ORIGINAL ARTICLE

# Improving communication and teamwork during labor: A feasibility, acceptability, and safety study

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## Abstract

**Background:** TeamBirth was designed to promote best practices in shared decision making (SDM) among care teams for people giving birth. Although leading health organizations recommend SDM to address gaps in quality of care, these recommendations are not consistently implemented in labor and delivery.

**Methods:** We conducted a mixed-methods trial of TeamBirth among eligible laboring patients and all clinicians (nurses, midwives, and obstetricians) at four high-volume hospitals during April 2018 to September 2019. We used patient and clinician surveys, abstracted clinical data, and administrative claims to evaluate the feasibility, acceptability, and safety of TeamBirth.

**Results:** A total of 2,669 patients (approximately 28% of eligible delivery volume) and 375 clinicians (78% response rate) responded to surveys on their experiences with TeamBirth. Among patients surveyed, 89% reported experiencing at least one structured full care team conversation ("huddle") during labor and 77% reported experiencing multiple huddles. There was a significant relationship between the

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number of reported huddles and patient acceptability ($P < 0.001$), suggestive of a dose response. Among clinicians surveyed, 90% would recommend TeamBirth for use in other labor and delivery units. There were no significant changes in maternal and newborn safety measures.

**Conclusions:** Implementing a care process that aims to improve communication and teamwork during labor with high fidelity is feasible. The process is acceptable to patients and clinicians and shows no negative effects on patient safety. Future work should evaluate the effectiveness of TeamBirth in improving care experience and health outcomes.

**KEYWORDS**
communication, labor and delivery, shared decision making

# 1 | INTRODUCTION

Across the United States (US), there is substantial opportunity to improve the safety and quality of maternity care.[1-5] Hospital-level cesarean birth rates vary 10-fold, from 7% to 70%, suggesting a need for more reliable labor management.[2-4] Current initiatives attempt to address these variations in care and outcomes primarily through closing gaps in clinician knowledge and skills or addressing misaligned malpractice or reimbursement incentives.[6-10] However, human factors are the most common root causes of obstetric sentinel events.[11-14] The World Health Organization (WHO) and leading US obstetric professional organizations recommend improving communication, coordination, and shared decision making (SDM) between providers and patients to address gaps in quality of care.[13-17] These recommendations are not consistently implemented in labor and delivery care, highlighting a need for system innovations to close this reliability gap.[18-20]

TeamBirth is a rigorously designed care process to improve care and SDM across the full care team, which includes the patient, their support person(s), nurse and physician or midwife, by ensuring reliability for best practices in communication and teamwork during labor and delivery.[21] TeamBirth aims to operationalize best practices in communication and clinical care from the major professional organizations in obstetrics, including the American College of Obstetricians & Gynecologists (ACOG), Society for Maternal-Fetal Medicine (SMFM), American College of Nurse-Midwives (ACNM), and Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN), to ensure these practices are occurring consistently throughout labor.[9,17,21,22] Although the solution was initially designed with a focus on reducing unnecessary cesarean deliveries, the pilot implementation experiences suggested that these practices may support a broader scope of quality improvement in labor and delivery, including shared decision making and safety culture. Key TeamBirth practices include:

1. Promoting the roles of the laboring patient, nurse, and delivering provider as members of the care team with equally valuable input for SDM,
2. Eliciting the patient's preferences, symptoms, and subjective experiences and integrating them with clinical data to inform patient care plans,
3. Distinguishing statuses and care plans for the mother, fetus, and labor progress, and
4. Setting shared expectations for the next planned evaluation.

These four practices are prompted by a simple, patient-facing, dry erase Shared Planning Board mounted in the labor room that includes one practice per quadrant. Research indicates that dry erase boards can be used in clinical settings to support safety and dignity in care, especially to improve patient–provider communication, teamwork, and patient satisfaction.[23,24] The planning board is initially filled out and subsequently updated during team "huddles" throughout labor. Huddles are defined as the full care team, including the patient, nurse, and delivering provider, discussing preferences for labor, making shared decisions about care plans, and setting plans for the next check-in or step. If the patient was non-English speaking, interpreter services were utilized during team huddles through in-person, virtual, or phone interpretation. Huddles occur at a minimum at admission, changes in the plan of care, clinical decisions, or the request of any team member. Huddle frequency and quantity are determined by the individual's course of labor.

From April 2018 to September 2019, we conducted an initial study to test whether TeamBirth would be

acceptable, feasible, and safe for clinicians and laboring patients in four high-volume community hospitals in the United States.

## 2 | MATERIALS AND METHODS

We conducted a mixed-methods trial of TeamBirth to evaluate the acceptability, feasibility, and safety of implementation. We developed a detailed study protocol at the beginning of the trial to delineate plans for both the quality improvement and research activities. We developed patient and clinician surveys based on the logic model for the mechanism underlying the intended outputs and short-term outcomes of TeamBirth, and cross-referenced all measures included in the study protocol against the Consolidated Framework for Implementation Research (CFIR) to ensure we were capturing all implementation domains relevant to the study.[25] In this paper, we report on the subset of measures related to the primary trial outcomes of the acceptability, feasibility, and safety of implementing TeamBirth. These primary outcomes were selected to emulate a Phase I clinical trial where we aim to ensure "tolerance" of TeamBirth before conducting a larger-scale effectiveness trial. We registered the trial, including two main acceptability measures (patient-perceived role in care and clinician recommendation of the project), on ClinicalTrials.gov (Identifier: NCT03529214). All other acceptability, feasibility, and safety measures presented in this paper were prioritized at the beginning of implementation in collaboration with the site teams based on perceived construct, reliability, and priority for monitoring and evaluating project success. Given the exploratory nature of the study, we did not specify predetermined targets for these measures before starting the study or implementation.

We assessed acceptability for patients based on their perceived experience of care, including their role in making decisions about labor. We also evaluated acceptability based on patients' self-reported ability to understand discussions with their clinical team and their perception of whether their preferences played a role in the care they received. These additional measures aimed to deepen our understanding of the ways they were engaged with their clinical team as a part of their role in care and decision making. We measured these concepts with a postpartum patient survey conducted on tablets or on paper after delivery but before discharge from the postpartum unit. Site teams aimed to offer surveys to all patients who met study criteria of 18 years or older (except at SF where we used a threshold of 15 years or older based on the hospital implementation team's requests to decrease the threshold to more accurately represent their younger birthing

population), and did not experience a fetal demise or scheduled cesarean birth. Surveys were offered in English and Spanish languages. Interpreter services were also available at all four hospitals to facilitate survey completion. Patients consented to be surveyed by reviewing written consents and then either proceeding with the survey on paper or by selecting "next" on the electronic survey. We conservatively approximated patient survey response rates based on the number of patients with records in the clinical file data who met these study criteria. In some cases, surveys may not have been administered if the site did not have an IRB-approved staff member available to distribute them.

We assessed acceptability for clinicians based on their perception of the value of TeamBirth and whether TeamBirth improved care and clarified decision making for nonurgent cesarean deliveries. "Improved care" and "clarified decision making" were not defined further to allow for individual interpretation. These quantitative responses combined with open-ended survey responses about "why or why not" clinicians would recommend TeamBirth aimed to provide greater understanding on acceptability to clinicians. On eight months postimplementation, surveys were offered to all nurses, midwives, and obstetricians practicing in each unit and were promoted for 4-6 weeks until we reached at least a 60% response rate.

We assessed feasibility based on patient-reported frequency of huddles and planning board use from the postpartum patient survey (described above). Site implementation team leaders decided they would not consider implementation fully successful unless the TeamBirth was happening in a way that was transparent and notable to participating patients. We also captured data from direct observations of huddles by site team members (eg, frontline champions, charge nurses, childbirth educators, and volunteers).

Finally, we defined safety as the absence of harm for patients or babies associated with the implementation of TeamBirth. Site teams monitored maternal and neonatal balancing measures throughout implementation, such as postpartum hemorrhage rates and unexpected newborn complications (see Appendix S1 for more details on clinical measure definitions and data file variation across sites). We also evaluated intervention measures, including low-risk cesarean birth rates and cervical dilation on admission. Site teams shared clinical data from abstraction, electronic medical record fields, or administrative claims. The data file varied slightly across each site based on the format of their internal system and partnerships with any external data services. We also tracked the negative responses to the clinician survey questions on acceptability to ensure TeamBirth was not making care processes worse in ways upstream of ultimate clinical outcomes.

All survey data were input through Qualtrics Survey Software, and clinical file data were shared through Accellion Kiteworks or SharePoint secure file transfer systems. Ongoing reports of survey data were developed in SSRS Visual Studio 2015, and clinical file data were analyzed in SAS version 9.4. The significance of a relationship between patient-reported experience of huddles and patient-reported acceptability was evaluated with a Fisher's exact test. Qualitative themes from open-ended clinician survey responses were generated inductively and coded in Microsoft Excel. A second researcher double-coded a 16% sample of the data to ensure clarity in theme definitions and consistency in their application.

Quality improvement activities detailed in the study protocol included implementation of the TeamBirth solution at four hospitals across the United States. We selected hospitals based on four criteria:

1. Opportunity to improve the quality of labor management, as indicated by their low-risk cesarean birth rates,
2. Organizational support for the project from executives, unit leadership, and clinicians,
3. Capacity to participate in both research and quality improvement, and
4. Established relationships within their state or network that would position them to be effective partners in scaling this approach beyond their hospital if TeamBirth was demonstrated to be acceptable, feasible, and safe.

Our aim was to test the solution across several different contexts while closely partnering with each site for implementation and learning about the program. The selected sites were four community hospitals across the United States with varied practice models and geographies. South Shore Hospital (SS) is located in South Weymouth, MA, and performs 3300 deliveries annually on a labor unit staffed by 82 nurses, 17 midwives, and 25 physicians. SS's nulliparous, term, singleton, vertex (NTSV) cesarean birth rate for 2017 was 28.6%. Saint Francis Hospital (SF) is located in Tulsa, Oklahoma, and performs 4200 deliveries annually on a labor unit staffed by 68 nurses and 30 physicians (no midwives). SF's NTSV cesarean birth rate in 2017 was 33.2%. Overlake Medical Center (OL) is located in Bellevue, and WA performs 3600 deliveries annually on a labor unit staffed by 70 nurses, 10 midwives, and 31 physicians. OL's NTSV cesarean birth rate in 2017 was 30.4%. EvergreenHealth (EH) Medical Center is located in Kirkland, WA, performs 4600 deliveries annually on a labor, delivery, recovery, and postpartum unit staffed by 112 nurses, six

midwives, and 32 physicians. EH's NTSV cesarean birth rate for 2017 was 31.2%. All hospitals have level III neonatal intensive care units (NICU) with the exception of SF, who has a level IV NICU.

The implementation strategy involved a high-touch approach, partnering closely with site teams through site visits, coaching calls, and data feedback. We followed an implementation pathway, which included preparing plans for the implementation process with the site team, engaging, and coaching frontline clinicians on TeamBirth, implementing the program across the full unit, and sustaining the program as a standard of care in the unit. The site teams were multidisciplinary, including a provider lead (site PI), nurse leaders, provider and nurse champions, project managers, and quality department leads.

The project launches were staggered across sites to allow the study team to incorporate iterative learning from earlier sites into implementation at subsequent sites. As the first site, SS began implementation in April 2018 and officially launched in September 2018. Based on the lessons learned from SS, all subsequent sites included at least three months of preparation, stakeholder engagement, and clinician coaching before project launch. SF launched in September 2018, and OL and EH launched in January 2019.

Throughout the prepare phase, the research team worked closely with the site teams to establish study infrastructure, including ethics approvals and data collection processes, and either build or adapt their existing quality improvement capacity to engage and coach clinicians on the project. Early in the implementation period, we created dashboards that were sent to the sites throughout the project for monitoring and evaluation of the research and quality improvement activities. Data on research data collection and operations were reported weekly; acceptability, feasibility, and safety data from surveys and observations were reported monthly; and deeper qualitative data from clinician interviews and implementation team focus groups were reported at the middle and end of the project. The research team and site teams had individual coaching calls weekly to review the data and identify opportunities for adjusting implementation activities, and all four sites connected on webinars quarterly to compare data and share lessons learned across teams.

Site team implementation costs were supported by the hospitals and/or partners (eg, Premera Blue Cross funded a project manager for OL and EH). Within each site, costs included personnel time for leaders and frontline champions and purchasing and printing costs for the project planning boards and materials (eg, education materials, posters, and handouts). These costs were comparable with the implementation of other quality improvement projects on labor and delivery units.

# 3 | RESULTS

Throughout eight months of implementation of the TeamBirth program at each site, we collected a total of 2669 patient surveys (approximately 28% of eligible delivery volume) and 12-18 months of clinical file data, including at least three months of prelaunch baseline data. At eight months, we collected 375 clinician surveys (78% response rate) from nurses, midwives, and obstetricians. Characteristics of patient and clinician survey respondents are shown in Table 1.

Patient-reported fidelity to the TeamBirth behaviors was high: 89% of respondents reported experiencing at least one huddle throughout their labor and delivery care. Over three-quarters of the patients (77%) surveyed reported experiencing multiple huddles and 98% of patients reported using the Shared Planning Boards with their huddles. The instance of huddles increased in frequency over time with almost 10-percentage point increases in the frequency of one or multiple huddles (86% to 93% and 75% to 82%, respectively). The frequency of Shared Planning Board use with huddles remained stable at approximately 98% (Figure 1). We also collected fidelity data from direct observations of huddles, but we excluded these data based on our concerns about reliability in collection across sites and individual observers.

TeamBirth was acceptable to both patients and clinicians. Over eight months of our implementation, 99% of all patients surveyed definitely or somewhat had the role they wanted in making decisions about their labor. Among the subset of patients who wanted information about their labor and delivery process and wanted to make collaborative decisions with their clinicians, 99% definitely or somewhat had the role they wanted in making decisions about their labor. Ninety-nine percent reported that their nurse and provider definitely or somewhat talked about their labor in a way they could understand and 96% definitely or probably felt that their preferences made a difference in the care they received (Figure 2). There was a significant relationship between the number of huddles patients reported throughout their labor and patient-reported acceptability, which is suggestive of a potential dose response between huddles and positive experience (P < 0.001) (Figure 3).

Among clinicians surveyed after eight months of implementation, 90% of nurses, midwives, and obstetricians reported they would definitely (68%) or probably (22%) recommend TeamBirth for use in other labor and delivery units (Figure 4A). Ninety-four percent reported that the project definitely (60%) or somewhat (34%) improves care for patients, and 88% reported that the project definitely (42%) or somewhat (46%) helps clarify when a cesarean birth should be performed in nonurgent situations (Figure 4B). Open-ended survey responses revealed that clinicians' main reasons for recommending TeamBirth included involving and empowering the patient and their family in care, improving team communication, and creating transparency and accountability across team members. Among clinicians who would maybe (8.2%), probably not (3.9%), or definitely not (0.7%) recommend the project, the main reason was not believing TeamBirth represented a substantial change from their prior practices.

Run charts for trends in maternal and neonatal outcome measures, including severe maternal morbidity, postpartum hemorrhage, blood transfusion, unexpected newborn complications, and low-risk cesarean birth rates, showed expected, common-cause variation but no substantial changes that would indicate any safety concerns with the implementation of TeamBirth (see Appendix S1 for measure definitions and data). None of the clinicians surveyed reported that the project makes care worse or makes decision making about cesarean deliveries less clear, suggesting the absence of any upstream harms that would not be captured through clinical intervention or outcome measures alone.

# 4 | DISCUSSION

At four community hospitals across the United States, we demonstrated the acceptability, feasibility, and safety of implementing TeamBirth, a SDM care process during labor and delivery. Throughout the implementation of the process, the majority of patients surveyed reported having the role they wanted in their care, and the majority of clinicians surveyed would recommend TeamBirth for other labor and delivery units. Additional survey questions exploring patients' experiences of care and clinicians' perceptions of the program supported these positive reports on the impact of TeamBirth on care delivery. All sites experienced expected, common-cause variation on maternal and neonatal outcomes (including low-risk cesarean birth rates), suggesting that patients and clinicians can substantively change the way they communicate as teams throughout intrapartum care without causing unintended harm.

Many health care innovations have demonstrated effectiveness but have lacked scalability in real-world contexts.[26] SDM tools have demonstrated benefits in obstetrical care by improving patient education, satisfaction, perception of choice, and decreased conflict and anxiety around decision making, but standards for SDM are not reliably implemented and measured in intrapartum care around labor management.[19,27-30] There is limited evidence available on the acceptability and feasibility of implementing SDM tools, especially in regard to patient

**TABLE 1** Characteristics of patient survey respondents

| Characteristics | All sites |
|---|---|
| Patients | |
| Denominator | 3924 |
| | N (%) |
| Age category | |
| Under 20 years old | 79 (2%) |
| 20-24 years old | 443 (11.3%) |
| 25-29 years old | 1105 (28.2%) |
| 30-34 years old | 1439 (36.7%) |
| 35-39 years old | 707 (18%) |
| 40 years old or older | 107 (2.7%) |
| Missing/PNA[a] | 44 (1.1%) |
| Race/Ethnicity | |
| Non-Hispanic White | 2462 (62.7%) |
| Non-Hispanic Black | 159 (4.1%) |
| Hispanic | 325 (8.3%) |
| Asian | 564 (14.4%) |
| Other/Multi-Racial | 337 (8.6%) |
| Missing/PNA | 77 (2%) |
| Level of education | |
| Some HS/HS Degree | 575 (14.7%) |
| Some College/College Degree | 2277 (58%) |
| Some Post-grad/Post-grad Degree | 986 (25.1%) |
| Missing/PNA | 86 (2.2%) |
| Nulliparous | |
| Yes | 1827 (46.6%) |
| No | 2059 (52.5%) |
| Missing/PNA | 38 (1%) |
| Singleton | |
| Yes | 3734 (95.2%) |
| No | 32 (0.8%) |
| Missing/PNA | 158 (4%) |
| Delivery mode | |
| Vaginal delivery | 3077 (78.4%) |
| Cesarean birth | 573 (14.6%) |
| Operative vaginal delivery | 262 (6.7%) |
| Missing/PNA | 12 (0.3%) |
| **Clinicians** | |
| Denominator | 375 |
| | N (%) |
| Discipline | |
| Nurse | 253 (67.5) |
| Midwife | 26 (6.9) |
| Obstetrician | 96 (25.6) |

**TABLE 1** (Continued)

| | N (%) |
|---|---|
| Years in clinical role | |
| Nurse | 253 |
| 0-4 years | 76 (30.0) |
| 5-14 years | 81 (32.0) |
| 15-24 years | 50 (19.8) |
| 25+ years | 46 (18.2) |
| Midwife | 26 |
| 0-4 years | 7 (26.9) |
| 5-14 years | 9 (34.6) |
| 15-24 years | 5 (19.2) |
| 25+ years | 5 (19.2) |
| Obstetrician | 96 |
| 0-4 years | 6 (6.3) |
| 5-14 years | 25 (26.0) |
| 15-24 years | 38 (39.6) |
| 25+ years | 27 (28.1) |
| Years at hospital | |
| Nurse | 253 |
| 0-4 years | 94 (37.2) |
| 5-14 years | 89 (35.2) |
| 15-24 years | 49 (19.4) |
| 25+ years | 21 (8.3) |
| Midwife | 26 |
| 0-4 years | 10 (38.5) |
| 5-14 years | 8 (30.8) |
| 15-24 years | 6 (23.1) |
| 25+ years | 2 (7.7) |
| Obstetrician | 96 |
| 0-4 years | 26 (27.1) |
| 5-14 years | 31 (32.3) |
| 15-24 years | 29 (30.2) |
| 25+ years | 10 (10.4) |

[a]Missing data are from paper surveys where patients left questions blank instead of selecting a response option or prefer not to answer; tablet-based surveys had built in logic to prevent missing responses.

anxiety, satisfaction and cost savings.[30] Common challenges to scalability include the willingness of clinicians to change practice, perceived increase time burden for clinicians, organizational culture, and infrastructure.[26,30,31] With these scaling challenges in mind, TeamBirth was intentionally designed and tested to support people in labor and their care teams to produce reliable and high-quality teamwork, communication, and SDM. Modeling our study after an FDA phase 1 trial, we set out to first test whether TeamBirth was acceptable, feasible, and safe before a more extensive effectiveness test was completed.[32]
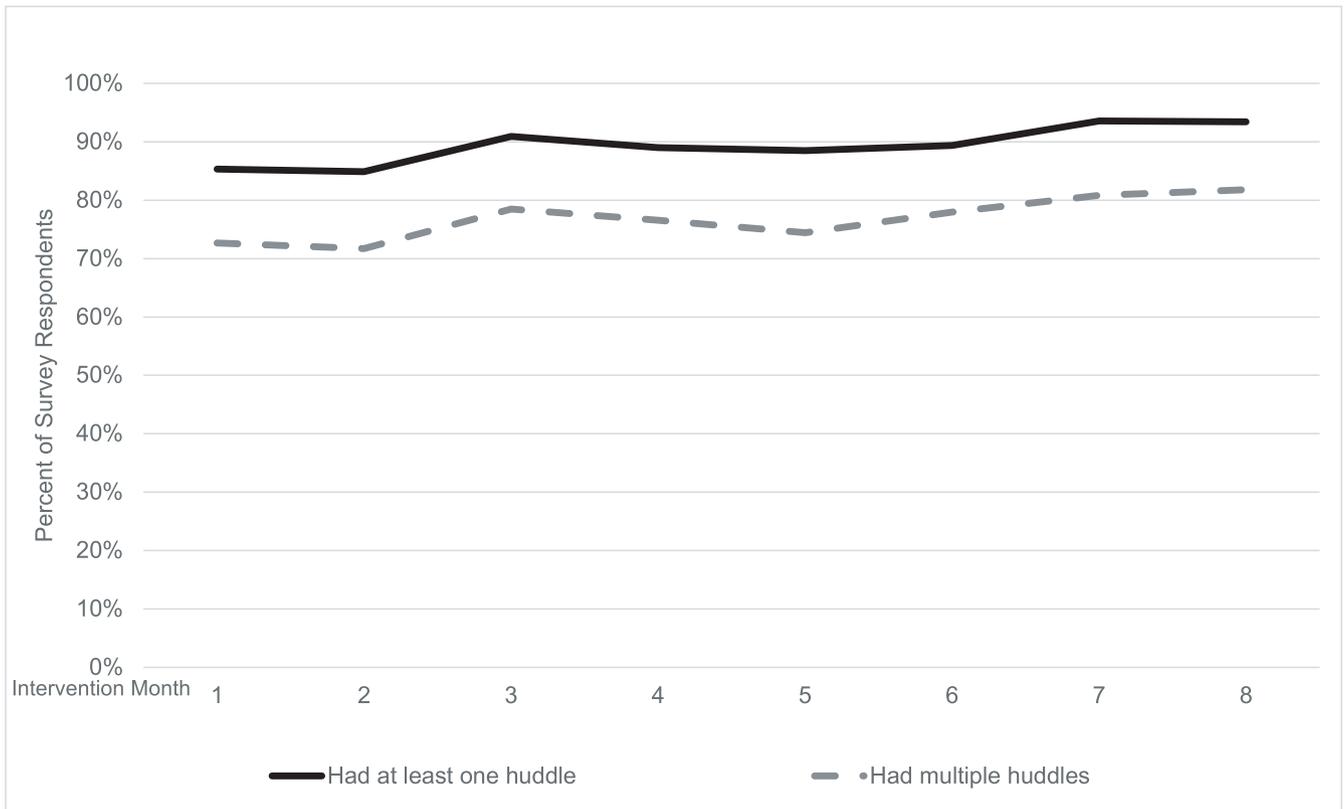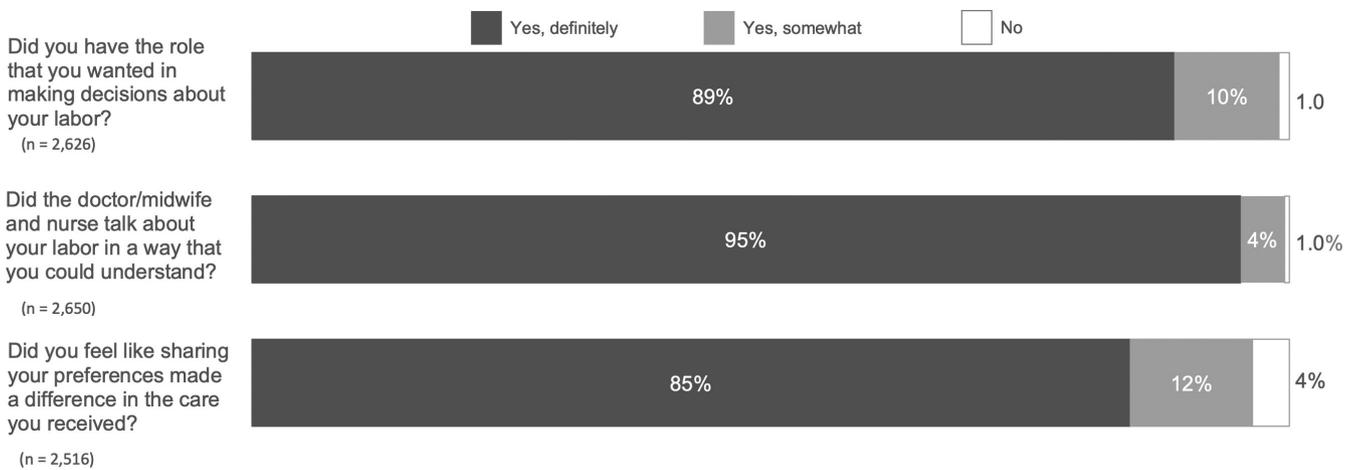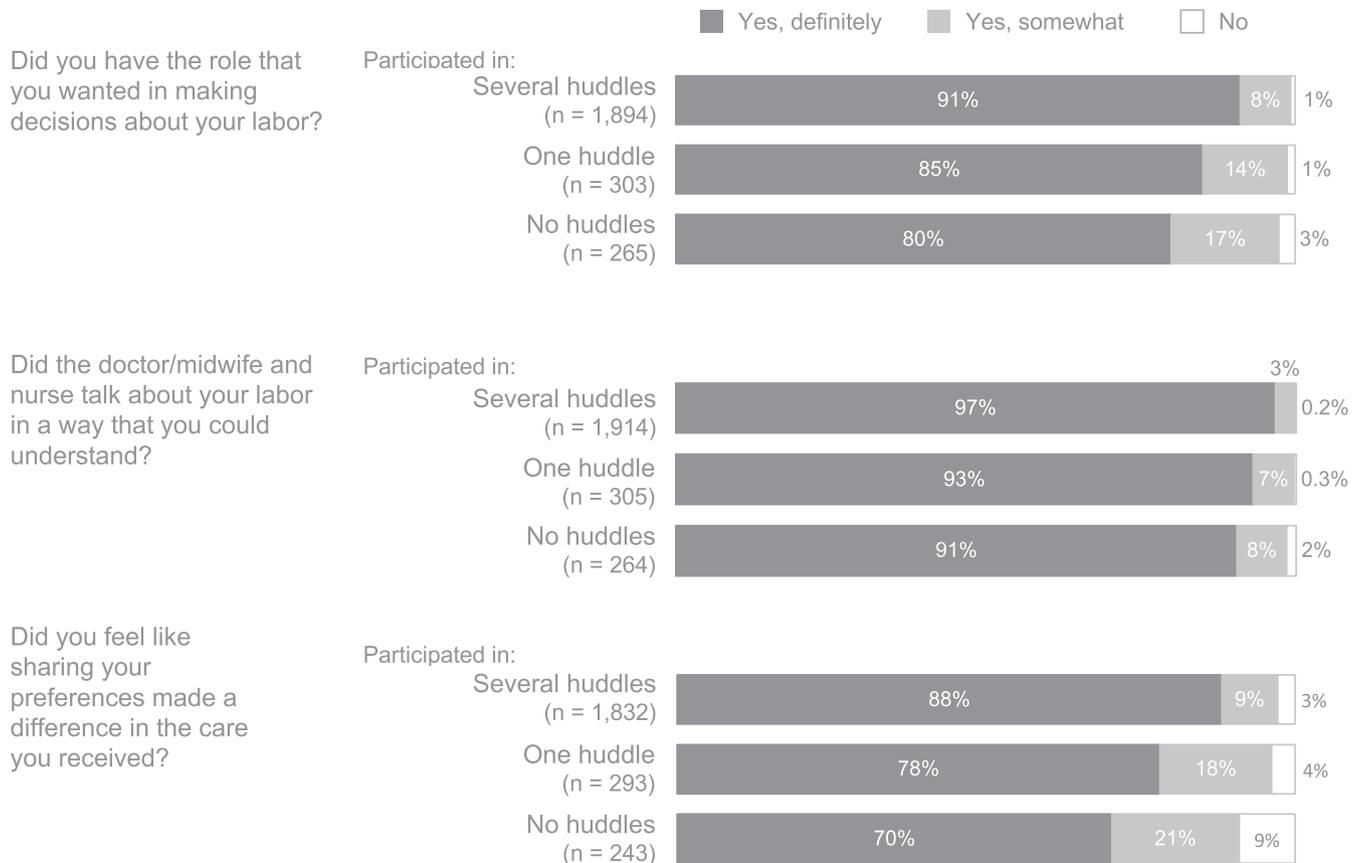
**FIGURE 1** Patient-reported Fidelity of TeamBirth Implementation. Data collected through patient surveys in the postpartum period before hospital discharge. The instance of huddles increased in frequency over time with almost 10-percentage point increases in the frequency of one or multiple huddles (86% to 93% for one; 75% to 82% for multiple)
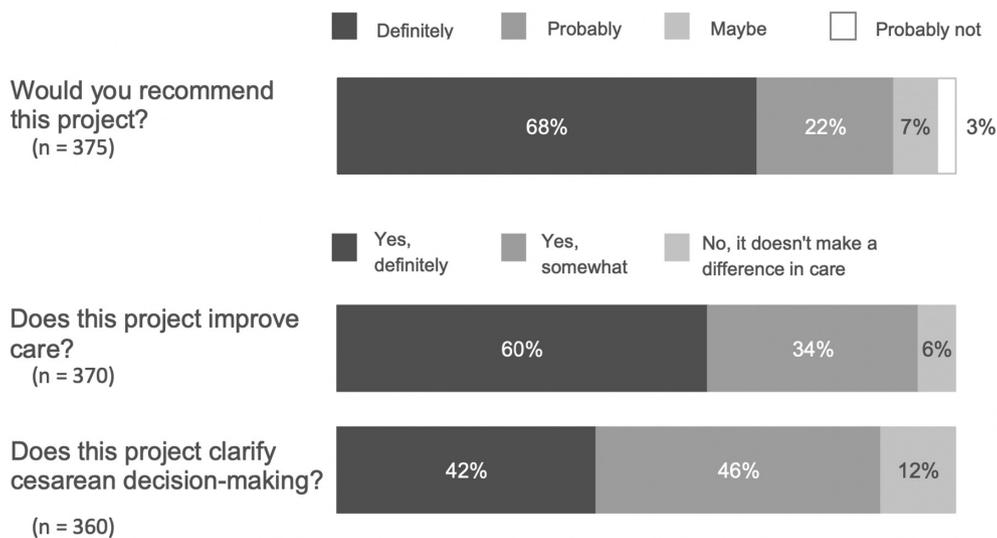


**FIGURE 2** Patient-Reported Acceptability of TeamBirth. Data collected through patient surveys in the postpartum period before hospital discharge. Over eight months of our implementation, 99% of all patients surveyed definitely or somewhat had the role they wanted in making decisions about their labor. Among the subset of patients who wanted information about what was happening in their labor and delivery process and wanted to make collaborative decisions with their clinicians, 99% definitely or somewhat had the role they wanted in making decisions about their labor. Ninety-nine percent reported that their nurse and provider definitely or somewhat talked about their labor in a way they could understand and 96% definitely or probably felt that their preferences made a difference in the care they received

**Did you have the role that you wanted in making decisions about your labor?**

Legend: Yes, definitely | Yes, somewhat | No

Participated in:
- Several huddles (n = 1,894): 91% / 8% / 1%
- One huddle (n = 303): 85% / 14% / 1%
- No huddles (n = 265): 80% / 17% / 3%

**Did the doctor/midwife and nurse talk about your labor in a way that you could understand?**

Participated in:
- Several huddles (n = 1,914): 97% / 0.2% / 3%
- One huddle (n = 305): 93% / 7% / 0.3%
- No huddles (n = 264): 91% / 8% / 2%

**Did you feel like sharing your preferences made a difference in the care you received?**

Participated in:
- Several huddles (n = 1,832): 88% / 9% / 3%
- One huddle (n = 293): 78% / 18% / 4%
- No huddles (n = 243): 70% / 21% / 9%

\* Reported responses exclude "Don't know/No opinion", "Prefer not to answer", and missing

**FIGURE 3** Patient-Reported Acceptability of TeamBirth by Number of Huddles Experienced. Data collected through patient surveys in the postpartum period before hospital discharge. Our study shows a significant relationship between the number of huddles patients reported throughout their labor and patient-reported acceptability, which appears to be suggestive of a potential dose response between huddles and positive experience ($P < 0.001$)

Legend: Definitely | Probably | Maybe | Probably not

**Would you recommend this project?** (n = 375): 68% / 22% / 7% / 3%

Legend: Yes, definitely | Yes, somewhat | No, it doesn't make a difference in care

**Does this project improve care?** (n = 370): 60% / 34% / 6%

**Does this project clarify cesarean decision-making?** (n = 360): 42% / 46% / 12%

\* Reported responses exclude "Don't know/No opinion"

**FIGURE 4** Clinician-Reported Acceptability of TeamBirth. Among clinicians surveyed after eight months of implementation, 90% of nurses, midwives, and obstetricians reported they would definitely (68%) or probably (22%) recommend TeamBirth for use in other labor and delivery units (A). Ninety-four percent reported that the project definitely (60%) or somewhat (34%) improves care for patients, and 88% reported that the project definitely (42%) or somewhat (46%) helps clarify when a cesarean birth should be performed in nonurgent situations (B)

Although this study experienced some of the same challenges demonstrated in other SDM research, the strength of this study includes evidence of both positive clinician and patient experience.

Patient–provider communication failures are a major root cause of obstetrical sentinel events and other adverse outcomes in maternal care, and prior research has shown that investment in teamwork and communication may have the potential to impact all aspects of the quadruple aim.[11,33-36] In 2017, the World Health Organization (WHO) published eight standards for quality of maternal and newborn care, including the commitment to patient-led, SDM during childbirth.[37] Improved communication and SDM may be supported through TeamBirth by creating reliability in communication and teamwork behaviors during intrapartum care, as suggested by the dose response where patients who experienced more huddles were more likely to report understanding conversations with their team and believing their preferences influenced the care they received. Although this study was not designed to measure the effects of TeamBirth on clinical outcomes, the majority of clinicians surveyed reported that they perceived that TeamBirth improved care.[38,39] With a longer implementation timeline in future effectiveness research, it may be possible to observe positive trends in outcomes.

Generalizability of the trial results is limited by our study design. First, we tested TeamBirth in four community hospitals in three different geographies in the United States. These hospitals had limited diversity in the clinician and patient population, and may not represent all care delivery contexts. Compared with the United States in 2019, our study had an older and less diverse birthing population, with the largest proportion being 30- to 34-year-olds and fewer births to non-Hispanic Black and Hispanic patients.[40] Nonetheless, we were able to demonstrate proof of concept in terms of the ability to implement TeamBirth in a range of settings and geographies. Second, we provided sites high-touch implementation support, which may not be feasible for replication at scale. This level of support was necessary for collaborative learning and design throughout the trial but would not be needed for future implementation. Third, there is no gold standard acceptability and feasibility, and we expected both domains would be low because of difficulty in changing behavior and unit culture.[41] Our results indicated this was not the case for TeamBirth, but the survey results may be biased since we have no insight into the experiences of the clinicians or patients who did not complete the surveys, and all sites were motivated to see an improvement in patient experience and reduction in the NTSV cesarean birth rates. Finally, the study duration limited the ability to see

positive trends in clinical outcomes, nor was the study powered to do so. Given the complexity of labor and delivery cultures and variation in outcome measures, it may be necessary to extend the measurement period to see outcome changes that are sustainable. We are also unable to connect clinical outcomes to acceptability and feasibility survey data because of study design limitations. Future work should explore the acceptability and feasibility of TeamBirth in additional contexts including less engaged hospitals and with lighter-touch implement support, and study the effectiveness of TeamBirth in improving clinical and experiential outcomes in labor and delivery.

## CONFLICTS OF INTEREST
The authors have no conflicts of interest to report.

## ETHICAL APPROVAL
The Harvard Human Resource Protection Program's institutional review board approved the study protocol and consent processes, and participating hospitals approved the study protocol and consent processes with their internal institutional review boards or ceded review to the Harvard institutional review board.

## DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available because of privacy or ethical restrictions.

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