Title
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Journal
Journal of perinatology : official journal of the California Perinatal Association, 39(10)

ISSN
0743-8346

Authors
Kaimal, Anjali J
Grobman, William A
Bryant, Allison
et al.

Publication Date
2019-10-01

DOI
10.1038/s41372-019-0399-5

Peer reviewed

HHS Public Access

Author manuscript

J Perinatol. Author manuscript; available in PMC 2021 November 16.

Published in final edited form as:

J Perinatol. 2019 October ; 39(10): 1340–1348. doi:10.1038/s41372-019-0399-5.

The association of patient preferences and attitudes with trial of labor after cesarean

Anjali J Kaimal[1], **William A Grobman**[2], **Allison Bryant**[3], **Cinthia Blat**[4], **Peter Bacchetti**[5], **Juan Gonzalez**[4], **Mari-Paule Thiet**[4], **Yamilee Bermingham**[6], **Miriam Kuppermann**[7]

[1] Department of Obstetrics and Gynecology, Massachusetts General Hospital, Boston, MA, USA.

[2] Department of Obstetrics and Gynecology, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA.

[3] Department of Obstetrics and Gynecology, Massachusetts General Hospital, Boston, MA, USA.

[4] Department of Obstetrics, Gynecology & Reproductive Sciences, University of California, San Francisco, San Francisco, CA, USA.

[5] Department of Epidemiology & Biostatistics, University of California, San Francisco, San Francisco, CA, USA.

[6] Marin Community Clinic, San Rafael, CA, USA.

[7] Departments of Obstetrics, Gynecology & Reproductive Sciences and Epidemiology & Biostatistics, University of California, San Francisco, San Francisco, CA, USA.

Abstract

Objective: To evaluate the association of patient preferences and attitudes with TOLAC.

Study Design: Prospective observational study of TOLAC-eligible women at 26–34 weeks gestation. Preferences (utilities) were elicited using the time trade-off and standard gamble metrics. Logistic regression was used to identify preference- and attitude-based factors associated with TOLAC.

Results: Of the 231 participants, most (n=197, 85%) preferred vaginal delivery, but only 40% (n=93) underwent TOLAC. Utilities for uterine rupture outcomes did not differ based on delivery approach. In multivariable analysis, strength of preference for vaginal delivery, value for the experience of labor, and the opinion of the person whom the participant thought of as most important to this decision were associated with TOLAC.

Corresponding author: Anjali Kaimal, MD, MAS, Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Massachusetts General Hospital, 55 Fruit Street, Boston, MA 02114, p) 617-643-7407, f) 617-726-4267, akaimal@partners.org.

Contribution to authorship:

All authors certify that they made substantial contributions to the conception or design of the work (AK, WG, AM, PB, MK); or the acquisition, analysis, or interpretation of data for the work (AK, WG, AM, PB, MK, CB, JG, MPT, YB); AND Drafted the work or revising it critically for important intellectual content (AK, WG, AM, PB, MK, CB, JG, MPT, YB); AND Gave final approval of the version to be published (AK, WG, AM, PB, MK, CB, JG, MPT, YB); AND Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. (AK, WG, AM, PB, MK, CB, JG, MPT, YB).

Conflicts of interest: None of the authors have any relevant conflicts of interest to disclose.

Conclusions: Future decision support interventions incorporating individualized information regarding the likelihood of vaginal birth and empowering patients to express their preferences and engage their families in the decision-making process may improve decision quality and increase TOLAC rates.

Keywords

mode of delivery; trial of labor after cesarean; time trade off; patient preferences; shared decision making

Introduction

In 2015, the Unites States cesarean delivery rate was 32.0%, accounting for over 1.2 million births.[1] Elective repeat cesarean deliveries (ERCD) contribute significantly to the cesarean rate, resulting from the combination of a high rate of primary CD and a relatively low rate of vaginal birth after cesarean (VBAC), which was 11.9% in 2015[2] as compared to a high of 28.3% in 1996.[3] In general, the decline in VBAC is attributable to a decline in trial of labor after cesarean (TOLAC), rather than to decreasing rates of VBAC in the setting of TOLAC. A substantial portion of this decrease is related to women foregoing TOLAC even when they are appropriate candidates and this option is available to them.[4]

The process of counseling regarding approach to delivery after cesarean has traditionally been framed as a balancing of the clinical risks and benefits of ERCD against those of a TOLAC. A significant body of literature regarding the individual patient characteristics (i.e. age, BMI, delivery history) that affect the likelihood of VBAC exists to help clinicians counsel their patients regarding the likelihood of vaginal birth. However, recognition of the key role that maternal preferences and priorities should play in this decision[5] means that this type of clinical information is only one component of what is needed to support patient-centered, evidence-based care. Understanding the impact of patient preferences, attitudes, and perceived social norms on the decision for TOLAC or ERCD and systematically incorporating this information into counseling are important parts of ensuring the delivery of high-quality care to all women. We sought to evaluate the association of patient preferences (utilities) and attitudes with TOLAC among a diverse population of English- or Spanish-speaking, TOLAC-eligible pregnant women.

Methods

We conducted a prospective observational study from December 1, 2014, to April 1, 2016. Participants were recruited from outpatient settings associated with hospitals offering TOLAC in 3 geographically distinct areas of the US: Boston (Massachusetts General Hospital (MGH)); Chicago (Northwestern University Medical Center (NWU)); and the San Francisco Bay Area (University of California San Francisco (UCSF) and Marin Community Clinic in San Rafael). Inclusion criteria included one prior CD, no prior VBAC, no absolute contraindication to VBAC (defined as history of other prior uterine surgery or uterine rupture), a singleton gestation at 26–34 weeks, and the ability to complete an interview in English or Spanish. Participation consisted of one face-to-face interview that included completion of a sociodemographic and attitudinal questionnaire and a series of preference

elicitation exercises, and permission for the researchers to access medical records for clinical information. Participants received usual care regarding decision making for mode of delivery in the setting of a prior cesarean, which consisted of counseling by their provider at all participating institutions. No formal educational intervention, web tools, or decision support was in place in any of the sites; use of the NICHD VBAC prediction tool was at the discretion of the prenatal provider. All participants signed written informed consent prior to the interview and received $50 as remuneration. The study received IRB approval at all participating institutions.

After asking each participant "If you could be guaranteed an uncomplicated delivery of either type, which delivery would you prefer?" with response options of "vaginal delivery" or "cesarean delivery," we assessed the strength of their preference for the potential outcomes of ERCD and TOLAC, using the time tradeoff (TTO) metric. The TTO, which generates values ranging from 0 to 1, where 0=death (or the worst outcome) and 1=ideal health (or the "ideal" outcome), has been used to evaluate patient preferences for outcomes of myriad health care decisions, including gynecologic and labor and delivery outcomes in other contexts.[6,7] To measure the TTO, participants are presented with a choice between the less-than-ideal outcome being evaluated (Choice 1) and a hypothetical "ideal" outcome (Choice 2, determined by their stated mode of delivery preference) that they could experience in exchange for giving up a certain number of years of life. The number of years that Choice 2 requires giving up to achieve the ideal outcome is varied until the participant is indifferent between living her full life expectancy having experienced the less preferred outcome versus a reduced life expectancy with the ideal outcome. Following the measurement of the TTO utilities, a standard gamble utility was elicited to calculate a "strength-of-preference-for-vaginal-delivery" score (0–1, with higher scores indicating a stronger preference for vaginal delivery), which was associated with the likelihood of vaginal delivery in a prior study.[8] For example, if a woman had a stated preference for vaginal delivery, but indicated she would opt for a planned cesarean if there was a 20% chance that labor would end in a cesarean, her strength-of-preference score would be 0.20, indicating a weak preference for vaginal delivery. But if she would only opt for a planned cesarean if there was an 80% chance of her TOLAC ending in cesarean, her strength-of-preference score for vaginal delivery would be 0.80, indicating a strong preference for vaginal birth. Participants with a stated preference for cesarean delivery were assigned a vaginal delivery preference score of 0.[8] The narratives used for the preference elicitation exercises (Table 1) were developed based on the literature regarding the most common clinical scenarios encountered in the setting of TOLAC and ERCD as well as prior qualitative work; the narratives then underwent an iterative process of feedback and revision based on participant responses to develop the final set of scenarios. To minimize potential bias due to the order in which scenarios were assessed, participants were randomly assigned to evaluate scenarios in different sequences using stratified blocked randomization based on stated delivery preference. To avoid either starting or ending the preference assessments with a scenario involving potentially devastating outcomes, uterine rupture outcomes were always presented in the middle of the list. Investigators performing chart review and analyses were blinded to group assignment.

The choice of additional candidate variables was based upon the Theory of Planned Behavior, which provides a theoretical account of the way in which patient-reported attitudes, subjective norms and perceived behavioral control combine to predict a given behavior.[9,10] Attitudes towards labor, cesarean delivery, and vaginal birth were measured utilizing a series of questions developed based on literature review and prior qualitative and quantitative work.[7,8] Using confirmatory factor analysis, we created scales measuring 4 underlying constructs: (1) value for the experience of labor and vaginal birth, (2) value for less medical intervention during labor and birth, (3) concern regarding pain, urogynecologic and sexual function outcomes, and (4) perceived behavioral control. Each scale score was calculated based on the mean of the responses to the items included in that scale. A single item regarding the participants' report of the opinion of the person other than their provider whose opinion matters most to them ("important other") was evaluated as a measure of social norms regarding approach to delivery. Finally, an item regarding the patient's perception of their provider's recommendation for approach to delivery was included.

After delivery, patient outcomes and clinical data regarding the prior cesarean as well as the current delivery were abstracted from the medical record. Delivery approach was defined based upon the approach documented on admission to labor and delivery; if a patient presented in labor but ERCD was desired and performed as soon as clinically appropriate, ERCD was the defined approach. Participants who developed an indication for cesarean between preference elicitation and delivery (e.g. breech presentation or previa) were excluded from the analysis as they were no longer eligible for TOLAC.

We conducted multivariate logistic regression to investigate independent predictors of undergoing TOLAC. As the focus of this analysis was on identifying the association of maternal preferences and attitudes with TOLAC, the primary analyses considered TTO utilities, the strength-of-preference-for vaginal-delivery score, attitudes and social norms around delivery mode, and plans for future childbearing as candidate predictors of interest. The clinical predictors associated with VBAC have already been well investigated in larger cohorts; the probability of VBAC if TOLAC is undertaken (based upon the NICHD calculator[11]) was included in this analysis as a composite assessment of the clinical factors most predictive of VBAC. Recruitment site and probability of VBAC were included in all models *a priori* because we believed that these could be important confounders of the relationships of interest. All other candidate predictors were evaluated using forward selection with model entry set at $p<0.05$.

In Model 1, only the TTO utilities, the strength-of-preference-for-vaginal-delivery score, recruitment site and probability of VBAC were considered. We evaluated this restricted set of candidate predictors first because we hypothesized that attitudes could be mediators of the association between utilities and delivery approach, and we wanted to avoid masking any of their effects. In Model 2, model selection was repeated with the candidate variables evaluated in Model 1 plus attitudes, social norms, and plans for future childbearing. After each model was selected, we evaluated each remaining unselected candidate variable as a single addition to the final model. While the perceived opinion of the provider was anticipated to be an important predictor of delivery approach, it was not included in these initial analyses as the goal was to investigate patient attitudes and preferences, and we

wanted to avoid masking or distorting these effects. Sensitivity analysis adding this covariate to the final selected model was performed.

Statistical analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC). Our planned sample size of 240 was selected based upon prior data indicating a 33% rate of TOLAC in the participating centers. Thus, a simple logistic regression analysis with a utility score as a continuous variable, and up to 8 other predictors, would have 80% power if the odds ratio (OR) per standard deviation (SD) increase in utility score were 1.52 or greater.[12]

Results

290 eligible women were approached for participation; 246 participants enrolled (84.8%). All participants completed the interview and had chart review information regarding clinical history, demographics, and outcomes available. Fifteen participants were noted to have a contraindication to TOLAC at the time of chart review (persistent breech presentation or placenta previa at the time of delivery), leaving data from 231 participants for analysis. The mean age of these participants was 33.9 years (SD ±4.2). Together, they constituted a geographically (45.5% Chicago, 28.1% Boston, and 26.4% San Francisco Bay Area) and racially-ethnically (55.4% White, 13.0% Black, 13.9% Asian/Asian American and 12.6% Latina) diverse sample (Table 2). The majority were married/living with their partner (92.5%), receiving prenatal care from an obstetrician (84.6%), privately insured (83.5%), and college educated (77.1%). Regarding their pregnancy histories, as expected based upon the inclusion criteria for the study, most had only had one prior delivery, their primary cesarean (92.1%). 76.6% experienced labor in their prior pregnancy, and 7.9% had a vaginal delivery prior to their CD. Indications for prior CD were varied, and most participants did not plan to have additional children in the future. The predicted chance of VBAC, based on the NICHD calculator, ranged from 17% to 92% with a mean of 57.7% $\pm$ 14.9%. At the time of the interview, most (n=197, 85.3%) of the participants stated a preference for vaginal delivery if they could be guaranteed an uncomplicated delivery of either type, but only 40.3% (n=93) ultimately underwent TOLAC. Of these, 74.2% had a VBAC. (Table 2)

Time tradeoff utilities, strength-of-preference-for-vaginal-delivery score, and attitudes varied by planned delivery approach (Table 3). In particular, strength of preference for vaginal delivery was higher among participants who opted for TOLAC, and the TTO utility decrement for TOLAC ending in CD or minor maternal surgical complications associated with ERCD was smaller for participants who opted for ERCD, consistent with a greater tolerance for delivering by cesarean. With regards to the strength-of-preference-for-vaginal-delivery score, on average, participants who chose TOLAC stated they would be willing to accept nearly a 72% chance that the TOLAC would end in a cesarean delivery before opting for a planned cesarean, while those who chose an ERCD indicated that they would be willing to accept up to approximately a 35% chance of a TOLAC resulting in a CD. In terms of attitudes and social norms, greater value placed on the experience of labor and vaginal birth, greater desire for less medical intervention, and a recommendation to undergo TOLAC made by an important person other than the woman's health care provider were associated with undertaking TOLAC. Utilities for outcomes associated with uterine rupture were not significantly different based on delivery approach.

In the initial multivariable logistic regression analysis in which recruitment site and likelihood of VBAC when a TOLAC is undertaken were included *a priori* and utilities were evaluated as candidate predictors, stronger preference for vaginal delivery and greater decrement in utility for minor maternal surgical complications in the setting of ERCD were associated with TOLAC (Table 4). When attitudes were evaluated in addition to the utilities, strength of preference for vaginal delivery, desire for the experience of labor and vaginal birth, and the opinion of the person (other than the provider) whom the participant thought of as most important to this decision-making process remained associated with TOLAC.

In sensitivity analysis, addition of the measure of patient perception of their provider's recommendation resulted in attenuation of the relationship between VBAC calculator risk score and TOLAC (aOR 1.48 [95% CI 1.10, 1.96] in the original selected model, aOR 1.26 [95% CI 0.92, 1.17] after the addition). The relationship between the opinion of the important other and TOLAC was also attenuated by this addition (aOR 1.47 [95% CI 1.06, 2.04] in the original selected model, aOR 1.25 [95% CI 0.83, 1.86] after the addition). The associations between strength of preference for vaginal delivery and desire for the experience of labor and vaginal delivery and TOLAC were not substantively changed.

Discussion

In this group of TOLAC-eligible women, we found that strength of preference for vaginal delivery and value placed on the experience of labor and vaginal birth, along with endorsement of TOLAC by the person whose opinion they valued most (other than their provider) were associated with undergoing TOLAC. We also found that addition of a measure of patient perception of their provider's opinion attenuated the impact of the opinion of the "important other" but did not affect the relationship between the preference and attitude measures and TOLAC, suggesting that the individual woman's preferences and attitudes remain key determinants of delivery approach. While these findings may appear intuitive, coupled with the fact that a significant proportion of the participants in our study ultimately chose ERCD despite their initial stated preference for vaginal delivery if they could be guaranteed an uncomplicated delivery of either type, they suggest an opportunity for enhanced decision support to ensure that women and their families have the data they need to express informed preferences and participate in shared decision-making regarding TOLAC and ERCD.

While discussion of complications of uterine rupture are often a focus in counseling regarding TOLAC, the mean utility scores that participants who underwent TOLAC and ERCD assigned to the maternal and neonatal outcomes associated with uterine rupture did not differ significantly, indicating that both groups are similarly concerned about avoiding these devastating but rare complications. However, the strength of preference for vaginal delivery did differ significantly between groups. These findings suggest that for patients, as for providers,[13] the likelihood of vaginal delivery may be a more critical factor in determining a woman's choice of approach to delivery after prior cesarean than the risk of potential complications.

Interestingly, based upon the strength-of-preference-for-vaginal-delivery score, women who underwent TOLAC in this cohort indicated that they would be willing to accept almost a 72% chance of a cesarean in labor before opting for an ERCD. As a substantial amount of the morbidity of TOLAC is incurred by women who undergo TOLAC but then require cesarean in labor,[14] previous literature has suggested that women whose likelihood of vaginal birth is approximately 70% represent the group that incur a similar risk of morbidity whether undertaking a TOLAC or an ERCD.[15,16] Based on our data, we cannot confirm whether the stated willingness of participants to accept a much lower likelihood of vaginal delivery reflects a strong value for the experience of labor and vaginal birth, even in the setting of possible complications, or a knowledge gap regarding the potential complications of a CD in labor. However, the independent association of the attitude score measuring the value a woman places on the experience of labor and vaginal birth, even after controlling for their strength of preference for vaginal delivery, as well as the fact that the majority of this cohort had experienced labor ending in a cesarean in the past, suggests that lack of knowledge or information is unlikely to be the only determinant of these associations. While the population-level clinical data regarding morbidity in the setting of TOLAC were not intended to be used as a sole criterion for TOLAC, the potential disconnect between the patient perspective and the clinical information that may inform provider recommendations requires additional exploration to ensure that shared decision making is not only informed by the best evidence available but also weighted according to the specific values of the patient.[17,18]

Finally, the key role that the opinion of people other than their health care providers plays highlights the importance of engaging the patient's support system in counseling and shared decision-making regarding approach to delivery. While in some cases this may be possible during prenatal appointments, work and childcare commitments as well as other barriers may make this challenging. Designing decision support and educational tools that allow women to share reliable information outside of the context of an office visit may help ensure that they can engage their partners and other important people in their lives to help them make their decision.

Prior studies indicate that for most women, the recommendation of their provider will be a key determinant of their decision making.[13] Ideally, this recommendation is informed by both clinical factors and informed patient preference. As the provider recommendation could either result from or lead to the patient's preferences regarding delivery approach, we chose to exclude our measure of the patient's perception of their provider's opinion from the primary analysis. Nevertheless, our sensitivity analysis shows that accounting for provider recommendation does not impact the association between maternal preferences and attitudes and TOLAC.

Our study is not without limitations. While the participants were geographically and racially-ethnically diverse, they were more highly educated and more likely to be partnered and privately insured than the general population, and most of them received prenatal care from obstetricians at academic medical centers, potentially limiting the generalizability of our findings. In addition, while the preferences and attitudes explored were developed through review of the literature and prior qualitative work, other factors that were not

measured may impact this decision. In addition, this was not designed as an intervention study: while completing the study measurements may have impacted their discussions with their providers, participants received usual care regarding decision making for mode of delivery in the setting of a prior cesarean and detailed information regarding that counseling is not available. Finally, preferences are known to vary through the course of gestation; we chose to constrain the gestational age of participants to 26–34 weeks in order to target a timeframe in which preferences should approximate those at delivery, but still before acute peripartum events occur. However, this limits our ability to assess the impact of gestational age on the relationship between preferences and mode of delivery.

In spite of these limitations, our data add important information regarding women's preferences and attitudes to the rich clinical information regarding predictors of VBAC that is already a central part of counseling about approach to delivery after cesarean. The large sample size and the focus on TOLAC-eligible women is a strength, as is the ability to perform a detailed exploration of preferences and attitudes while accounting for sociodemographic and clinical variables previously identified as predictive of TOLAC. While this study was not designed as an intervention, this information can be utilized in the design of patient-centered, evidence based decision support for this population.

Decision-making regarding approach to delivery after cesarean is complex, requiring consideration and discussion of the probabilities of clinical outcomes and integration of the preferences and priorities of women. Our findings suggest that future decision support interventions can help to maximize patient-centered shared decision-making by incorporating individualized information regarding the likelihood of vaginal birth based on clinical information while also empowering patients to express their preferences and engage their families in the decision-making process.

Acknowledgments

Funding source: This work was supported by NIH/NICHD R01 HD078748 (PI Kuppermann). The funders had no role in study design; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

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Table 1.

Scenario descriptions and order of presentation for time trade-off utility assessments

Brief Description	Full Scenario Presented to Participants	Group 1 Order	Group 2 Order
TOLAC common outcomes			
TOLAC, VBAC, no interventions or complications (assigned a value of 1 when TOLAC is preferred)	You choose to have a trial of labor. You go into labor and at the hospital your labor progresses as expected. You have a vaginal birth. You and your baby go home 2 days later. Full physical recovery takes 1–2 weeks.	1	9
TOLAC, oxytocin augmentation, VBAC	You choose to have a trial of labor. You go into labor but at the hospital your labor stops progressing. You get an IV medicine (Pitocin)[1] to make your contractions stronger and more frequent. You have a vaginal birth. You and your baby go home 2 days later. Full physical recovery takes 1–2 weeks.	2	10
TOLAC, chorioamnionitis, VBAC	You choose to have a trial of labor. During labor, you develop a fever and are given antibiotics. You have a vaginal birth. Because of the fever, your baby needs antibiotics after the delivery. You and your baby go home 2 days later. Full physical recovery takes 1–2 weeks.	3	11
TOLAC, VBAC, 3rd or 4th degree laceration	You choose to have a trial of labor. You have a vaginal birth. During the delivery, a tear occurs in the vagina and muscles around the anus, which is repaired with stitches. You and your baby go home 2 days later. You have discomfort from the tear for the first 1–2 weeks. You have an increased chance of losing stool beyond your control in the future.	4	12
TOLAC, CD, no complications	You choose to have a trial of labor. While you are in labor, your provider determines that you need a C-Section. You have a C-Section without complications. You and your baby go home 4 days later. Full physical recovery takes about 6 weeks.	5	5
TOLAC rupture outcomes			
TOLAC, rupture, CD with rupture easily repaired	You choose to have a trial of labor. While you are in labor, your provider determines that you need a C-Section. During the delivery, the doctor sees that the uterine scar from your previous C-Section has opened. The opening is easily repaired and your baby does not have any complications. You and your baby go home 4 days later. Full physical recovery takes about 6 weeks.	6	6
TOLAC, rupture, CD, hysterectomy (no infant complications)	You choose to have a trial of labor. While you are in labor, your provider determines that you need a C-Section. During the delivery the doctor sees that the uterine scar from your previous C-Section has opened. The opening cannot be repaired, and a hysterectomy is necessary. This means that you will not be able to get pregnant in the future.	7	7

Brief Description	Full Scenario Presented to Participants	Group 1 Order	Group 2 Order
	Your baby does not have any complications. You and your baby go home 4 days later. Full physical recovery takes about 6 weeks.		
TOLAC, rupture, CD, severe infant complication (HIE or death)	You choose to have a trial of labor. While you are in labor, your provider determines that you need a C-Section. During the delivery your doctor sees that the uterine scar from your previous C-Section has opened. The opening is repaired. However, your baby has serious complications related to the delivery and has to stay in the hospital. In some cases, your baby may die; if he or she survives, he or she will have serious, lifelong medical problems.	8	8
ERCD outcomes			
ERCD, no complications (assigned a value of 1 when CD is preferred)	You choose to have a scheduled C-section. You have a C-Section without complications. You and your baby go home 4 days later. Full physical recovery takes about 6 weeks.	9	1
ERCD, minor surgical complications (surgical site infection/wound dehiscence)	You choose to have a scheduled C-section. 3 days after surgery, your surgical incision becomes infected and the skin opens up. Your baby does not have any complications. You and your baby go home 6 days later. You have to get daily wound care at home for 2–4 weeks. Full physical recovery takes about 6 weeks.	10	2
ERCD, transient neonatal complications (transient tachypnea of the newborn)	You choose to have a scheduled C-section. Your baby has difficulty breathing and is admitted to the neonatal intensive care unit for 24 hours. Your baby recovers well and you both go home 4 days later. Full physical recovery takes about 6 weeks.	11	3
ERCD, CD, future complications (accreta with late preterm birth)	You choose to have a scheduled C-section. You and your baby go home 4 days later. Full physical recovery takes about 6 weeks. Two years later, you decide to have another baby. During that pregnancy, you are told that your placenta is covering the birth canal and appears to have grown too deeply into the uterus as a result of your prior C-sections. You are told that you are at increased risk of having a premature baby. You deliver about 5 weeks before your due date. Your baby stays in the hospital for 3 weeks. You have a hysterectomy at the time of your delivery because of the placental problem. This means that you will not be able to get pregnant in the future.	12	4

[1]"Pitocin" was used rather than oxytocin as during the development/pretesting of these materials, participants were not all familiar with the generic term

[2]To minimize potential bias due to the order in which scenarios were assessed, participants were randomly assigned to evaluate scenarios in different sequence

J Perinatol. Author manuscript; available in PMC 2021 November 16.

Table 2.

Sociodemographic and clinical characteristics of study participants (n=231)

	N (%) or Mean(±SD)
Recruitment Site	
Chicago	105 (45.5%)
Boston	65 (28.1%)
San Francisco Bay Area	61 (26.4%)
Age (continuous)	
Mean (±SD)	33.9 (±4.2)
Race	
White	128 (55.4%)
Asian/Pacific Islander	32 (13.9%)
Black	30 (13.0%)
Latina	29 (12.6%)
Mixed/Other/Missing	12 (5.2%)
Current relationship status	
Married or living with a partner	214 (92.5%)
Significantly involved with a partner, but not living together	11 (4.8%)
Single/not significantly involved	6 (2.6%)
Primary obstetric care provider	
Obstetrician	196 (84.6%)
Midwife, family practice physician, other	35 (15.4%)
Health insurance type	
Private insurance/Other	193 (83.5%)
Public insurance	38 (16.5%)
Educational attainment	
High school graduate or less	18 (7.8%)
Some college	35 (15.2%)
College graduate	178 (77.1%)
Annual household income	
<= $50K	43 (18.8%)
>$50K – <$100K	44 (19.2%)
$100K +	142 (62.0%)
Parity = 1 (primary cesarean only prior delivery)	211 (92.1%)
Experienced labor in the past	177 (76.6%)
Prior vaginal birth (preceding cesarean)	18 (7.9%)
Indications for prior cesarean [1]	
Active phase arrest	129 (55.8%)
Fetal intolerance of labor	62 (26.8%)

	N (%) or Mean(±SD)
Breech	40 (17.3%)
Maternal status inappropriate for labor	13 (5.6%)
Placenta Previa	9 (3.9%)
Fetal status inappropriate for labor	8 (3.5%)
Multiple gestation	7 (3.0%)
Cesarean delivery on maternal request	5 (2.2%)
Macrosomia	5 (2.2%)
Plans to have more children	48 (20.8%)
VBAC calculator score	57.7 (14.9)

[1] Sums to greater than 100% as all that applied are included

Not all categories sum to 231 as women could decline to answer any question.

Table 3.

Time tradeoff utilities, strength of preference for vaginal delivery, attitudes and social norms by delivery approach. Utilities are presented above the double line; Attitudes and social norms are presented below the double line

	TOLAC (n= 93)	ERCD (n= 138)	
	Mean(±SD)	Mean(±SD)	p-value
TOLAC, oxytocin augmentation, VBAC	0.940 (±0.114)	0.955 (±0.097)	0.27
TOLAC, chorioamnionitis, VBAC	0.930 (±0.118)	0.945 (±0.124)	0.20
TOLAC, VBAC, 3rd or 4th degree laceration	0.876 (±0.17)	0.867(±0.205)	0.79
TOLAC, CD, no complications	**0.912 (±0.135)**	**0.953 (±0.096)**	**0.005**
TOLAC, rupture, CD with rupture easily repaired	0.932 (±0.1)	0.950 (±0.092)	0.09
TOLAC, rupture, CD, hysterectomy (no infant complications)	0.860 (±0.188)	0.897 (±0.164)	0.09
TOLAC, rupture, CD, severe infant complication (HIE or death)	0.437 (±0.304)	0.453 (±0.313)	0.78
ERCD, minor surgical complications	**0.885 (±0.184)**	**0.931 (±0.129)**	**0.02**
ERCD, transient neonatal complications (Transient tachypnea of the newborn	0.870 (±0.181)	0.910 (±0.152)	0.10
ERCD, CD, future complications (accreta with late preterm birth)	0.816 (±0.234)	0.863 (±0.205)	0.08
Strength of preference for vaginal delivery	**0.719 (±0.364)**	**0.349 (±0.376)**	**<0.001**
Value for the experience of labor and vaginal birth [1]	**4.2 (±0.6)**	**3.1 (±1.1)**	**<0.001**
Value for less medical intervention [2]	**3.3 (±0.9)**	**2.6 (±0.8)**	**<0.001**
Concern regarding urogynecologic and sexual function [3]	**2.7 (±0.8)**	**3.0 (±0.7)**	**0.004**
Perception of control[4]	3.1 (±0.8)	3.1 (±0.8)	0.91
Opinion of important other regarding TOLAC [5]	**3.8 (±1.0)**	**2.5 (±1.3)**	**<0.001**

[1] Value of the experience of vaginal birth (1–5 scale, 5= stronger preference for experience of labor/vaginal birth)
- I would really like to experience labor
- Having a cesarean would be most convenient for my family (reversed)
- I would really like to have a vaginal delivery

[2] Value of less medical intervention (1–5 scale, 5= prefer less medical intervention)
- Labor is a natural process that should not be controlled
- Too many women are having cesareans
- I want to have as little medical intervention as possible at my delivery
- Modern medicine interferes too much in pregnancy

[3] Concern regarding urogynecologic and sexual function (1–5 scale, 5=higher concern regarding these issues)
- Having a cesarean would be less painful than having a vaginal delivery
- Having a cesarean would be better for my future sex life
- Having a vaginal delivery would increase my chances of leaking urine later on in life (reversed)

[4] Control (1–5 scale, 5= higher perception of control)
- There is little I can do to control the course of my labor and delivery (reversed)
- What happens to me during my delivery will be within my control
- I have little control over what happens to me (reversed)

[5] 1–5 scale, 5=recommend TOLAC

Table 4.

Multivariable predictors of TOLAC

Predictors included in multivariable model[1]	Type 3 p-value	Adjusted Odds Ratio (95% CI)
Model 1		
Recruitment site	0.21	
Northwestern		Reference
San Francisco Bay Area		2.02 (0.92–4.45)
Massachusetts General		1.66 (0.79–3.46)
VBAC calculator risk score [2]	**0.011**	**1.36 (1.07–1.73)**
Strength of preference for vaginal delivery score [3]	**< 0.001**	**1.29 (1.18–1.40)**
Time trade off utility for ERCD, minor surgical complications [3]	**0.026**	**0.79 (0.64–0.97)**
Model 2		
Recruitment site	0.63	
Northwestern		Reference
San Francisco Bay Area		1.38 (0.54–3.53)
Massachusetts General		1.47 (0.68–3.18)
VBAC calculator risk score	**0.0097**	**1.48 (1.10–1.98)**
Strength of preference for vaginal delivery score	**0.0025**	**1.17 (1.06–1.30)**
Value of the experience of labor and vaginal birth	**< 0.001**	**3.46 (2.01–5.96)**
Opinion of important other regarding TOLAC	**0.021**	**1.47 (1.06–2.04)**

[1] Candidate predictors evaluated included recruitment site, VBAC calculator risk score, TTO utilities, strength of preference for vaginal delivery, attitudes and social norms around delivery mode, and plans for future childbearing. Recruitment site and probability of VBAC were included in all models *a priori*. All other predictors were evaluated using forward selection with model entry set at $p<0.05$. Initial model evaluated utilities and strength of preference for vaginal delivery (presented in the top portion of the table). Model 2 (presented in the bottom portion of the table) evaluated utilities, attitudes, social normal and plans for future child bearing. Predictors with $p < 0.05$ are bolded.

[2] Utilizing the NICHD pre-admission VBAC calculator. aOR is for every 10-point increase in the likelihood of VBAC if a TOLAC is undertaken.

[3] aOR for every 0.1 point increase on a 0–1 scale