

Risk Factors Associated with Cesarean Delivery on Maternal Request in a High-Risk Maternity Hospital: A Case Control Study

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Abstract

BACKGROUND

Cesarean delivery on maternal request (CDMR) is increasing worldwide, and identifying its determinants is essential to guide strategies aimed at stabilizing this trend.

METHODS

The aim of this study was to analyze risk factors for cesarean delivery on maternal request (CDMR) and its subcategories: elective (CDMRele) and induction withdrawal (CDMRiw). A case–control study was conducted using retrospective data from electronic delivery records at a public tertiary maternity hospital in Brazil, from October 2017 to October 2021. The CDMR group included both primary and second cesarean deliveries. For each CDMR case, one control (the closest vaginal delivery) was selected. Variables analyzed as potential risk factors for cesarean delivery on maternal request included: maternal age, education, skin color, marital status, comorbidities, previous cesarean delivery, and the presence of a companion during labor. Associations were assessed using univariate and multivariable logistic regression. Model fit and collinearity were evaluated using the Hosmer–Lemeshow test and the Variance Inflation Factor, respectively.

RESULTS

Among 330 matched pairs, the presence of comorbidities significantly increased the risk of CDMR (OR = 12.02, 95% CI = 6.63–21.81), with similar effects observed for both CDMRele (OR = 13.05, 95% CI = 5.58–30.52) and CDMRiw (OR = 13.46, 95% CI = 5.07–35.77). A previous cesarean delivery was also associated with an increased risk of CDMR (OR = 7.01, 95% CI = 3.86–12.74), including CDMRele (OR = 8.78, 95% CI = 4.08–18.89) and CDMRiw (OR = 5.51, 95% CI = 1.94–15.62).

CONCLUSION

The presence of comorbidities and a history of previous cesarean delivery are major determinants of maternal request for cesarean section. In high-risk populations, particularly in countries with elevated cesarean rates, strategies to prevent primary cesarean delivery and optimize the management of maternal comorbidities are essential.

BACKGROUND

The worldwide increase in cesarean delivery (CD) rates is a concern for the World Health Organization (WHO) and the International Federation of Gynecology and Obstetrics (FIGO), as these rising rates are not associated with improved maternal or perinatal outcomes [1, 2].

The increase in CD rates is a multifactorial phenomenon influenced by women, their families and friends, healthcare professionals, beliefs and preferences, remuneration and financing, and healthcare organization [3, 4]. These factors affect perceptions of safety and contribute to the normalization of CD as a mode of delivery, which may ultimately result in maternal request for CD.

The most widely adopted definition of cesarean delivery on maternal request (CDMR) is “primary CD requested by the woman in the absence of any maternal or fetal medical indication that justifies the procedure” [5]. However, this definition is not universally accepted, and other international organizations do not restrict CDMR to primary CD [2, 6, 7]. International organizations generally support women's right to request CD but emphasize the responsibility of healthcare professionals to provide appropriate counseling based on the best available evidence [2].

Evidence shows that CD is associated with maternal risks, including postpartum infection, hemorrhage, blood transfusion, organ injury, anesthetic complications, maternal mortality, placenta accreta spectrum, and uterine rupture in subsequent pregnancies [1, 8, 9]. Potential adverse perinatal outcomes include prematurity and respiratory complications. Recent studies have also suggested that children born by CD may have an increased risk of diabetes, obesity, asthma, and autoimmune diseases [10–12]. Considering the potential influence of CD on the short- and long-term health of women and their infants, unnecessary CD should be avoided.

With the increasing postponement of childbearing and the growing number of women with pre-existing or pregnancy-related complications, the interplay between medical indications and maternal request has become increasingly complex. This context may contribute to increasing social intolerance of unexpected adverse perinatal outcomes, which are often attributed to vaginal delivery (VD). Nevertheless, the perception that CD is safer than VD does not fully account for emerging evidence regarding the longer-term health risks for women and their offspring [9, 12].

To better understand the growing phenomenon of CDMR, we assessed the risk factors associated with CDMR among women receiving care at a referral maternity hospital in Brazil.

METHODS

The aim of this study was to analyze risk factors associated with cesarean delivery on maternal request (CDMR) and its subcategories: elective CDMR (CDMRele) and CDMR following withdrawal from labor induction (CDMRiw).

We conducted a case-control study based on a retrospective analysis of electronic medical records of all deliveries between October 2017 and October 2021 at a public referral maternity hospital in Southeastern Brazil [13]. The cases comprised cesarean deliveries on maternal request (CDMR), categorized as elective CDMR (CDMRRele) or CDMR following withdrawal from labor induction (CDMRiw) [14]. Women with two or more previous cesarean deliveries were excluded because, according to the local protocol, vaginal delivery is not recommended for these women. One control with vaginal delivery (VD) was selected for each CDMR case. Controls were identified as the temporally closest VD occurring at the same institution.

Data were obtained from electronic medical records and compiled into a dedicated secondary database developed for this study. Given the retrospective design and the anonymous nature of the data, the requirement for informed consent was waived by the Research Ethics Committee. Patients who delivered at the institution did not remain under longitudinal follow-up at this hospital, they returned for a postpartum visit approximately 15 days after delivery and were subsequently discharged from the institution. Consequently, long-term follow-up of these patients within the institution was not feasible. In view of the impossibility of obtaining informed consent from all eligible women, the use of the Data Use Commitment Form was approved for the use of data retrieved from the medical records. The study was approved by the **Research Ethics Committee of the Center for Integral Women's Health Care (CAISM), University of Campinas (UNICAMP)** - protocol No. 65705922.0.0000.5404.

Age, educational level, skin color, marital status, presence of a companion, comorbidities, and one previous cesarean delivery were compared between the groups using univariable logistic regression analysis. For the multivariable analysis, educational level, skin color, and marital status were excluded because of missing data. Model goodness of fit was assessed using the Hosmer–Lemeshow test, with $P > 0.05$ indicating adequate fit, and multicollinearity was assessed using the variance inflation factor (VIF). Statistical analyses were performed using the Statistical Analysis System for Windows, version 9.4 (SAS Institute Inc., Cary, NC, USA). A two-sided P value < 0.05 was considered statistically significant [15].

RESULTS

Figure 1 describes the study sample. Initially, 420 cases of CDMR were identified: 246 (58.6%) in the CDMRRele group and 118 (28.1%) in the CDMRiw group. An additional 56 women (13.3%) requested CD after spontaneous labor had already begun (labor withdrawal) and were therefore excluded from further analysis. The remaining 364 cases comprised the CDMRRele and CDMRiw groups. After applying the eligibility criteria, 330 cases were included and matched to 330 controls.

Figure 1: **Flowchart which describes the sample of the study**

Tables 1 and 2 present the results of the univariable and multivariable conditional logistic regression analyses assessing the association between potential risk factors and CDMR, including its two categories: elective CDMR (CDMRRele) and CDMR following withdrawal from labor induction (CDMRiw).

Table 1
Associated risk factors to cesarean delivery on maternal request - paired sample, univariate analysis.

		CDMR	CDMRele	CDMRiw	OR			P VALUE			95% CI	
		N = 330	N = 219	N = 111	CDMR	CDMRele	CDMRiw	CDMR	CDMRele	CDMRiw	CDMR	CDMRele
Educational level	≤ 9 years(ref)				1.00	1.00	1.00	-	-	-	-	-
	≥ 10 years	N = 15 (4.5%)	N = 9 (4.1%)	N = 6 (5.4%)	0.40	0.50	0.33	0.273	0.571	0.341	0.08–2.06	0.05–5.51
Skin color	Mixed/black (ref)				1.00	1.00	1.00	-	-	-	-	-
	White	N = 37 (11.2%)	N = 27 (12.3%)	N = 10 (9.0%)	1.14	0.67	4.00	0.796	0.530	0.215	0.41–3.15	0.19–2.36
Marital status	With partner (ref)				1.00	1.00	1.00	-	-	-	-	-
	Without partner	N = 208 (63.0%)	N = 138 (63.0%)	N = 70 (63.0%)	1.39	1.56	1.20	0.145	0.144	0.602	0.89–2.18	0.86–2.81
Companion	Alone (ref)				1.00	1.00	1.00	-	-	-	-	-
	Partner	N = 330 (100%)	N = 219 (100%)	N = 111 (100%)	1.49	1.16	2.41	0.091	0.600	0.040	0.94–2.35	0.66–2.04
	Others	N = 330 (100%)	N = 219 (100%)	N = 111 (100%)	0.91	0.64	1.92	0.699	0.156	0.172	0.55–1.50	0.35–1.19
Age	≤ 29 years old (ref)				1.00	1.00	1.00	-	-	-	-	-
	≥ 30 years old	N = 330 (100%)	N = 219 (100%)	N = 111 (100%)	2.42	2.86	1.71	< 0.001	< 0.001	0.080	1.71–3.43	1.86–4.39
Comorbidities	No (ref)				1.00	1.00	1.00	-	-	-	-	-
	Yes	N = 330 (100%)	N = 219 (100%)	N = 111 (100%)	13.07	15.75	10.00	< 0.001	< 0.001	< 0.001	7.73–22.09	7.71–32.18
Previous CD	No (ref)				1.00	1.00	1.00	-	-	-	-	-
	Yes	N = 330 (100%)	N = 219 (100%)	N = 111 (100%)	8.83	12.78	4.89	< 0.001	< 0.001	< 0.001	5.43–14.38	6.48–25.18

Missing data: CDMR: educational level n = 15 (4.5%); skin color n = 37 (11.2%); marital status n = 122 (37%). CDMRele: educational level n = 210 (95.9%); skin color n = 81 (37%); marital status n = 81 (37%). CDMRiw: educational level n = 105 (94.6%); skin color n = 101 (91%); marital status n = 41 (36.9%).

Table 2
Associated risk factors to CDMR (N = 330), CDMRele (N = 219) and CDMRiw (N = 111) – multiple conditional analysis for paired sample.

	RISCK FACTOR	DESCRIPTION	OR	P value	95% CI
CDMR	Companion	Alone (ref)	1.00	-	-
		Partner	1.60	0.218	0.76–3.37
		Other	0.79	0.558	0.35–1.76
	Age	≤ 29 years (ref)	1.00	-	-
		≥ 30 years	1.14	0.652	0.66–1.96
	Comorbidities	No (ref)	1.00	-	-
		Yes	12.02	< 0.001	6.63–21.81
	Previous CD	No (ref)	1.00	-	-
		Yes	7.01	< 0.001	3.86–12.74
CDMRele	Companion	Alone	1.00	-	-
		Partner	0.99	0.995	0.35–2.81
		Other	0.46	0.138	0.16–1.29
	Age	≤ 29 years (ref)	1.00	-	-
		≥ 30 years	1.87	0.081	0.93–3.79
	Comorbidities	No (ref)	1.00	-	-
		Yes	13.05	< 0.001	5.58–30.52
	Previous CD	No (ref)	1.00	-	-
		Yes	8.78	< 0.001	4.08–18.89
CDMRiw	Companion	Alone	1.00	-	-
		Partner	2.81	0.095	0.84–9.46
		Other	1.38	0.653	0.34–5.63
	Age	≤ 29 years (ref)	1.00	-	-
		≥ 30 years	0.51	0.195	0.19–1.41
	Comorbidities	No (ref)	1.00	-	-
		Yes	13.46	< 0.001	5.07–35.77
	Previous CD	No (ref)	1.00	-	-
		Yes	5.51	0.001	1.94–15.62

The results showed that comorbidities and previous CD were significantly associated with CDMR, as well as with both CDMRele and CDMRiw. Age was significantly associated with CDMRele in the univariable analysis, but this association was no longer significant in the multivariable analysis. The presence of a companion was significantly associated with CDMRiw in the univariable analysis but not in the multivariable analysis (Table 2).

Despite the high odds ratios observed for comorbidities and previous CD, the models showed adequate goodness of fit according to the Hosmer–Lemeshow test ($P > 0.05$). Multicollinearity was assessed using the variance inflation factor (VIF), with consistently low values (approximately 1), indicating no evidence of multicollinearity among the independent variables and supporting the stability of the models (Table 3).

Table 3
Model fit and multicollinearity diagnostics

MODEL	HL X ² (DF)	P-VALUE	VIF RANGE
CDMR	6.47 (8)	0.5953	1.001–1.152
CDMRele	4.69 (7)	0.6976	1.001–1.181
CDMRiw	5.45 (7)	0.6058	1.012–1.138

HL = Hosmer–Lemeshow test; VIF = Variance Inflation Factor.

Variables included in the VIF calculation: companion, age, comorbidities, and previous CD.

DISCUSSION

We found that a previous CD was associated with sevenfold higher odds of CDMR, while the presence of comorbidities was associated with 12-fold higher odds. As this study was conducted at a referral maternity hospital specializing in high-risk pregnancies, a substantial proportion of women had comorbid conditions, particularly diabetes and hypertension. Even when these well-controlled conditions did not constitute a formal medical indication for CD [16, 17], their presence may have contributed to women's requests for CD. Women may request CD because they perceive it as a safer or better option for themselves or their newborns, even when they have been informed about the safety of labor induction under appropriate hospital supervision [18].

Our results are consistent with findings from other studies conducted in developing countries. In Southeastern India, the prevalence of CDMR was 14.5% of all deliveries, and a previous CD was identified as a significant risk factor associated with CDMR [19]. A cross-sectional study conducted in Nepal reported an overall CD rate of 50.2%, with CDMR accounting for 2.7% of all deliveries. Previous CD was the largest contributor to the overall CD rate. Five key themes were identified as influencing CD rates: (1) medical factors, including repeated CD, complicated cases, and breech presentation; (2) sociodemographic factors, including advanced maternal age, precious baby, and defensive CD; (3) financial factors, including income generation in private hospitals; (4) maternal request; and (5) health service-related factors, including lack of resources, urban centralization of health facilities, and lack of policies and protocols [20].

In the United States, data showed that among low-risk nulliparous patients, White women had higher rates of CDMR than women from other racial groups [21]. A retrospective cohort study conducted in Canada found that factors associated with CDMR included advanced maternal age, higher educational level, conception through in vitro fertilization, anxiety, nulliparity, White race, care at hospitals providing higher levels of maternal care, and obstetrician-led antenatal care [22]. In Italy, CDMR accounted for 9% of all cesarean deliveries and was more frequent among women with higher educational attainment, previous CD, a history of miscarriage, and previous assisted reproductive technology. These findings suggest a perception of greater safety associated with CD among these women [23].

Among women with high-risk pregnancies, the presence of comorbidities may play an important role in their perception of the safety and appropriateness of CD. Some women may perceive requesting a CD as a way of ensuring hospital admission and a guaranteed bed for delivery [24].

In our sample, age and skin color were not associated with higher odds of CDMR. Information on educational level was missing for the majority of cases and controls and was therefore excluded from the multivariable analysis. Age was significantly associated with CDMR and CDMRele in the univariable analysis but not after adjustment in the multivariable analysis.

We also found no association between the presence of a companion during labor or marital status and CDMR. In a qualitative study conducted in the same high-risk population, companions reported that they were often informed that VD was safer for women and newborns; however, they perceived their role as supporting women's decisions regarding cesarean delivery in cases of CDMR [25].

The reasons underlying requests for CD after the initiation of labor induction, or even after spontaneous labor has begun, may be related to the combination of the cultural perception of CD as an acceptable mode of delivery in Brazil and a historical emphasis on women's autonomy and freedom of choice [14, 25–28].

In 2025, 61.5% of all deliveries in Brazil were by CD, with relatively small variations across geographic regions: 67% in the Center-West, 63% in the South, 62% in the Southeast, 60% in the Northeast, and 56% in the North [26]. In addition, a state law guarantees women's right to request CD [27], and the Brazilian medical regulatory body also supports women's right to request CD [28].

In fact, international organizations have adopted similar positions, recommending respect for women's autonomy within the context of appropriate counseling. These recommendations are aligned with ethical considerations surrounding CDMR and also recognize healthcare professionals' right to decline a woman's request for CD, provided that appropriate alternative care can be arranged through another qualified professional or healthcare service [2, 5–7, 29].

Regardless of the importance of respecting women's autonomy and choice, the increasing rates of CD remain a matter of international concern. Several strategies have been proposed to address the rising rates of CD, either individually or in combination, with varying degrees of effectiveness. These include providing resources to support continuous care during labor and birth, such as midwives, trained staff, and birth centers; increasing awareness of the risks and benefits of different modes of childbirth through antenatal education, counseling, and public awareness initiatives; reforming CD policies and protocols; promoting physiological birth; and implementing the WHO Labour Care Guide [29–31].

In Brazil, several interventions have already been evaluated in both public and private institutions, either individually or as part of multifaceted interventions. These have included auditing CD rates using the Robson classification in public institutions and implementing a set of evidence-based practices in private institutions [32, 33]. Other strategies, such as prenatal education, reorganization of obstetric care involving a multidisciplinary team, non-pharmacological and pharmacological interventions for pain relief when needed, second-opinion practices, and audits of CD rates with feedback, may also contribute to reducing unnecessary cesarean deliveries [34–36].

The literature suggests that the effectiveness of interventions aimed at reducing CDMR may depend on several factors, including the mix of obstetric conditions and clinical complications during pregnancy, healthcare provider training, health system organization, access to respectful maternity care, and cultural beliefs and practices surrounding childbirth.

Considering the Brazilian context, characterized by persistently high CD rates over several decades, a comprehensive, multifaceted approach combined with a strong and coordinated commitment to safe and respectful vaginal birth may be necessary to reduce requests for CD, particularly among women with high-risk pregnancies.

Our study has some limitations. First, it was conducted in a specific population of women with high-risk pregnancies, which may limit the generalizability of our findings to other populations. Second, the study relied on routinely collected electronic medical records and secondary data analysis. In addition, several case-control pairs had to be excluded from the final analysis because of missing socioeconomic and demographic information, particularly educational level, marital status, and skin color. Nevertheless, our findings highlight the relevance of comorbidities and previous CD in the context of decision-making regarding CDMR, even among women receiving routine antenatal counseling and in the absence of a medical indication for CD.

Future prospective studies following women with high-risk pregnancies from antenatal care through delivery planning and birth are warranted to better understand the motivations underlying requests for CD and how these factors interact with medical indications and antenatal counseling.

CONCLUSIONS

Comorbidities and previous CD were strongly associated with CDMR and may play an important role in women's decisions regarding mode of delivery. High-quality prenatal care, including individualized counseling on the risks and benefits of each mode of delivery, is essential, particularly for women with high-risk pregnancies. Optimal management of maternal clinical conditions, careful assessment of the need for labor induction, and prevention of the first CD may help align women's preferences with the safest possible mode of delivery, while respecting maternal autonomy.

Abbreviations

CD
cesarean delivery
CDMR
cesarean delivery on maternal request
CDMRele
elective cesarean delivery on maternal request
CDMRiw
cesarean delivery on maternal request by induction withdraw
WHO
World Health Organization
FIGO
International Federation of Gynecology and Obstetrics
VD
vaginal delivery

Declarations

Ethics approval and consent to participate:

This study was approved by the local Research Ethics Committee (# 65705922.0.0000.5404), in accordance with the Declaration of Helsinki, 2013. Informed consent was waived due to the retrospective and anonymous nature of the data.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

CMSB was responsible for conceptualization, data curation, project administration, and writing the original manuscript. CJLSM contributed to data curation and writing the original manuscript. JPSG contributed to methodology, formal analysis, review and editing of the manuscript. HCM contributed to methodology, formal analysis, review and editing of the manuscript. EA contributed to conceptualization, project administration, supervision, review and editing of the manuscript. All authors approved the final version of the manuscript.

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Data Availability

The datasets generated and analysed during the current study are available in the REDU repository. <https://doi.org/10.25824/redu/QFUPVD>

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Figures

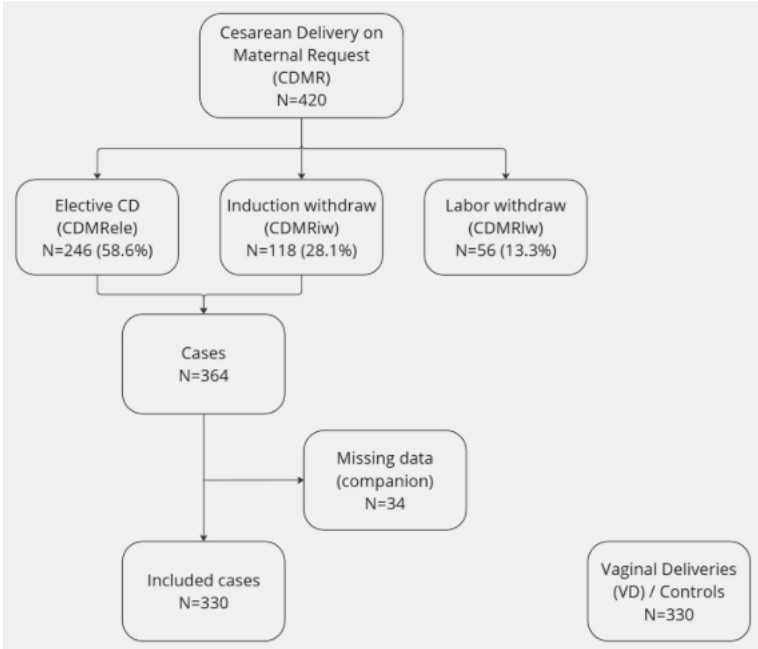


Figure 1

Flowchart which describes the sample of the study