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Lessons learned from the perinatal audit of uterine rupture in the Netherlands: A mixed-method study

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Abstract

Background and Aims: To analyze outcomes of nationwide local audits of uterine rupture to draw lessons for clinical care.

Methods: Descriptive cohort study. Critical incident audit sessions within all local perinatal cooperation groups in the Netherlands. Women who sustained uterine rupture between January 1st, 2017 and December 31st, 2019.

Main Outcome Measures: Improvable factors, recommendations, and lessons learned for clinical care. Women's case histories were discussed in multidisciplinary perinatal audit sessions. Participants evaluated care against national and local clinical guidelines and common professional standards to identify improvable factors. Cases and outcomes were registered in a nationwide database.

Results: One hundred and fourteen women who sustained uterine rupture were discussed in local perinatal audit sessions by 40–60 participants on average: A total of 111 (97%) were multiparous of whom 107 (94%) had given birth by cesarean section in a previous pregnancy. The audit revealed 178 improvable factors and 200 recommendations. Six percent ($N = 11$) of the improvable factors were identified as very likely and 18% ($N = 32$) as likely to have a relationship with the outcome or occurrence of uterine rupture. Improvable factors were related to inadequate communication, absent, or unclear documentation, delay in diagnosing the rupture, and suboptimal management of labor. Speak up in case a suspicion arises, escalating care by involving specialist obstetricians, addressing the importance of accurate documentation, and improving training related to fetal monitoring were the most frequent recommendations and should be topics for team (skills and drills) training. **Conclusions:** Through a nationwide incident audit of uterine rupture, we identified improvable factors related to communication, documentation, and organization of care. Lessons learned include “speaking up,” improving the transfer of information and team training are crucial to reduce the incidence of uterine rupture.

Abbreviations: PCG, perinatal cooperation group; TOL, trial of labor.

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KEYWORDS

audit, maternal near miss, perinatal mortality, severe maternal morbidity, trial of labor after cesarean section, uterine rupture

1 | INTRODUCTION

Uterine rupture is a rare complication during labor, which—in high-income countries—mainly occurs in women with a scarred uterus. In addition to previous cesarean section (CS), other factors associated with the occurrence of uterine rupture are labor induction and augmentation in presence of a uterine scar, epidural analgesia, advanced maternal age, being overweight, having a non-Western ethnic background and pre- or postterm birth.^{1,2} Uterine rupture is associated with potentially life-threatening conditions for the woman, such as major obstetric hemorrhage, peripartum hysterectomy, and placenta accreta spectrum in subsequent pregnancies, as well as perinatal mortality and morbidity.^{2–8} Uterine ruptures have great impact on women, partners, and health professionals.

The diagnosis of uterine rupture is not always straightforward: signs during labor (e.g., pain, fetal distress, and prolonged labor by weak uterine contractions) are common and easily misinterpreted. These may be masked by pain relief or attributed to alternative diagnoses underlying fetal distress.⁹ It is of utmost importance that maternity caregivers are alert to signs of uterine rupture and give timely consideration to this diagnosis.

Following rising concerns about the increasing proportion of births by CS in the Netherlands (from 10.8% in 1999 to 15.7% in 2019), and the perceived impact of this increase on severe maternal and neonatal morbidity and mortality, the uterine rupture was introduced as a theme for nationwide discussions in perinatal audit sessions.^{10,11} Within this national system of local perinatal audit sessions, maternity care is systematically discussed and quality of care analyzed in multidisciplinary teams to identify relevant lessons learned. Audit sessions are expected to strengthen inter- and transdisciplinary cooperation by jointly looking into a specific case history and learn from it to optimize care.^{12,13}

The aim of this specific study is to describe qualitative and quantitative outcomes of the nationwide perinatal audit of uterine rupture in the Netherlands.

2 | MATERIALS AND METHODS

2.1 | Design

For the purpose of this study, a mixed-method descriptive, cohort design was employed for women who sustained uterine rupture whose cases were discussed in perinatal audit sessions.

2.2 | Setting perinatal audits

In the Netherlands, maternity care is provided by community midwives, hospital midwives, and obstetricians. Community midwives focus on low-risk women and facilitate home births, births in primary care birth clinics, or low-risk birth units within hospitals, according to the choice of the pregnant woman. Hospital midwives provide care during medical births and function with a great deal of professional independence but under the final responsibility of an obstetrician in secondary or tertiary care. Around 27% of all pregnant women in the Netherlands give birth in primary care.¹⁴ Together, community and hospital midwives, and obstetricians collaborate in local perinatal cooperation groups (PCG).

A nationwide system of structured local perinatal audit sessions within such PCGs was introduced in 2010 and earlier described by Eskes et al.¹² and Kortekaas et al.¹³ Audit in the Netherlands is theme-based. To enable perinatal audits, chronological reports of the cases discussed are made and anonymized in advance of a perinatal audit by members of local audit teams. These reports contain information about the course of the pregnancy and delivery, obstetric history, general history, and theme-specific information. Over the period 2017–2019, the uterine rupture was chosen as a theme for an audit because of its impact on women, families, and healthcare professionals as well as the resulting severe maternal and neonatal complications.

During a perinatal audit, all participants (obstetricians, community and hospital-based midwives, pediatricians, obstetric nurses, ambulance staff, pathologists, anesthesiologists, and maternity care assistants) discuss and formulate improvable points in delivered care. Participants substantiate the care provided to standard care and/or guidelines during the audit so the improvable points are opinions of the auditors but objectified by standards and guidelines.

2.3 | Inclusions

Women were eligible for this thematic perinatal audit when there was a complete or incomplete uterine rupture together with severe maternal morbidity or maternal mortality or severe neonatal morbidity (see definitions in Textbox 1) or at the request of the healthcare provider.

2.4 | Data collection

From January 1st, 2017, up to and including December 31st, 2019, women with uterine rupture, and associated medical data and outcomes

TEXTBOX 1. Definition of uterine rupture as used in nationwide perinatal audit in the Netherlands 2017–2019

Uterine rupture was defined as complete (myometrium and peritoneum ruptured) or incomplete rupture (ruptured myometrium but intact peritoneum).

Maternal morbidity was defined as postpartum hemorrhage of >1000 ml or undergoing embolization or hysterectomy. Perinatal asphyxia was defined as the need for neonatal intensive care unit (NICU) admission for at least 24 hours of term-born children with asphyxia (documented in the discharge letter to the general practitioner or midwife).

of perinatal audit sessions were registered into a national database at Perined. Perined is the national birth registry comprised of a linked database of the medical registries of the three main professional organizations involved (midwives, obstetricians, and pediatricians) containing 96% of all pregnancies and birth outcomes in the country.¹⁵ The database includes mandatory items such as general characteristics, obstetric history, general and family history, perinatal outcomes, such as mode of birth, pain relief, augmentation during labor, trial of labor (TOL), Apgar scores, and admission into a NICU. Uterine rupture is included in the registry but notoriously underreported, probably because it is not a mandatory item, but requires selecting the option from a dropdown list of maternal complications.

After each local audit session, identified improvable factors and recommendations were entered into the Perined database by participants of the perinatal audit session. The participants also indicated for every factor the relationship (very likely; likely; not or unlikely; and not clear or no consensus) with the outcome of uterine rupture. Concerning the assignment of improvable factors to the categories, summarized in Table 2, employees of Perined discussed the assigned labels in the agreement. In case of no agreement or no consensus, the local PCG was contacted for clarification of the assigned label. Recommendations were classified by audit participants themselves over the main themes and subthemes as presented in Textbox 2. This classification system was developed by van Diem et al.¹⁶

2.5 | Data analysis

To enable analyzing the data, we performed data extractions of two data files containing information contained in the perinatal audit database on the theme of uterine rupture. The first file contained all chronological reports on uterine ruptures and a summarized overview of the cases. The summarized overview contained baseline characteristics of woman and child but also perinatal outcomes such as perinatal mortality, NICU admission, and information about the main reason for the outcome as agreed during the local perinatal audit

TEXTBOX 2. Classifications of recommendations

Within perinatal audit recommendations are classified into the following categories:

- A. *Organization of care*—strictly focus on how care is organized; recommendation focused on
 - a. nationwide agreements;
 - b. regional agreements;
 - c. agreements with local perinatal cooperation group;
 - d. agreements among professionals, for example, midwives, general practitioners; and
 - e. own practice or that of a hospital department.
- B. *Education*—improvement action focus on continuous training of
 - a. knowledge;
 - b. skills; and
 - c. cooperation, team training.
- C. *Guidelines, standards, and usual care*—professional improvement actions
 - a. proposal for national guidelines;
 - b. proposal for local protocol or adaptation of local protocol; and
 - c. proposal for change of usual care.
- D. *Documentation*—prevention of documentation errors or incompleteness of
 - a. baseline information including counseling, instructions, contact, appointments; improvement of information and communication technology facilities;
 - b. diagnostic processes including tests;
 - c. policies and considerations; and
 - d. handover of care
- E. *Communication*—measures to structure transfer or consultation and improve communication to and from patients:
 - a. handover of care/consultation between echelons;
 - b. handover of care within echelons for example consultation within one echelon but different professionals (midwife–general practitioner; obstetrician–internist);
 - c. internal handover of care, consultation within the same profession; and
 - d. handover of information to the patient/communication with the patient.
- F. *Diagnostics*
 - a. applying the correct test and
 - b. applying the test at the right moment.

session and follow-up information up to and including 28 days postpartum. The second file contained all improvable factors, the relationship of the improvable factor with the uterine rupture, and recommendations as described by the audit teams. Both files were linked using linking variables (ID local PCG, ID perinatal audit session,

date of birth of the woman, date of birth of the child) to link improvable factors to chronological reports and provide insight into the context of the improvable factor.

One researcher (Ageeth N. Rosman) checked the data extractions for missing data and checked whether they could still be extracted from the chronological reports. If so, data were added to the summarized overview.

Frequency tables were made of standard baseline characteristics for both women and children as well as perinatal outcomes. In the baseline table, we also include obstetric history (CS in history), the onset of labor, augmentation of labor, pain relief, perinatal asphyxia, and perinatal mortality. Obstetric history was only available for the perinatal audit case histories. Nonetheless, we included this in the baseline table as being an important risk factor for uterine ruptures. We compared baseline characteristics of the discussed women with all women in the nationwide registry over the years 2017–2019 without uterine rupture as a reference group. To create an overview of the recommendations, the previously described framework of van Diem et al was used (see Figure 1).¹⁶ This framework, combined with an inductive approach, was used to determine recommendations. Due to the descriptive nature of this study, we opted not to apply statistical testing.

2.6 | Ethical approval

In the Netherlands, all pregnant women are asked permission for anonymous use of their pregnancy data for the purpose of perinatal audit at booking. Formal ethical approval is not required for this type of study in the Netherlands, although the Steering Committee of the Netherlands Perinatal Registry approved it. However, most women whose case histories are discussed in a perinatal audit session are informed by the responsible health care professional (midwife or obstetrician). The woman concerned has the right at all times not to consent to being discussed in a perinatal audit session.

3 | RESULTS

From January 1st, 2017 to December 31st, 2019, 114 women with uterine rupture were discussed in local perinatal audit sessions throughout the Netherlands by on average 40–60 participants per session. Table 1 shows baseline characteristics of women who sustained uterine rupture versus all women in the perinatal registry who did not sustain uterine rupture over the years 2017–2019.

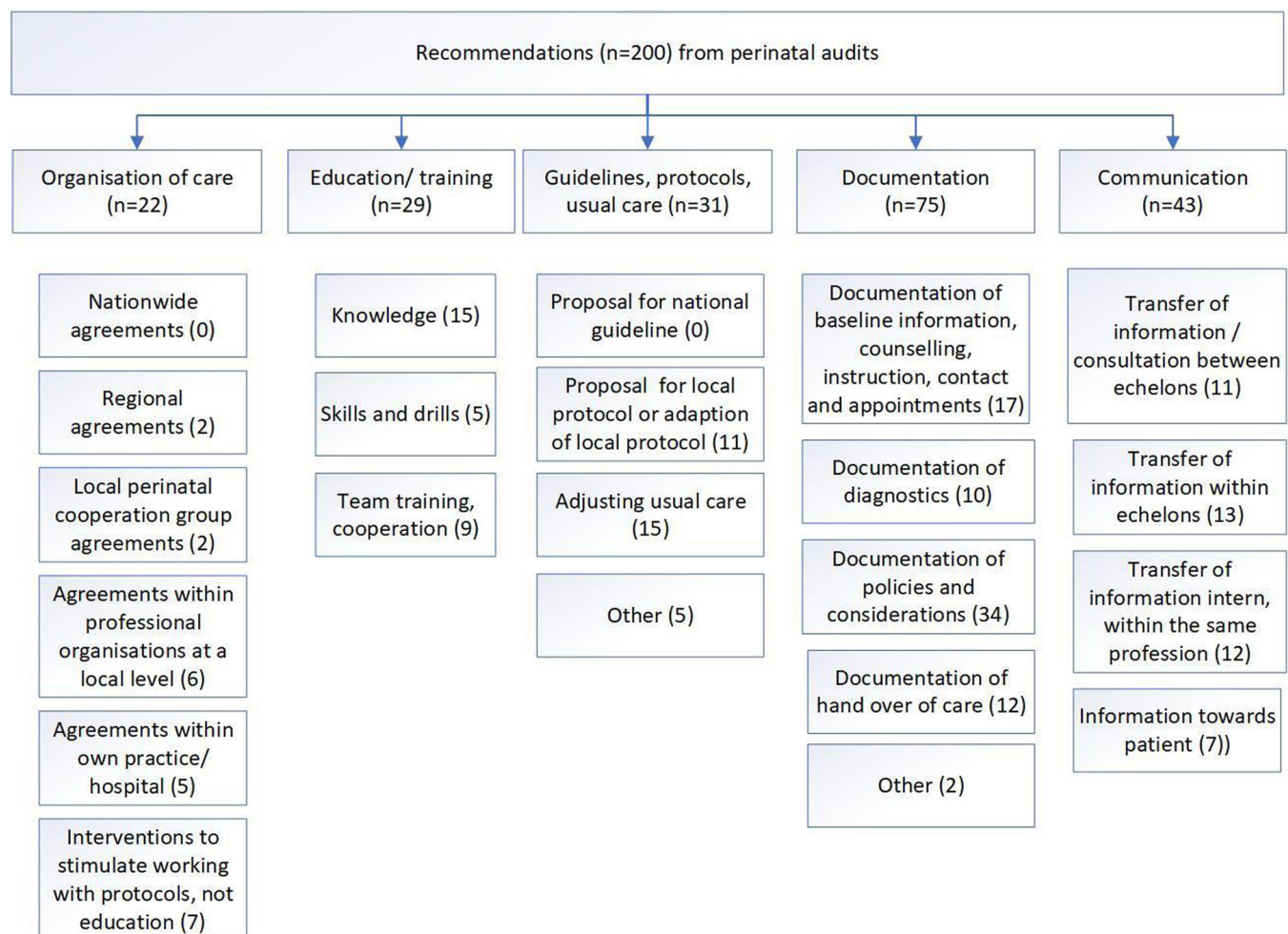


FIGURE 1 Framework of van Diem et al.¹⁶ to classify recommendations from perinatal audits.

TABLE 1 Baseline characteristics and perinatal outcomes of women with uterine rupture discussed in perinatal audit sessions versus the nationwide registry as references

Variable	Outcome ^a (year 2017–2019), N = 114	Nationwide registry ^a (year 2017–2019), N = 757,018
Age (years, median, IQR)	32 (30–36)	31 (28–34)
Ethnicity		
Western	79 (69.3)	463,406 (61.2)
Unknown	5 (4.4)	126,355 (16.7)
Language barrier (present)	21 (18.4)	Not available
Parity (multiparous)	111 (97.3)	429,693 (55)
Body mass index (median, IQR)	24.5 (21.3–28.0)	Not available
CS in history (yes)	107 (93.9)	Not available
Onset of labor		
Spontaneous	60 (52.6)	431,454 (57.0)
Intervention	50 (43.9)	201,751 (26.6)
Priming prostaglandins	2 (4.0)	19,535 (13.1)
Priming mechanical	34 (68.0)	117,296 (78.5)
Induction oxytocin	5 (10.0)	11,915 (8.0)
Priming and induction	0	700 (0.5)
Planned CS	6 (12.0)	52,298 (6.9)
Not specified	3 (6.0)	7 (0)
Unclear	4 (3.5)	123,813 (16.4)
Augmentation during labor (yes)	58 (51.0)	234,361 (31.0)
Mode of delivery		
Spontaneous	7 (6.1)	481,972 (63.7)
Instrumental birth	5 (4.4)	49,079 (6.5)
Planned CS	10 (8.8)	52,298 (6.9)
Emergency CS	89 (78.1)	49,916 (6.6)
Missing	3 (0.9)	123,753 (16.3)
Pain relief during labor (yes)		
Epidural analgesia	64 (56.1)	137,462 (18.2)
Opioids	13 (11.4)	83,922 (10.7)
Timing of pain relief		
≤3 cm dilatation	29 (28.1)	Not available
>3 cm dilatation	50 (48.5)	
Perinatal asphyxia ^b	12 (11)	1477 (0.2)
Perinatal mortality (yes)	14 (12)	464 (0.1)

Abbreviations: CS, cesarean section; IQR, interquartile range; NICU, neonatal intensive care unit.

^aNumber (%) unless otherwise stated.

^bPerinatal asphyxia was defined as having an Apgar score <7 after 5 min; born in the term period and admitted to a NICU for at least 24 h.

Uterine rupture was diagnosed during 10 planned CS. In eight cases, there was a complete uterine rupture, twice a uterine dehiscence. Nine women had a CS in history and were planned for repeat CS. Seven of them contacted the hospital during the preterm period and went, following triage by phone, to the hospital for unexplained abdominal pain, vaginal blood loss, unclear complaints with an unclear urgency for direct consultation, anxiety, or preterm labor. Two women came into labor before the planned CS date and underwent an emergency CS due to fetal distress without an immediate suspicion of uterine rupture. The rupture was diagnosed during the CS. One woman was brought in after a blunt abdominal trauma and underwent an emergency CS due to signs of placental abruption.

Perinatal mortality occurred in 14 cases: eight stillbirths, four neonatal deaths after failed neonatal resuscitation, one neonatal death at birth due to unexpected trisomy 18, and there was one end-of-life decision due to asphyxia one week after birth.

Participants of audit groups identified a total of 178 improvable factors. In 43 of the 114 women, the improvable factors were classified as having a “very likely” ($n = 11$) or “likely” ($n = 32$) association with uterine rupture (Table 2).

In Table 3, an overview of improvable factors related to both adherence to guidelines and usual care is given. The main points are lack of knowledge of and adherence to the guideline “fetal monitoring,” especially associations between uterine contraction, fetal heart rate patterns, and interpretation of these. Improvable factors within usual care focus on the lack of having continuity of a case manager responsible for ensuring complete and adequate information in the patient files and handing over of care. Relevant information was not always clearly visible in the electronic data systems. But also lack of accurate verbal transfer of information during the shift and between professionals as well as with the patient leads to improvable factors and delay in providing the right care at the right moment (Textbox 3).

3.1 | Recommendations

In total, 200 recommendations were formulated after determining improvable factors. Most recommendations were done in the fields of documentation ($n = 75$) and communication ($n = 43$). In Figure 1, we entered the recommendations in numbers for the main and subcategories. Recommendations focused on improving baseline documentation were seen as minimally necessary information that should have been in patients' files and easily found. The use of summary field notes on the cover page of an electronic patient file was strongly recommended. Perinatal audits also revealed that emailing between obstetricians, midwives, and pediatricians to hand over care, outcomes of consultations, or policy agreements were considered less than optimal care. Recommendations for a structured manner of communication like situation background assessment recommendation repeat (SBARR) were frequently mentioned. Adaptation of local protocols was recommended if the protocol did not

follow nationwide guidelines or needed to be adapted to new evidence. Adjusting usual care was recommended after establishing together that work as done differed from work as imagined. Agreements within professional organizations included recommendations to discuss or clarify the time of referral during pregnancy and shared care.

4 | DISCUSSION

An audit of 114 cases of uterine ruptures during local perinatal audit meetings in the Netherlands over the years 2017–2019 revealed 178 improvable factors and 200 recommendations to improve care. In 25% of the women who sustained uterine rupture, participants of the audits indicated improvable factors as having a (very) likely relationship with uterine rupture. Poor communication, inadequate documentation, and organizational problems especially a lack of adherence to agreements in and between echelons and within the own practice or hospital were the most identified improvable factors. Team training and training in speaking up are seen as key factors for optimizing cooperation in care and to reduce the chances of getting a uterine rupture.

Pattinson et al.¹⁷ concluded after a systematic review of critical incident audits and feedback to improve perinatal and maternal mortality and morbidity, feedback has the best possible effect on the improvement of care if the feedback is provided to relevant people. Perinatal audits in the Netherlands are multidisciplinary. Involved healthcare professionals of the discussed cases are emphatically invited to attend the audit. Despite the fact that the audit in the Netherlands is anonymous, we see that many involved healthcare providers actively share information about what happened and are highly motivated to learn from what happened and to make others aware of how it could have happened.

Results of a previous nationwide study indicated that poor communication and inadequate or incomplete documentation led to undesirable adverse perinatal outcomes.² Improvable factors identified in the current study remain similar. Braaf et al.¹⁸ analyzed failures in communication through documents and documentation across the perioperative pathway. They concluded that communication (lack of or poor verbal transfer of information) and organization of the right care at the right time failed because important information like information about patients' history or policy agreements, was hidden away or lacking in medical files causing delays in decisions or interventions. In our study, we also recognized the problem of hidden information in medical files (such as agreements about the duration of TOL, pain relief starting before induction of labor, augmentation during labor, and time of induction of labor). Audit participants indicated this as a relevant but also recurring problem and to have had a very likely relationship with the outcome in 50% of all improvable factors. The problem of hidden information in combination with crowded labor wards, may have a negative influence on patients safety. Therefore, proper documentation and communication should be a focus.¹⁸ Electronic data systems should be arranged in such a

TABLE 2 Likelihood of improvable factors and outcome uterine rupture as determined by audit groups

Improvable factor (n, %)	Guideline not followed (n) (58)	Problems in usual care (n) (120)	
Very likely to have a relationship with the outcome (11, 6.2%)	Fetal monitoring (2)	Delay in applying the correct diagnostic test ^a (3)	
	Local protocols (1)	Communication issues (1)	
Likely to have a relationship with the outcome (32, 18.0%)	Fetal monitoring (11)	Insufficient describing fetal monitoring (1)	
		Delay in care, professional based (1)	
		Organizational problems (1)	
		Unclear counseling with regard to the mode of birth (1)	
		Insufficient/incomplete documentation (5)	
		Communication issues (5)	
		Insufficient describing fetal monitoring (3)	
None or unlikely to have a relationship with the outcome (133, 74.7%)	Fetal monitoring (7)	Insufficient diagnostics (3)	
		Organizational problems (1)	
		Technical or logistic problem with equipment (1)	
		Other (3)	
		Local protocols (9)	Insufficient/incomplete documentation (29)
		Standard care (7)	Communication issues (13)
		Fetal monitoring (7)	Organizational problems (13)
		Diabetes (5)	Insufficient diagnostics incl post mortem (7)
		Hypertension (3)	Insufficient supervision (6)
		Anemia (2)	Insufficient describing fetal monitoring (3)
No consensus (2, 1.1%)	Other guidelines (9)	Delay in care, patient-based (3)	
		Technical or logistics problems with equipment (2)	
		Other (13)	
No consensus (2, 1.1%)	Other guidelines (9)	Insufficient documentation (1)	
		Communication issue (1)	

^aWithin the perinatal audit diagnostics are defined as the use of a wrong test or the wrongful use of the correct test (too late or not at all).

way that adequate documentation can be easily realized and immediately found in case of emergency.

In this study, 19 recommendations focused on education (improving knowledge, improving skills and drills) and nine on stimulating cooperation through team training. Improving knowledge, skills, and drills, and team training contribute to understanding why uterine ruptures occur, which determinants are important to take into account, and having the opportunity to optimize care processes.

Speaking up and using methodologies such as SBARR may be effective in optimizing cooperation between professionals and have positive impacts on patient safety.^{19,20,21} We found that a lack of knowledge related to how to apply SBARR in daily practice, policy agreements to use the SBARR method during professional consultations and failure to speak up about observations or considerations in multidisciplinary settings were examples of improvable factors. It is unknown to what extent these communication issues could have

TABLE 3 Improvable factors within guidelines, communication, documentation, and organization of care

Guidelines	Communication	Documentation	Organization of care
Inadequate registration of uterine contractions	Not expressing suspicion of uterine rupture	Hidden information in patient files	Too heavy workload in labor rooms
Lack of knowledge as to how to interpret the fetal cardiotocogram (CTG)	Not jointly or regularly assess CTGs	Loss of information during handovers of care between primary and secondary care but also during daily shifts	Assigning patients during the shift without considering risk profiles
Lack of feeling responsible or unclear responsibility assignments in terms of assessing the CTG	Delay in interprofessional consultations whereby signs of uterine ruptures were seen but not spoken out or followed by adequate interventions such as stopping augmentation, administering tocolysis, or performing an emergency CS.	Inadequate and insufficient documentation of obstetric history, the current course of pregnancy, labor progress, fetal heart rate, and considerations and decisions made during labor	Failure to use an obstetric warning system (red button) for obstetric emergencies
	Lack of verbal transfer of information during the shift, about the course of the delivery, about policy agreements		The woman presented herself in the wrong department in the hospital for adequate obstetric care
	Lack of having continuity of a case manager responsible for ensuring complete and adequate information in the patient files and handing over of care		Prolonged time intervals between suspicion of uterine rupture and birth

Abbreviation: CS, cesarean section.

TEXTBOX 3 Examples of improvable factors

Urgency expressed as a time frame to start emergency CS was not clearly communicated by the obstetrician to the anesthetist, even though this is described in the national guideline as necessary for the organization of acute obstetric care.

Counseling for the mode of birth in a woman with a previous CS was not documented and the mode of birth, therefore, had to be discussed during labor. This, while the nationwide guideline described that counseling should have taken place around 34–36 weeks and the outcome of the counseling clearly documented in the medical records.

Augmentation of labor resulted in overstimulation in a woman with a previous CS. This overstimulation was not noticed until fetal bradycardia developed.

influenced outcomes. Recurring local calamity skills and drills training, preferably including also primary care midwives, training of routine in which communication is part of the training, can contribute to bridging this gap and is, therefore, an important lesson from this study.

From 56 cases (49%), information about the decision-to-birth interval (DBI) was available whereby the mean time DBI was 41 min

(range 8–175 min). The American College of Obstetricians and Gynecologists guideline recommends a time interval of 30 min for emergency CS.²² Fuhrmann et al.²³ and Bidon et al.²⁴ described the positive effects of team training on DBI for emergency CS. They performed a before and after study regarding the 30 min time interval from the decision to birth by an emergency CS. Training of teams resulted in a significantly higher number of emergency CS performed within 30 min time frame ($p = 0.017$). Considering the mean time and the broad range in this study, there seems to be room for improvement.^{23,24}

In the Netherlands, uterine rupture can be registered as an item in the national birth registry but is notoriously underreported. Therefore, we asked local PCGs over the years 2017–2019 to audit and register cases of uterine ruptures. Perinatal audits function as well-visited quality instruments. This allowed us to obtain insight into improvable factors associated with uterine ruptures. For the Netherlands, this is the first time to discuss and analyze care around uterine ruptures in a multidisciplinary setting. This structured way of discussing may help participants to draw relevant lessons for clinical care.

A limitation of the study is that we did not audit all uterine ruptures in the Netherlands over the years 2017–2019. Local PCGs have to audit a minimum of four cases a year but are free to choose from the themes selected for perinatal audits (perinatal asphyxia, uterine rupture, hyperbilirubinemia, preterm mortality). Therefore, we cannot exclude selection bias. It is thinkable that only severe cases of uterine ruptures were audited but we think we have a

reliable overview of all different severities of care. The main effect of a perinatal audit is to create awareness about improvable points in delivered care. Every case discussed potential contributes to the improvement of care. A perinatal audit is a very labor-intensive process whereby it is not realistic to audit every case. Local perinatal audit committees select the most instructive or most serious cases for a perinatal audit. This study describes a selection of the most interesting cases. We feel this is not a major limitation for qualitative studies like this one. Quantitative data are reported elsewhere. To audit all uterine ruptures in the Netherlands, a nationwide prospective cohort study into all uterine ruptures could be the next step but would pose a significant burden on available resources.

Next to registration in Perined, there is another database to register major maternal morbidity, the Netherlands Obstetric Surveillance System (NethOSS) database.²⁵ A qualitative analysis of women registered within NethOSS is following. In the future, a linked database between Perined and NethOSS can be organized to overview and analyze most uterine ruptures in the Netherlands.

A second limitation is the design of the perinatal audit and its database. The aim of the perinatal audit was to improve the quality of perinatal healthcare in the Netherlands. From the start of perinatal audits and onwards, cases were registered in a nationwide database managed by Perined. This database was not set up for scientific research but as a quality tool to monitor and give feedback on a nationwide level to perinatal audit regions and local PCGs. The entered case histories were anonymized and a link with the perinatal registration was therefore not possible. This limited us to zoom in on more specific individual information pertaining to individual cases in the perinatal registration whereby as a result of which we were not always able to indicate all improvable factors. This limitation was previously recognized.¹³

5 | CONCLUSION

Perinatal audit of uterine rupture provided insight into improvable factors and recommendations as identified in perinatal audit sessions. Improvable factors seem to be persistent and recurring, therefore research into effective methods to translate improvable factors into sustainable changes in care is necessary. Lessons for optimizing clinical care include a necessity to facilitate team training on communication skills, cooperation, documentation, fetal monitoring and jointly considering critical determinants of delivered care.

The most important issues to be educated and practiced during team and skill training are:

1. speaking up (if one witnesses adverse events there must be a safe environment facilitating the sharing of such concerns for all those present);
2. proper documentation at all times (loss of information is an important barrier in handover; many professionals understandably tend to act first and document later; and innovative ways to facilitate quick and accurate documentation are desired); and

3. assess the fetal cardiotocogram always in relation to maternal contractions.

AUTHOR CONTRIBUTIONS

Ageeth Rosman was responsible for the data extraction from the nationwide database of Perined and preparing the research files for the study. Ageeth Rosman analyzed the data and discussed this with Thomas van den Akker, Jeroen van Dillen, and Joost Zwart. Ageeth Rosman, Thomas van den Akker, and Jeroen van Dillen wrote the manuscript. Joost Zwart, Timme Schaap, Evelien Overtoom, and Kitty Bloemenkamp contributed to reviewing and finetuning of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy restrictions.

TRANSPARENCY STATEMENT

This manuscript is an honest, accurate, and transparent account of the study being reported; no important aspects of the study have been omitted.

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REFERENCES

1. Al-Zirqi I, Daltveit AK, Forsén L, Stray-Pedersen B, Vangen S. Risk factors for complete uterine rupture. *Am J Obstet Gynecol.* 2017;216(2):165.
2. Zwart JJ, Richters JM, Ory F, Bloemenkamp KWM, van Roosmalen J. Uterine rupture in the Netherlands: a nationwide population-based cohort study. *BJOG.* 2009;116:1069-1080.
3. Baron J, Weintraub A, Eshkoli T, Hershkovitz R, Sheiner E. The consequences of previous uterine scar dehiscence and cesarean delivery on subsequent births. *Obstet Gynecol Surv.* 2014;69(11):645-647.
4. Silver R. Implications of the first cesarean: perinatal and future reproductive health and subsequent cesareans, placentation issues, uterine rupture risk, morbidity, and mortality. *Semin Perinatol.* 2012;36(5):315-323.
5. Van Roosmalen J, Zwart J. Severe acute maternal morbidity in high income countries. *Best Pract Res Clin Obstet Gynaecol.* 2009;23:297-304.
6. Van den Akker T, Brobbel C, Dekkers OM, Bloemenkamp KWM. Prevalence, indications, risk indicators, and outcomes of emergency

- peripartum hysterectomy worldwide. *Obstet Gynecol.* 2016;128:1281-1294.
7. Al-Zirqi I, Daltveit AK, Vangen S. Infant outcome after complete uterine rupture. *Am J Obstet Gynecol.* 2018;219(1):109.
 8. Al-Zirqi I, Stray-Pedersen B, Forsén L, Daltveit A-K, Vangen S. Uterine rupture: trends over 40 years. *BJOG.* 2016;123(5):780-787.
 9. Vlemminx MW, de Lau H, Oei SG. Tocogram characteristics of uterine rupture: a systematic review. *Arch Gynecol Obstet.* 2017;295(1):17-26.
 10. Vandenbergh G, Bloemenkamp K, Berlage S, et al. The international network of obstetric survey systems study of uterine rupture: a descriptive multi-country population-based study. *BJOG.* 2019;126:370-381.
 11. Motomura K, Ganchimeg T, Nagata C, et al. Incidence and outcomes of uterine rupture among women with prior caesarean section: WHO Multicountry Survey on Maternal and Newborn Health. *Sci Rep.* 2017;10(7):44093.
 12. Eskes M, Waelput AJM, Erwich JJHM, et al. Term perinatal mortality audit in the Netherlands 2010-2012: a population-based cohort study. *BMJ Open.* 2014;4(10):e005652.
 13. Kortekaas JC, Scheuer AC, de Miranda E, et al. Perinatal death beyond 41 weeks pregnancy: an evaluation of causes and substandard care factors as identified in perinatal audit in the Netherlands. *BMC Pregnancy Childbirth.* 2018;18(1):380.
 14. Perined. Annual report 2019 (in Dutch). Accessed January 10, 2020. <https://www.perined.nl/onderwerpen/publicaties-perined/jaarboek-zorg>
 15. Methodology perinatology data: van ontvangst tot gebruiksklare data voor onderzoek, benchmarking en rapportage [From reception to ready-to-use data for research, benchmarking and reporting]. Perined, Utrecht, The Netherlands; 2020 (in Dutch).
 16. van Diem MT, Timmer A, Gordijn SJ, et al. Classification of substandard factors in perinatal care: development and multi-disciplinary inter-rater agreement of the Groningen-system. *BMC Pregnancy Childbirth.* 2015;15:215.
 17. Pattinson RC, Say L, Makin JD, Bastos MH. Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database Syst Rev.* 2005;2005(4):CD002961.
 18. Braaf S, Riley R, Manias E. Failures in communication through documents and documentation across the perioperative pathway. *J Clin Nurs.* 2015;24(13-14):1874-1884.
 19. Omura M, Maguire J, Levett-Jones T, Stone TE. The effectiveness of assertiveness communication training programs for healthcare professionals and students: a systematic review. *Int J Nurs Stud.* 2017;76:120-128. doi:10.1016/j.ijnurstu.2017.09.001
 20. Dupuis O, Sayegh I, Decullier E, et al. Red, orange and green caesarean sections: a new communication tool for on-call obstetricians. *Eur J Obstet Gynecol Reprod Biol.* 2008;140(2):206-211.
 21. Manning ML. Improving clinical communication through structured conversation. *Nurs Econ.* 2006;24(5):268-271.
 22. American College of Obstetricians and Gynecologists. ACOG committee opinion no. 256: committee on obstetric practice. optimal goals for anesthesia care in obstetrics. *Obstet Gynecol.* 2001;97(5 pt 1):1-3.
 23. Fuhrmann L, Pedersen TH, Atke A, Møller AM, Østergaard D. Multidisciplinary team training reduces the decision-to-delivery interval for emergency caesarean section. *Acta Anaesthesiol Scand.* 2015;59(10):1287-1295.
 24. Bidon C, Desgranges FP, Riegel AC, Allaouchiche B, Chassard D, Bouvet L. Retrospective cohort study of decision-to-delivery interval and neonatal outcomes according to the type of anaesthesia for code-red emergency caesarean sections in a tertiary care obstetric unit in France. *Anaesth Crit Care Pain Med.* 2019;38(6):623-630.
 25. Schaap TP, van den Akker Th, Zwart JJ, van Roosmanen J, Bloemenkamp KWM. A national surveillance approach to monitor incidence of eclampsia: the Netherlands Obstetric Surveillance System. *Acta Obstet Gynecol Scand.* 2019;98(3):342-350.

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