

OBSTETRICS

Mode of delivery and postpartum depression: the role of patient preferences

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OBJECTIVE: The purpose of this study was to explore the relationship between strength of preference for vaginal delivery, delivery mode undergone, and postpartum depression.

STUDY DESIGN: We conducted a secondary analysis of data from a longitudinal study of delivery-mode preferences. During an interview between 24-36 weeks of gestation, participants were asked whether they preferred vaginal or cesarean delivery; the strength of this preference was measured by the standard gamble metric. Depression was assessed antepartum and at 8-10 weeks and 6-8 months after delivery by using the Patient Health Questionnaire (PHQ-9). The primary outcome was PHQ-9 score at 8-10 weeks after delivery. We used multivariable regression analysis to assess the effect of strength of preference for vaginal delivery and delivery mode undergone on postpartum depression.

RESULTS: Of 160 participants, 33.1% were nulliparous, and 30.6% had a previous cesarean delivery. Most of the participants (92.4%)

preferred vaginal delivery, but the strength of preference varied substantially. The mean strength-of-preference score (0-1 scale; higher scores denote stronger vaginal delivery preference) was 0.658 (SD, ± 0.352). A significant interaction emerged between the effects of delivery mode and vaginal delivery preference score on postpartum PHQ-9 score ($P = .047$). Specifically, a stronger preference for vaginal delivery was associated with higher PHQ-9 scores among women who underwent cesarean delivery ($P = .027$) but not among women who underwent vaginal delivery ($P = .761$). The interaction between delivery mode and vaginal delivery preference score was no longer significant at 6-8 months after delivery.

CONCLUSION: Women who have a strong antepartum preference for vaginal delivery and deliver by cesarean may be at increased risk for depression in the early postpartum period.

Key words: mode of delivery, patient preferences, postpartum depression

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Depression is a common but often overlooked diagnosis in the postpartum period that affects approximately 15% of women who give birth.¹ Although the American College of Obstetricians and Gynecologists does not recommend universal antepartum or postpartum screening, they acknowledge

that diagnosis and treatment are beneficial to women and their families.² The American Academy of Pediatrics recommends screening for postpartum depression because it can have an impact on infant development.³ Despite these recommendations, rates of screening, diagnosis, and treatment

remain low, at least in part because of a number of clinical barriers including time constraints, patient discomfort, and lack of expertise with psychiatric disorders.^{4,5}

The identification of women who are at increased risk for postpartum depression is one strategy to focus screening and improve care. Women with a history of depression are more likely to have postpartum depression, accounting for approximately one-half of the cases.⁶ Additional risk factors include lack of social support, stressful life events, and pregnancy complications.^{4,6,7} Numerous studies have explored the association between cesarean delivery and postpartum depression,⁸⁻¹⁶ and most studies have concluded that mode of delivery is not a predictor.^{8-11,13,15} However, a patient's antepartum delivery preferences may play an important role in the determination of how a woman perceives her childbirth experience and outcome,

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which potentially could affect her risk for postpartum depression.

To our knowledge, whether the strength of a woman's antepartum preference for a particular mode of delivery affects the relationship between mode of delivery and postpartum depression has not been investigated systematically. We aimed to investigate the role of patient preferences for mode of delivery in relationship to postpartum depression. As planned vaginal delivery remains most common, we sought to use data from a prospective study of mode of delivery preferences to gain an understanding of the association, if any, between strength of preferences for vaginal delivery, delivery mode undergone, and postpartum depression.

MATERIALS AND METHODS

The "Mode of Delivery Preferences among Diverse Populations of Women" study was conducted at the University of California, San Francisco, from 2008-2012. Details of this study have been described elsewhere.^{17,18} Briefly, women who received prenatal care were sent letters that described the study that included an "opt-in/opt-out" response card. Patients who returned the card with "opt in" checked off or who did not return the card were contacted by a research associate who further described the study and assessed the woman's eligibility and interest in participation. Additionally, patients who contacted the research associate after seeing a flyer or hearing about the study by word of mouth were enrolled if they met eligibility criteria, which included being English-speaking and <36 weeks of gestation. Participants received \$40 remuneration for each face-to-face interview. Institutional review board approval was obtained from the University of California, San Francisco, Committee on Human Research. Written informed consent was obtained from all participants.

Between 24-36 weeks of gestation, participants underwent a face-to-face interview, during which they completed a questionnaire that included items that were related to sociodemographic characteristics (age, race/

ethnicity, education, employment, marriage status, and income), pregnancy history, their preferred delivery mode, and a 9-item depression measure (Patient Health Questionnaire [PHQ-9]).¹⁹ The PHQ-9, which is recommended by American College of Obstetricians and Gynecologists for perinatal depression assessment,² has been validated in obstetrics and gynecology clinical settings²⁰ and is used commonly in research and clinical practice to assess symptoms of depression, to make a preliminary diagnosis of depression, or to categorize depression severity. Scores range from 0-27; higher scores indicate more depressive symptoms (specifically, 0-4, 5-9, 10-14, and >15 represent minimal, mild, moderate, and severe levels of depression, respectively).

During the baseline interview, participants also completed a series of standard gamble²¹ exercises with the use of a computer tool our group developed for preference elicitation.²² The standard gamble exercise yields a preference score that ranges from 0-1, with 0 defined as the least desired outcome of a decision being considered and 1 defined as the most preferred outcome. Scores for intermediately ranked outcomes are generated by presenting the assessor with a hypothetical choice between certainty of experiencing the intermediate ranked outcome and a gamble between experiencing the preferred outcome vs experiencing the least desired outcome. The probability of experiencing the preferred vs the least desired outcome is varied until the assessor is indifferent between certainty of the intermediary outcome and the gamble.

As planned vaginal delivery is the most common delivery approach in the United States, we focused on the strength of preference for vaginal delivery. For this measurement, participants who had a stated preference for vaginal delivery were presented with a choice between certainty of having an uncomplicated planned cesarean delivery and a gamble between an uncomplicated vaginal delivery (their preferred delivery mode) vs undergoing labor and ending with an

uncomplicated cesarean delivery (their less desired delivery mode in this exercise). The probability that their labor would end in a cesarean delivery was varied until the woman was indifferent between the 2 choices. Stronger preferences for vaginal delivery are reflected in a higher score, indicating women would accept a greater chance that labor would end in a cesarean delivery before opting for an uncomplicated planned cesarean delivery. The preference score for vaginal delivery was calculated as the probability of having the planned vaginal delivery end in a cesarean delivery at her indifference point. For example, if a woman who had a stated preference for vaginal delivery but indicated that she would opt for a planned cesarean delivery if the chance that her planned vaginal birth would end in cesarean delivery was 25%, her preference score for vaginal delivery would be assigned a value of 0.25. On the other hand, if a woman with a stated preference for vaginal delivery indicated that she would opt for a planned cesarean delivery only if the chance of labor ending in a cesarean delivery was 75%, she would have a preference score of 0.75 for vaginal delivery. As this analysis focused on the strength of preference for a vaginal delivery, participants who had a stated preference for cesarean delivery (ie, those who indicated they would "probably" or "definitely" choose to have a cesarean delivery) were assigned a preference score of 0 for vaginal delivery.

A telephone interview was conducted at 8-10 weeks after delivery during which participants again completed the PHQ-9, and the delivery mode undergone was assessed. At 6-8 months after delivery, participants had a face-to-face interview during which they completed the PHQ-9 a third time.

The primary outcome for this analysis was PHQ-9 score at 8-10 weeks after delivery; PHQ-9 score at 6-8 months after delivery was a secondary outcome. The primary predictors were the strength of preference for vaginal delivery and delivery mode undergone. Univariable and multivariable regression analyses were performed to identify predictors of PHQ-9 score at each of the postpartum time points. In the

multivariable analyses, we included the primary predictors, an interaction term between delivery mode and strength of preference for vaginal delivery, and covariates that included the antepartum PHQ-9 score, parity, preterm delivery (defined as delivery at <37 weeks of gestation), age, race/ethnicity, education, income, employment status, and relationship status. We used a backward elimination procedure to remove hypothesized predictors with probability values that exceeded 0.20 for the final multivariable model. The data contained missing values so we fit the models to 20 multiply imputed datasets created with SAS PROC MI (version 9.2; SAS Institute Inc, Cary, NC). The imputation model included all predictor and outcome variables that were used in regression models. Imputed values for binary and categorical variables were rounded and truncated to the nearest category.²³ Parameters and standard errors were estimated by the combination of the results across the 20 imputed datasets, according to Rubin's rules²⁴ and Meng and Rubin.²⁵ A probability value of < .05 was considered statistically significant. All analyses were implemented with SAS software (version 9.2).

RESULTS

One hundred sixty participants completed the baseline assessment. More than one-third of these women (37.5%) were ≥35 years old. The participants comprised an ethnically and racially diverse group with a range of previous birth experiences (Table 1). Slightly less than one-half of the women identified as white (47.5%); more than one-quarter (26.3%) were African American; 8.8% were Latina, and 17.7% identified as being a member of another racial/ethnic group. Nulliparous women comprised 33.1% of the sample, and 30.6% had a history of a cesarean delivery.

Antepartum, most women (92.4%) had a stated preference for a vaginal delivery. When we included the women who preferred cesarean delivery, the mean and median vaginal delivery preference scores were 0.658 (SD ±0.352) and 0.750 (interquartile range, 0.500–0.994). These utility scores show

TABLE 1

Baseline sociodemographic and clinical characteristics (n = 160)

Characteristic	Total
Age, y ^a	31.9 ± 5.9
<25 y, n (%)	22 (13.8)
25-29 y, n (%)	30 (18.8)
30-34 y, n (%)	48 (30.0)
≥35 y, n (%)	60 (37.5)
Race/ethnicity, n (%)	
African American	42 (26.3)
Latina or Hispanic	14 (8.8)
Other ^b	28 (17.6)
White	76 (47.5)
Educational attainment, n (%)	
High school or less	34 (21.2)
Some college	32 (20.0)
College degree or higher	94 (58.8)
Employed, n (%)	86 (54.1)
Married or living with partner, n (%)	131 (81.9)
Annual household income, n (%)	
<\$25K	39 (24.7)
\$25K-50K	24 (15.2)
\$50K-100K	34 (21.5)
≥\$100K	61 (38.6)
Primary prenatal care provider, n (%)	
Obstetrician	86 (54.8)
Midwife	69 (43.9)
Other ^c	2 (1.3)
Nulliparous women, n (%)	53 (33.1)
Multiparous women, n (%)	
Vaginal deliveries only	58 (36.3)
Cesarean deliveries only	40 (25.0)
Vaginal and cesarean deliveries	9 (5.6)
Baseline 9-item Patient Health Questionnaire score ^{a,d}	5.8 ± 4.1
Strength of preference for vaginal delivery ^{a,e}	0.658 ± 0.35

^a Data are given as mean ± standard error; ^b Includes Asian/Pacific Islander (n = 26) and Native American (n = 2); ^c Primary prenatal care provider was "other" and specified as homebirth midwife (n = 1) and several providers (n = 1); ^d Scores range from 0–27; higher scores indicate more depressive symptoms; ^e Measured by the standard gamble metric; scores range from 0 (preference for cesarean delivery) to 1 (strongest preference for vaginal delivery).

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that, on average, these women indicated that they would opt for a planned cesarean only if the probability that an attempted vaginal birth would end in a cesarean delivery reached 65.8%.

Approximately one-quarter of the participants (26%) delivered by cesarean. The incidence of postpartum depression (moderate and severe; defined as >9 on the PHQ-9) was 9.1% at 8-10

weeks and 12.8% at 6-8 months after delivery. Antepartum PHQ-9 score, income, and identification as Asian/Pacific Islander/Native American and delivery mode all emerged as significant independent predictors of PHQ-9 score at 8-10 weeks after delivery (Table 2). However, at the 6- to 8-month assessment, the association with mode of delivery was no longer present, and only antepartum PHQ-9 score and income remained as predictors of PHQ-9 score at 6-8 months after delivery (Table 3).

A significant interaction between delivery mode and vaginal delivery preference score on the PHQ-9 score at 8-10 weeks after delivery was observed ($P = .047$). Among women who underwent a vaginal delivery, no effect of vaginal delivery preference score on PHQ-9 score emerged ($P = .761$). But among women who ultimately had a cesarean delivery, higher vaginal delivery preference scores were associated with higher mean PHQ-9 scores at 8-10 weeks after delivery ($P = .027$). Specifically, for every 0.10-point increase in the vaginal delivery preference score, there was a 0.25-point increase in PHQ-9 score. At the mean level of preference for vaginal delivery (0.658), cesarean delivery was associated with a 1.13 higher PHQ-9 score (95% CI, 0.01–2.26; $P = .048$; Figure). By 6-8 months after delivery, this interaction effect was no longer significant ($P = .313$).

COMMENT

To our knowledge, this is the first study to examine a woman's strength of preference for vaginal delivery as a predictor of postpartum depression. In this population, the strength of a woman's preference for vaginal delivery was associated positively with 8- to 10-week postpartum PHQ-9 scores among women who underwent cesarean delivery. In contrast, women who had a vaginal birth as they had anticipated did not appear to be at increased risk for postpartum depressive symptoms. This finding may be clinically useful in identifying ways to improve counseling and message framing when cesarean delivery is recommended, to help patients understand that a planned vaginal

birth that ends in a cesarean delivery is not a "failure." Furthermore, it may be useful in the identification of women who are at increased risk for depression in the postpartum period.

The average PHQ-9 score among women at the mean vaginal preference score (0.658) who underwent a cesarean delivery was 4.6, which represents mild depressive symptoms. The score increased to 5.5 for those with the strongest preference for vaginal delivery who underwent cesarean delivery (Figure). Although a PHQ-9 score >10 generally is considered a marker of moderate depressive symptoms, there can be relevant clinical differences between the minimal and mild ranges. One study demonstrated that women with mild symptoms (5-9) in the postpartum period had a significantly higher mean number of disability days and symptom-related difficulties (patients reporting depression that caused difficulty at work, at home, or in relationships) than those women with PHQ-9 scores of 0-4.²⁶ It has been suggested that PHQ-9 scores from 5-9 may warrant patient follow up and reevaluation, but the efficacy of this has been questioned because the symptoms resolve.²⁷ By 6-8 months after delivery, neither delivery mode nor the strength of preference for vaginal delivery remained associated significantly with PHQ-9 scores, which suggests that the effect of the strength of preference for vaginal delivery on depression among women who have a cesarean delivery may be relatively short term. This may help explain why most other studies have not found an association between mode of delivery and postpartum depression. Furthermore, the mean PHQ-9 scores that we observed represent mild depressive symptoms, which may be more likely to resolve over a shorter amount of time.

Our study has limitations. Although racially and ethnically diverse, participants were somewhat older and more educated than the general pregnant population, and all participants were recruited in a single geographic area. Moreover, many of the participants received prenatal care from midwives, and all deliveries were in academic centers

with low cesarean delivery rates compared with national averages, both of which may be associated with stronger preferences for vaginal delivery. In addition, we did not collect data regarding diagnoses of or treatments for depression from participants' medical records. Instead, we relied on the scores that we obtained by administering the PHQ-9, which is an instrument that has been validated as a measure of depression severity in several populations, as our indicator of depression. Furthermore, because this study focused only on strength of preference for an idealized vaginal delivery and patient report of delivery mode, we could not explore how the indication for cesarean delivery or unanticipated complications during a vaginal delivery in the setting of a desired vaginal delivery might affect postpartum mood. We could not determine, for example, whether women who underwent cesarean deliveries for urgent indications (such as nonreassuring fetal heart tracing) were more likely to have depressive symptoms than women who underwent cesarean delivery for less urgent indications (such as planned breech cesarean delivery) or whether an unanticipated complicated vaginal delivery would increase the likelihood of depressive symptoms. Similarly, we were unable to assess the effect of neonatal events on the risk of depressive symptoms; neonatal intensive care nursery admission after an unanticipated cesarean delivery may have contributed to the association with early depressive symptoms. Finally, although we attempted to control for confounding factors, it is possible that we were unable to identify additional confounders. In spite of these limitations, given our novel findings, the strengths of our prospective data methods and the diversity of the population that we investigated, we believe that the relationship described between preference for vaginal delivery, delivery mode undergone, and postpartum depression warrants further study in a broader population.

Postpartum depression is a major cause of postpartum maternal morbidity in the United States. It is often undiagnosed, and untreated depression has significant

TABLE 2

Association between patient characteristics, delivery mode, and, 9-item Patient Health Questionnaire score at 8-10 weeks after delivery

Characteristic	Univariable regression coefficient B (95% confidence interval)	P value	Multivariable regression coefficient ^a B (95% confidence interval)	P value
Age, y		.461		
<25	Reference			
25-29	-0.41 (-2.29 to 1.47)	.670		
30-34	-1.27 (-2.97 to 0.43)	.143		
≥35	-0.73 (-2.39 to 0.93)	.387		
Race/ethnicity		.094		.102
African American	1.39 (0.10-2.67)	.035	0.85 (-0.61 to 2.31)	.253
Latina or Hispanic	1.17 (-0.98 to 3.33)	.286	1.15 (-0.76 to 3.06)	.241
Other ^b	1.32 (-0.16 to 2.81)	.080	1.37 (0.18-2.57)	.025
White	Reference		Reference	
Educational attainment		.864		
High school or less	0.17 (-1.21 to 1.54)	.813		
Some college	0.32 (-1.08 to 1.72)	.653		
College degree or higher	Reference			
Employed	-0.21 (-1.30 to 0.88)	.702		
Married or living with partner	-0.40 (-1.81 to 1.01)	.578		
Annual household income		.018		.015
<\$25K	-0.08 (-1.41 to 1.26)	.910	-0.82 (-2.27 to 0.63)	.268
\$25K-50K	1.90 (0.29-3.52)	.021	0.70 (-0.80 to 2.19)	.363
\$50K-100K	-0.98 (-2.35 to 0.40)	.164	-1.39 (-2.52 to -0.26)	.016
≥\$100K	Reference		Reference	
Multiparous women	1.40 (0.30-2.50)	.012	0.66 (-0.29 to 1.62)	.173
Delivery at <37 weeks of gestation	-0.90 (-3.08 to 1.28)	.418	-1.51 (-3.27 to 0.25)	.093
Antepartum 9-item Patient Health Questionnaire score ^c	0.44 (0.31-0.57)	<.001	0.41 (0.29-0.53)	<.001
Cesarean delivery ^d	1.67 (0.46-2.89)	.007	1.13 (0.01-2.26)	.048
Vaginal delivery preference score ^e				
When cesarean delivery ^f	0.24 (0.02-0.47)	.034	0.25 (0.03-0.47)	.027
When vaginal delivery ^f	-0.08(-0.23 to 0.07)	.318	-0.02 (-0.19 to 0.14)	.761
Interaction term between mode of delivery and preference score			0.28 (0.00-0.55)	.047

^a Final multivariable regression model includes the predictors that were retained in the backward elimination procedure ($P < .20$) and significant interaction term with actual delivery mode by vaginal preference score; ^b Includes Asian/Pacific Islander ($n = 26$) and Native American ($n = 2$); ^c Unstandardized regression coefficient for every 1 point increase on the 9-item Patient Health Questionnaire scale; scores range from 0-27 (higher scores indicate more depressive symptoms); ^d Measured at the mean preference score for vaginal delivery (0.658); measured by the standard gamble metric; scores range from 0 (preference for cesarean delivery) to 1 (strongest preference for vaginal delivery); ^e Unstandardized regression coefficient for every 0.10 point increase in vaginal preference score; ^f Reported effect of vaginal preference score at each mode of delivery undergone.

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clinical and public health significance. Although it should be reassuring to clinicians that the interaction between

preference and delivery mode undergone is diminished by the late postpartum period, we believe that the early

association warrants clinical attention. Risk factors for postpartum depression may extend beyond traditionally regarded

TABLE 3

Association between patient characteristics, delivery mode, and 9-item Patient Health Questionnaire score at 6-8 months after delivery

Characteristic	Univariable regression coefficient B (95% confidence interval)	P value	Multivariable regression coefficient ^a B (95% confidence interval)	P value
Age, y		.287		
<25	Reference			
25-29	-1.07 (-1.18 to 3.32)	.351		
30-34	-0.74 (-2.76 to 1.29)	.475		
≥35	-0.22 (-2.21 to 1.78)	.831		
Race/ethnicity		.663		
African American	0.85 (-0.66 to 2.37)	.269		
Latina or Hispanic	0.93 (-1.49 to 3.35)	.454		
Other ^b	0.33 (-1.47 to 2.13)	.721		
White	Reference			
Educational attainment		.631		
High school or less	0.57 (-1.06 to 2.20)	.493		
Some college	0.61 (-0.97 to 2.18)	.449		
College degree or higher	Reference			
Employed	-0.82 (-2.09 to 0.45)	.205	-0.87 (-2.05 to 0.31)	.148
Married or living with partner	-0.84 (-2.51 to 0.84)	.328		
Annual household income		.034		.043
<\$25K	-0.26 (-1.79 to 1.28)	.742	-1.38 (-2.83 to 0.08)	.064
\$25K-50K	2.59 (0.71-4.48)	.007	1.21 (-0.46 to 2.87)	.156
\$50K-100K	-0.10 (-1.71 to 1.52)	.907	-0.49 (-1.90 to 0.92)	.493
≥\$100K	Reference		Reference	
Multiparous	1.33 (-0.02 to 2.69)	.054		
Delivery at <37 weeks of gestation	0.02 (-2.52 to 2.55)	.990		
Antepartum 9-item Patient Health Questionnaire score ^c	0.52 (0.38-0.65)	<.001	0.50 (0.36-0.63)	<.001
Cesarean delivery	1.35 (-0.15 to 2.86)	.079		
Vaginal delivery preference score ^d	-0.02 (-0.21 to 0.16)	.819		

^a Final multivariable regression model including the predictors that were retained in the backward elimination procedure ($P < .20$) and significant interaction term with delivery mode undergone by vaginal preference score; ^b Includes Asian/Pacific Islander ($n = 26$) and Native American ($n = 2$); ^c Unstandardized regression coefficient for every 1 point increase on the 9-item Patient Health Questionnaire; scores range from 0-27 (higher scores indicate more depressive symptoms); ^d Unstandardized regression coefficient for every 0.10 point increase in the vaginal preference score (range, 0-1), measured by the standard gamble metric; scores range from 0 (preference for cesarean delivery) to 1 (strongest preference for vaginal delivery).

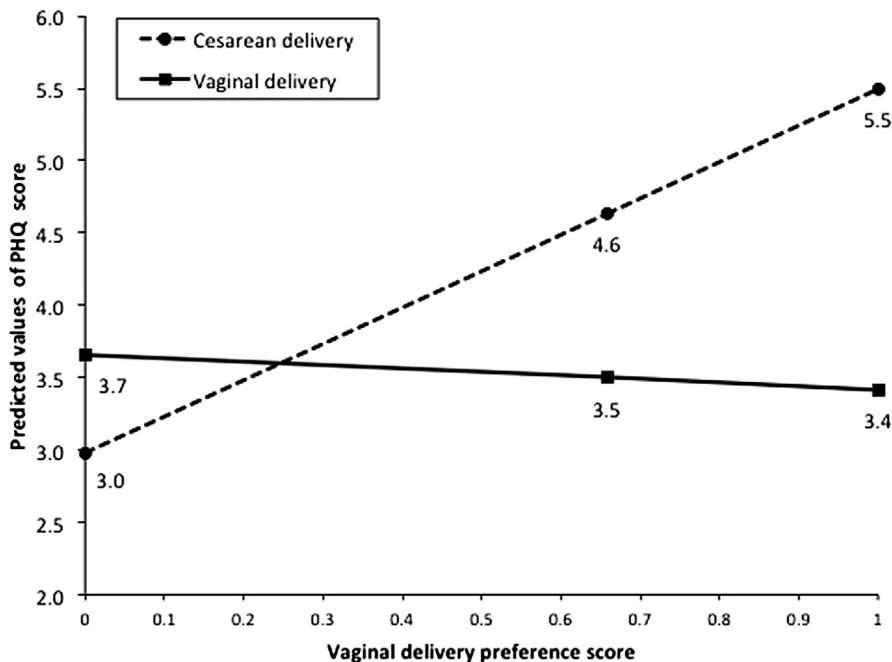
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factors such as antenatal depression and psychosocial stressors. When a woman's delivery experience is not what she anticipated, it may be a particular source of stress in the early postpartum period. Given the described association between strength of preference for vaginal delivery, delivery mode undergone, and postpartum depression, we believe it may be

useful for the clinician to think about the way that women who plan a vaginal delivery and ultimately deliver by cesarean may view these events and take these factors into account to identify women who may be at higher risk for postpartum depression. Antenatal counseling that provides sufficient education to ensure realistic expectations and that explores

and supports a woman's preferences may enable women who undergo something other than their preferred birth to have a more positive delivery and postpartum experience. Further investigation is required to understand whether therapeutic interventions can alter the risk of depression in women who do not undergo their stated delivery preference. ■

FIGURE
Predicted postpartum 9-item Patient Health Questionnaire score



The predicted postpartum PHQ-9 score at 8-10 weeks after delivery by vaginal delivery preference score for mode of delivery undergone. PHQ-9 scores ranged from 0–27; the higher scores indicate more depressive symptoms. The vaginal delivery preference score was measured by the standard gamble metric; the scores ranged from 0 (preference for cesarean delivery) to 1 (strongest preference for vaginal delivery). Cesarean delivery: $B = 0.25$ (per 0.10 increase in preference score); $P = .027$. Vaginal delivery: $B = -0.02$ (per 0.10 in preference score); $P = .761$. Mean preference score for vaginal delivery, 0.658.

PHQ-9, 9-item Patient Health Questionnaire.

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