

Original Research

# Clinical Factors Associated With Presentation Change of the Second Twin After Vaginal Delivery of the First Twin

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**OBJECTIVE:** To identify clinical factors associated with a change from vertex to nonvertex presentation in the second twin after vaginal birth of the first.

**METHODS:** We assembled a retrospective cohort of women with viable vertex–vertex twin pregnancies who delivered the presenting twin vaginally. Women whose second twin changed from vertex to nonvertex after vaginal birth of the first were classified as experiencing an intrapartum change in presentation. Characteristics associated with intrapartum presentation change in a univariate analysis with a  $P$  value  $\leq .10$  were then evaluated in a multivariate logistic regression model.

**RESULTS:** Four-hundred fifty women met inclusion criteria, of whom 55 (12%) had intrapartum presentation change of the second twin. Women experiencing intrapartum presentation change were more likely to be multiparous (69% compared with 47%,  $P < .01$ ) and to have had a change in the presentation of the second twin between the most

recent antepartum ultrasonogram and the ultrasonogram done on admission to labor and delivery (11% compared with 4%,  $P = .04$ ). In an adjusted analysis, multiparity and gestational age less than 34 weeks were significantly associated with presentation change (adjusted odds ratio [OR] 2.9, 95% CI 1.5–5.6 and adjusted OR 2.6, 95% CI 1.1–5.9, respectively). Women with intrapartum presentation change were more likely to undergo cesarean delivery for their second twin (44% compared with 7%,  $P < .01$ ) with an adjusted OR of 10.50 (95% CI 5.20–21.20) compared with those with stable intrapartum presentation. Twenty of the 24 (83%) cesarean deliveries performed in the intrapartum presentation change group were done for issues related to malpresentation.

**CONCLUSION:** Multiparity and gestational age less than 34 weeks are associated with intrapartum presentation change of the second twin.

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From 1995 to 2008, the cesarean delivery rate for vertex–vertex twins increased from 45.1% to 68.2% in the United States.<sup>1</sup> In more recent years, national guidelines reflecting contemporary neonatal safety data now recommend that women with vertex-presenting twins without contraindications to labor attempt a vaginal delivery.<sup>2–4</sup>

Clinical concerns about the unpredictability of the nonpresenting twin's status could be a driving force in the country's rising cesarean delivery rate for vertex–vertex twins.<sup>1</sup> Limited data suggest that up to 11% of women with vertex–vertex twins may experience malpresentation of the second twin after delivery of the first.<sup>5,6</sup> This intrapartum change in presentation from



vertex to nonvertex has been associated with combined delivery, in which vaginal delivery for the first twin is followed by cesarean delivery for the second.<sup>7-9</sup> Given the known maternal and neonatal morbidity of combined delivery, some patients or obstetric care providers may favor elective cesarean delivery for vertex-vertex twins as a result of the unpredictability of the second twin's presentation.<sup>5,8,10-12</sup> In an attempt to promote evidence-based decisions regarding labor in this population, we sought to identify factors associated with intrapartum presentation change of the second twin after vaginal delivery of the first in a cohort of laboring women with vertex-vertex twins.

## MATERIALS AND METHODS

We used hospital birth records to assemble a retrospective cohort of women delivering twin pregnancies of at least 24 0/7 weeks of gestation at a large academic tertiary care center between 2007 and 2015. We included women with vertex-vertex twins on admission to labor and delivery who delivered the presenting twin vaginally. Women with a prior cesarean delivery, stillbirth of either twin, or lethal fetal anomaly were excluded. Standard terms and definitions for obstetric vocabulary were obtained from the reVITALize summary with the exception of the term "combined delivery."

We reviewed delivery records to classify women as having either intrapartum presentation change or a stable intrapartum presentation of the second twin at the time of delivery. All patients in this cohort had an ultrasonogram performed by a registered diagnostic medical ultrasonographer on the date of admission or by the admitting obstetric care provider on arrival to labor and delivery. Ultrasonograms to confirm twin presentation on labor and delivery were either performed or directly supervised by board-certified or board-eligible obstetricians or chief residents in their final year of training per unit policy. The delivering obstetric care providers recorded each twin's spontaneous presentation at delivery with an attending obstetrician present for confirmation. The non-presenting twin's presentation after birth of the first was categorized as vertex or nonvertex before any version maneuver. We defined nonvertex presentation as any fetal presentation that would not result in spontaneous vertex vaginal delivery without obstetric intervention and included transverse, compound, and breech presentation. Women with nonvertex second twins after birth of the presenting twins were classified as those with intrapartum presentation change, our primary outcome.

We then identified clinical factors associated with intrapartum presentation change of the second twin. Maternal, fetal, obstetric, and neonatal characteristics were obtained from the obstetric record as previously

described.<sup>5,13</sup> We then reviewed formal ultrasonograms either performed or attested by board-certified radiologists or maternal-fetal medicine specialists. Although office-based ultrasonography is available at our institution, antepartum ultrasound results reported in this study were performed in dedicated ultrasound units. These formal studies are reliably present for review in the electronic medical record and were verified by qualified radiologists. Chorionicity, antenatal fetal presentation, estimated fetal weights, and presence of fetal anomalies were transcribed directly from these ultrasound records. Women with a nonvertex presentation of the second twin on the antenatal ultrasonogram temporally closest to labor admission were categorized as having an antepartum presentation change.

We considered secondary outcomes according to intrapartum presentation change, including mode of delivery, composite maternal morbidity, and composite neonatal morbidity. Combined delivery was defined as a vaginal delivery for the first twin followed by cesarean delivery of the second twin. The composite maternal outcome consisted of death, postpartum hemorrhage greater than 1,500 mL, or need for transfusion; infection; need for postpartum dilation and evacuation, laparotomy, hysterectomy, or uterine artery embolization; venous thromboembolism; or intensive care unit admission as previously described.<sup>5</sup> Infection was defined as clinical endometritis (maternal fever greater than 38°C more than 24 hours after delivery requiring antibiotics), significant wound cellulitis, intraabdominal abscess, bacteremia, pneumonia, or *Clostridium difficile* colitis. Rates of severe obstetric laceration including third- and fourth-degree perineal lacerations and cervical lacerations are also reported. For the neonate, we reported intertwin delivery intervals, 5-minute Apgar scores less than 7, and need for neonatal intensive care unit admission for neonates born beyond 36 weeks of gestation for the presenting twin, nonpresenting twin, and pregnancy overall. Our composite neonatal outcome included death, intraventricular hemorrhage, intubation for greater than 2 days, trauma, transfusion, culture-proven infection, and necrotizing enterocolitis. Because our study was not powered to evaluate maternal or neonatal morbidity, we intended only to document the rates of these outcomes among our cohort rather than compare them.

Univariate analyses were conducted using  $\chi^2$  or Fisher exact tests for categorical variables and the Wilcoxon rank-sum test for continuous variables. Statistical significance was defined with a two-tailed *P* value  $\leq .05$ . To identify independent factors associated with intrapartum presentation change, variables associated with the primary outcome of interest with a *P* value  $\leq .10$  were combined in a multivariable logistic regression model.



To identify potential confounders, clinical and demographic variables were evaluated individually by univariate analysis. Any variable that modified a univariate odds ratio by 10% or more was kept in the final multivariate model. For the logistic regression, we categorized continuous variables as follows: maternal age in years, gestational age in weeks, neonatal birth weight per 500 g, and body mass index (calculated as weight (kg)/[height (m)]<sup>2</sup>). Data analysis was performed with SAS 9.4. This study was approved by the Partners Human Research Committee institutional review board without need for informed consent (#2012P001737).

## RESULTS

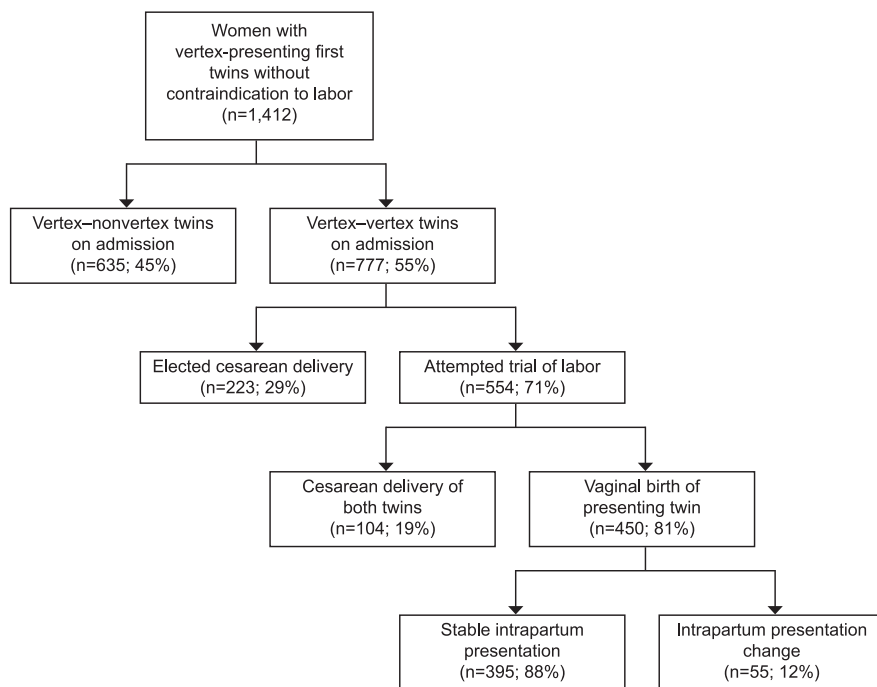
A total of 1,412 women at least 24 weeks of gestation without a contraindication to labor delivered twins during the study period, of whom 777 (55%) had vertex–vertex twins, with 554 (71%) attempting a trial of labor. Ultimately, 450 (81%) delivered the presenting twin vaginally, thus meeting inclusion criteria for the study (Fig. 1). Among these women, 55 (12%) had intrapartum presentation change of the second twin.

Women with intrapartum presentation change were more likely to be multiparous (69% compared with 47%,  $P<.01$ ), deliver before 34 weeks of gestation (29% compared with 16%,  $P=.01$ ), or have higher rates of antepartum presentation change compared with those with a stable presentation (11% compared with 4%,  $P=.04$ ). There were no other significant differences in baseline maternal, fetal, or obstetric char-

acteristics (Table 1). Differences in the rate of spontaneous onset of labor (49% compared with 38%,  $P=.10$ ) were included in our multivariate analysis according to our statistical plan.

The final multivariate model included parity, gestational age less than 34 weeks, the presence of antepartum ultrasound change, spontaneous onset of labor, and birth weight of the nonpresenting twin less than 2,500 g (Table 2). Birth weight of the nonpresenting twin was included in the model because it tested positive as a confounder. No other variables were found to be confounders. In the adjusted analysis, multiparity (adjusted odds ratio [OR] 2.9, 95% CI 1.5–5.6) and gestational age less than 34 weeks at delivery (adjusted OR 2.6, 95% CI 1.1–5.9) were the only two variables that remained significantly associated with intrapartum presentation change. Antepartum presentation change was no longer associated with intrapartum presentation change with an adjusted OR of 2.5 (95% CI 0.9–7.1). Of the 26 multiparous women who delivered before 34 weeks of gestation, 7 (27%) had an intrapartum presentation change and 4 of the 7 (57%) had a combined delivery. In contrast, among the 174 nulliparous women delivering at 34 weeks of gestation or later, only 8 (5%) experienced an intrapartum presentation change.

Only a small number of patients with gestational age less than 34 weeks or antepartum presentation change underwent an intrapartum presentation change ( $n=7$  and  $n=6$ , respectively; Table 2).



**Fig. 1.** Flowchart for screening and inclusion in cohort. Contraindications to labor included placenta previa, prior transabdominal uterine surgery, transabdominal cerclage, monochorionic gestation, and category 3 fetal heart rate tracing on admission. Other exclusion criteria included a prior cesarean delivery and stillbirth or lethal fetal anomaly of either twin.

Panelli. Intrapartum Presentation Change of the Second Twin. *Obstet Gynecol* 2017.



**Table 1. Demographic and Clinical Characteristics According to Intrapartum Presentation Change**

Characteristic	Stable Intrapartum Presentation (n=395)	Intrapartum Presentation Change (n=55)	P
Maternal age (y)	33.7 (30.0–37.0)	33.4 (28.8–38.0)	.78*
Race			.60
White	258 (65)	36 (66)	
Black	41 (10)	8 (15)	
Hispanic	54 (14)	8 (15)	
Asian	37 (9)	2 (4)	
Other	5 (1)	1 (2)	
Maternal BMI (kg/m <sup>2</sup> )	30 (27–33)	29 (27–34)	.47*
Multiparous	186 (47)	38 (69)	<.01
Spontaneous conception	185 (47)	26 (47)	1.00
Any hypertension	104 (26)	13 (24)	.74
Preeclampsia	95 (24)	12 (22)	.87
Pregestational diabetes	14 (4)	4 (7)	.25
Gestational age (wk)	36.3 (34.9–37.3)	36.1 (33.7–37.3)	.37*
Gestational age less than 34 wk	62 (16)	16 (29)	.01
Monochorionic	84 (21)	8 (15)	.29
Intrauterine growth restriction (either twin)	79 (21)	9 (17)	.59
Antepartum ultrasound presentation change <sup>†</sup>	16 (4)	6 (11)	.04
Antepartum ultrasonogram within 14 d	358 (91)	50 (91)	1.00
Days from last ultrasonogram to delivery	4 (2–8)	5 (2–8)	.52*
Spontaneous onset of labor	148 (38)	27 (49)	.10
Epidural analgesia	372 (94)	51 (93)	.56
Birth weight of twin A less than 2,500 g	214 (54)	29 (53)	.89
Birth weight of twin B less than 2,500 g	231 (59)	34 (62)	.66
Birth weight discordance, larger twin A <sup>‡</sup>	96 (24)	11 (20)	.61
Birth weight discordance, larger twin B <sup>‡</sup>	19 (5)	4 (7)	.31

BMI, body mass index.

Data are median (interquartile range) or n (%) unless otherwise specified.

\* *P* value determined by Wilcoxon rank-sum test.

<sup>†</sup> Defined as presentation change in the nonpresenting twin (twin B) between last antepartum ultrasonogram and admission ultrasonogram.

<sup>‡</sup> Discordance defined as 20% difference in birth weight between twins, with twin A being the presenting twin.

Therefore, a sensitivity analysis was conducted to evaluate the influence of these variables on our final results. After removing either of these variables from the model, none of the ORs changed by more than 10%, and the significance of the results also remained stable. We observed one exception, because the OR for spontaneous labor changed by more than 10% after removing gestational age from the model. However, the relationship between this variable and our outcome remained nonsignificant regardless of the gestational age adjustment. Exact logistic regressions were then used to further evaluate the associations between these two variables and our outcome. The relationship between gestational age and intrapartum presentation change remained significant (exact *P*=.03), whereas the relationship between unstable antepartum presentation change and the outcome did not (exact *P*=.10).

Ninety-three percent (n=368) of women with a stable second twin intrapartum presentation had vaginal delivery of both twins compared with only

56% (n=31) of those with an intrapartum presentation change (*P*<.01; Fig. 2). Nineteen of the 55 women (34%) with an intrapartum presentation change underwent immediate cesarean delivery for malpresentation; 5 of 55 (9%) of those with intrapartum presentation change underwent cesarean delivery after a failed attempt at breech extraction (Table 3). In total, 20 of 24 women with intrapartum presentation change (83%) underwent cesarean delivery for either malpresentation or a failed breech extraction. For the 30 cases in which breech extraction was attempted, women experienced a vaginal delivery 83% of the time (n=25). Within this group of 24 women who ultimately underwent cesarean delivery, 11 were multiparous with concordantly grown fetuses greater than 32 weeks of gestation. When accounting for parity, ultrasound stability, spontaneous onset of labor, intrapartum presentation change, and birth weight of the second twin, intrapartum presentation change was highly associated with combined delivery with an adjusted OR of 10.5 (95% CI 5.2–21.2). Maternal



**Table 2. Unadjusted and Adjusted Odds Ratios for Variables of Interest for Intrapartum Presentation Change**

Variable	Stable Intrapartum Presentation (n=395)	Intrapartum Presentation Change (n=55)	OR (95% CI)	Adjusted* OR (95% CI)
Parity			2.5 (1.4–4.6)	2.9 (1.5–5.6)
Multiparous (n=224)	186 (83)	38 (17)		
Nulliparous (n=226)	209 (92)	17 (8)		
Gestational age (wk)			2.2 (1.2–4.2)	2.6 (1.1–5.9)
Less than 34 (n=78)	62 (79)	16 (21)		
34 or greater (n=372)	333 (90)	39 (10)		
Antepartum ultrasound presentation change <sup>†</sup>			2.9 (1.1–7.8)	2.5 (0.9–7.1)
Yes (n=22)	16 (73)	6 (27)		
No (n=428)	379 (89)	49 (11)		
Spontaneous onset of labor			1.6 (0.9–2.8)	1.2 (0.6–2.3)
Yes (n=175)	148 (85)	27 (15)		
No (n=275)	247 (90)	28 (10)		

OR, odds ratio.

Data are n (row %) unless otherwise specified.

\* Adjusted simultaneously for each of the variables plus birth weight of the nonpresenting twin less than 2,500 g. No other demographic or obstetric variable ruled in as a confounder in the analysis.

<sup>†</sup> Defined as presentation change in the nonpresenting twin between last antepartum ultrasonogram and admission ultrasonogram.

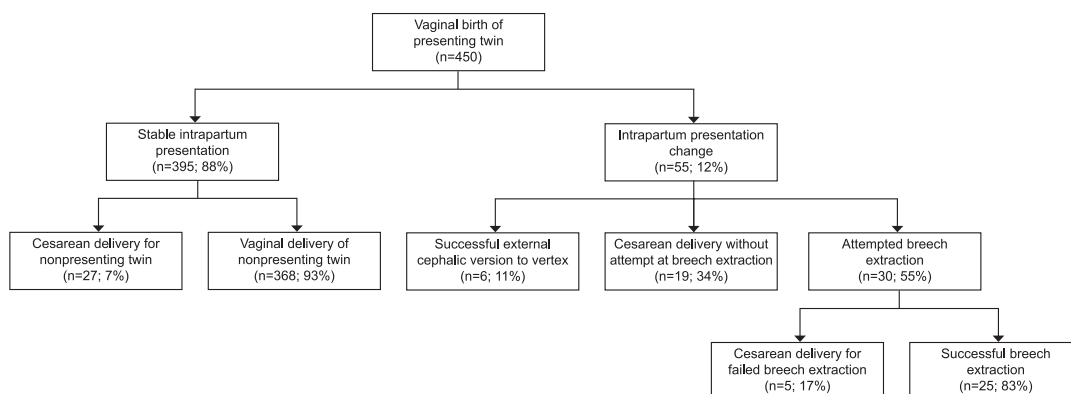
and neonatal morbidity outcomes were tabulated, but this project was not adequately powered to identify differences among the groups with respect to these outcomes (Table 4).

## DISCUSSION

We have confirmed prior research showing that intrapartum presentation change of the second twin is associated with combined vaginal and cesarean delivery. Lack of preparation for breech extraction may promote combined delivery if the second twin becomes nonvertex, driving rates of elective cesarean delivery with vertex–vertex twins. Despite evidence of safety, breech extraction remains neither universally available nor acceptable to all patients.<sup>14</sup>

Risk stratification is therefore an important tool, because patients who are most likely to retain a stable presentation may be encouraged to proceed with labor, even if breech extraction is not part of the delivery plan.

Alternatively, those with higher risk for intrapartum presentation change—in our study, multiparous women and those less than 34 weeks of gestation—may need increased preparation for breech extraction before delivery. This could be accomplished by establishing an on-call system for obstetric care providers with this skill set or transfer of care to a practice that can make this service available. Patients with both of these risk factors still experienced vertex–vertex delivery 78% of the time, which may



**Fig. 2.** Intrapartum presentation change and mode of delivery for women laboring with vertex–vertex twins after vaginal birth of the presenting twin.

Panelli. *Intrapartum Presentation Change of the Second Twin*. *Obstet Gynecol* 2017.



**Table 3. Delivery Outcomes According to Intrapartum Presentation Change**

Outcome	Stable Intrapartum Presentation (n=395)	Intrapartum Presentation Change (n=55)	P*
Vaginal birth, both twins	368 (93)	31 (56)	<.01
Vacuum or forceps-assisted vaginal birth, twin B	57 (14)	2 (4)	.03
Breech extraction of twin B	0	25 (46)	<.01
Cesarean delivery for twin B	27 (7)	24 (44)	<.01
Indication for cesarean delivery <sup>†</sup>			
Category 2 or 3 tracing	12 (44)	3 (13)	.02
Failure to progress	7 (26)	1 (4)	.05
Failed vacuum or forceps	5 (19)	0	.05
Cord prolapse	4 (15)	0	.11
Malpresentation	0	15 (63)	<.01
Failed breech extraction	0	5 (21)	.02
Intertwin delivery interval (min)	13 (7–30)	16 (7–29)	.84 <sup>‡</sup>

Data are n (%) or median (interquartile range) unless otherwise specified.

\* P values determined using  $\chi^2$  test or Fisher exact test as appropriate unless otherwise specified.

<sup>†</sup> Some patients had more than one documented indication for cesarean delivery, and each was listed in the table. Denominator for percentages is all women each group who had a cesarean delivery. Malpresentation includes nonvertex presentation without attempt at breech extraction and including those where external cephalic version was attempted and unsuccessful.

<sup>‡</sup> Continuous variables presented as median (interquartile range) with P value determined by Wilcoxon rank-sum.

encourage these patients to attempt labor even if breech vaginal delivery will not be attempted.

Limited contemporary data exist describing the incidence or risk factors for intrapartum presentation change among twins. Like with our study, prior

studies have identified parity as a risk factor for presentation change.<sup>14</sup> Perhaps this is because the multiparous uterus is more pliable. Similarly, early gestational age has also been linked to unstable presentation, which we observed as independent of fetal

**Table 4. Maternal and Neonatal Outcomes According to Intrapartum Presentation Change\***

Outcome	Stable Intrapartum Presentation (n=395)	Intrapartum Presentation Change (n=55)
Maternal		
Composite maternal morbidity <sup>†</sup>	51 (13)	5 (9)
Postpartum hemorrhage	36 (9)	3 (6)
Severe obstetric laceration	10 (3)	2 (4)
Postpartum infection	6 (2)	1 (2)
Nonpresenting twin		
5-min Apgar score less than 7	11 (3)	2 (4)
NICU admission	39 (10)	4 (7)
NICU length of stay (d) <sup>‡</sup>	8.0 (4.0–10.5)	5.0 (4.5–8.5)
Composite neonatal morbidity <sup>§</sup>	23 (6)	6 (11)
Neonatal death	1 (0.3)	1 (2)
Either twin		
5-min Apgar score less than 7	16 (4)	2 (4)
NICU admission	55 (14)	6 (11)
NICU length of stay (d) <sup>‡</sup>	6.5 (4.0–11.0)	5.0 (4.0–10.0)
Composite neonatal morbidity <sup>§</sup>	32 (8)	6 (11)
Neonatal death	1 (0.3)	1 (2)

NICU, neonatal intensive care unit.

Data are n (%) or median (interquartile range).

\* P values not listed because this study was not adequately powered to detect a significant difference in morbidity outcomes between the groups.

<sup>†</sup> Composite maternal morbidity includes postpartum hemorrhage, infection, need for additional procedure, severe obstetric laceration, intensive care unit admission, or dilation and evacuation for bleeding or infection.

<sup>‡</sup> P value determined by Wilcoxon rank-sum.

<sup>§</sup> Composite neonatal morbidity includes death, intraventricular hemorrhage, intubation greater than or equal to 2 days, trauma, transfusion, serious infection, and necrotizing enterocolitis. Outcomes for either twin include whether or not the outcome was present for the pregnancy. NICU admission considered only for nonanomalous fetuses beyond 36 weeks of gestation.



size.<sup>15,16</sup> The majority of the existing literature describes rates and risks for antepartum rather than intrapartum presentation change with a strong emphasis on the first twin's presentation.<sup>15-17</sup> These studies are unable to evaluate the role of delivery-related variables such as labor induction and gestational age and therefore are less relevant to our specific clinical question.

Our combined delivery rate was 11%, which is higher than the range of 4–9.5% reported in the literature.<sup>8-10</sup> The majority of the cesarean deliveries done for nonvertex second twins in our cohort were performed for reasons related to malpresentation. Failure to attempt or complete breech extraction is likely reflective of contemporary obstetric practice in which nonvertex vaginal birth is performed and taught infrequently.<sup>17</sup> In contrast, the lower published rates reflect practice in the years 1995–1997, before publication of the Term Breech Trial and the resultant decline in singleton breech delivery.<sup>14</sup>

The rising rate of cesarean deliveries for twins coupled with low reported experience with breech extraction among practicing U.S. obstetricians suggest that obstetric care provider skill may play a role in the high rate of cesarean delivery for unanticipated nonvertex second twins.<sup>17</sup> We hypothesize that for some of the women with intrapartum presentation change and cesarean delivery without an attempt at breech extraction, this decision may be at least in part attributable to a variation in obstetric care provider skill level. Although we lack the ability to quantify skill level retrospectively, future work should look at the effect of access to skilled obstetric care providers on combined delivery rates.

Although clinically relevant and actionable, our study is not without limitations. Its retrospective nature limits our ability to ascertain how many patients were offered a breech extraction. The findings from a large academic tertiary care center, with ready access to obstetric care providers trained in high-risk pregnancy, may not be generalizable to all populations. That said, the diversity and range of delivering obstetric care providers' experience at our institution are likely in line with national twin delivery practices.<sup>2,18</sup> Validation of our findings with a larger data set, particularly in specific subgroups in which our sample size was limited, would further inform practice changes.

Despite these limitations, the strong influence of parity and gestational age on intrapartum presentation change among vertex–vertex twins is clinically relevant. Although we hope patients with vertex–

vertex twins will be supported in choosing a trial of labor and have access to breech extraction when indicated, we realize that breech delivery of the second twin will not likely become a universal option. Given that breech vaginal delivery is an uncommon event, simulation and mentoring models will likely need to be introduced on a wide scale to improve obstetric care provider training. Although transfer of care to a qualified practice could be considered as an alternative, logistically this will not be possible or desirable for all patients. Given this, individualized patient counseling and heightened obstetric care provider awareness regarding intrapartum presentation change could be an important strategy to decrease rates of elective cesarean delivery and combined delivery for twins.

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