto Rican	13,687	2.5%
United States Citizen	368,593	67.6%
Missing	199	0.0%
Insurance type		
Free care	13,221	2.4%
Private	269,414	49.4%
Public	244,735	44.9%
Self-pay	17,838	3.3%
Missing	73	0.0%
Prepregnancy BMI		
Underweight	19,023	3.5%
Normal weight	242,085	44.4%
Overweight	128,204	23.5%
Obese I	85,723	15.7%
Obese II	16,396	3.0%
Missing	53,850	9.9%
Education		
No high school degree	52,868	9.7%
High school degree	94,745	17.4%
Some college	133,967	24.6%
College degree	251,780	46.2%
Missing	11,893	2.2%
Delivery method		
Vaginal	359,984	66.0%
VBAC	14,078	2.6%
Primary C-section	94,067	17.3%
Repeat C-section	77,124	14.1%

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(continued)

Robson results
After classifying birthing people into the 10 Robson groups, less than 1% of birthing people were missing information on grouping factors and unable to be classified into one of the 10 groups. Half of all births involved people without a prior cesarean and without an induction, either having a first-birth (group 1%−26%) or multiparous (group 3%−25%) (Table 3). Group 5, multiparous birthing people with a prior cesarean delivery, made up 14.3% of the birthing population but were the largest contributor to the cesarean delivery rate, with 38.4% of cesarean deliveries (Table 3). Breech births (groups 6 and 7) had the highest cesarean delivery rate (>90%) while group 3, consisting of people who had already given birth vaginally at least once, had the lowest cesarean delivery rate (less than 3%). Throughout the rest of this article, groups 1 (NTSV with spontaneous labor), 3 (Multiparous TSV with spontaneous labor), and 4 (multiparous TSV with induction or planned cesarean) are considered the low-prevalence groups (due to their low cesarean delivery rates); groups 2 (NTSV with induction or planned cesarean) and 10 (preterm delivery) are considered the medium-prevalence groups (as their cesarean delivery rates fall between 30% and 50%), and groups 5 (prior cesarean TSV), 6 (nulliparous breech), 7 (multiparous breech), 8 (plural pregnancies), and 9 (transverse/oblique lies) are considered the high-prevalence groups (for their high cesarean delivery rates).

Robson group results
The distribution of demographic characteristics across Robson groups is provided in Supplemental Table 3. Patterns of comorbidities and labor and delivery complications varied by Robson group. The distribution of comorbidity and complication prevalence across Robson groups is shown in Supplemental Figure 3.

Low cesarean prevalence groups
Almost 60% of all births in Massachusetts during the study period were

TABLE 2
Distribution of demographic factors in Massachusetts birthing people, 2011 to 2018 (continued)

Characteristic	N	%
Maternal comorbidities present	247,924	45.5%
Cesarean only	110,571	64.6%
Vaginal only	137,353	36.7%
Labor and delivery complications present	277,644	50.9%
Cesarean only	137,720	80.4%
Vaginal only	139,924	37.4%

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in the low-risk groups and the cesarean delivery rate across these groups was 9.9% (Table 4). Approximately 31% of these births had comorbidities and 41% had documented labor and delivery complications (Table 4). Group 1 (NTSV with spontaneous labor) had the lowest prevalence of maternal comorbidities among cesarean deliveries (28%) and group 4 (multiparous TSV with induction or planned cesarean) had the highest (49%). However, for labor and delivery complications group 3 (multiparous TSV with spontaneous labor) had the lowest prevalence (35%) and group 1 had the highest (46%).

Medium cesarean prevalence groups
One-fifth of all births in Massachusetts during the study period were in the medium cesarean-risk group (Table 4). The cesarean delivery rate in the medium-risk group was 40%. Roughly 57% of all births in the medium cesarean delivery risk group had maternal comorbidities and 62% had labor and delivery complications. While the distribution of labor and delivery complications were similar for groups 2 (NTSV with induction or no labor cesarean) and 10 (preterm delivery), the prevalence of comorbidities was 23 percentage points higher in group 10 than in group 2.

High cesarean prevalence groups
The high cesarean-risk group comprised the remaining 20% of birthing

people (Table 4). Eighty-four percent of people in this group had a cesarean delivery. About 80% of all births had documented maternal comorbidities and 70% had labor and delivery complications. Among the high-risk group, group 5 (prior cesarean TSV) had the highest prevalence of labor and delivery complications and the lowest prevalence of comorbidities. Inversely, group 6 (nulliparous breech) had the lowest prevalence of labor and delivery complications but the highest prevalence of comorbidities (Table 4).

We also explored patterns in specific maternal comorbidities across Robson groups and by delivery method. Results are shown in Supplemental Figures 4 and 5.

Comment
Principal findings
Overall, the highest cesarean delivery rates in Massachusetts are among births with malpresentation of the fetus (either breech, transverse, or oblique lie), which is consistent with current medical practices. While there was a general dose-response relationship between cesarean-risk group and maternal comorbidities and complications, there were no noticeable patterns in specific comorbidities or complications across the Robson groups. Interestingly, nulliparous, singleton breech deliveries (Robson group 6), while having a high cesarean delivery rate, had relatively low rates of maternal comorbidities.

Results in the context of what is known
The findings from our Robson analysis are consistent with a previous analysis conducted by Hehir et al[12] in the United States using data from 2005 to 2014, notably that nulli- or multiparous single, term, cephalic deliveries with noninduced labor (groups 1, 3, and 5) were also the largest proportion of births. Interestingly, we observed a lower CS rate among deliveries with transverse or oblique lie (group 9) compared to Hehir et al.[12] One reason for this may be that Hehir et al relied solely on birth certificate data, whereas our data was based on both birth certificate and hospital discharge data, which increases our specificity for both cesarean deliveries and for fetal position. In a secondary analysis, we compared Robson group cesarean delivery rates across 5 different countries (available in the supplement). For all countries, breech and transverse lie deliveries had cesarean rates close to 90%, indicating medical consensus on the necessity of cesarean delivery. Other groups, like multiple pregnancies and preterm deliveries, had varying rates of cesarean delivery and indicate potential differences in cultural/social practices around cesarean delivery rates within these groups. For example, Sweden's low multiple pregnancy cesarean delivery rate and low repeat cesarean delivery rate (~50% for both groups) may suggest that a shift in provider and hospital policies and practices for this group could reduce the cesarean delivery rate in Massachusetts. The prevalence of midwife-attended births in the United States is noticeably lower than Sweden, for example, and previous research has shown a direct relationship between midwifery-attended births and reduced risk of cesarean delivery.[13,14] Additionally, more isolated hospitals may not provide trial of labor after cesarean as an option for birthing people due to the risk of complications and lack of resources. These differences across groups internationally highlight the complexity in studying drivers of cesarean delivery, especially

TABLE 3

Distribution of birthing people into Robson classification groups

Robson group	Number of births	Proportion of births	Number of cesarean deliveries	Cesarean delivery rate	Contribution to cesarean delivery rate
1	143,826	26.4%	22,637	15.7%	13.2%
2	66,637	12.2%	31,429	47.2%	18.4%
3	141,275	25.9%	4405	3.1%	2.6%
4	44,776	8.2%	7474	16.7%	4.4%
5	77,993	14.3%	65,800	84.4%	38.4%
6	7509	1.4%	7463	99.4%	4.4%
7	3673	0.7%	3528	96.1%	2.1%
8	11,210	2.1%	7907	70.5%	4.6%
9	1364	0.3%	1112	81.5%	0.7%
10	43,125	7.9%	16,369	38.0%	9.6%
Undefined	3865	0.7%	3067	79.4%	1.8%
Total	541,388		171,191	31.6%	

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across different populations and hospital settings.

A common narrative among maternal health researchers is that the nulliparous, term, singleton, vertex (commonly abbreviated as NTSV) primary cesarean deliveries are generally avoidable cesarean deliveries and are typically the focus of interventions designed to reduce the cesarean delivery rate in the United States.[15–17] In this analysis, we found that almost half of all NTSV births (with no induction and no planned cesarean) had labor complications and over 60% of induced or planned cesarean NTSV deliveries had labor complications.

Further, this research reveals that multiparous birthing people with a prior cesarean delivery are the largest contributor to the current cesarean

TABLE 4

Maternal comorbidity and labor and delivery complication prevalence by Robson group among birthing people in Massachusetts, 2011 to 2018

Robson groups	N (%)	Cesarean delivery rate	Maternal comorbidities	L&D complications
Low risk	**322,314 (59.1%)**	**9.9%**	**31.2%**	**40.8%**
1	139,949 (25.7%)	15.2%	27.6%	46.3%
3	138,437 (25.4%)	2.9%	29.2%	35.4%
4	43,928 (8.1%)	15.1%	48.8%	40.2%
Medium risk	**110,254 (20.2%)**	**40.4%**	**57.1%**	**62.0%**
2	64,240 (11.8%)	45.3%	48.1%	61.3%
10	46,014 (8.4%)	33.5%	70.9%	63.0%
High risk	**109,440 (20.1%)**	**84.4%**	**79.7%**	**70.7%**
5	74,737 (13.7%)	84.0%	89.4%	65.4%
6	10,755 (2%)	96.8%	25.4%	99.8%
7	7485 (1.4%)	92.9%	46.9%	99.0%
8	11,044 (2%)	70.6%	65.6%	76.2%
9	5419 (1%)	81.3%	28.3%	93.3%

The bolded values here represent group total percentages (e.g. total cesarean delivery % in Medium Risk Group) to differentiate from the group-specific rate (e.g. Group 2 cesarean delivery rate).

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delivery rate. About 86% of individuals with a prior cesarean delivery had a repeat cesarean delivery in this sample, a rate comparable to the national average.[18]

Clinical and research implications

Examining patterns labor and delivery complications for NTSV births may provide important information for cesarean delivery interventions aimed at this population. Additionally, given the high contribution of repeat cesarean deliveries to the overall cesarean delivery rate, researchers invested in identifying intervention points for the reduction of the cesarean delivery should continue to explore interventions targeted to this group. Especially since current research on the success of trial of labor after cesarean delivery (TOLAC) and vaginal delivery after cesarean (VBAC) is limited.

Finally, few studies have examined pregnancy outcomes, like hemorrhage and cesarean delivery, using the Robson classification system, and those that have were done outside the United States.[19−21] Understanding differences in cesarean delivery risk in these groups may shed more light on understanding cesarean delivery risk in the entire birthing population, and not just the NTSV birthing population.

Strengths and limitations

This study is not without limitations. First, this study relies on birth certificate and hospital discharge records, and not medical records or self-report (except for demographic information like race/ethnicity). While we believe cesarean delivery records were sensitive and specific to the true delivery method, there is the potential for misclassification for some of the variables used in this analysis. For example, the prevalence of pre-existing diabetes in these data is lower than national data suggest.[22−25] Previous literature has also found that birth certificates and hospital discharge records show low sensitivity in capturing labor inductions, so we may have misclassified birthing people who belong in groups 2 and 4 into groups 1 and 3 instead.[22] While birth certificates

have been found to have low/moderate agreement with medical records when it comes to maternal comorbidities and labor complications, combining hospital discharge records with birth certificate records likely increased the accuracy of these conditions in our analysis.[26]

Additionally, we were unable to take hospital practices and policies into account in this research. Previous literature has identified hospital and provider practices as being strongly correlated with cesarean delivery rates.[27−30] While all the birthing people in our dataset were from Massachusetts, there were about 70 different birth sites. Since the likelihood of a cesarean delivery for a birthing person is strongly tied to hospital cesarean delivery rates, this is an important factor that we were unable to investigate.[27] Accuracy in hospital billing records and birth certificates have been found to be linked to hospital (for specific factors like gestational age and cesarean delivery), so this is another important aspect of validity that we are unable to account for in this analysis.[23]

It is also important to note that the conditions used in this analysis for cesarean delivery doesn't necessarily capture the range of experiences and reasons for a cesarean delivery: some individuals may not have a documented clinical condition that may indicate cesarean delivery but could have had a cesarean delivery for other equally important factors.[31,32] For example, failed induction, a common indication for cesarean delivery, is not included on the birth certificates (although we do have induction). Obtaining population estimates for cesarean deliveries due to failed induction of labor is difficult, as failed induction depends on a variety of factors, including how long different clinicians allow patients to wait before calling a failed induction and whether other indications arise during the immediate postinduction window. Similarly, we were unable to account for fetal distress (also called nonreassuring fetal status) another important indication for cesarean delivery. Estimates for the proportion of cesarean deliveries due to fetal distress hover between 3% and 5%.[33−35]

We also included anemia as a maternal comorbidity even though it is not an independent risk factor for cesarean delivery. We included anemia as it is included in the birth certificate records and is an important factor for compounding risk factors, however patterns in the rate of anemia are likely not relevant for understanding drivers of cesarean delivery.

Strengths

This is one of the only studies utilizing the Robson classification system in the United States. Not only were we able to obtain all birth certificate records for all births in Massachusetts between 2011 and 2018, but we were able to link these with hospital discharge records to ensure high-quality data sources. Using this data, we were able to categorize almost all births into one of the 10 Robson groups and analyze prevalence of maternal comorbidities and delivery complications across these groups.

Conclusions

While, in general, maternal comorbidities, and labor and delivery complications followed mirrored patterns cesarean delivery rates across Robson groups (eg, higher comorbidities in higher prevalence groups), there were some interesting discrepancies, especially in births with noncephalic presentations where maternal comorbidity rates matched lower cesarean-risk groups like the nulliparous single-term cephalic births.

Glossary

Indicated cesarean delivery: A cesarean delivery performed due to a clinical/medical reason

Nonindicated cesarean delivery: A cesarean delivery performed due to maternal request (elective) or declined vaginal birth after cesarean

Emergent cesarean delivery: A cesarean delivery performed after onset of labor

Planned cesarean delivery: A cesarean delivery scheduled before labor begins

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Primary C-section: A C-section performed on someone with no history of prior C-section

Parity: The number of prior live births a person has had

Nulliparous: No prior live birth

Multiparous: At least one prior live birth

Grand multiparous: More than 3 live births

Fetal presentation: The orientation of the fetus at the time of labor

Cephalic: Fetal presentation is head first

Vertex: Neck is tucked into chest

Breech: Fetal presentation is feet first

Transverse or oblique lie: Fetal presentation is sideways (hip first)

Gestational age: Number of weeks of gestation

Term: At least 37 weeks gestation at time of birth

Preterm: Less then 37 weeks gestation at birth

Plurality: The number of fetuses in the womb

Singleton: One fetus in the womb

Multiple pregnancy: More than one fetus in the womb

CRediT authorship contribution statement

Ruby Barnard-Mayers: Writing − original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Eugene Declercq:** Writing − review & editing, Methodology, Conceptualization. **Eleanor J. Murray:** Writing − review & editing, Methodology. **Tina D. Yarrington:** Writing − review & editing, Methodology. **Martha M. Werler:** Writing − review & editing, Supervision, Methodology, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.xagr.2025.100470.

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