




The design of “TeamBirth”: A care process to improve communication and teamwork during labor

Reena Aggarwal MRCOG, MBBChir, MSc, BPharm^{1,2}  | Avery Plough MPH²  |
 Natalie Henrich PhD, MPH² | Grace Galvin MPH² | Amber Rucker BA² | Chris Barnes BA³ |
 William Berry MD, MPA, MPH² | Toni Golen MD^{4,5} | Neel T. Shah MD, MPP^{1,4,5} 

¹Guy's and St Thomas' NHS Foundation Trust, London, UK

²Ariadne Labs, Boston, MA, USA

³Emphatic Communications, Olympia, WA, USA

⁴Beth Israel Deaconess Medical Center, Boston, MA, USA

⁵Harvard Medical School, Boston, MA, USA

Correspondence

Neel T. Shah, MD, MPP, 401 Park Drive, Landmark Center, Floor 3 East, Boston, MA 02215, USA.

Email: neel@post.harvard.edu

Funding information

The study was funded by the Peterson Center on Healthcare. The Peterson Center on Healthcare was not involved in the study design, the collection, analysis and interpretation of data, the writing of the report, or the decision to submit the article for publication.

Abstract

Background: Despite evidence that communication and teamwork are critical to patient safety, few care processes have been intentionally designed for this purpose in labor and delivery. The purpose of this project was to design an intrapartum care process that aims to improve communication and teamwork between clinicians and patients.

Methods: We followed the “Double-Diamond” design method with four sequential steps: Discover, Define, Develop, and Deliver. In Discover, we searched professional guidelines and peer-reviewed literature to delineate the challenges to quality of intrapartum care and to uncover options for solutions. In Define, we convened an interdisciplinary group of experts to focus the problem scope and prioritize solution features. In Develop, we created initial prototype solutions. In Deliver, we engaged clinicians and patients in rapid cycle testing to iteratively produce a care process called “TeamBirth” that aims to improve team communication.

Results: We designed TeamBirth, an intrapartum care process composed of brief team meetings (“huddles”) between clinicians and patients. Huddles are navigated by a shared planning board placed in the labor and delivery room in view of the patient and their care team. The board promotes transparent and reliable communication and contains four areas to be acknowledged or discussed: (a) the names of the team members, starting with the patient; (b) the patient's preferences; (c) the care plan for the patient, baby, and labor progress; and (d) when the next team huddle is anticipated.

Discussion: We identified an opportunity to improve the safety and dignity of child-birth care through an intrapartum care process that promotes reliable and structured communication and teamwork. Future work should evaluate the acceptability and feasibility of implementation and potential impact on safety and experience of care.

KEY WORDS

communication, huddle, intrapartum, teamwork

The study was conducted by the Ariadne Labs at Brigham and Women's Hospital and the Harvard TH Chan School of Public Health, Boston, Massachusetts.

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1 | INTRODUCTION

Almost all sentinel events in health care can be attributed to the ways individuals and teams interact with systems (“human factors”) rather than medical inevitability.^{1,2} These challenges are particularly apparent in obstetrics where resource needs can be highly dynamic and clinicians may struggle to effectively coordinate their efforts and make decisions collaboratively with patients.³⁻⁵ Although sentinel events in health care are usually classified by clinical diagnosis, many causes of preventable harm appear to be rooted in failures of communication and teamwork.⁶ These failures may be because of, in part, clinical environments and care processes that are not well designed to support team-based work.⁷⁻⁹ Nonetheless, the science of designing, testing, and implementing care models that promote communication and teamwork remains nascent.

Traditional improvement efforts in clinical settings focus on alternate approaches: making evidence-based information more readily available by means of guidelines or direct decision-support, auditing clinician performance, or adjusting incentives by means of payment or malpractice reform.¹⁰⁻¹³ These efforts represent important steps to improve outcomes, but initiatives focusing on these strategies alone have not been successful in creating large-scale and sustained improvements.^{14,15} Knowledge and motivation may be insufficient to change the status quo without redesigning and structuring care processes. Notably, improvement efforts that include innovations that simplify care processes and promote teamwork have had significant impact on patient safety at scale.^{16,17}

The rate of first-time cesarean births—a potential marker for quality of care—is known to vary tremendously between hospital in the United States and often independently from patient needs or preferences.¹⁸ We describe our use of design thinking methodology to produce a scalable, intrapartum care

process that aims to improve communication and teamwork between clinicians and patients to address harmful variation in the quality of childbirth care in the United States and potentially beyond.

2 | MATERIALS AND METHOD

Between January and December 2017, we employed the “Double-Diamond” design thinking process (Figure 1).¹⁹ This model provides a process for exploring and testing ideas through sequential phases of divergent thinking where potential solutions and options are creatively generated (Discover and Develop phases), and convergent thinking, where ideas are pared down and refined (Define and Deliver phases). In our application of this process, the transition from divergent to convergent thinking was based on reaching saturation of distinct options, and the transition from convergent to divergent thinking was guided by a prespecified logic and/or direct data and feedback from end users or expert consultants. The process was led by the multidisciplinary author team, which includes practicing obstetricians, health system researchers, designers, and implementation scientists, based within an innovation center at the Harvard TH Chan School of Public Health and Brigham and Women's Hospital.

2.1 | Discover phase

The Discover phase is the first divergent phase of the Double-Diamond process where the design team explores the problem they want to solve and deepens their understanding of the issue and all the potential solution options. During this phase, we conducted an extensive exploratory review of professional guidance, peer-reviewed literature, and public quality improvement toolkits to understand the

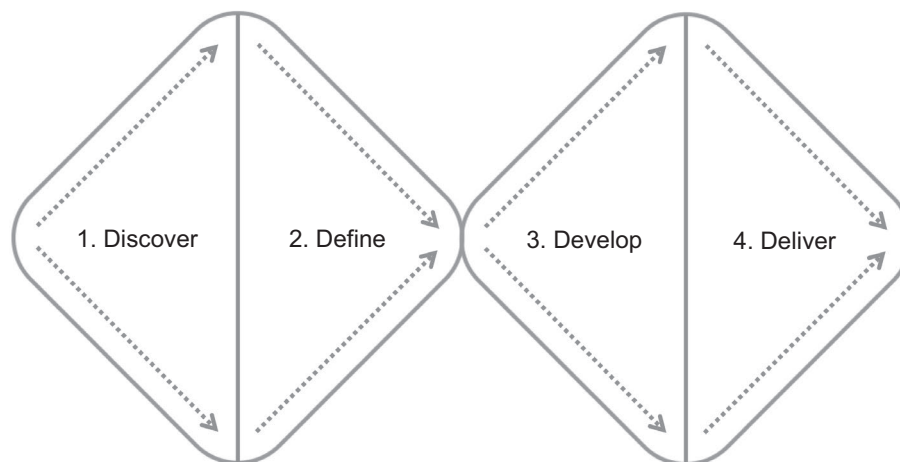


FIGURE 1 The Double-Diamond Design Model. The Double-Diamond design was popularized by the British Design Council and includes four divergent and convergent phases: Discover, Define, Develop, and Deliver

context of variation in obstetric outcomes in the United States.^{3,4,7-14} We put particular emphasis on variation in hospital-level cesarean birth rates based on broad stakeholder interest in the relationship between cesarean birth and value-based care and precedent for cesarean as a proxy for quality of labor management.^{20,21} We synthesized the broad range of strategies identified into higher-level categories to consider targeting with our solution (eg, limiting cesareans for lack of progress in the latent phase, requiring a second opinion for intrapartum cesareans) and then developed a causation map of all potential strategies and the mechanisms through which they could affect cesarean birth rates.

2.2 | Define phase

The Define phase is the first convergent phase of the Double-Diamond process where the background from the Discover phase is synthesized into a refined problem and solution scope. We conducted this scoping process by defining the key constraints within which our solution needed to fit. Based on our organizational mission to improve the delivery of health care services, we focused our problem statement on facility-level improvement, rather than health policy reform, professional education, or other strategies. We bounded our ideation to the clinical episode between admission to the birth facility and birth of the baby based on identifying this as a high leverage moment to impact care. Based on methods previously used to develop other simple communication tools, including the WHO Safe Surgical Checklist and the WHO Safe Childbirth Checklist, our interdisciplinary team, including obstetric clinicians, researchers, and designers, developed a set of hierarchical criteria for evaluating the merits of each strategy to further narrow the focus of our design work:

1. **Evidence:** We reviewed the level of evidence for each publication and included all high-quality publications (level IA-IC); we also included other unpublished studies, reports, and guidelines, which may have had lower levels of evidence, but were directionally consistent with high-level evidence.
2. **Impact:** We prioritized strategies that would capture and affect the greatest number of laboring patients based on the magnitude of their impact in prior studies and the portion of cesarean births they would address based on current population-level data (eg, the prevalence of the type of cesarean birth they addressed such as repeat vs. primary cesareans, and the prevalence of the indication(s) they addressed).
3. **Simplicity:** We prioritized strategies that would integrate within existing workflows and optimize processes for clinicians.

4. **Scalability:** We prioritized strategies that could be used across a wide range of facility types and care delivery contexts.

These criteria first prioritize the design team's level of confidence in the potential effectiveness of each strategy in preventing unnecessary cesarean births (evidence and impact), followed by those that the team felt had highest potential to be addressed through simple and scalable solutions (Appendix S1).

We then convened an expert consultant group of over 50 stakeholders within childbirth disciplines to critically review the problem scope, potential solution strategies, and the ranking of these strategies. We chose these stakeholders to ensure we had viewpoints from differing perspectives and widespread contexts, including practicing clinicians, professional organizational leadership (American College of Obstetricians and Gynecologists, Association of Women's Health, Obstetrics and Neonatal Nurses, and American College of Nurse-Midwives), implementers of established childbirth quality improvement bundles (Institute for Healthcare Improvement and California Maternity Quality Care Collaborative), patient advocates and doulas, and researchers with expertise in obstetric quality improvement, and/or design and engineering methods. Given our aim to design a solution that could be scalable across contexts, we also prioritized including perspectives from a broad range of geographies across the United States, hospital types, and practice models.

The expert consultant group participated in a two-day, in-person meeting where we conducted multidisciplinary small and large group sessions that surfaced as many considerations as possible about the proposed rankings (not necessarily reach consensus), and concerns and weaknesses for each strategy. All design meetings were held under "Chatham House Rule," to reduce the risk of groupthink and avoid exclusion of unpopular views—participants were encouraged to speak as individuals and contest opinions of other participants. We avoided attribution to individuals to minimize concern for personal reputation or official duties and affiliations. In this manner, the group identified facilitators and barriers that may affect the design and implementation of a solution for each strategy. After completion of the solution design, participants opted in to being identified as meeting participants to registered viewers of our freely available website (www.ariadnelabs.org/aria).

We reevaluated the rankings and prioritization after the meeting and identified intrapartum decision-making as a focal point. The experts highlighted timing as a key challenge for intrapartum management, particularly with regard to determining when to admit, when labor is not progressing adequately, and when to perform an operative delivery. Existing guidelines lack specificity with regard to the timing of decisions, which in cases of error appeared to either occur

too soon or too late. In the absence of specificity, the expert consultants shared the view that decision-making is often tacit and one-sided rather than collaborative. We also recognized that this lack of collaboration, particularly with regard to keeping the patient informed and engaged in decision-making, may have an impact on cesarean rates, and on quality of care. The discussion also raised the issue that tools that only operate at the moment of decision to deliver are often too late to influence the outcome.

2.3 | Develop phase

The Develop phase is the second divergent phase in the Double-Diamond process where the design team explores potential design options within the scope established in the Define phase. We started our solution development process by mapping the key actions and interactions for each member of the clinical care team from triage through delivery to understand existing workflows around teamwork, communication, and decision-making in intrapartum care and to identify opportunities for improvements.²² We also conducted 23 semi-structured “rapid cycle feedback” interviews with frontline nurses, midwives, and obstetricians in the United States to understand their decision-making processes and to identify the minimum set of information that each team member needed to provide effective, safe, and dignified care. The clinicians interviewed came from a diverse set of facilities with delivery volumes ranging from 50 to over 5000 births annually and different practice models, including midwifery care, hospitalist care, and private practice, to allow us to design for scalability early in the development of our solution.

Based on the opportunities for improvement identified through the mapping and interviews, we developed “prototypes” (rough models or samples of possible product designs) for potential solutions. The prototypes represented the “minimum viable product” (MVP): a low-time, low-cost prototype that contains just enough content and structure to enable effective feedback on features that would be usable. The low investment nature of an MVP allows product developers to make rapid and substantial changes to refine the tools based on testing and feedback.²³ The prototypes focused on structuring the minimum content that should be communicated for every patient, during every labor assessment, across all, or almost all, contexts.

We developed a logic model as a visual way to describe the relationship between resources, activities, and outcomes for our intrapartum decision-making strategies and prototypes.²⁴ The logic model aimed to ensure that the tools and activities we developed were clearly on a pathway toward our targeted outcomes. We iteratively revisited the logic model throughout the Develop and Deliver phases based on our

refined designs to ensure that no extraneous features were added into designs that did not directly lead teams toward our intended outcomes.

2.4 | Deliver phase

The Deliver phase is the final convergent phase of the Double-Diamond process where the design team refines the prototype options to develop and test a final version of the solution. To guide our refinement process, we used two key principles that our solution needed to be optimized for:

1. **Simplicity:** Designs should provide the minimum necessary structure to make it easier for teams to do the “right” thing.
2. **Team communication:** Designs should promote teamwork, including “psychological safety” and structured communication opportunities within the care team, including the patient, the nurse, delivering practitioner (obstetrician or midwife), and others who may be present to provide clinical care or offer labor support.²⁵

We reconvened our interdisciplinary expert group to share our MVPs of a structured labor assessment conversation and to solicit critiques on the content, resource, and workflow considerations that would affect them. The group explored how the MVPs would affect each team member individually and interpersonally in the labor and delivery process. This discussion highlighted an opportunity to be more intentional about integrating the voice of the patient and their perspectives on assessments and plans during intrapartum care.

After this second convening, we revised the prototypes and reformulated the structured labor assessment as a process of brief team meetings throughout labor (“huddles”) centered on a shared planning board in the labor and delivery room, which provides a simple reference for the minimum essential content the team should discuss. We then solicited further feedback using interviews with frontline clinicians, unit managers, and patient advocates, and interdisciplinary simulations with clinical teams at three local labor and delivery units. We used this feedback to refine the prototypes and increase the likelihood that the huddle process and shared planning board could work across multiple contexts and clinical care environments. The interdisciplinary simulations in particular aimed to capture the way the teams would interact with each other and the shared planning board to ensure we were designing for our goal of promoting more effective team communication throughout labor. The final versions were generated by an expert in human-centered design after industry best practices (unambiguous language, efficient layout, and font and object sizing).

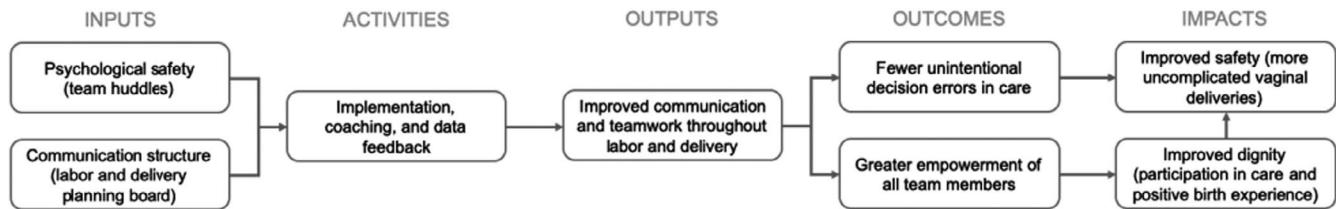


FIGURE 3 Logic Model for TeamBirth. The ultimate logic model for TeamBirth theorizes that the psychological safety fostered by the team huddles and structured communication prompted by the shared labor and delivery planning board will lead to improved safety and dignity by improving communication and teamwork throughout labor and delivery

4 | DISCUSSION

We identified an opportunity to improve the safety and dignity of childbirth care through an intrapartum care process that promotes reliable and structured communication and teamwork. In creating TeamBirth, we aimed to address pain points and motivations of the patient and the practitioner team. The huddle process and collaborative planning board creates a shared mental model for all team members upstream of critical decision points. The huddle brings the key team members (patient, nurse, and practitioner) together at important moments and provides a structure for shared decision-making. This process fosters communication as a collaborative process among all team members, which not only brings accountability, but also brings transparency and psychological safety. By enabling more reliable communication, we hypothesize that decision-making will be more consistent and precise, and therefore lead to more inclusive, safer, and patient-centered decisions, including those about the timing of admission and delivery.

The huddles and shared planning board align with recent World Health Organization guidelines, which advocate moving from rigid adherence to labor progress protocols and toward an enhanced model of team communication and feedback²⁶; recent evidence has also shown that huddles enable transparency and allow key team members to align on care plans.²⁷⁻³⁰ Although TeamBirth aims to address these challenges, successful implementation will require changes in institutional and occupational cultures and perhaps enhancements in communication skills. These changes may be facilitated by intentionally designed approaches that provide structure and promote accountability without burdening clinical teams.

Design methods are rarely described in obstetric literature; they may, however, provide important insights and opportunities for critical inquiry into how care is provided. The merit of the TeamBirth design must ultimately be determined by its efficacy across a broad range of practice contexts. Our intention is to present the initial output of what we hope will be an incremental effort to design, test, and scale improvements in intrapartum care. The strengths of our approach include rigorous human-centered design methodology and use of evidence-based features. We coproduced the ultimate

solution with expert stakeholders and end users to ensure face and construct validity. By integrating simplified and structured communication and shared decision-making processes directly into existing clinical workflows, our solution has higher potential to be acceptable to clinicians, desirable to patients, and feasible to implement.

Our design has several limitations. The care process is scoped to address intrapartum decision-making during the delivery hospitalization period. Therefore, this design will not address all of the systemic factors that may be affecting safety and dignity of childbirth care across the United States, such as limited prenatal education or implicit or explicit bias. Within the scope of our initial design process, we were also limited in our ability to test our design with laboring patients in real clinical scenarios. The simulations with clinical teams highlighted many key practical considerations, but there will be further adaptations needed based on implementing TeamBirth in various care contexts. Future work is needed to test these tools in practice and to evaluate their acceptability to clinicians and patients, their ease of use, their feasibility of implementation, and their impact on maternal and neonatal outcomes.

ACKNOWLEDGMENTS

The authors would like to thank the Peterson Center on Healthcare for funding this design process, and our expert collaborators who participated in consultation meetings to advise on the design and testing of TeamBirth.

CONFLICT OF INTEREST

The authors report no conflict of interest.

ORCID

Reena Aggarwal  <https://orcid.org/0000-0003-4818-1907>
 Avery Plough  <https://orcid.org/0000-0002-0049-8190>
 Neel T. Shah  <https://orcid.org/0000-0002-8971-7627>

REFERENCES

1. Institute of Medicine (US) Committee on Quality of Health Care in America. Chapter 3: Why Do Errors Happen? In: Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err is Human: Building a Safer Health System*. Washington, DC: National Academies Press (US); 2000:49–68. <https://doi.org/10.17226/9728>

2. The Joint Commission. Human Factors Analysis in Patient Safety Systems. *The Source* 2015;13(4). <https://www.jcrinc.com/human-factors-analysis-in-patient-safety-systems/>. Accessed December 10, 2019
3. Snowden JM, Darney BG, Cheng YW, McConnell KJ, Caughey AB. Systems factors in obstetric care: the role of daily obstetric volume. *Obstet Gynecol.* 2013;122(4):851-857. <https://doi.org/10.1097/AOG.0b013e3182a2dd93>
4. Declercq ER, Sakala C, Corry MP, Applebaum S, Herrlich A. Major survey findings of listening to mothers(sm) III: pregnancy and birth: report of the third national U.S. survey of women's child-bearing experiences. *J Perinat Educ.* 2014;23(1):9-16.
5. House S, Havens D. Nurses' and Physicians' perceptions of nurse-physician collaboration: a systematic review. *J Nurs Adm.* 2017;47(3):165-171.
6. Rosenbaum L. Divided we fall. *N Engl J Med.* 2019;380(7):684-688
7. Plough A, Polzin-Rosenberg D, Galvin G, et al. An exploratory study of the relationship between facility design and the provision of childbirth care. *J Midwifery Womens Health.* 2019;64(1):12-17.
8. Plough A, Henrich N, Galvin G, Shah NT. Common challenges managing bed and staff availability on labor and delivery units in the United States: A qualitative analysis. *Birth.* 2018;45(3):303-310.
9. Plough AC, Galvin G, Li Z, et al. Relationship between labor and delivery unit management practices and maternal outcomes. *Obstet Gynecol.* 2017;130(2):358-365.
10. Mahoney J. The alliance for innovation in maternal health care: a way forward. *Clin Obstet Gynecol.* 2018;61(2):400-410.
11. Prgomet M, Li L, Niazkhani Z, Georgiou A, Westbrook JI. Impact of commercial computerized provider order entry (CPOE) and clinical decision support systems (CDSSs) on medication errors, length of stay, and mortality in intensive care units: a systematic review and meta-analysis. *J Am Med Inform Assoc.* 2017;24(2):413-422.
12. Chaillet N, Dumont A, Abrahamowicz M, et al. A cluster-randomized trial to reduce cesarean delivery rates in Quebec. *N Engl J Med.* 2015;372(18):1710-1721.
13. Sudhof L, Shah NT. In pursuit of value-based maternity care. *Obstet Gynecol.* 2019;133(3):541-551.
14. Teleki S. Birthing A Movement To Reduce Unnecessary C-Sections: An Update From California. Health Affairs Blog. <https://www.healthaffairs-org.ezp-prod1.hul.harvard.edu/do/10.1377/hblog20171031.709216/full/>. Published 2017. Accessed February 3, 2020
15. Dixon-Woods M, McNicol S, Martin G. Ten challenges in improving quality in healthcare: lessons from the Health Foundation's programme evaluations and relevant literature. *BMJ Qual Saf.* 2012;21(10):876-884.
16. Sacks GD, Shannon EM, Dawes AJ, et al. Teamwork, communication and safety climate: a systematic review of interventions to improve surgical culture. *BMJ Qual Saf.* 2015;24(7):458-467.
17. Molina G, Jiang W, Edmondson L, et al. Implementation of the surgical safety checklist in south Carolina hospitals is associated with improvement in perceived perioperative safety. *J Am Coll Surg.* 2016;222(5):725-736.
18. Kozhimannil KB, Law MR, Virnig BA. Cesarean delivery rates vary tenfold among US hospitals; reducing variation may address quality and cost issues. *Health Aff (Millwood).* 2013;32(3):527-535.
19. Double Diamond – Innovation and entrepreneurship in education. <https://innovationenglish.sites.ku.dk/model/double-diamond-2/>. Accessed January 24, 2020
20. Rhea D. Bringing Clarity to the Fuzzy Front End. In: Laurel B, ed. *Design Research: Methods and Perspectives*. Boston: MIT Press; 2003:148-150.
21. The Joint Commission. Perinatal Care Measure PC-02—Cesarean Section. Specifications Manual for Joint Commission National Quality Measures (v2020A2). <https://manual.jointcommission.org/releases/TJC2020A2/MIF0167.html>. Published 2019. Accessed January 11, 2020
22. Journey mapping powers better design thinking. <https://www.invisionapp.com/inside-design/journey-mapping-design-thinking/>. Accessed January 25, 2020
23. Lenarduzzi V, Taibi D. MVP explained: A systematic mapping study on the definitions of minimal viable product. In: *2016 42th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)*. IEEE; 2016:112-119. <https://doi.org/10.1109/SEAA.2016.56>
24. W.K. Kellogg Foundation. Using Logic Models to Bring Together Planning, Evaluation, and Action: Logic Model Development Guide. In: *Using Logic Models to Bring Together Planning, Evaluation, and Action: Logic Model Development Guide*. Battle Creek, Michigan; 2004:1-25. https://doi.org/10.1007/SpringerReference_75910
25. Edmondson AC. Psychological safety and learning behavior in work teams. *Adm Sci Q.* 1999;44(2):350-383.
26. WHO. *WHO Recommendations: Intrapartum Care for a Positive Childbirth Experience*. Geneva: WHO; 2018:19-120.
27. Provost SM, Lanham HJ, Leykum LK, McDaniel RR, Pugh J. Health care huddles: managing complexity to achieve high reliability. *Health Care Manage Rev.* 2015;40(1):2-12.
28. Martin HA, Ciurzynski SM. Situation, background, assessment, and recommendation-guided huddles improve communication and teamwork in the emergency department. *J Emerg Nurs.* 2015;41(6):484-488.
29. McQuaid-Hanson E, Pian-Smith MCM. Huddles and debriefings: improving communication on labor and delivery. *Anesthesiol Clin.* 2017;35(1):59-67. <https://doi.org/10.1016/j.anclin.2016.09.006>
30. NHS. *Implementing Handovers and Huddles: A Framework for Practice in Maternity Units*. London, UK: NHS Improvement; 2019.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Aggarwal R, Plough A, Henrich N, et al. The design of “TeamBirth”: A care process to improve communication and teamwork during labor. *Birth.* 2021;48:534-540. <https://doi.org/10.1111/birt.12566>