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Medical Indications for Primary Cesarean Delivery in Women with and without Disabilities

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Abstract

Background: Prior research has found that women with disabilities are more likely to deliver by cesarean than are women without disabilities. It is not clear whether all of the cesarean deliveries among women with disabilities are medically necessary.

Objectives: To examine the associations between maternal disability status and type, mode of delivery, and medical indications for cesarean delivery in California deliveries.

Study design: Retrospective cohort study of all nulliparous births in California between 2000 and 2012. We classified births as to whether or not women underwent a trial of labor, and determined if medical indications for cesarean delivery were present. Multivariable logistic regression models examined the association of disability with trial of labor and indications for cesarean delivery.

Results: Women with disabilities had lower odds of having a labored delivery, compared to women without disabilities (adjusted odds ratio (aOR) = 0.45, 95% confidence interval (CI) 0.41 – 0.49). In the sample of women who labored (90.5% of total), women with disabilities were more

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Disclosure of Interest

The authors report no conflicts of interest.

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likely to have a medical indication for cesarean delivery (aOR = 1.15, 95% CI 1.10–1.21), and were more likely to have a cesarean delivery (aOR = 1.46, 95% CI = 1.38–1.54). In the subsample of unlabored cesarean deliveries, women with disabilities were less likely to have documented medical indications for cesarean delivery (aOR = 0.45, 95% CI = 0.41–0.50).

Conclusions: Women with disabilities were less likely to labor, and these unlabored cesarean deliveries were less likely to have a medical indication for cesarean, compared to women without disabilities.

Keywords

Cesarean section; disabled persons; visually impaired person; hearing impaired persons; intellectual disability

Introduction

Prior research has found that women with disabilities who give birth are more likely to deliver by cesarean than are women without disabilities [1–10]. However, it is not clear whether all of the cesarean deliveries among women with disabilities are medically necessary. Many women with disabilities can safely deliver vaginally [11], but have reported inadequate access to trial of labor even when they desired a vaginal delivery [12, 13]. While cesarean delivery is the appropriate standard of care in some situations and can be a life-saving procedure, the available literature suggests it may be over-utilized in women with disabilities. For example, women with spinal cord lesions at or above T6 frequently deliver by cesarean due to fears of autonomic dysreflexia [3, 14], although an epidural can be sufficient to prevent that risk while allowing vaginal delivery [15].

Cesarean delivery is major surgery and not without risks. Anesthesia, surgery and recovery may be particularly challenging for women with disabilities [11, 16]. Therefore, it is a scientific and clinical priority to accurately characterize the frequency of cesarean delivery and the presence of medical/obstetric indications for the procedure in women with disabilities. The objectives of this study were to: 1) compare the labored status of deliveries (labored or unlabored) between women with and without disabilities; and 2) determine whether, within each labored status category, women with and without disabilities differed in likelihood of having a documented medical indication for cesarean delivery.

Methods

We conducted a retrospective cohort study using linked hospital discharge and vital records data (birth certificates and death files [17]) for all births in California between 2000 and 2012 (N = 6,745,201). This study was approved by the California Office of Statewide Health Planning and Development, and the Institutional Review Board of the authors' university.

To remove the issue of prior cesarean delivery as a medical indication for repeat cesarean, we examined nulliparous women experiencing their first delivery only. We then excluded the following from our analytic sample: infants with non-cephalic presentation, multiple gestations, and records with gestational ages <23 weeks. Exclusion of non-cephalic

presentation removed a slightly higher proportion of women with disabilities (3,202 births, or 8.7% of 36,821 singleton records with gestational age ≥ 23 weeks) than women without disabilities (453,902, or 6.7% of 6,708,380 otherwise eligible records, $p < 0.001$) from the analytic sample. Preterm birth was also considered as an exclusion criterion in a sensitivity analysis; however, results were unchanged from those reported here and would have excluded an even greater proportion of births to women with disabilities (13.3% vs. 8.6% of births to women without disabilities). Therefore, preterm births were retained in the sample. Our final analytic sample consisted of 2,419,193 births (Figure 1).

Our outcomes of interest included: 1) whether or not a woman labored; and 2) whether or not medical indications for cesarean delivery were present, stratified by the presence of labor. Mode of delivery (cesarean versus any vaginal) was also considered as a separate outcome in the subgroup of labored deliveries. We used a published algorithm [18] to classify a delivery as labored if there was documentation of vaginal mode of delivery or other indicators of labor (e.g. amniotomy, cord prolapse, augmentation of labor) in either the birth certificate or the mother's discharge file (see Table 1, Supplemental Digital Content 1). We additionally classified each birth as to the presence of any medical indication for cesarean delivery. Medical indications for cesarean delivery (Table 2, Supplemental Digital Content 1) were derived from either the birth certificate or ICD-9 codes in the mother's discharge file.

We identified our key independent variables (disability status and type) using the International Classification of Diseases, 9th revision, clinical modification (ICD-9) diagnosis and procedure codes from the mother's discharge file. Disability was classified as either present or absent, and into subgroups of physical, hearing, vision, or intellectual/developmental (IDD) disabilities using a published algorithm [6]. (See Table 3, Supplemental Digital Content 1 for conditions used to classify disability status and type). An individual woman could be in more than one disability category if she had multiple disability codes recorded on her discharge record.

Sociodemographic covariates included maternal race/ethnicity (non-Hispanic White as referent, non-Hispanic Black, Hispanic, non-Hispanic Asian, non-Hispanic Other), maternal education (completion of high school/GED and at least 16 years of age as the referent), maternal age (< 35 years at birth as referent), and insurance status (public insurance as referent, private insurance, none). Health covariates of the mother included chronic diabetes (ICD-9 code 250), gestational diabetes (ICD-9 codes 648.0, 648.8), chronic hypertension (birth certificate, ICD-9 codes 410.0, 642.0–642.2), gestational hypertension/preeclampsia (birth certificate, ICD-9 codes 642.3–642.5), and mental health diagnoses (see Table 4, Supplemental Digital Content 1 for codes used). Additional covariates were initiation of prenatal care (initiation in the first trimester as referent), preterm birth status (< 37 weeks gestation, as identified on the birth certificate), and year of delivery (2012 as referent).

In our analyses, we examined whether women experienced labor or not, and examined the presence of medical indications for cesarean delivery among women who labored and did not. We first used bivariate tests of differences to identify statistically significant differences in our outcomes (any labor among all deliveries; indication for cesarean delivery among

labored deliveries; and indication for cesarean delivery among unlabored deliveries) by presence of disability and by disability subgroup (physical, hearing, vision, IDD) compared to women without disability. Second, we used multivariable logistic regression, controlling for demographic and health factors, to estimate the odds of labored delivery and of having documented indications for cesarean delivery (stratified by labored status). The physical disability category, which was by far the largest disability group, was further subdivided into nervous system disabilities, musculoskeletal disabilities, injuries, and congenital anomalies [6]; results of these analyses are presented in Supplemental Digital Content 2. We accounted for data clustering at the hospital level using robust standard errors [19].

Our findings rely on the accurate ascertainment of the labored status of delivery. To acknowledge the potential for misdiagnosis of labor, codes that could be assigned before labor begins – uterine rupture, cephalopelvic disproportion, and fetal distress – were removed from our indicators of labor for a sensitivity analysis. Our results did not change meaningfully under this analysis. Similarly, amniotomy, a procedure that can be coded during the process of a cesarean delivery, was removed in a separate sensitivity analysis for ascertainment of labored status. Our results did not change meaningfully under these separate analyses. We used an internally-derived algorithm of medical indications for cesarean to determine whether cesarean was medically indicated or not. We conducted two sensitivity analyses for medical indications of cesarean, comparing two existing algorithms to our expanded algorithm. In the first, we utilized the Joint Commission's list of contraindications for vaginal delivery [20]; results did not change significantly. Second, when utilizing Gregory's algorithm alone (without our additions) for medically indicated cesarean [21], results did not change significantly. These sensitivity analyses indicated that our algorithms for identifying labored deliveries [18] and for medically indicated cesarean delivery – while more comprehensive than other published algorithms -- yielded results consistent with previous literature. We present only the final analysis using the algorithms presented in Supplemental Digital Content 1. Analyses were conducted in Stata (release 14, StataCorp, College Station TX). Figures were prepared in R (version 3.4.2, R Foundation for Statistical Computing, Vienna Austria).

Results

Deliveries to women with disabilities comprised 0.6% (14,411/2,404,782) of our analytic sample. Compared to women without disabilities, women with disabilities had higher proportions of high school completion (81.6% vs 74.7%, respectively), advanced maternal age (17.4% vs 9.8%), and insurance coverage (98.9% vs 97.9%). Women with disabilities also had higher proportions of preterm birth (12.4% vs 7.9%) and mental health diagnoses (7.3% vs 1.3%), compared to women without disability (Table 1).

In the first step of our first analysis, we included all live births and examined whether or not labor occurred. Experiencing labor prior to delivery differed by disability status and type (Figure 2A). Overall, 76.5% of women with disabilities had indicators that they experienced labor, versus 90.5% of women without disabilities ($p<0.001$). Women with vision disabilities had the lowest proportion undergoing labor (70.1%), while those with hearing disabilities had the highest proportion undergoing labor (86.4%) among women with disabilities

($p < 0.001$ for both, compared to women without disabilities). After controlling for demographic and health factors, women with disabilities overall had lower odds of undergoing labor (adjusted odds ratio (aOR) = 0.45, 95% confidence interval (CI) 0.41–0.49, Table 2). Similar results – decreased odds of experiencing labor, compared to women without disability – were observed in women with physical, vision, and intellectual/developmental disabilities (Table 2).

Among all births, regardless of mode of delivery, a higher proportion of women with disabilities had documented medical indications for cesarean delivery than women without disability (Figure 2B). Overall, 42.2% of women with disabilities had a medical indication for cesarean, versus 39.6% of women without disability ($p < 0.001$). Women with hearing disabilities had the highest proportion of medical indications for cesarean (46.2%).

Next, we analyzed births stratified as to whether the delivery had indicators of labor or not. In the first of these analyses, we examined births whose records had codes indicating a labored delivery (Table 1, Supplemental Digital Content 1). In the subsample of women who had indicators of a labored delivery, a higher proportion of women with disabilities had medical indications for cesarean (regardless of how they ultimately delivered) than women without disabilities (Figure 3A). In women who labored, 46.2% of women with disabilities had an indication for cesarean, compared with 39.6% of women without a disability ($p < 0.001$). This relationship persisted in multivariable analyses (aOR 1.15, 95% CI 1.10–1.21). Similar results were observed when stratifying by disability type (Table 2).

Next, we analyzed actual mode of delivery in women who labored. The majority of women with disabilities delivered by a non-operative vaginal delivery, except for women with vision disabilities, where slightly fewer than half delivered by this mode (Figure 3B). The odds of cesarean delivery in women who labored were markedly higher in women with disabilities compared to those without. Women with disabilities overall had nearly a 50% increase in the odds of primary cesarean (aOR 1.46, 95% CI 1.38–1.54), and those with intellectual and developmental disabilities (IDD) had nearly double the odds (aOR 1.95, 95% CI 1.65–2.31) of primary cesarean when compared to women without disabilities (Table 2).

Finally, we examined the unlabored subgroup of births. Using our labor algorithm, unlabored births were those in which cesarean delivery occurred and there were no indicators for labor; these were presumed to be prelabor scheduled cesareans. In this group of births, women with disabilities overall had a significantly lower proportion of medical indications for cesarean, compared to women without disabilities (25.9% vs 38.7% respectively, $p < 0.001$, Figure 3C). Women with hearing disabilities had a similar proportion with medical indications for cesarean (39.6%, $p = 0.8$) as women without disabilities, while women with physical disabilities showed the greatest difference from those without disabilities (24.6%, $p < 0.001$). Even after controlling for medical and demographic factors, women with disabilities had significantly lower odds of having a recorded medical indication for cesarean delivery in unlabored delivery: aOR 0.45 (95% CI 0.41–0.50) compared to women without a disability (Table 2).

Discussion

We utilized linked vital record and discharge data to quantify whether women experienced labor or not, and examined the presence of medical indications for cesarean delivery among women who labored and did not. We found that women with disabilities had significantly lower odds of having a delivery with labor. Women with disabilities who did experience labor had greater odds of having an indication for cesarean and delivering by cesarean than women without disabilities. However, in women who had presumed prelabor scheduled cesareans – that is, delivering by cesarean and without indicators of labor – women with disabilities had significantly lower odds of having a medical indication for cesarean, compared to women without disabilities.

Our results regarding higher proportions of cesarean delivery among women with disabilities are consistent with prior research [1–10, 22, 23]. Our data were also consistent with previous research in finding that women with disabilities were more likely to have other risk factors for cesarean delivery, such as preeclampsia [6, 9, 24, 25], although controlling for these factors did not fully account for differences in delivery mode. Other possible reasons for higher odds of cesarean delivery among women with disabilities have been discussed elsewhere [3, 6, 14, 26] and range from autonomic dysreflexia to unmet needs for support in preparing for birth. However, prior research has not considered whether or not labor occurred prior to cesarean delivery. Nor have previous studies examined medical indications for cesarean deliveries in women with disabilities, although the medical necessity of these cesareans has been questioned [11].

Our finding of more frequent indications for cesarean among women with disabilities who labored compared to women without disabilities who labored suggests that deliveries among women with disabilities may sometimes be more complicated than deliveries among women without disabilities, resulting in more intrapartum cesareans in women with disabilities. Additionally, perhaps women with disabilities have more challenges with the labor process leading to more cesareans during labor. There were also more cesareans without labor in women with disabilities. Anticipation of potential complications during labor and vaginal delivery may contribute to the higher proportions of unlabored deliveries we observed among women with disabilities. Further, concerns about possible communication challenges or limited ability to consent to a cesarean while in labor may have played a role in decisions to plan ahead for cesarean deliveries for some women with disabilities rather than considering trial of labor.

Importantly though, among women with unlabored deliveries, women with disabilities were significantly less likely to have medical indications for cesarean. This finding raises the possibility that disability itself may be treated as an indication for cesarean in many cases. We cannot be certain that these cesarean deliveries are not medically necessary; the specific characteristics of a given woman's disability may present challenges to vaginal delivery that are not adequately captured by codes for factors typically requiring cesarean delivery. That said, our findings do raise further questions as to whether some women with disabilities may be scheduled for cesareans without adequate consideration of the potential for a safe vaginal delivery. In addition to the challenges women with disabilities may face in undergoing and

recovering from cesarean delivery [11,16], these cesareans have implications for women who desire additional children [27–29]. Thus, the benefits and harms of these surgeries should be carefully weighed. Examination of clinician decision making and counseling of patients with disabilities is needed to further understand the reasons for unlabored cesarean deliveries, particularly those that do not appear to be medically indicated based on administrative data. Additionally, research into labor practice among women with disabilities with a prior cesarean delivery is necessary.

Limitations of our study include the substantial challenges of defining disability based solely on diagnoses. The degree of functional limitation associated with any given diagnosis may vary considerably, and the ICD-9 classification system does not contain a comprehensive framework for identifying functional status or disability [30]. Moreover, we only had access to ICD-9 codes from the delivery record and may therefore have missed relevant diagnoses from a woman's prior medical history. However, our approach to disability ascertainment means that we likely identified disabilities that were perceived as relevant to clinical management of pregnancy and delivery. Thus, while we may not capture all disability, we do capture disability deemed pertinent to clinical practice, but our results may not be generalizable to less obvious or severe disabilities. Additional limitations relate to the assignment of labored status and medical indications for cesarean delivery. Labored or unlabored status of delivery is not explicitly captured in administrative or discharge data, although induction of labor (in this study, an indicator of labored status of delivery) is captured with high sensitivity via ICD-9 [31]; further, we used a previously-published algorithm to assign labored status of delivery [18], and our findings were robust in multiple sensitivity analyses to examine the impact of potentially misclassified deliveries. Our analyses also rely on the accurate ascertainment of medical indication for cesarean delivery. The accuracy of a prior algorithm for identification of non-medically indicated (i.e., elective) cesarean delivery – upon which our algorithm is based – is 96.6%, with sensitivity and specificity of 73.1% and 98.1%, respectively [32].

Our findings can be used by clinicians when counseling pregnant women with disabilities about labor and delivery. For instance, even after undergoing labor, women with disabilities were more likely to deliver by cesarean. Alerting women to this fact would allow them to prepare for the possibility of an intrapartum cesarean. It is also important to note that many women with disabilities did deliver vaginally, including some women with medical indications for cesarean. Given the subjective nature of some indications for cesarean [33], the presence of certain indications should be interpreted as a sign that a cesarean *may* be needed, not that one *necessarily* is. Clinicians should carefully consider and discuss with women with disabilities how to proceed in the presence of different types of indicators for possible cesarean delivery.

In conclusion, we found key differences in laboring status and medical indications for cesarean delivery in women with disabilities when compared to women without disabilities. Our findings contribute new information about the potential complexities of delivery in women with disabilities while also identifying a pattern of unlabored cesarean deliveries that do not appear to be medically indicated. The latter finding raises the possibility that trial of labor could be offered more broadly (and prelabor cesarean delivery be utilized more

sparingly) among women with disabilities. As the number of women with disabilities who experience pregnancy and birth continues to grow [34], it will be essential to conduct further research on obstetric care and outcomes in this population to define best practices and to optimize outcomes for women and their babies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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* Women may have more than one diagnosis.

† See Table 1, Supplemental Digital Content 1, for labor status indications.

Figure 1.
Analytic sample flow diagram.

Figure 2. Labored status of delivery (A) and medical indication for cesarean delivery (B) in analytic sample of California births to women with and without disabilities, 2000–2012 (n = 2,419,193). P-values are relative to women without disability.

Figure 3. Medical indication for cesarean delivery (A) and mode of delivery (B) in women with any labored delivery (n = 2,118,161); medical indications for cesarean delivery in women with unlabored cesarean delivery (C), California 2000–2012 (n = 231,032). P-values are relative to women without disability.

Table 1.

Demographics.

	Cohort	Disability Status		Disability Type			
		None	Any	Physical	Hearing	Vision	IDD*
Count (%)	2,404,782	2,404,782 (99.4)	14,411 (0.6)	11,722 (0.48)	1,134 (0.05)	890 (0.04)	858 (0.04)
Maternal race/ethnicity							
White	740,041 (30.83)	733,726 (30.75)	6,315 (44.15)	5,343 (45.94)	399 (35.31)	322 (36.47)	328 (38.54)
Black	131,209 (5.47)	130,222 (5.46)	987 (6.9)	772 (6.64)	56 (4.96)	71 (8.04)	113 (13.28)
Hispanic	1,162,521 (48.43)	1,157,081 (48.49)	5,440 (38.04)	4,296 (36.94)	514 (45.49)	362 (41)	339 (39.84)
Asian	310,050 (12.92)	308,830 (12.94)	1,220 (8.53)	937 (8.06)	139 (12.3)	109 (12.34)	52 (6.11)
Other	56,766 (2.36)	56,426 (2.36)	340 (2.38)	283 (2.43)	22 (1.95)	19 (2.15)	19 (2.23)
p-value	-	Ref.	<0.001	<0.001	0.015	<0.001	<0.001
Completed high school							
	1,809,296 (74.79)	1,797,536 (74.75)	11,760 (81.6)	9,695 (82.41)	876 (77.25)	728 (81.8)	601 (70.05)
p-value	-	Ref.	<0.001	<0.001	<0.001	<0.001	<0.001
Age 35							
	239,289 (9.89)	236,782 (9.85)	2,507 (17.4)	2,104 (17.95)	170 (14.99)	169 (18.99)	97 (11.31)
p-value	-	Ref.	<0.001	<0.001	<0.001	<0.001	0.357
Insurance Status							
Public	1,068,031 (44.15)	1,062,225 (44.18)	5,806 (40.29)	4,411 (37.63)	612 (53.97)	359 (40.34)	549 (63.99)
Private	1,300,208 (53.75)	1,291,760 (53.72)	8,448 (58.63)	7,181 (61.27)	514 (45.33)	522 (58.65)	298 (34.73)
None	50,625 (2.09)	50,469 (2.1)	156 (1.08)	129 (1.1)	8 (0.71)	9 (1.01)	11 (1.28)
p-value	-	Ref.	<0.001	<0.001	<0.001	0.007	<0.001
Initiation of prenatal care during 1st trimester							
	2,028,488 (83.85)	2,016,118 (83.84)	12,370 (85.84)	10,191 (86.94)	935 (82.45)	774 (86.97)	620 (72.26)
p-value	-	Ref.	<0.001	<0.001	0.344	0.006	<0.001
Chronic diabetes							
	13,122 (0.54)	12,616 (0.52)	506 (3.51)	241 (2.06)	14 (1.23)	269 (30.22)	13 (1.52)
p-value	-	Ref.	<0.001	<0.001	0.001	<0.001	<0.001
Gestational diabetes							
	132,404 (5.47)	130,890 (5.44)	1,514 (10.51)	1,057 (9.02)	112 (9.88)	314 (35.28)	73 (8.51)
p-value	-	Ref.	<0.001	<0.001	0.239	<0.001	<0.001
Chronic hypertension							
	22,368 (0.92)	21,962 (0.91)	406 (2.82)	290 (2.47)	14 (1.23)	88 (9.89)	27 (3.15)
p-value	-	Ref.	<0.001	<0.001	<0.001	<0.001	<0.001

	Cohort	Disability Status		Disability Type			
		None	Any	Physical	Hearing	Vision	IDD*
Gestational hypertension/ preeclampsia	184,400 (7.62)	182,802 (7.6)	1,598 (11.09)	1,157 (9.87)	121 (10.67)	248 (27.87)	107 (12.47)
	p-value	Ref.	<0.001	<0.001	<0.001	<0.001	<0.001
Mental health diagnosis	31,867 (1.32)	30,818 (1.28)	1,049 (7.28)	855 (7.29)	63 (5.56)	65 (7.3)	85 (9.91)
	p-value	Ref.	<0.001	<0.001	<0.001	<0.001	<0.001
Preterm birth	192,991 (7.98)	191,200 (7.95)	1,791 (12.43)	1,368 (11.67)	123 (10.85)	218 (24.49)	128 (14.92)
	p-value	Ref.	<0.001	<0.001	<0.001	<0.001	<0.001

* IDD = intellectual/developmental disabilities

Table 2.

Adjusted odds ratios* (95% CI) for outcomes.

	No disability	Any disability		Physical		Hearing		Vision		IDD**	
		aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Labored delivery in full analytic sample (Figure 2, n = 2,236,879)	Ref.	0.45 (0.41–0.49)	<0.001	0.43 (0.39–0.47)	<0.001	0.86 (0.69–1.07)	0.167	0.45 (0.35–0.59)	<0.001	0.43 (0.35–0.52)	<0.001
Medical indication for CD [†] in labored delivery (Figure 3A and 3B, n = 2,026,903)	Ref.	1.15 (1.10–1.21)	<0.001	1.13 (1.08–1.20)	<0.001	1.33 (1.15–1.54)	<0.001	1.17 (0.96–1.43)	0.128	1.18 (0.99–1.41)	0.061
Delivery by CD [†] in labored delivery (Figure 3A and 3B, n = 2,026,903)	Ref.	1.46 (1.38–1.54)	<0.001	1.46 (1.38–1.54)	<0.001	1.30 (1.10–1.54)	0.002	1.42 (1.16–1.74)	0.001	1.95 (1.65–2.31)	<0.001
Medical indication for CD [†] in unlabored delivery (Figure 3C, n = 209,976)	Ref.	0.45 (0.41–0.50)	<0.001	0.42 (0.38–0.46)	<0.001	1.18 (0.79–1.77)	0.419	0.40 (0.29–0.56)	<0.001	0.68 (0.46–0.99)	0.043

* Adjusted for maternal race/ethnicity (White as referent), education, insurance (private as referent), prenatal care initiation, year of delivery (2012 as referent), mental health diagnoses, chronic hypertension, gestational hypertension/preeclampsia, chronic diabetes, gestational diabetes, and preterm birth.

** IDD = intellectual/developmental disability

[†]CD = cesarean delivery