Obstetric Telephone Triage

Development & Evaluation

Bernice Engeltjes

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Obstetric Telephone Triage

Development & Evaluation

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General introduction

Obstetric care

Worldwide, every day more than 350.000 children are born[1]. The care for pregnancy and births is provided by many care professionals. Obstetric care is provided in three phases: the prenatal, natal, and postnatal period. According to the World Health Organization (WHO), accessibility to healthcare during pregnancy for every woman is a minimum requirement[2]. In each country, the organization of obstetric care is designed differently. In the Netherlands, traditionally prenatal care was divided into three echelons: primary, secondary, and tertiary care. Based on risk selection, pregnant women receive care in one of these echelons[3,4]. In recent years, investments have been made in setting up integrated systems of care for pregnant women, where care is provided jointly by all care professionals[5]. One of the most important requirements in obstetric care is that there is no delay in care when there is an emergency. Vice versa it is also desirable to treat non-urgent patients at short notice in a planned consultation[5,6]. Therefore, a valid and reliable triagesystem is seen as a tool to solve this problem. This also improves the quality of obstetric care.

Telephone Triage

In the case of unplanned care requests, in western society, it is usual for most women to first make a telephone call asking whether it is necessary to have a consultation at the emergency department[7-9]. In daily practice, obstetric emergency care departments in hospitals receive multiple telephone calls from pregnant women per day. During these calls, midwives, nurses or doctor's assistants use their obstetric knowledge and experience to determine the severity of the complaints and the necessity for a physical consultation with an obstetrician or a midwife. By definition, this triage is not always in the hands of optimally trained personnel. Moreover, this telephone triage is a medical procedure that is not performed in a uniform manner due to the lack of a specific obstetric telephone triage system. Therefore, in Dutch obstetric care there is a need for an evidence-based triage system[8,10], which provides a uniform and concrete basis for assessing the severity of the symptoms of obstetric emergency and other unplanned care requests originating by telephone.

Triage in general healthcare

Obstetric telephone triage is the method used to prioritize the severity of symptoms of obstetric emergency and other unplanned care requests originating from telephone calls. Evidence suggests that uniformity of triage would have a favorable effect on the safety and efficiency of emergency care[11,12]. In general healthcare, triage systems such as the Manchester Triage System (MTS), the Emergency Severity Index (ESI) and the

guidelines of the Dutch Triage Standard (NTS) contain background information about presenting symptoms and prioritization codes, which aim to indicate the maximum acceptable medical waiting time[13-15]. However, as they do not address the physiological changes in pregnancy, the triage systems for general emergency care are not specific enough for unplanned obstetric care requests of pregnant women.

History of obstetric telephone triage

For this reason, the Rotterdam Obstetric Triage System (ROTS) has been developed between 2007 and 2013[16,17]. During this time, midwives studying on the master's program of de University of Applied Sciences of Rotterdam (RUAS) further developed an existing part of the system for physical (face-to-face) triage. Each study year, one of the presenting symptoms was tested empirically by the group of students in the hospitals where they were employed. The system was well received in practice. In the same period one of the first obstetric triage systems – the Obstetric Triage Acuity Scale (OTAS) – was developed in Canada[13,18]. In the United States, the Maternal Fetal Triage Index (MFTI) has been developed, which is based on the ESI[19,20]. In Switzerland, an obstetric section has been added to the general Swiss Emergency Triage Scale (SETS)[21]. Hence, it is important to note that these systems have all been developed to classify the urgency of care requests by means of physical (face-to-face) triage, whereas in practice it is usual for most women to first make a telephone call asking whether it is necessary to have a consultation at the emergency department[7,8]. Ideally, a triage system should be usable on both occasions[8]. Telephone triage has many positive aspects, such as efficiency and uniformity, both for care professionals and for the pregnant women. Challenges exist though, because of the lack of a physical examination during the telephone call and because the lack of specific diagnostic information, e.g., blood pressure[7,8].

Development of DOTTS

Using the already developed (obstetric) physical triage systems as a basis, we set out to develop a valid and reliable obstetric telephone triage guideline. In the development of this Dutch Obstetric Telephone Triage System (DOTTS), all relevant stakeholders are involved. Involvement and co-creation with stakeholders in the developmental phase of a service-design is recognized to be of great importance in order to successfully implement innovations in daily practice[22-24]. This is especially important when there is a need to deliver significant societal impact via dynamic, locally adaptive communities[25]. This theory of co-creation is based on three components of successful stakeholder engagement: creating awareness, building support and making the change real[22]. In addition, a system perspective with a creative approach of research on improving human experience, and careful attention emphasis on the process[25] are considered necessary for success.

Validation

All well-known triage systems are based on consensus by experts. Evaluation of triage systems involves assessments of validity and reliability. Triage can be viewed as a diagnostic assessment; therefore, the methodology of diagnostic studies is applicable. Diagnostic validation studies of triage should ideally evaluate whether the triage process accurately predicts the correct level of urgency. However, there is no single outcome measure that captures the concept of urgency[26]. Validation of (non-obstetric) triage systems in different studies is commonly based on some of the following outcomes; the agreement of the system with expert opinions, assessment of vital signs, admission to intensive care unit (ICU), death, need for operations and/or follow-up[12]. In addition to assessment of internal validity, where studies are performed in a single setting, external validity can also be studied. External validity is based on studies in different settings[26]. Diagnostic validity of triage systems used in different emergency departments shows a wide variation of existing scales and also a wide variation of results[12,27]. However, no diagnostic validation studies have been performed for obstetric physical triage systems[13,18-21,28-30].

Reliability

Reliability should evaluate the level of the internal consistency. For reliability, a distinction is made between inter-rater reliability (IRR) and intra-rater-reliability (ITR). IRR of a triage system is the degree of agreement between different professionals, whereas ITR is agreement of the same professionals between different moments in time[28]. Both measurements are usually rated by using a weighted Cohen's Kappa and Intraclass Correlation Coefficient (ICC)[13,18,20,21,28,29,31]. The inter-rater reliability of the existing physical obstetric triage systems are moderate to good (ranging between Kappa 0.69 – 0.86 and Interclass correlation (ICC) 0.75 – 0.96). Intra-rater reliability showed an ICC of 0.81 for SETS and a Kappa of 0.65 for OTAS[13,21]. However, due to the heterogeneity of methods, results and quality of the studies, it is difficult to compare these studies[28].

Implementation

The DOTTS is an innovation within the field of obstetric emergency care, as it prioritizes care based on level of urgency, it creates the use of digital tools, it requires change in the care processes for pregnant women, as well as shifts in roles and responsibilities and improvement in interprofessional collaboration. As such, evaluation of its' implementation is possible by using theories from implementation science and change management ideology. In each case prior to the start using the DOTTS, an implementation team jointly developed a tailored implementation plan, which would be an actionable, specific work plan for the users of DOTTS at each individual hospital. A digital application was built into the main hospital's information system and was accessible in the patient's record. In addition, specific training was given to the staff

responsible for triage (obstetrical nurses or doctor's assistants). The implementation team went through the steps of the implementation strategies before getting started with the DOTTS. Which implementation strategy was used, as well the order and the extent of the steps performed differed per hospital. To achieve optimal effect in daily care the ultimate goal was that DOTTS should be adopted by triage staff. Adoption of new ideas is often very difficult. Change management theories regularly demonstrate a linear/stepwise process to innovation. The degree of adoption partly depends on the diffusion of the innovation. Diffusion is the process by which participants create and share information with each other to reach mutual understanding of the innovation[32].

Evaluation

When introducing a complex innovation, evaluation of the implementation can optimize this process, and in turn, lessons learned can improve new or further implementations[33,34]. Implementation science has evolved to provide better understanding and explanation of why implementation of innovations succeeds or fails, with the aim to overcome these problems and to improve the method and/or the implementation[35]. Numerous theories, models and taxonomies of implementation have been defined to classify and study implementations[36,37]. The Normalization Process Theory (NPT) has been developed and added to implementation science in order to evaluate (the change) on an organizational level. Normalization Process Theory characterizes implementation as a social process of collective action[38-40]. According to NPT, routine embedding of innovations in practice can be understood in four constructs: coherence, cognitive participation, collective action and reflexive monitoring. In implementation science, attention is also paid to the context of implementations[41]. In the end, implementation of new innovations in healthcare should contribute to improving quality and effectiveness of care[35].

Patients experiences

The collective result of the development process described in this thesis is an evidence-based system based on input from stakeholders, literature, guidelines, and protocols. Evidence-based working is the norm in medical care. Categorizing patients into a system such as that suggested by DOTTS might result in less tailor-made care. However, the use of DOTTS should be used based on a combination of professional insight and patient preferences in accordance with the concept of evidence-based practice[42]. Otherwise, implementation of a triage system might conflict with patient-centered care. Customization per patient is essential, not every patient will fit into a system. Patient-centered care, as well as family-centered care, involves shifting away from the patient being the passive goal of interventions to the patient participating as an active part in the care process. Patient evaluations with subsequent options for patients' involvement to improve care has become important since the introduction of patient-centered care. However, whether implementation of an obstetric telephone triage system conflicts with patient-centered care has not been studied before.

In summary, the DOTTS was developed to provide a uniform and practical basis for estimating the severity of symptoms of unplanned obstetric care requests by telephone. The research presented in this thesis will address questions about reliability and validity. As it facilitates the correct use of capacity and prevents unnecessary overload of care, this work can be said to add to body of knowledge relating to delivery of obstetric care.

Aims of these thesis

The overall aim of this thesis is to develop a valid and reliable and nationwide usable obstetric telephone triage system for unplanned care requests of pregnant women, including the evaluation of patients' experiences of the system and the evaluation of the normalization of the use of the system within different hospital settings by health-care professionals.

More specifically, the aims of this thesis are:

1. To develop an obstetric guideline for telephonic triage in co-creation with users.
2. To determine the diagnostic and external validity of the Dutch obstetric telephone triage system in obstetric emergency care.
3. To determine the reliability of Dutch obstetric telephone triage system by testing inter-rater-reliability and intra-rater-reliability.
4. To gain insight into the degree of implementation (normalization) and to evaluate which lessons can be learned from the implementation of Dutch obstetric telephone triage system for future implementations.
5. To explore patients' experiences with telephone triage when using the Dutch obstetric telephone triage system.

Thesis outline

The first aim of these thesis is addressed in **chapter 2.** An evidence-based guideline for obstetric telephone triage was developed through a multi-phase multi-center study with consecutive drafts of the triage guideline using four focus groups, four observations of training sessions and two expert consultations based on the Delphi method. Consensus was reached and the guideline was judged ready for transfer into obstetric practice.
The second aim is addressed in **chapter 3.** A prospective observational study in four hospitals was performed to study the validity of the Dutch obstetric telephone triage system. The diagnostic validity was determined by comparing the assigned urgency level of the Dutch obstetric telephone triage system with a reference standard.
Chapter 4 describes the third aim. A vignette study was performed to determine the inter-rater-reliability (IRR) and intra-rater-reliability (ITR) using vignettes.
The fourth aim is addressed in **chapter 5**. An evaluation study with a mixed methods design was performed. All triage staff members in hospitals who implemented the Dutch obstetric telephone triage system before September 1st, 2019, were invited to complete the Normalization MeAsure Development (NoMAD) questionnaire. Sub-

sequently, an analysis of the questionnaires was discussed during a focus group.
In **chapter 6** an exploration of patients' experiences with the Dutch obstetric telephone triage system is given as a result of a study with a descriptive qualitative design. Semi-structured interviews were held. Participants, recruited from two Dutch hospitals, were pregnant women who received triage by telephone.

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Obstetric Telephone Triage

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Abstract

Objective:
Little is known about obstetric telephone triage: the methods used to prioritize the severity of symptoms of obstetric emergency and other unplanned care requests originating by telephone. In large-scale obstetric units there is a need for an evidence-based triage guideline. The aim of this study was to develop an obstetric guideline for telephonic triage.

Design, setting and participants:
A multi-phase multi-center study was performed with consecutive drafts of the triage guideline using four focus groups, four observations of training sessions and two expert consultations based on the Delphi method. The study was performed in ten hospitals in the Netherlands. The obstetric care professionals involved were gynecologists, midwives, nurses, doctor's assistants, team managers and application managers. After each focus group, each observation and each expert consultation, an interpretative analysis was undertaken. Based on these analyses, the obstetric telephone triage guideline was drafted.

Measurements and results:
The designed guideline describe the primary symptoms presented, five prioritization categories and several descriptors. Consensus (>90%) was reached during the second expert consultation. Fifty-seven (91.9%) participants stated that the obstetric telephone triage guideline was clinically complete, correct, user-friendly and well-designed, and 61 (98.4%) participants judged that the newly designed triage guideline was ready to use in daily practice.

Key-conclusions and implications for practice:
An evidence-based guideline for obstetric telephone triage was developed through a multi-phase multi-center study with all stakeholders. The guideline was found to be clinically complete, correct, well-designed and user-friendly. It provides a uniform and concrete basis for assessing the severity of the symptoms of obstetric emergency and other unplanned care requests originating by telephone. It also provides a good basis to further develop this evidence-based guideline for telephone triage by continuous registration of all calls.

Keywords:
Midwifery; Obstetric Telephone Triage; Triage guideline; unplanned telephone obstetric care.

Introduction

In the Netherlands, the geographical concentration of acute obstetric care has led to an increase in the number of pregnant women per location. On average, obstetric emergency care departments in Dutch hospitals receive 20 to 30 telephone calls from pregnant women per day. During these calls, midwives, nurses or doctor's assistants use their obstetric knowledge and experience to determine the severity of the complaints and the necessity for a physical consultation with an obstetrician or a midwife. This telephone triage is a medical procedure that is currently not performed in a uniform manner due to lack of specific guidelines[1-3].

Evidence suggests that uniformity of triage would have a favorable effect on the safety and efficiency of emergency care[4]. In general healthcare, triage systems such as the Manchester Triage System (MTS), the Emergency Severity Index (ESI) and the guidelines of the Dutch Triage Standard (NTS) contain background information about presenting symptoms and prioritization codes, which aim to indicate the maximum acceptable medical waiting time[5,6]. However, as they do not address the physiological changes in pregnancy, the triage systems for general emergency care are not specific enough for unplanned obstetric care requests of pregnant women[7]. For this reason, the Rotterdam Obstetric Triage System (ROTS) has been developed between 2007 and 2013[8,9] *(articles in Dutch)*. In the same period one of the first obstetric triage systems – the Obstetric Triage Acuity Scale (OTAS) – devolved in Canada[10,11]. In the United States, the Maternal Fetal Triage Index (MFTI) has been developed, which is based on the ESI[12]. In Switzerland, an obstetric section has been added to the general Swiss Emergency Triage Scale (SETS)[7].

It is important to note however that these guidelines have all been developed to classify the urgency of care requests by means of physical (face-to-face) triage. Nonetheless, in practice most women call first to ask whether it is necessary to have a check-up. Telephone triage has many positive aspects, such as efficiency and uniformity, both for care professionals and for women. Challenges exist because of the lack of a clinical perspective during the telephone call and because the lack of specific diagnostic information, e.g., blood pressure. Ideally, a triage guideline should be usable on both occasions[3,13]. The aim of this study was to develop an obstetric guideline for telephonic triage.

Material and methods

Design

A multi-phase multi-center study was performed with consecutive drafts of the telephone triage guideline using four focus groups, four observations of training sessions and two expert consultations based on the Delphi method[14,15]. After focus group, and/or observation and the Delphi round, interpretative analysis was undertaken. Based on these analyses, a new version of the obstetric telephone triage guideline was drafted (Table 1).

The aims of the focus group discussions were 1) to investigate the current procedures for unplanned telephone consultations, 2) to evaluate the applicability, value and limitations of the physical triage system ROTS for telephone triage and 3) to determine quality themes for obstetric telephone triage.

1	**Focus group 1**	**Aim:** insight into the views of care professionals regarding obstetric triage and quality criteria **Context:** general hospital 1 **Result:** design of the obstetric triage guideline, version 1
2	**Observation Training 1 + 2**	**Aim:** observations of the use of the first version of the obstetric triage guideline during a triage training session **Context:** general hospital 1 **Result:** design of the obstetric triage guideline, version 2 (Together with the results of focus group 2)
3	**Focus group 2**	**Aim:** insight into the views of care professionals regarding obstetric triage and quality criteria **Context:** academic hospital 1 **Result:** design of the obstetric triage guideline, version 2 (Together with the results of observations training 1 and 2)
4	**Observation Training 3 + 4**	**Aim:** observations of the use of the second version of the obstetric triage guideline during the triage training session **Context:** academic hospital 1 **Result:** design of the obstetric triage guideline, version 3 (Together with the results of focus group 3)
5	**Focus group 3**	**Aim:** insight into the views of care professionals regarding obstetric triage and quality criteria **Context:** general hospital 2 **Result:** design of the obstetric triage guideline, version 3 (Together with the results of observations training 3 and 4)

6	**Focus group 4**	**Aim:** insight into the views of care professionals regarding obstetric triage and quality criteria **Context:** general hospital 3 **Result:** design of the obstetric triage guideline, version 4 & Formulate quality criteria for obstetric telephone triage.
7	**Delphi - round 1**	**Aim:** digital expert consultation (open-ended questions) **Context:** eight general and two academic hospitals **Result:** design of the obstetric triage guideline, version 5
8	**Delphi - round 2**	**Aim:** digital expert consultation (close-ended questions) **Context:** eight general and two academic hospitals **Result:** design of the obstetric triage guideline, version 6

Table 1: *Schematic overview of the consecutive phases of development of the telephone triage guideline.*

For the observations, the objectives were 1) to evaluate the usability of the triage guideline, and 2) to correct incompleteness and inaccuracies.

In the digital expert consultation (Delphi rounds) the objectives were 1) to formulate an obstetric telephone triage guideline based on sufficient consensus and 2) to test and optimize the transferability of the guideline (Table 1).

Participants
During the focus groups, observations and Delphi rounds, participants represented a broad range of obstetric care professionals: nursing personnel (specialized nurses, general nurses and doctor's assistants), medical personnel (gynecologists, residents, physician assistants and, clinical midwives) and supporting services personnel (policy makers, managers and management team leaders, application managers).

Focus groups
Focus groups consisted of six to nine care professionals from four different hospitals (three general hospitals and one academic hospital). The first author (BE) had the role of observer during all focus groups. The moderator was a psychologist or a policy maker. Topics to be discussed were chosen according to Wester and Peters[16] (Table 2). All focus groups were verbatim transcribed.

	Topic	Explanation of topic
1	**Behavior and product**	Current procedure with respect to pregnant women with unplanned care requests, insight into the understanding and usefulness of the triage guideline in general. The department's willingness to change.
2	**Policy**	Discussion of existing local and national protocols.
3	**Departmental aspects**	Presence of a specific triage department (evaluation rooms and office) and the analysis of the available personnel and/or of the desire to create such a department. Insight into the culture and organization of the department obstetrics.
4	**Gathering suggestions and ideas**	Suggestions and ideas for the optimization and implementation of obstetric triage.
5	**Finding out what is already known from experiences and literature**	Earlier results of ROTS with respect to primary symptoms, prioritization categories. Current trends in Dutch policy regarding the perception of decreased fetal movements and the treatment of hypertension-associated symptoms. The draft 'triage obstetric guideline' (Thijse et al 2007; Engeltjes et al, 2014).

Table 2: *Overview of topics for the focus groups and explanation*

Transcripts of the focus groups were analyzed with respect to themes. Meaningful sections of text were coded via open coding, axial coding, codes/topics and subcodes/subtopics[17]. After each focus group, a summary was written and presented to the participants for their review (member check). Each focus group ended with adjustments of the draft guideline.

Observations of training sessions

Four triage training sessions were observed. During each training session, twelve obstetric care professionals applied the triage guideline draft (Table 1) to twenty cases, which were purposefully chosen from practice. Mild, moderate and severe cases were included. The first and second training sessions were conducted with a group of intended users (nurses and doctor's assistants). In the third and fourth training sessions, the group was expanded to include all obstetric care professionals (gynecologists, clinical midwives, nurses, and doctor's assistants). The training sessions were led by a psychologist, and the roles of the pregnant women were played by actors. Any lack of clarity that became apparent during these observations

regarding the usefulness of the triage guideline was corrected and changes were incorporated into the obstetric triage guideline draft (version 2 and 3) (Table 1).

Delphi method

The Delphi rounds were executed until consensus was achieved, with consensus being defined as at least 90% agreement[14,15].

All participants of the focus groups of the four hospitals were invited to participate in the Delphi rounds. To test and optimize transferability of the triage guideline, in addition also participants from six other hospitals were selected (Table 1). The optimal number of participants was 60. Taking non-responders into account, 75 care professionals were invited to participate in the first Delphi round. For the second Delphi round, all professionals of the first Delphi round were invited again to participate. Those who had not responded to the invitation for the first round were asked if they were willing to participate this time. In the second round 69 care professionals were invited.
The Delphi rounds were held according to the theory of van Zolingen en Klaassen (2002)[15]. During the first expert consultation, 75% of the questions were open-ended questions about obstetric triage[14,15,18]. The analyses of the results from the first Delphi round were discussed and summarized by the research group (BE, EW, RR, FS) based on the quality themes formulated during the focus group discussions. The interpretations of the feedback were incorporated into the next version of the obstetric triage guideline (Version 5, Table 1). During the second Delphi round, interpretations of the first round were shared with participants. During this second round, mainly close-ended and more in-depth questions were asked.

Before sending the questions to all participants of the Delphi rounds, the questions were pretested by independent experts who had not previously participated in the study. The questions were presented along with the obstetric telephone triage guideline in PDF format (Table 1). The first Delphi round was held between March 26th and April 19th 2017 and the second Delphi round was held between June 16th and July 14th 2017.

Ethical approval

The study was approved by the Medical Research Ethics Committees United (MEC-U) and the Medical Ethics Committee of Leiden University Medical Center (LUMC, 2016) Act (W.16.053 & P17.075/PG/pg).

Results

In total, 30 care professionals participated in the focus groups. During four training sessions, 48 care professionals were observed. In the first Delphi round, 62 (82.7%) of

the 75 invitees participated, and in the second Delphi round, 62 (89.9%) of the 69 invitees responded (Table 3). The average age and number of years of work experience in clinical obstetrics were equal in both rounds. Of the 62 participants of each round, 57 (91.9%) took part in both Delphi rounds. About half of the participants of the Delphi rounds had also previously participated in the focus groups, while the other half had no previous acquaintance with the subject of triage and the obstetric triage guideline. The average age and number of years of work experience among participants were equal in both rounds.

Professions	**Nursing personnel (Doctor's assistants, general nurses and specialized nurses)**	**Medical personnel (Gynecologists, residents, physician assistants, midwives)**	**Supporting services personnel (Policy makers, managers and manager team leaders, application managers)**
Focus group			
Focus group 1	3	3	2
Focus group 2	2	2	2
Focus group 3	3	4	2
Focus group 4	2	2	3
Training			
Training 1	12	0	0
Training 2	12	0	0
Training 3	6	6	0
Training 4	5	7	0
Delphi			
Delphi round 1	22	36	4
Delphi round 2	21	36	5

Table 3: *Participants in the focus groups, triage training & Delphi rounds*

Focus groups

Current procedure of unplanned care

During the focus groups, it became clear that the existing procedure for prioritizing unplanned care differed within hospitals, depending on which professional was on

call. Also differences existed between hospitals with respect to logistics and care content. Care professionals stated that it was necessary to develop a structured approach, not only because of the increased number of consultations in recent years but also because of a lack of transparency in the telephone triage process.

According to the current procedure, most pregnant women called the nurse or doctor's assistant on duty. Based on this call, sometimes the pregnant woman was advised to come to the hospital immediately. In other cases, the nurses or doctor's assistants considered, based on their knowledge, a consultation not necessary and advised the patient to stay at home. It was not always clear if a midwife or gynecologist was consulted during this decision-making process.

Departmental aspects
Two hospitals had a stand-alone triage department. At two other hospitals, the delivery room or outpatient clinic was used for triage.

Current policy and ideas for implementation
The participants were aware of the lack of a standard policy for unplanned telephone obstetric triage at the national level. At the local level, various protocols were used, with different levels of details.

Evaluation ROTS
The participants of the focus groups agreed that the already existing physical triage system (ROTS) could be used as the basis for the telephone triage guideline. In their opinion the lack of the clinical perspective during the telephone call and of certain specific information, such as blood pressure, adjustments to this physical triage system were necessary, in order to make it suitable for telephone triage.

Based on information gained from the focus groups, unplanned obstetric care requests over the telephone could be grouped into five categories resulting in the following presenting symptoms: fluid loss, vaginal bleeding, abdominal pain, concerned pregnant/non-somatic symptoms and other physical symptoms. After discussion, consensus on these categories was reached within each focus group.

In order to design a working triage guideline, prioritization categories were determined. The first focus group came up with four prioritization categories: Resuscitation & life threatening, Emergency, Urgent, Non-urgent (Figure 1). Focus group 2 added the category 'self-care advice', in line with both practical experience and general emergency care.

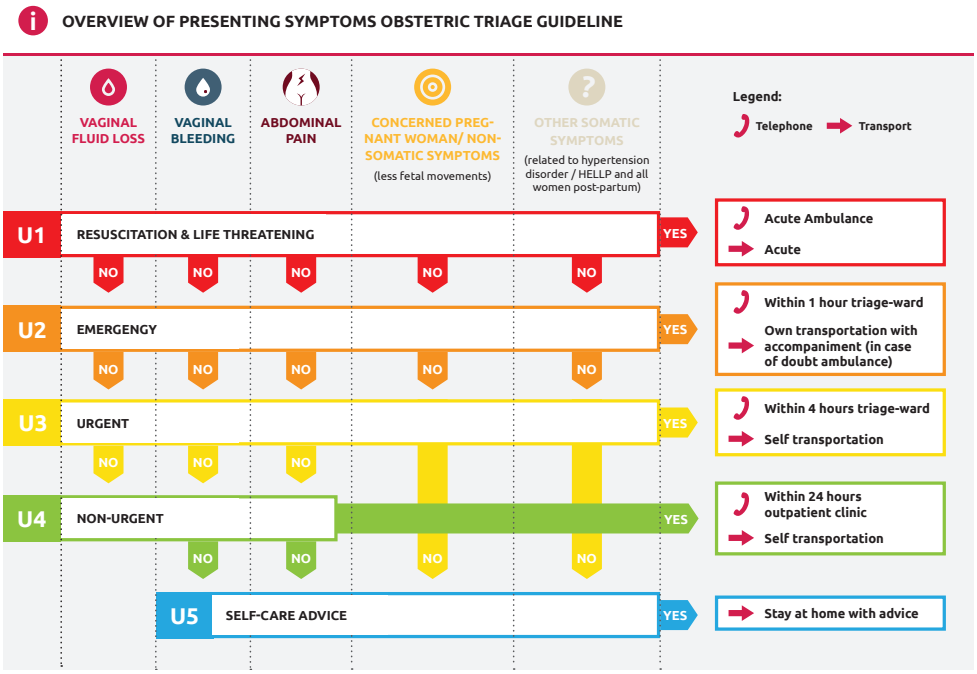

Figure 1: *Triage guideline - overview of presenting symptoms and prioritization categories (U= urgency)*

Quality criteria

After analyzing the focus group discussions, two quality criteria for the telephone triage guideline were identified. These quality criteria were 1) *clinical correctness & completeness and 2) user-friendliness & supportive design*. User-friendliness should be achieved by developing an application in the electronic patient record. The design should support the recognition of the presenting symptoms and prioritization categories. To this end, participants recommended the use of colors and symbols, as well as an intuitive arrangement of the categories.

Observations of triage training sessions

During the training sessions, care professionals (Table 1 and 3) were observed as they applied the obstetric telephone triage guideline (versions 1 and 2) to various cases in daily practice. Based on these observations, changes were made to the applied version of the triage guideline to increase its clinical correctness, completeness, design, and user-friendliness. For example, 'duration of pregnancy' was added to the descriptor 'fewer fetal movements'. Also 'pregnancy unconfirmed by ultrasound' was added to the descriptor 'light vaginal bleeding'. In addition, the contents were displayed in a different lay-out.

Delphi method

Consensus was reached during the second Delphi round, as 57 (91.9%) of the 62 participants considered the obstetric triage guideline to be complete, correct, user-friendly and well-designed. Sixty-one (98.4%) participants regarded the newly designed triage guideline and judged it was ready to implement the telephone triage in daily practice (Figure 1, 2).

Clinical correctness and completeness

After the first Delphi round, the clinical correctness was regarded as good by 44 participants (71.0%). Suggested additions were incorporated into the obstetric triage guideline, for instance 'limbs and hands' was added to the 'itch' descriptor. In the second Delphi round, the obstetric triage guideline was regarded as correct by 55 participants (88.7%).

The obstetric triage guideline (version 4) was judged as clinically complete by 55 participants (88.7%) after the first Delphi round. Only a few additions were incorporated into the triage guideline, such as more information about the 'breakdown of vital parameters' diagram. During the second Delphi round, 54 participants (85.7%) stated that the obstetric triage guideline (version 5) was sufficiently complete. Five participants who did not deem the obstetric triage guideline to be complete stated that minor additions and a few corrections to the content of the self-care advice were necessary.

User-friendliness and design

During the first Delphi round, the PDF version of the triage guideline was rated as user-friendly by 25 (41.6%) participants. During the second Delphi round, 59 (95.9%) participants considered the obstetric triage guideline to be user-friendly. The design was rated as good and attractive by 47 (75.8%) participants of the first Delphi round. During the second Delphi round, 61 (98.4%) participants stated that the design was sufficient.

Various points of improvement were suggested by the participants, most of which were related to support the user-friendliness in the form of digital aids and posters. Participants also indicated that the user-friendliness could be increased by developing a specific training and implementation program. The obstetric triage guideline was amended in response to the feedback submitted during the first Delphi round. Suggestions were also made with respect to improving digital support and designing posters, including a schematic overview of all presenting symptoms (Figure 2). A schematic overview of a structured triage consultation was designed (Figure 3).

OVERVIEW OF PRESENTING SYMPTOMS OBSTETRIC TRIAGE GUIDELINE

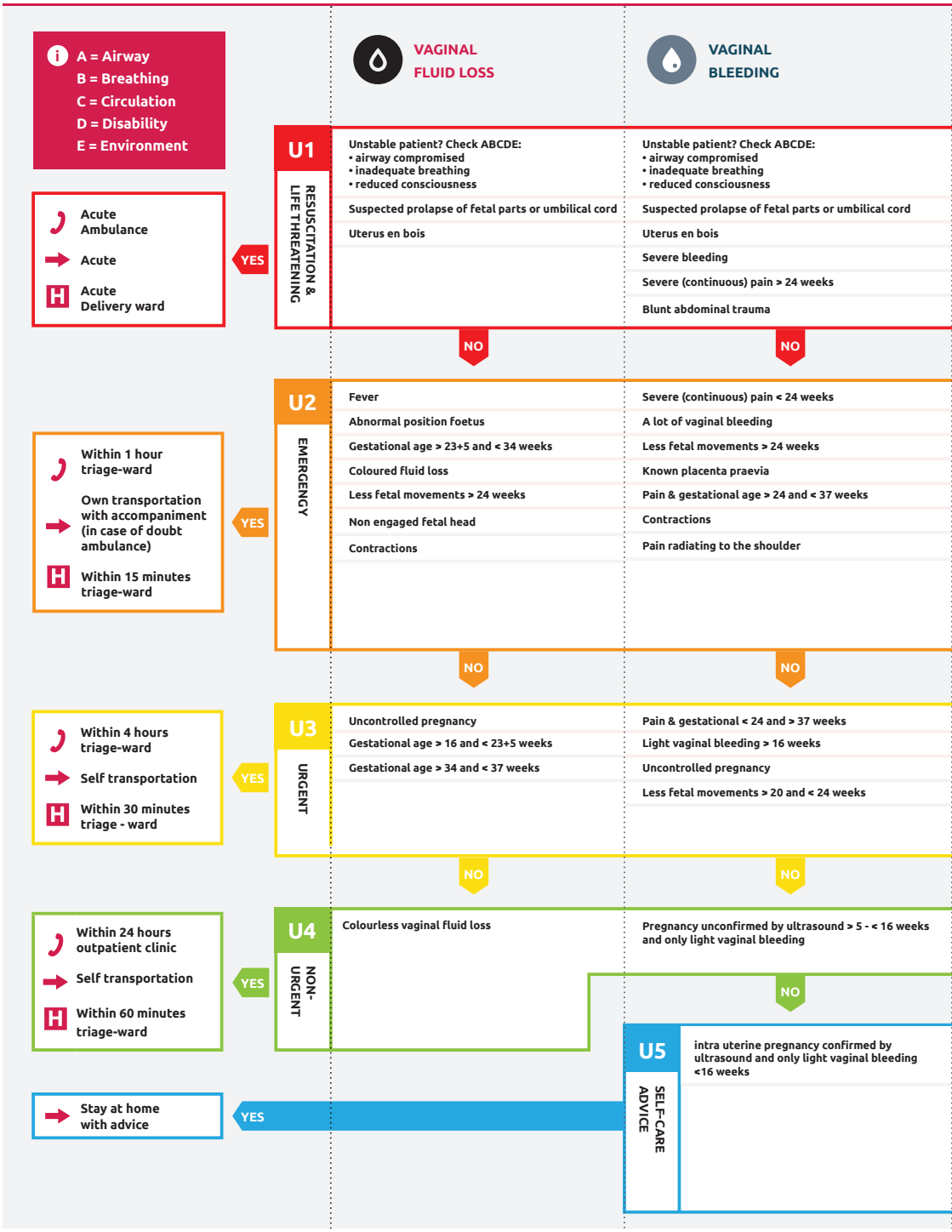

Figure 2: *Complete triage guideline - overview of presenting symptoms and prioritization categories (U= urgency)*

Legend:

Telephone → Transport H Hospital

ABDOMINAL PAIN

Unstable patient? Check ABCDE:
- airway compromised
- inadequate breathing
- reduced consciousness

Suspected prolapse of fetal parts or umbilical cord

Uterus en bois

NO

Colored fluid loss

Severe pain < 24 weeks

Less fetal movements > 24 weeks

Fever

Pain radiating to the shoulder

A lot of vaginal bleeding

Pain & gestational age > 24 weeks

Contractions

Blunt-abdominal trauma

Epigastric pain + vomiting or upper abdominal pain

NO

Pain & gestational < 24 weeks

Light vaginal bleeding

Uncontrolled pregnancy

Vaginal fluid loss colorless

Persistent vomiting

Diarrhea or constipation

NO

Dysuria

NO

CONCERNED PREGNANT WOMAN / NON-SOMATIC SYMPTOMS

(less fetal movements)

Unstable patient? Check ABCDE:
- airway compromised
- inadequate breathing
- reduced consciousness

Suspected prolapse of fetal parts or umbilical cord

- Vaginal fluid loss
- Vaginal fluid loss
- Abdominal pain
- Other somatic symptoms

NO

Absence or less fetal movements > 24 weeks

In panic

Confused

High risk of self injury

NO

Problematic previous history

Environmental factors

Psychosocial problems

Anxious

Less fetal movements > 20 and < 24 weeks

NO

Feeling no fetal movements < 20 weeks

Less fetal movements < 2 hours

OTHER SOMATIC SYMPTOMS

(related to hypertension disorder / HELLP and all women post-partum)

Unstable patient? Check ABCDE:
- airway compromised
- inadequate breathing
- reduced consciousness

Uterus en bois

Severe chest pain < 12 hours

NO

Severe pain

Seriously ill

Severe chest pain > 12 hours

Dyspnea < 24 hours

Headache + visual complaints

Vomiting/diarrhea and diabetes

Epigastric pain + vomiting or upper abdominal pain

Pain radiating to the shoulder

Severe chest pain < 12 hours

NO

Back pain

Headache

Stomach ache

Pleural pain

Complaints of extremities

Itching extremities (hands or feet)

Fever

Complaints < 24 hours

Exacerbate existing complaints in the last 24 hours

Uncontrolled pregnancy

NO

Oedema

Headache (cold) without any other symptoms

Hemorrhoids

Constipation

Morning sickness

Pelvic pain (lower back pain)

Diarrhea

Triage - consultation

1 Structured phone response (name of hospital, profession and own name)

2 Note and verify basic characteristics of patient
- name and date of birth
- residence and phonenumber at **THIS** moment
- open patient file

3 Assessment of ABCDE stability
Resuscitation?
D (disability)
A (airway)
B (breathing)
C (circulation)

4 Reason for contact of help

5 Choose presenting symptom
- **Vaginal fluid loss**
- **Vaginal blood loss**
- **Abdominal pain**
- **Concerned pregnant woman / non-somatic symptoms** (less fetal movements)
- **Other somatic symptoms** (related to hypertension disorder / HELLP and all postpartum women)

6 Choose prioritisation category

Assessment whether there are other triage-criteria such as alarm signs, high risk factors or contextual factors

	Telephone triage (time and place)	Physical triage (time and place)		
Resuscitation & life threatening	Acute Ambulance		**Red**	**U1**
Emergency	Within 1 hour triage-ward	Within 15 minutes triage-ward	**Orange**	**U2**
Urgent	Within 4 hours triage-ward	Within 30 minutes triage-ward	**Yellow**	**U3**
Non-Urgent	Within 24 hours outpatient clinic	Within 60 minutes triage-ward	**Green**	**U4**
Self-care advice			**Blue**	**U5**

7 Choose and organise the follow-up
Telephone → **Transport** **H** **Hospital**

8 Obtain the patient's commitment

Figure 3: Schematic overview of telephone triage

Discussion

Using a multi-phase study, a telephone triage guideline for unplanned obstetric care by telephone was developed in co-creation with professionals. Consensus was reached and the guideline was judged ready for transfer into obstetric practice. To the best of our knowledge, the present study is the first to explore consensus on the content and design of obstetric triage by telephone.

In the development of this telephone triage guideline, all relevant stakeholders were involved. Involvement and co-creation with stakeholders in the developmental phase of a service-design has been recognizes in literature to be of great importance in order to successfully implement innovations in daily practice[19,20].

Our findings suggest that when introducing changes to clinical practice such as the implementation of a new working method in the department, involving new tasks and responsibilities, the chances of success will be improved by training of those affected by the change, in our case the triage nurses. This should receive attention during the implementation phase of the guideline. An important aspect is to develop a contextual thinking capacity, i.e. to be able to take into account specific circumstances, contexts and complexity[21]. Previous studies[7,10] also found that investments need to be made in the learning capacity of triage specialists so that they can properly operate within the digital environment of triage. The need for training and incorporation of the triage guideline into the electronic patient records used were also an important outcome of the focus groups and the first Delphi round. Furthermore, training and supervision during implementation need to be developed as an important part of achieving a high-quality, properly functioning triage guideline[3,5,7,22,23].

The obstetric telephone triage guideline was developed as a tool to be used by triage nurses. If used correctly, the guideline should not reduce professional autonomy or responsibility. Given the current defensive culture within healthcare, any deviation from a guideline can be experienced as an ethical dilemma[24]. Attention must be paid to this fact if this guideline becomes part of obstetric care. The guideline should be used based on a combination of professional insight and patient preferences in accordance with the concept of evidence-based practice[25]. Users clinical insight and the feeling that something is 'not right' should be taken into account when making decisions[26,27]. Research on general emergency care has shown that this 'not-right' feeling is important and constitutes a legitimate reason for changing the prioritization category[4,28].

A strength of this study was the use of different research methods that were continually analyzed and evaluated (triangulation)[29]. In addition, all professional groups equally participated in the focus groups, training sessions and Delphi rounds, with a high level of response. In this study the minimum degree of consensus required was set at 90%.
Due to a strong demand for a telephone obstetric triage guideline[3] our study has a high degree of clinical relevance. In the Netherlands, the use of this obstetric telephone triage guideline is rapidly expanding. And a structured approach to unplanned obstetric care requests has also become one of the quality marks in accreditation guidelines for hospital care. Our study shows that it is possible to use an inclusive framework to ensure that clinical professionals can work jointly to develop a high-quality, clinical correct and complete telephone triage guideline, with corresponding scientific evaluations. For the international field, this triage guideline may serve as a useful tool or as an example to be tailored to local culture and context.

Having reached consensus about the content of the obstetric telephone triage guideline, the next step will be to examine its reliability and diagnostic validity. The validity of the triage guidelines used in general emergency care was found to vary significantly[5]. To provide clarity about the validity of the obstetric telephone triage guideline, a prospective observational study at various hospitals is under construction as recommended[5,29,30].

Conclusion

Using the existing obstetric physical triage system ROTS as a basis, we developed an obstetric telephone triage guideline, which was judged by professional users to be clinically complete, correct, well-designed and user-friendly.

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3

Validation of Dutch Obstetric Telephone Triage system:

a prospective validation study

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Abstract

Objective and purpose:
A triage system that prioritizes care according to medical urgency has a favorable effect on safety and efficiency of emergency care. The Dutch obstetric telephone triage system is comparable to physical triage systems. It consists of five urgency levels: resuscitation & life threatening (U1), emergency (U2), urgent (U3), non-urgent (U4) and self-care advice (U5). The purpose of this study was to determine the diagnostic and external validity of the Dutch obstetric telephone triage system in obstetric emergency care.

Patients and methods:
The validity of the Dutch obstetric telephone triage system was studied in a prospective observational study in four hospitals. Diagnostic validity of usual care was determined by comparing the assigned urgency level of the Dutch obstetric telephone triage system with a reference standard. This reference standard was obtained by face-to-face clinical assessment in hospital following telephone triage. Clinical follow-up after assessment was also recorded. For statistical analyses urgency levels were dichotomized into high urgency (U1, U2) and intermediate urgency (U3, U4). Self-care advice (U5) could not be studied because these patients were not referred to hospital.

Results:
In total, 983 cases (U1-U4), across the four hospitals were included, 625 (64%) cases were categorized as high urgency and 358 (36%) as intermediate urgency. The Dutch obstetric telephone triage system's urgency level agreed with the reference standard in 53% (n=525; 95%CI 50-57%). According to the reference standard the Dutch obstetric telephone triage system had undertriage in 16% (n=160) and overtriage in 30% (n=298) of the cases. Sensitivity for high urgency was 76% (95%CI 72-80), specificity 49% (95%CI 44-53). Positive predictive value and negative predictive value was 60% (95%CI 56-63) and 67% (95%CI 62-72) respectively. After clinical assessment urgent care was needed in 8,7% (n=31) of the intermediate-urgency cases, none of these cases were life threatening situations.

Conclusion:
DOTTS shows an acceptable diagnostic validity with room for improvement.

Keywords:
Telephone triage; Diagnostic validity; External validity; Under-triage; Sensitivity; Obstetric emergency care

Introduction

The increased volume of obstetric emergency care and the pursuit of high-quality interpretation and documentation of unplanned obstetric care consultations, require improvement of current care processes[1-3]. A triage system by telephone that prioritizes care according to urgency is known to have a favorable effect on safety and efficiency of emergency care[4-8].

The Manchester Triage system (MTS), Canadian Triage and Acuity Scale (CTAS) and Emergency Severity Index (ESI) are commonly used in emergency departments worldwide[5,9]. However, triage systems for emergency departments are not specific enough for unplanned obstetric care. Therefore, in several countries obstetric physical triage systems have been developed, e.g., in Canada the Obstetric Triage Acuity Scale (OTAS)[10-12], in the United States the Maternal Fetal Triage Index (MFTI) and in the United Kingdom, the Birmingham Symptoms specific Obstetric Triage System (BSOTS)[2,13,14]. In Switzerland, an obstetric section has been added to the general Swiss Emergency Triage Scale (SETS)[3,15]. Recently the Iranian Obstetric Triage Index (IOTI) has been developed in Iran (2020)[16].

All these triage systems are based on consensus of opinion by experts. Evaluation of triage systems involves assessments of validity and reliability. Triage can be viewed as a diagnostic assessment; therefore, the methodology of diagnostic studies is applicable. However, no diagnostic validation studies have been performed for obstetric physical triage systems[2,3,10,11,13-16]. Diagnostic validation studies of triage should ideally evaluate whether the triage process accurately predicts the correct level of urgency. However, there is no single outcome measure that captures the concept of urgency[17]. Validation of (non-obstetric) triage systems in different studies is commonly based on some of the following outcomes; the agreement of the system with expert opinions, assessment of vital signs, admission to intensive care unit (ICU), death, need for operations and/or follow-up[5].

In addition to assessment of internal validity, where studies are performed in a single setting, external validity can also be studied. External validity is based on studies in different settings[17]. Diagnostic validity of triage systems used in different emergency departments show a wide variation of existing scales and also a wide variation of results[5,9]. Diagnostic external validity of MTS shows an agreement of triage of 49.7-61.6% with a 6.2 -14.1% range of undertriage and a 26.9- 44.0% range of overtriage; sensitivity is reported to be between 0.47 and 0.87 and specificity between 0.83 and 0.89[9]. Analyses of the diagnostic validity of MTS, ESI and CTAS show sensitivity values of 0.58 - 0.88 and specificity values of 0.59 - 0.84 for ICU admission. And hospitalization or discharge after the emergency visit had a sensitivity of 0.08 - 0.65 and a specificity of 0.64 - 0.98 for low urgency patients[5]. The obstetric triage systems SETS and MTFI show

higher agreement. Agreement was 78.4% with SETS and 72.9% with MFTI, both had no purpose to search for diagnostic validity. No diagnostic validation studies have been performed for OTAS, BSOTS, IOTI[10,11,14,16].

It is important to note, that all these triage systems[2,3,5,9-11,13-16] have been developed to determine the urgency of care requests by means of physical (face-to-face) triage. In practice, most women call first to ask whether it is necessary to have a consultation[18,19]. To provide a uniform and practical basis for estimating the severity of symptoms of unplanned obstetric or other emergency obstetric care requests by telephone, the Dutch obstetric telephone triage system (DOTTS) was developed. DOTTS is an evidence-based guideline for obstetric telephone triage and is developed through a multi-phase multi-center study with relevant stakeholders. DOTTS was introduced in 2015 and is currently used in 25% of all Dutch hospitals (n=20/78)[20-22]. The purpose of the present study was to determine the diagnostic and external validity of DOTTS in obstetric emergency care.

Material and methods

Design

The diagnostic and external validity of DOTTS were studied in a prospective observational study. Diagnostic validity was determined by comparing the assigned urgency level of DOTTS with a reference standard. This reference standard was the urgency level of DOTTS determined by a medical doctor (obstetrician in training) or hospital midwife, after clinical assessment during follow-up in the hospital. Also, patients' follow-up after assessment was studied. Patients' follow-up was recorded in two classifications: 1) urgent care (hospitalization – life threatening situation or hospitalization with treatment or preterm labor) and 2) non-urgent care (hospitalization without treatment or in labor after 37 weeks or home after consultation). The external validity was determined by comparing the results of four hospitals.

DOTTS consists of five presenting symptoms: fluid loss, vaginal bleeding, abdominal pain, concerned pregnant/non-somatic symptoms and other physical symptoms. DOTTS is comparable to other triage system, in that it consists of five urgency levels: resuscitation & life threatening, emergency, urgent, non-urgent and self-care advice. Staff is given the opportunity to overrule the DOTTS urgency category[22].

Participants, organizational context and study period

To test external validity, four different hospitals were included in this study. Hospital A, B and C are teaching hospitals, hospital A and C each with approximately 3100 deliveries per year. Hospital B is one of the largest in the Netherlands, with over 6100 deliveries per year. Hospital D is a smaller, non-teaching hospital, with about 1100 deli-

veries a year. Three hospitals have a stand-alone triage department next to the delivery ward. In one hospital, the triage consultations are performed in the delivery ward. The four hospitals are geographically spread out throughout the Netherlands.
In all hospitals DOTTS was implemented into usual care by way of protocol change. The implementation process of DOTTS was individually guided: a digital application was built in the main hospital's information system and was accessible in the patient's record. In addition, specific training was given to the staff responsible of triage (obstetrical nurses or doctor's assistants). Furthermore, all professionals from the reference standard followed an information session and received written information about this research. A special application was added to the patient's digital record in which entering of the reference standard items was obligatory. In each hospital, a medical professional was available for any questions to the research.

The study was conducted in Hospital A between April 2018 and September 2019. In Hospital B between March to December 2018. In Hospital C between July 2017 and December 2018, and Hospital D between June 2018 and November 2019. This study period depended on the date of implementation of DOTTS.

Data collection and statistical analysis
During every telephone call triage staff used DOTTS to record patients' characteristics, categories of presenting symptoms and urgency levels in a digital application in patient's record. Patient characteristics gathered were: age, gestational age, gravidity/parity, singleton/multiple pregnancy, presenting symptoms and urgency levels. Triage staff were able to overrule DOTTS, if they didn't agree with the classification. Urgency levels assigned by triage staff, even overruled, was used during analysis. Only comparison of urgency categories U1-U4 (resuscitation & life threatening, emergency, urgent, non-urgent) could be studied. As category U5 (self-care advice) resulted in the patient not being referred to the hospital.

Following face-to-face clinical assessment, the urgency of referral (reference standard) based on presenting symptoms, urgency levels (U1-U5) and follow-up after assessment were also recorded in the patient's record. In the application, the reference standard was guided to prevent them from personal interpretations of the complaints by using three questions with fixed answers. In this way, urgency levels and follow-up were structured into fixed categories.

The validity of DOTTS was determined by comparing the outcome of the urgency level assigned by DOTTS with the independent reference standard. Agreed, over- and undertriage using DOTTS were calculated. Agreed triage was defined as the proportion of patients who had exactly the same urgency level as a result of assessment via DOTTS,

compared to the assessed urgency level from the reference standard. Over- and undertriage were defined as the proportion of patients who respectively had a higher or lower urgency level as a result of assessment via DOTTS, compared to the assessed urgency level from the reference standard. In addition, sensitivity, specificity, positive predictive value, negative predictive value and likelihood ratios were determined for cases classified as high urgency. Patients' urgency levels were dichotomized into high urgency (U1, U2) and intermediate urgency (U3, U4). Also likelihood ratios were calculated to assess the goodness of fit of DOTTS versus the reference standard.

The results from all hospitals were analyzed collectively to determine external validity, and per hospital to determine internal validity. Weighted analyses were performed to correct for over or underrepresentation of characteristics caused by different numbers of cases per hospital.

To test the clinical relevance of DOTTS, follow-up data were also analyzed. Patients' follow-up was recorded in two classifications: 1) urgent care (hospitalization – life threatening situation or hospitalization **with** treatment or preterm labor) and 2) non-urgent care (hospitalization **without** treatment or in labor after 37 weeks or home after consultation). Analysis was by, which care was provided after the consultation (urgent or non-urgent), in comparison with the classification according to DOTTS (high or intermediate urgency). During the follow-up analysis we expected cases categorized in DOTTS as intermediate urgency, would result in little-to-no (clinical) classification of patients as requiring urgent care (i.e., hospitalization).

All analyses were performed using SPSS, version 26.

Ethical approval

The study was submitted to and approved by the daily Boards of the Medical Research Ethics Committees United (MEC-U) and the Medical Ethics Committee of Leiden University Medical Center (LUMC) Act (W.16.053 & P17.075/PG/pg). As a result of these reviews, the boards declared that the rules laid down in the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) do not apply to the study and according to their judgement there was no ethical objection to perform the study.

In accordance with Dutch legal agreements, an application statement has been requested and obtained within each hospital. In this way, permission was obtained at the local level ethical committees for conducting the research. The study started when DOTTS was offered regularly.

In the Netherlands, all pregnant women are informed during the first antenatal checkup about the use of their perinatal data for scientific research and about the

opting out procedure. Withdrawal can be asked at any moment and without explanation or reason and without consequences for delivered care. Withdrawal was recorded in the Electronic Patient File. Privacy is guaranteed in accordance with Dutch legislation. Clients' anonymity was maintained by using anonymous patient identifiers.

Results

The outcomes of DOTTS were compared with the reference standard in 983 triage consultations (hospital A: 624 cases, hospital B: 193 cases, hospital C: 116 and hospital D: 50). Mean age of patients was 31 years (SD 5) and mean gestational age 32+4 weeks. 382 nullipara's (38.9%) and 597 multiparous (60.7%) women were included. In four cases parity was unknown (0.4%). Most pregnancies were singleton: 878 (89.3%); 91 (9.3%) were multiple (14 missing/unknown (1.4%)) (Table 1). In 13 (1.3%) cases triage staff overruled the urgency level of DOTTS.

Hospital, Number of patients triaged = n, (%)*	**Hospital A n=624 (63)**	**Hospital B n=193 (19)**	**Hospital C n=116 (11)**	**Hospital D n=50 (5)**	**Total n=983 (100)**
Mean age years, mean (SD)	31 (5)	32 (5)	30 (5)	30 (4)	31 (5)
Gestational age days, mean (SD)	230 (49)	217 (60)	220 (58)	257 (31)	227 (53)
Parity**					
• Multiparous, n (%)*	371 (60)	112 (58)	86 (74)	28 (56)	597 (61)
Singleton, n (%)* ‡	558 (89)	178 (92)	95 (93)	47 (94)	878 (89)
Number of cases where DOTTS overrruled, n	5	3	5	0	13
Urgency levels, n (%)*					
• U1 – Resuscitation	2 (0)	0 (0)	0 (0)	1 (2)	3 (0)
• and life-threatening					
• U2 – Emergency	406 (65)	118 (61)	71 (61)	27 (54)	622 (63)
• U3 – Urgent	162 (26)	65 (34)	42 (36)	16 (32)	285 (29)
• U4 – Not Urgent	54 (9)	10 (5)	3 (3)	6 (12)	73 (7)
Presenting symptoms, n (%)* ^					
Abdominal pain	166 (27)	60 (31)	26 (22)	11 (22)	263 (27)
Anxious pregnant woman/ non-somatic symptoms	135 (22)	56 (29)	26 (22)	14 (28)	231 (23)
Vaginal fluid loss	93 (15)	21 (11)	11 (9)	11 (22)	36 (14)
Other physical symptoms	76 (12)	22 (11)	29 (25)	3 (6)	130 (13)
Vaginal bleeding	70 (11)	29 (15)	16 (14)	5 (10)	120 (12)
Two or more complaints	84 (13)	0 (0)	0 (0)	6 (12)	90 (9)

* due to rounding the percentages do not add to 100%
** Missing Parity n=4
‡ Missing Singleton n=14
^ Missing Presenting symptoms n=13

Table 1: *Characteristics of study population and presenting symptoms*
The urgency level U2 (emergency) was the level most often registered (n=622, 63%). In total 625 (64%) cases were categorized as high urgency and 358 (36%) as intermediate urgency. Abdominal pain (n=263, 27%) was the most common presenting symptom followed by anxious pregnant woman/non-somatic symptoms (n=231, 23%) (Table 1).

DOTTS' urgency level fully agreed with the reference standard in 53% (n=525; 95%CI 50-57) of cases. In total, undertriage by DOTTS was seen in 16% of cases (n=160) and overtriage in 30% (n=298) according to the reference standard. In 85% (n=135) of cases the amount of undertriage in DOTTS compared to the reference standard was one category and in 15 % (n=25) more than one category. In 74% (n=220) of the cases the amount of overtriage by DOTTS was one category, and in 26% (n=78) more than one category (figure 1).

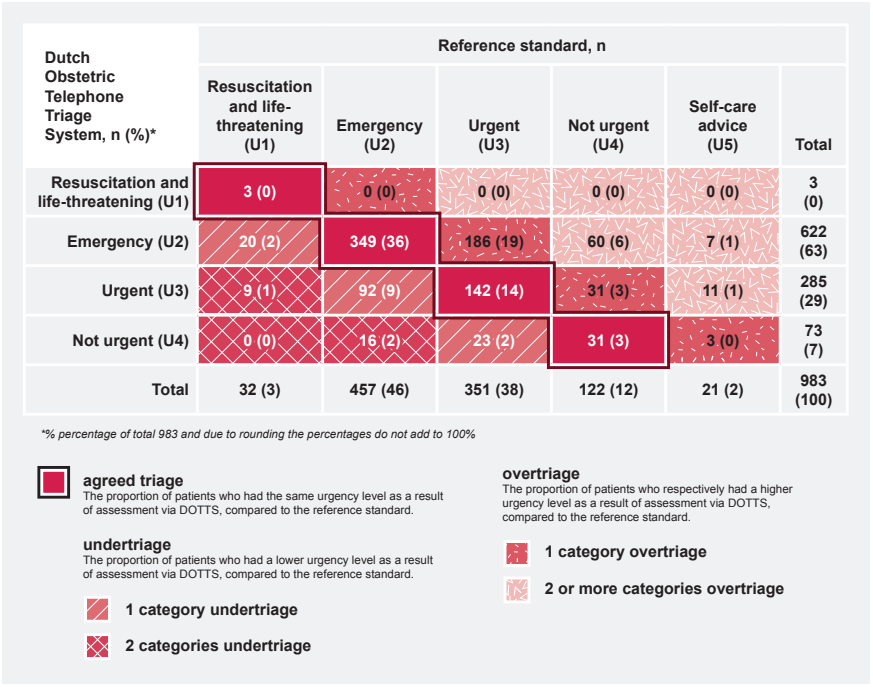

Figure 1: *DOTTS compared with reference standard*

Overall sensitivity of DOTTS was 76% (95%CI 72-80), and specificity 49% (95%CI 44-53). The overall positive predictive value (PPV) was 60% (95%CI 56-63) and the overall negative predictive value (NPV) 67% (95%CI 62-72) (table 2). Weighted analysis did not reveal significant differences (sensitivity 75% (95%CI 69-80), specificity, 50% (95%CI 46-53), PPV 59% (95%CI 56-62) and NPV 67% (95%CI 63-71) (table 2). Likelihood ratios were LR+ 1.49 LR- 0.49 which indicates that DOTTS is a well-fitting triage system.

	Total cases, n	Sensitivity % (95%CI)	Specificity % (95%CI)	Positive predictive value (PPV) % (95%CI)	Negative predictive value (NPV)% (95%CI)
All hospitals	**983**	**76 (72-80)**	**49 (44-53)**	**60 (56-63)**	**67 (62-72)**
Hospital A	624	77 (69-86)	47 (41-52)	60 (55-64)	67 (61-74)
Hospital B	193	76 (61-91)	54 (44-65)	64 (55-72)	68 (57-79)
Hospital C	116	75 (54-96)	50 (38-63)	55 (43-67)	71 (58-85)
Hospital D	50	63 (37-88)	50 (30-70)	54 (35-72)	59 (38-80)

Table 2: *Diagnostic validity of the Dutch Obstetric Telephone Triage System for the category 'high urgency' per hospital*

There were no life-threatening cases classified with DOTTS as intermediate urgency. However, 31 (9%) patients who were classified by DOTTS as intermediate urgency received hospitalization with treatment. Overall, when high and intermediate urgency were combined, in most cases (n=753, 77%) only a consultation was needed (table 3).

		Follow-up after assessment		
Dutch Obstetric Telephone Triage System		Urgent Care, n (%) *Hospitalization – life threatening situation* *Hospitalization **with** treatment or in labor before 37 weeks*	Non-urgent care, n (%) *Hospitalization **without** treatment orin labor after 37 weeks* *Home after consultation*	Total, n (%)
	High Urgency*, n (%)	47 (60) *5* *42*	572 (64) *89* *483*	625 (64)
	Intermediate urgency Urgency**, n (%)	31 (40) *0* *31*	321(36) *51* *270*	358 (36)
	Total (%)	78 (100)	893 (100)	983 (100)

* Missing high urgency 6 ** Missing intermediate urgency 6

Table 3: *Urgency of care after clinical assessment*

Discussion

To the best of our knowledge, the present study is the first diagnostic validity study of an obstetric triage by telephone. DOTTS compared to a reference standard has an agreement of 53% (95%CI 50-57), and there was overtriage in 30% and undertriage in 16% of the cases. The overall sensitivity and specificity were 76% and 49%. After clinical assessment urgent care was needed in 8.7% (n=31) of the intermediate-urgency cases, none of these cases were life threatening situations. Due to absence of diagnostic validation studies for obstetric triage systems, we compared the results of our study with previous studies of physical triage systems, such as MTS, CTAS and ESI, used in general emergency. The validity of DOTTS is comparable to, or slightly better than the results of these systems. Diagnostic external validity of MTS showed an agreement of 50 – 62% with a range of 6 – 14% undertriage and a range of 27 – 44% overtriage; sensitivity was found to be 0.47 – 0.87 and specificity 0.83 – 0.89[9]. Analyses of the diagnostic validity of MTS, ESI and CTAS showed a sensitivity of 0.58 – 0.88 and specificity 0.59 – 0.84 for ICU admission[5]. However, due to the level of heterogeneity demonstrated in the literature these figures are difficult to compare.

Validity studies of MFTI and SETS, both physical triage systems at obstetric departments, with agreement percentages of 72.9 and 78.4% respectively, show better agreement compared to DOTTS. Sensitivity and specificity have not been studied for these systems[13,15]. These studies are about a different type of validity and due to heterogenicity of methods and quality of studies, it is difficult to compare these studies[3].

In this study we compared triage by telephone with a reference standard after clinical (physical) assessment. Telephone triage has more challenges compared to physical triage; such as, the lack of clinical assessment and initial diagnostic examinations[6,18,19]. In our study clinical assessment occurred later, after some waiting time (for example at home and/or during transport to the hospital) and after being able to do diagnostic tests, such as measuring blood pressure and monitoring fetal condition. It is unclear what effect waiting time and the results of availability of these tests have on the reference standard. However, we followed the method of Moll (2009), which advises to stay close to the reality of clinical practice. Moll argues that, as compared to diagnostic tests, there is no single outcome measure that captures the concept and therefore, researchers have to select the best proxy as a reference standard. This proxy, in our study and comparable studies, is the ultimate clinical decision that has been made, based upon the doctor's opinion, including physical examination and (laboratory) tests[17].

The sensitivity in our study is higher compared to specificity, indicating that DOTTS is able to classify highly urgent cases better than intermediate urgent cases. The likelihood ratio supported this outcome. This is of high clinical importance, as a triage

system is meant to classify the need for highly urgent care. In studies on physical triage in general emergency care, the opposite was observed. Further research is essential to confirm a hypothetical explanation regarding factors such as the difference in number of cases examined in this study and the difference in the amount of presenting symptoms. To increase agreement of triage sensitivity, specificity, PPV and NPV follow-up research, with special attention for sub-analysis, is needed. Undertriage should be avoided in a triage system, as it can be assumed that this could cause irreversible health damage as a result of waiting time. Every single case involving undertriage can indicate factors, which can be used to consider improvement of quality in future[23,24].

In addition to a good assessment of medical urgency, a telephone triage system is also intended to provide a good distribution of resources and to avoid unnecessary consultations. With a 49% level of specificity (95%CI 44-53) it can be said that DOTTS does not provide sufficient differentiation in the 'intermediate urgency' category. These findings are consistent with the literature[4,25]. While some overtriage can be explained by the lack of diagnostic examinations; we should review this aspect critically. Clearly, further research is needed to explore specificity, especially what is required to reduce overtriage.

Various studies have been performed to test the validity of triage systems. However, the lack of homogeneity, especially the variety in outcome measures, makes this challenging[16,17]. Current evidence suggests that the use of a multivariate approach with external validation can be seen as the highest achievable goal[4,5,17]. The results of this study, which was conducted in line with this approach, as well as (earlier) confirmation of DOTTS content validity[22] support this conclusion. Nevertheless, we need to stay critical about whether triage can be compared to screening tool studies.

Separate analysis of the outcomes in each of the four included hospitals showed no significant differences. Therefore, the external validity of the system is sufficient[17]. The results for specificity, PPV and NPV were almost identical in the hospitals studied (table 2). However, the sensitivity between the hospitals varied between 63 and 77%. Reasons for this are not studied but could include differences in the type (teaching or non-teaching), location and/or size of the hospitals studied. It is known that regular exposure to triage is required to use it properly[5]. However, more research is necessary in order to confirm whether additional factors, such as those we suggest, can also influence the sensitivity of telephone triage systems.

In follow-up research, special attention should also be given to urgency level 5 (U5), which is self-care advice. It is a weakness in this research that it was not possible to include this category. It can lead to overestimating or underestimating of the accuracy

of DOTTS. At this moment, we can state that in obstetric practice of Dutch hospitals, people who contact for the same complaint a second time will always be present in this study. The reason is that the clinical procedure is that if a patient calls again about the same complaint within 24 hours, she will always come to the hospital for clinical assessment. Special attention was given to this clinical procedure during the specific training.

In addition to validity, evaluations of triage systems also involve assessment of reliability. Reliability refers to the degree of intra-observer and inter-observer variability of the system[3,17]. Results of studies, which consider both reliability and validity can indicate what improvements are needed in the future. Also, insight into sensitivity and specificity per presenting symptom could lead to improvement of the system[26]. In addition, more information regarding the quality of the telephone conversation is important. Knowledge of which social skills and medical knowledge triage staff needs, are of particular value for future improvements. Recordings of telephone calls for training purposes and audits could provide more insight[6-8].

This was a prospective study conducted in daily practice, in which we used the usual care outcomes as reference standard. In comparable studies, specific individuals or simulators were selected as reference standard[4,15]. In our study any medical doctor or midwife could provide the reference standard. This makes our reference standard representative of daily practice. However, in a validation study a reference standard must identify the true urgency and there is debate concerning the best way to choose the reference standard[9]. Other studies[27] have shown that experience plays a role in decision making in triage. Therefore, a potential limitation of our study could be that this might have unfavorably influenced our results: especially in the case where a study participant had limited work experience.

The results showed that by using DOTTS an estimate of urgency level can be made. Therefore, the use of DOTTS can be encouraged in obstetric practice. In near future, additional research of DOTTS is necessary. If the urgency of care can be adequately estimated by telephone, this contributes to better distribution of human and financial resources. Ultimately, the increasing volume of urgent care within maternity service provision makes this necessary. This is comparable with any crisis, such as during the current COVID-19 pandemic, in which scarcity of medical professionals necessitates evaluation of symptoms by telephone.

Conclusion

DOTTS shows an acceptable diagnostic validity with room for improvement. The overall sensitivity was 76%, and DOTTS compared to a reference standard has an agreement of 53%, and overtriage in 30% and undertriage in 16% of the cases. Future studies need to establish reliability and diagnostic validity of self-care advise (U5). Also, more insight into specificity could lead to improvement of the system.

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4

Reliability of Dutch Obstetric Telephone Triage

A vignette study

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Abstract:

Background:
Safety and efficiency of emergency care can be optimized with a triage system which uses urgency to prioritize care. The Dutch Obstetric Telephone Triage System (DOTTS) was developed to provide a basis for assessing urgency of unplanned obstetric care requests by telephone. Reliability and validity are important components in evaluating such (obstetric) triage systems.

Objective:
To determine the reliability of Dutch Obstetric Telephone Triage, by calculating the inter-rater- and intra-rater reliability.

Methods:
To evaluate the urgency levels of DOTTS by testing inter-rater- and intra-rater reliability, 90 vignettes of possible requests were developed. Nineteen participants, from hospitals where DOTTS had been implemented, rated in two rounds a set of ten vignettes. The five urgency levels and five presenting symptoms had an equal spread and had to be entered in accordance with DOTTS per vignette. Urgency levels were dichotomized into high urgency and intermediate urgency. Inter-rater-reliability was rated as degree of agreement between two different participants with the same vignette. Intra-rater-reliability was rated as agreement by the same participants at different moment in time. The degree of inter-rater- and intra-rater reliability was tested using weighted Cohen's Kappa and ICC.

Results:
The agreement of urgency level between participants in accordance with predefined urgency level per vignette was 90.5% (95%CI 87.5 – 93.6) [335 of 370]. Agreement of urgency level between participants was 88.5% (95%CI 84.9 – 93.0) [177 of 200] and 84.9% (95%CI 78.3 – 91.4) after re-rating [101 of 119]. Inter-rater-reliability of DOTTS expressed as Cohen's Kappa was 0.77 and as ICC 0.87; intra-rater-reliability of DOTTS expressed as Cohen's Kappa was 0.70 and as ICC 0.82.

Conclusion:
Inter-rater- and intra-rater-reliability of DOTTS showed substantial correlation, and is comparable to other studies. Therefore DOTTS is considered reliable.

Keywords:
Obstetrics; Triage system; Inter-observer agreement, Intra-observer agreement; Undertriage; Overtriage

Introduction

A triage system that prioritizes care according to urgency is known to have a favorable effect on safety and efficiency of emergency care[1-4]. Triage systems contain background information about presenting symptoms and urgency levels, which aim to indicate the maximum acceptable medical waiting time. Triage is applied during a telephone and/or physical contact when registering for an emergency department. Triage systems such as the Manchester Triage System (MTS), the Emergency Severity Index (ESI) and the Canadian Triage and Acuity Scale (CTAS) are commonly used for triage in emergency departments worldwide[5-8].

However, general triage systems are not sufficiently specific for use in obstetrics. Therefore, in recent years physical (face-to-face) triage systems have been developed specifically for obstetrics[6,9-15]. The Obstetric Triage Acuity Scale (OTAS) from Canada[6,10], Swiss Emergency Triage Scale (SETS)[11], Birmingham Symptom specific Obstetric Triage System (BSOTS) from United Kingdom[12] and Maternal Fetal Triage Index (MFTI) from the United States of America[13,14] are well established obstetric physical triage systems. More recently, the Iranian Obstetric Triage Index (IOTI) was developed and published (2020)[15]. The inter-rater reliability of the existing physical obstetric triage systems are moderate to good (ranging between Kappa 0.69 – 0.86 and Interclass correlation (ICC) 0.75 – 0.96). Intra-rater reliability showed an ICC of 0.81 for SETS[11] and a Kappa of 0.65 for OTAS (2016)[6]. Intra-rater correlations are unknown for BSOTS, MFTI and IOTI[9,12,13,15]. Due to the heterogeneity of methods, results and quality of the studies, it is difficult to compare these studies[9].

All of the obstetric systems discussed have been developed for physical (face-to-face) triage. In practice, in western society, it is usual for most women to first make a telephone call asking whether it is necessary to have a consultation at the emergency department[16,17]. Therefore, in most instances the first triage is performed by telephone and occurs before the pregnant woman is clinically rated. In order to apply the correct level of priority, accurate rating of the urgency is crucial. The Dutch Obstetric Telephone Triage System (DOTTS) aims to provide a uniform and practical triage system, and was developed through a multi-phase multi-center study in consultation with all stakeholders[18]. DOTTS is an evidence-based triage system, which uses presenting symptoms to classify the level of urgency. Recently published research into validity of DOTTS showed an acceptable diagnostic validity with room for improvement. The overall sensitivity was 76%, and DOTTS compared to a reference standard has an agreement of 53%, and overtriage in 30% and undertriage in 16% of the cases[19]. DOTTS was introduced in 2015 and is currently used in 26% of all Dutch hospitals (n=20/78)[18,20]. The purpose of this study is to determine the reliability of DOTTS.

Material and methods

This study aims to evaluate the reliability of DOTTS by testing inter-rater-reliability (IRR) and intra-rater-reliability (ITR) using vignettes.

DOTTS is comparable to other triage systems. It consists of five urgency levels: 1) resuscitation & life threatening 2) emergency 3) urgent 4) non-urgent 5) self-care. It uses five presenting symptoms: 1) fluid loss 2) vaginal bleeding 3) abdominal pain 4) non-somatic symptoms 5) other physical symptoms. In this study we focused on the reliability of assigning the correct urgency levels.

Participants and development vignettes

From hospitals where DOTTS was implemented, triage staff (obstetrical nurses or doctors assistants) were asked to participate. Each participant had completed practical training in the use of DOTTS at the time of implementation in their hospital and had a minimum work experience of 3 months with DOTTS.

In order to further guarantee a basic knowledge level of DOTTS, completion of an interactive e-learning developed for this study was mandatory. In the e-learning information was given about DOTTS, after which this knowledge was quizzed. In case of incorrect answers, new questions were asked, until the participant demonstrated sufficient knowledge of DOTTS. A certificate was given after completion of the e-learning. Only certified participants received vignettes.

Ninety vignettes were developed using real-life clinical situations. The vignettes described cases with one of the five urgency levels and the five presenting symptoms as used by DOTTS. The urgency levels and presenting symptoms were equally distributed (Supplementary material, table A). An expert panel, comprising seven midwives with expertise in DOTTS and obstetric emergency skills training, reviewed all vignettes for accuracy, credibility, and completeness. The vignettes were modelled to standardize the order of the information and incorporated into an online questionnaire (Qualtrics©).

These 90 vignettes were divided into nine sets. Each participant received a set of ten vignettes per round. In each round, each vignette was judged by a minimum of two participants. Each participant was blinded for the ratings of others. The minimum number of participants was set at 18 participants. This number was determined based on feasibility for participants. The expected time needed to complete both rounds was two hours.

Urgency levels and presenting symptoms had to be entered in accordance with DOTTS. To avoid recall bias, the contents of the sets in the second round differed from

the first round, with three vignettes changed, and an adjusted order of the other seven vignettes.

For reliability, a distinction is made between inter-rater reliability (IRR) and intra-rater-reliability (ITR). IRR of a triage system is the degree of agreement between different professionals, whereas ITR is agreement of the same professionals between different moments in time[9]. To determine IRR, the first round was sent between June and August 2020. After at least two months (September-October 2020) the vignettes were resent for the second round to determine ITR.

Data collection and statistical analysis
Collected participant characteristics were as follows: age, professional category (nurse or doctor's assistant), hospital, obstetric experience (years) and number of hours and patients per week in the triage ward. Analyses of participants' characteristics were presented as numbers (N) with percentages (%) or median with interquartile ranges (IQR) and ranges. All analyses were performed using SPSS, version 25.

Based on the information presented in the vignettes, participants were asked to assign an urgency level based on presenting symptoms. Agreement with DOTTS was analyzed by comparison of the urgency level. Agreed triage was defined as triage by the participant in accordance with the predefined level of urgency in DOTTS. Disagreement in triage was considered undertriage when the participant indicated a lower level of urgency and overtriage when a participant assigned a higher urgency level.

For statistical analyses urgency levels were dichotomized into high urgency (U1, U2) and intermediate urgency (U3, U4 and U5). This resulted in 40 vignettes in the high urgency category and 50 vignettes in the intermediate urgency category (Supplementary material, table A).

Inter-rater-reliability (IRR) and intra-rater-reliability (ITR) was rated by using a weighted Cohen's Kappa to account for agreement in classifications based on chance alone, for multiple raters and multiple categories. Also, two-way-mixed Intraclass Correlation Coefficient (ICC) was calculated, to enable comparison of the reliability of DOTTS with other published triage systems. Interpretation of Cohen's Kappa was done according to the arbitrary scaling of Landis and Koch, with a kappa between 0.61 and 0.80 indicating substantial correlation, and the values 0.81-1.0 indicating near perfect correlation[6, 9-13, 21]. Interpretation of ICC values was based on the scaling of Koo and Li, meaning good reliability (0.75-0.9) and moderate reliability (0.5 – 0.75)[22].

Urgency levels, n **Presenting symptoms, n**	**Resuscitation and life-threatening (U1)**	**Emergency (U2)**	**Urgent (U3**	**Not-Urgent (U4)**	**Self-care advice (U5)**	**Total**
Abdominal pain	4	4	4	4	4	20
Anxious pregnant woman/ non-somatic symptoms	n.e.	6	6	n.e.	4	16
Other physical symptoms	5	4	4	n.e.	4	17
Vaginal bleeding	4	4	4	4	4	20
Vaginal fluid loss	5	4	4	4	n.e.	17
Total per urgency	18	22	22	12	16	90
Total high- and intermediate urgency (dichotomized)	40 high urgency		50 intermediate urgency			

n.e. Nonexistent

Table A: *Vignettes - overview of distribution of urgency levels and presenting symptoms*

Ethical approval

The study was approved by the daily Boards of the Medical Research Ethics Committees United (MEC-U) and the Medical Ethics Committee of Leiden University Medical Center (LUMC) Act (W.16.053 & P17.075/PG/pg).

All participants provided digital informed consent to use the data for analyses. All data was anonymously processed. Participants were able to withdraw consent at any time, without any statement of reasons.

Results

Overall, nineteen participants took part, fifteen (79%) nurses and four (21%) doctors assistants. One professional did not participate in round two. To enable inclusion of all vignettes in calculation of IRR, the set of vignettes of the dropped out professional, was rated in round two by another professional. This makes a total of 370 ratings of vignettes, for the IRR 200 ratings were available and for ITR 119 (Figure 1).

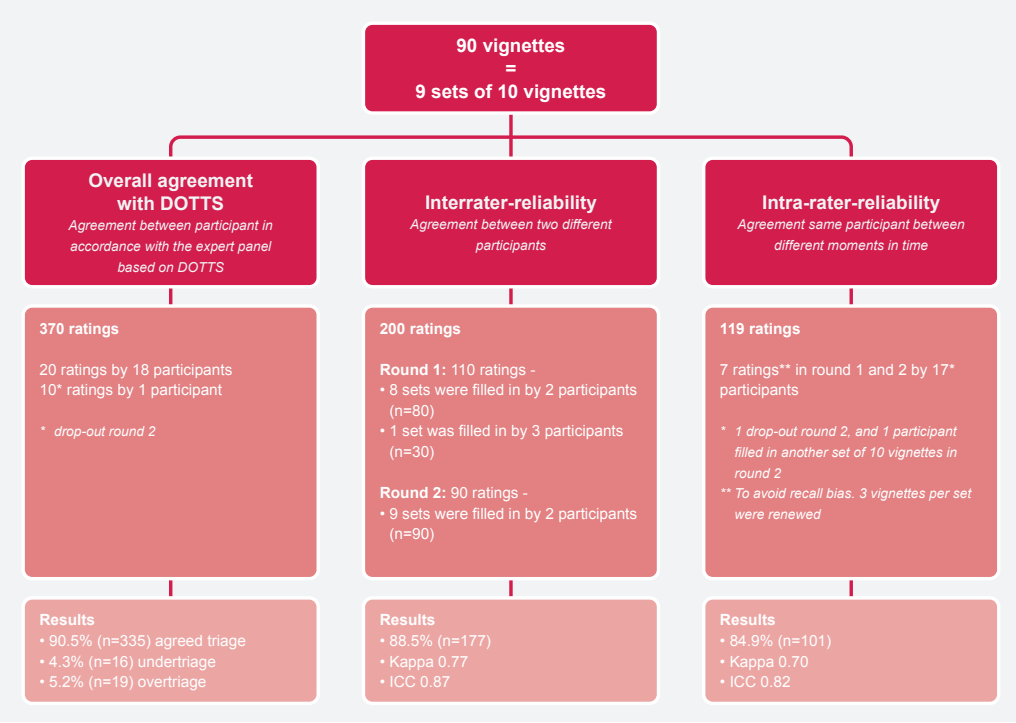

Figure 1: – *Schematic overview of participants, vignettes and results*

The participants had a median age of 53 years [IQR 44-55], and a median work experience in obstetrics of 20 years [IQR 8-33]. An overview of basic characteristics of participants, such as participation per hospital, working hours and experience with triage, is given in Table 1. Distribution of urgency levels and presenting symptoms were approximately equally divided (Table 1).

Participants, n (%)	**19 (100)**
Age, years median [IQR] (Range)	53.0 [44-55] (31)
Work experience in obstetrics, years median [IQR] (Range)	20.0 [8-33] (37)
Professional category	
Obstetrical nurse, n (%)	15 (78.9)
Doctor's assistants, n (%)	4 (21.1)
Hospital	
Academic hospital, n (%)	4 (21.1)
Teaching hospital, n (%)	9 (47.4)
Non-teaching hospital, n (%)	6 (31.6)
Exposure (average) to triage per week	
≥ 16 hours, n (%)	7 (36.8)
9-15 hours, n (%)	6 (31.6)
≤ 8 hours, n (%)	6 (31.6)
Exposure (average) to patients per week	
20-49 consults, n (%)	6 (31.6)
10-19 consults, n (%)	9 (47.4)
0-9 consults, n (%)	4 (21.1)
Vignettes - Urgency levels, n (%)	**90 (100)**
High urgency, n (%)	40 (44.4)
Intermediate urgency, n (%)	50 (55.5)
Vignettes - Presenting symptoms, n (%)	**90 (100)**
Abdominal pain, n (%)	20 (22.2)
Anxious pregnant woman/non-somatic symptoms, n (%)	16 (17.8)
Other physical symptoms, n (%)	17 (18.9)
Vaginal bleeding, n (%)	20 (22.2)
Vaginal fluid loss, n (%)	17 (18.9)

Table 1: – *Characteristics of participants and vignettes*

In total, 370 ratings were made. The overall agreement of urgency category was 90.5% (n=335). Undertriage was present in 4.3% of cases (n=16), overtriage was 5.2% (n=19) (Figure 1).

In total, 200 ratings were available to calculate IRR. In total 88 high urgency vignettes and 112 intermediate urgency vignettes were rated (Figure 1). Overall, in 88.5 % (n=177 of 200) the urgency categories were the same between two participants: IRR Kappa 0.77 (95%CI 0.68 – 0.86) and ICC 0.87 (95%CI 0.83 – 0.90) respectively. The level of agreement between participants in high urgency and intermediate urgency category was similar: 90.8 % (n=79 of 87), and 86.7 % (n=98 of 113) respectively (Table 2).

	Inter-rater-reliability **different participants with the same vignette**	**Intra-rater-reliability** **same participant at different moment in time**
Agreed triage, Total % (95%CI) [n]	88.5 (95%CI 84.9 – 93.0) [177/200]	84.9 (95%CI 78.3 – 91.4) [101/119]
High urgency category	90.8 (95%CI 84.6 – 97.0) [79/87]	90.1 (95%CI 81.8 – 98.5) [46/51]
Intermediate urgency category	87.5 (95%CI 80.3 – 93.1) [98/113]	80.9 (95%CI 71.3 – 90.4) [55/68]
Weighted Kappa**	0.77 (95%CI 0.68 – 0.86)	0.70 (95%CI 0.57 – 0.83)
Intraclass correlation coefficient+	0.87 (95%CI 0.83 – 0.90)	0.82 (95%CI 0.74 – 0.88)

**Scale references by Landis and Koch[21]: 0.61 – 0.80 = substantial correlation, 0.81 – 1.0 = near perfect correlation.
+Scale reference by Koo and Li[22]: 0.5 – 0.75 = moderate reliability and 0.75 – 0.9 good reliability

Table 2: *– Inter-rater- and intra-rater-reliability measures of DOTTS*

One hundred and nineteen vignettes were rated twice by the same participants. Of these vignettes, 51 had a high urgency level and 68 an intermediate urgency level. The ITR was calculated on these 119 paired ratings (Figure 1). Overall, in 84.9 % (n=101 of 119) of the urgency categories were rated the same in the first and second round: ITR Kappa 0.70 (95%CI 0.57 – 0.83) and ICC 0.82 (95%CI 0.74 – 0.88). In both rounds the participants scored 90.1% (n=46 of 51) the same in the high urgency category. In the intermediate urgency category this was 80.9 % (n=55 of 68) (Table 2).

Discussion

Overall agreement of urgency category was 90.5% (n=335). Agreement between the different participants (IRR) in using DOTTS was 88.5%, with weighted Kappa 0.77 and ICC 0.87. Agreement of the same participants between different moments in time (ITR), was 84.9%, with weighted Kappa 0.70 and ICC 0.82. Therefore, according to Landis and Koch's scale[21] our results demonstrate a substantial correlation and a good level of reliability according to Koo and Li[22]. A triage system is only beneficial if the reliability has been demonstrated by research[9]. These results confirm the internal consistency of DOTTS, the use of both measurements indicates the systematic reliability.

The reliability achieved for the DOTTS telephone triage system is comparable to that of physical (face-to-face) obstetric triage systems. In two studies in which reliability was reported, IRR of OTAS-2013 expressed as Kappa was 0.71 and that of SETS was expressed as ICC 0.75[10,11], this corresponds with the results of the reliability of DOTTS. Research of the ITR of OTAS-2016 showed a weighted Kappa of 0.65, and of SETS an ICC of 0.81[6, 11]. In their recent review, Moudi et al[9] showed that for obstetric triage systems, the quality of evidence is moderate to low, with only two systems (OTAS-2013 and SETS) presenting psychometric properties. Compared to these two triage systems, DOTTS shows comparable results (supplementary material - table B).

	Quality of evidence - conform review Moudi[9]	**Psychometric properties of reliability of obstetric triage tool - conform review Moudi[9]**	**Interrater reliability (IRR)**	**Intra-rater-reliability (ITR)**
OTAS-2013 Smitshon[9, 10]	Sufficient/ Moderate	Adequate	0.72 Kappa 0.79 Direct correlation coefficient	N.R.
SETS- 2017 Veit-Rubin[9, 11]	Sufficient / Low	Adequate	ICC 0.75 (95% CI 0.63 – 0.86)	ICC 0.81 (95% CI 0.73-0.89)
BSOTS-2017 Kenyon[9, 12]	Sufficient / Low	Doubtful	ICC 0.96 (95% CI 0.91 – 0.99)	N.R.
OTAS-2016 Gratton[6, 9]	Sufficient / Low	Doubtful	0.69 Kappa 0.77 Direct correlation coefficient	0.65 Kappa 0.74 Direct correlation coefficient
MFTI - 2015 Ruhl[9, 13]	Insufficient / Very low	Inadequate	0.65 Kappa	N.R.
IOI-2020 Moudi[15]	N.R.	N.R.	0.86 weighted Kappa (95% CI 0.81-0.91)	N.R.

N.R.: Not reported

Table B: *Overview Interrater- and Intra-rater-reliability and quality of evidence Obstetric Triage Systems*

The increased volume of obstetric emergency care and the pursuit of high-quality interpretation and documentation of unplanned obstetric care consultations require improvement of current care processes[9,14,23]. Nowadays, obstetric triage systems are being used more often in clinical practice[6,9–11,13,15,18]. A telephone triage system adds to this development. In addition, the use of a valid and reliable telephone triage system contributes to the correct distribution of patients and resources. This is increasingly necessary due to the growing concentration of acute care in obstetrics in general and is particularly relevant during the current COVID-19 pandemic[24].

Currently, DOTTS already has a digital application that supports clinical decision-making with algorithms suitable for use in every electronic patients' dossier. This is comparable to other triage systems that incorporate clinical decision support systems, to aid in the evaluation of patients' health conditions[2]. In future, DOTTS algorithms may benefit from more supporting technologies such as automatically calling of an ambulance and adding home-measurements of vital parameters such as saturation, blood pressure and fetal assessment by cardiotocography (CTG)[25]. Also, video observation and communication by healthcare professionals provide additional information such as assessment of the clinical status of the patient and/or the observation of vital signs such as the amount of blood loss. Currently, this is not yet available in the telephone triage system, which means that the professionals need to make assumptions exclusively based on the patient's self-report[24–27]. In future, such development(s) are likely to further improve the telephone triage systems and increase reliability.

Strengths and limitations

A strength of this study is that it mirrors the clinical situation as closely as possible. The vignettes were based on real clinical situations and were collected from hospitals where DOTTS was used. In addition, they were assessed for accuracy by experts. Another strength of the study is the use of an e-learning prior to the start of the study, participants' competency level was therefore ensured. In addition, the design of the questionnaire required the participants to complete answers to all questions, thus ensuring that completeness. Also, our results were generated from participants from a wide range of hospitals who actually use the system, which enhances generalizability[2–4,28–32].

A potential limitation, of the study is that it was undertaken with written vignettes, as opposed to a spontaneous conversation between patient and triage staff member. Participants could not continue to ask questions if anything was unclear. Also, the study environment differed from the reality of the (often overcrowded) triage ward. Severity of complaints, patient characteristics and follow-up are various factors which

influence the situation in real-life situations. In addition, due to the small sample size, no statement can be made about the outcomes per sort of hospital or work experience in obstetrics of the triagist. In this study the triagists were found to have a wide range of experience. Further research would be needed to establish any potential effect of this experience on reliability. Lastly, reading skills as opposed to listening skills of the participants may have influenced the results of this study[11,13,15,18,28,29,32].

Recommendations for further research

Triage is intended to indicate a correct level of urgency, and to prioritize patients with high urgency. In this study, undertriage and overtriage was minimal, 4.3% and 5.2% respectively. An obstetric triage system should help to reduce undertriage, because the potential consequence of undertriage could be irreversible health damage. Over-triage should also be avoided, as this can lead to work overload and inefficient use of resources. Moving forward, it is important to pay attention to all aspects of safety of triage in all hospital settings as well as to the patient experiences of such.

Conclusion

Inter-rater- and intra-rater-reliability of DOTTS showed substantial correlation, and is comparable to other studies. Therefore DOTTS can be considered a reliable obstetric telephone triage system. This telephone triage tool gives priority to care based on urgency before physical examination, further increasing the quality and efficiency of obstetric care.

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Evaluation of normalization after implementation of the digital Dutch Obstetric Telephone Triage System:

Mixed methods study with a questionnaire survey and focus group discussion.

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Abstract

Background:
The Dutch Obstetric Telephone Triage System (DOTTS) was developed to improve the quality of acute obstetric care. To achieve optimal effect, the DOTTS should be adopted in the daily care process by triage staff.

Objective:
The primary aim was to evaluate the degree of implementation (i.e. normalization) of the DOTTS, and the secondary aim was to evaluate which lessons can be learned from its current implementation in Dutch hospitals.

Methods:
An evaluation study with a mixed methods design was performed. All triage staff in nine Dutch hospitals that implemented the DOTTS before September 1, 2019, were invited to complete the Normalization Measure Development (NoMAD) questionnaire between December 2019 and July 2020. The questionnaire is based on the Normalization Process Theory (NPT). This self-reported questionnaire provides insights into the work people do in order to integrate and embed new practice in routine care. The NPT is based on the following four constructs: coherence, cognitive participation, collective action, and reflexive monitoring. Within the questionnaire, each construct is represented by 4-7 questions. Questions are scored on a 5-point normalization process scale. Descriptive statistics were used for analysis of questionnaire scores. Subsequently, the questionnaire findings were discussed during a focus group. Template analysis following the four constructs were used for analyzing the results of the focus group.

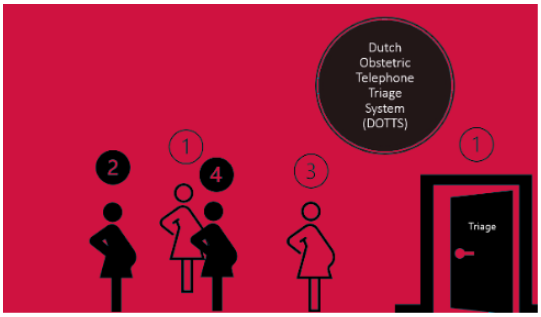
Results:
In total, 173 of 294 (59%) triage staff members completed the NoMAD questionnaire, and 90% of the participants had used the DOTTS for over six months. The digital application was used as much as possible or always by 137 of 173 (79.2%) participants. The overall normalization process score was 3.77 (SD 0.36). The constructs coherence, cognitive participation, collective action, and reflexive monitoring scored 4.01 (SD 0.47), 4.05 (SD 0.45), 3.5 (SD 0.45), and 3.72 (SD 0.47), respectively. Analysis of the focus group discussion showed that the added value of the DOTTS was seen as a quality improvement for the care of pregnant women. Dedication of the complete multi-disciplinary implementation team is important for facilitating normalization. Support from the medical staff and proper use by all disciplines involved in the triage were seen as facilitating factors. Participants appreciated training and evaluation, and indicated a need for ongoing training and evaluation in relation to goal achievement.

Conclusions:
The DOTTS has been integrated into normal care in daily practice. Evaluation by the NoMAD questionnaire provided a positive overall score. These results are in line with or, in some aspects, better than the results of other evaluation studies. Key factors in the normalization process of the DOTTS in obstetric triage are the shared added value for stakeholders, the dedication of the complete multidisciplinary implementation team, and implementation plans that are tailor made in the practical context of the hospital.

Keywords:
Obstetric Triage; Normalization Process Theory; Implementation Strategy; Hierarchy; Medical staff

Introduction

The Dutch Obstetric Telephone Triage System (DOTTS) was developed to provide a uniform and practical basis for estimating the severity of symptoms for unplanned obstetric care requests by telephone. In general, a triage system that prioritizes care according to medical urgency has a favorable effect on the safety and efficiency of emergency care[1,2]. The DOTTS is a reliable[3] and valid[4] evidence-based guideline in which presenting symptoms are used to classify the level of urgency from acute hospital admission using transport by ambulance to self-care with advice at home. It was developed through a multiphase multicenter study in consultation with all relevant stakeholders[5]. The stakeholders can be categorized into nursing, medical, and supporting service personnel. In the first category, we included specialized nurses, general nurses, and doctors' assistants. The second category consisted of obstetricians, obstetricians in training, and midwives. Supporting service personnel consisted of policy makers, managers and management team leaders, and information technology (IT) professionals. All stakeholders were involved in this new activity. The DOTTS has been developed as a digital application and is supported by training of the staff responsible for triage. The DOTTS can be considered as a substantial innovation within the field of obstetric emergency care because it prioritizes care based on the level of urgency in a prestructured manner and not based on the experience of professionals only, it needs the use of digital tools, and it requires changes in the care processes for pregnant women, as well as shifts in roles and responsibilities and improvements in interprofessional collaboration (Multimedia Appendix 1).



Multimedia Appendix 1: Video - Contextual preamble Dutch Obstetric Telephone Triage System (DOTTS). The DOTTS was developed through a multi-phase multi-center study in consultation with all relevant stakeholders. It is developed as a digital application and supported by training of the staff responsible for triage. DOTTS is an innovation within the field of obstetric emergency care

Implementation of new innovations in health care should contribute to improve the quality and effectiveness of care[6]. Many innovations are complex and require multiple changes at different levels and by different actors involved in the care processes. When introducing a complex innovation, evaluation of the implementation can optimize this process, and in turn, lessons learned can improve new or further implementation[7,8]. Implementation science has evolved to provide better understanding and explanation of why implementation of innovations succeeds or fails, with the aim to overcome these problems and to improve the methods or the implementation[6]. Numerous theories, models, and taxonomies of implementation have been defined to classify and study implementation[9,10]. To understand the process of implementation, these theoretical approaches can be divided into three overarching aims. The first aim is to understand and explain what influences the outcomes of implementation (e.g. determinant frameworks, classical theories, and implementation theories). The second aim is to describe and supervise the process of translating research into practice (e.g. process models). Finally, the third aim is to evaluate implementation (e.g. evaluation frameworks)[11].

In implementation science, attention is paid to the context of implementation[12]. The context can be divided at micro, meso, and macro levels[12-14]. Individual patients and professionals are considered to reflect the micro level. The meso level consists of intraorganizational matters that are characterized by culture and climate, readiness to change, support, and structures within the organization. The macro level is described as the wider environment of exogenous influences, such as policy, guide-

lines, benchmarking, and the organizational network. Lastly, social relations and support, financial resources, leadership, time availability, evaluation, and physical environment are referred to as being influential at all three levels[12–14].

At the organizational level, the Normalization Process Theory (NPT)[15–18] has been developed and added to implementation science. The NPT characterizes implementation as a social process of collective action[15–18]. The NPT offers a framework for process evaluation and for comparative studies of complex interventions. It focuses on factors that promote or inhibit routine embedding of complex interventions in health care practice from a care delivery perspective as opposed to patient- or system-level perspectives. Interactions between the intervention and the way caregivers work in a particular context are seen as core elements of the NPT[15–17]. This theory has been present for some time, has an established scientific basis, and has been evaluated several times for reliability and validity[15–17,19–22]. According to the NPT[15–17], routine use of innovations in practice (i.e. the fact that an innovation becomes "normal practice") can be understood in the following four constructs: coherence, cognitive participation, collective action, and reflexive monitoring. The construct coherence considers the clarity of the goal and the importance of the intervention for the individual care provider and among care providers jointly. Cognitive participation describes the way that care providers understand and commit to the working method of the intervention, as well as which work processes have changed as a result of the intervention. The construct collective action considers to what extent sufficient support, training, time, and the actual work to carry out the implementation are experienced. The construct reflexive monitoring describes the extent to which the intervention is evaluated and continues to align with expectations, needs, and progressive understanding (i.e. reflection). Together, these four constructs provide a heuristic tool for understanding and explaining change processes in health care. In the context of understanding the implementation of the DOTTS within hospitals, we chose to use the NPT as a heuristic tool.

The primary aim of this study was to evaluate the degree of implementation (i.e. normalization) of the DOTTS, and the secondary aim was to evaluate which lessons can be learned from its current implementation in Dutch hospitals. This evaluation of the implementation process and the intervention, within the first nine of 65 (14%) Dutch hospitals, can help to optimize current and new implementations.

Methods

Design

An evaluation study of the implementation of the DOTTS in daily practice with a mixed methods design was performed. As methods, a questionnaire survey and a qualitative focus group discussion were used.

Participating Hospitals and the Context of Implementation

All nine hospitals that implemented the DOTTS before September 1, 2019, were included in this study. Of the nine hospitals, two were academic hospitals, five were teaching hospitals, and two were nonteaching hospitals in the Netherlands. Participating hospitals were (1) Erasmus MC Rotterdam, (2) Leiden University Medical Center Leiden, (3) Jeroen Bosch Hospital 's-Hertogenbosch, (4) Antonius Hospital Utrecht, (5) OLVG Amsterdam, (6) Amphia Hospital Breda, (7) Elisabeth Tweesteden Hospital Tilburg, (8) Tjongerschans Hospital Heerenveen, and (9) IJsselland Hospital Capelle aan de IJssel.

In all participating hospitals, the DOTTS was implemented and introduced into routine care. Implementation strategies of the DOTTS were designed for each hospital separately. For this aim, each hospital formed an implementation team with stakeholders. In each hospital, stakeholders involved were at least one nurse and one other care professional (i.e. midwife, obstetrician, or obstetrician in training). In most hospitals, implementation teams were much more extensive. The implementation team comprised of a cross-functional team including managers, several nurses, doctors' assistants from the triage department and outpatient clinic, at least two professionals of the medical team, and an IT professional for adding the digital application of the DOTTS into the electronic patient record system.

The implementation team jointly developed a tailored implementation plan, which was an actionable specific work plan for the users of each individual hospital. This work plan included the following steps: researching whether there is support for the innovation, performing a baseline measurement, and formulating relevant goals of triage. In addition to the formulated goals, it was important to organize the right facilities, such as a physical workplace for obstetric triage with a computer, telephone, and headset. As well, an important step during the implementation process was integrating the digital application of the DOTTS into the hospital's electronic patient record system. Importantly, in all hospitals, specific training about the DOTTS was given to the staff responsible for triage. In most hospitals, this training was outsourced to an external organization. In some hospitals, this training was given by in-house experts. This choice was determined by the implementation team. Lastly, providing information to third parties before and after implementation was also an important step. The information about the innovation was given to patients, colleagues, and other cooperation partners (e.g. general practitioners and the hospital emergency department).

The implementation team went through the implementation strategies before getting started with the DOTTS. The order, as well as the extent of the steps performed, differed per hospital. Progress was evaluated and adjusted through interim process evaluation. The steps were not taken sequentially. Most implementation teams used process steps, which, in retrospect, show similarities with the process models of Kotter or Grol and Wensing[23–25]. These frameworks are intended to support stepwise planning and management of implementation efforts.

Sample

The participants of this study were users of the DOTTS. This were obstetrical nurses, nurses, and doctors' assistants, and they can be seen as triage staff. Users from all hospitals where the DOTTS was implemented were included. Before inviting participants for the questionnaire survey and the focus group discussion, an exploratory meeting was held with the manager of the department where the participants were employed. In this meeting, the manner of invitation of participants was discussed. Hence, a list of participants was formed. According to the preference of the managers and the intended participants, either email addresses were provided or an information letter including a hyperlink to the questionnaire was forwarded to the participants by the manager. At the end of the questionnaire, the participants were asked if they also wanted to participate in a follow-up study (focus group). After consent, these participants were contacted again for participation in the focus group.

Measures and Statistical Analysis

Questionnaire

The validated[26] Dutch version of the Normalization Measure Development (NoMAD) questionnaire based on the conceptual framework of the NPT was used[20,21,27]. Within the NoMAD questionnaire, each construct of the NPT is represented by 4-7 questions. Questions are answered using the normalization process scale (NPS) as follows: 1, not relevant; 2, strongly disagree; 3, disagree; 4, agree; and 5, strongly agree[26].

In addition to the NoMAD questionnaire, nine questions for characteristics were added to assess representativeness and distributions. These involved age, professional category (i.e. obstetrical nurse, nurse, doctor's assistant, or other), type of hospital (i.e. academic, teaching, or nonteaching), obstetric experience (i.e. years), average hours per week spent on triage activities, number of consultations on average per week, start date of the use of the DOTTS, and frequency of the use of the digital application of the DOTTS. All questions were incorporated into an online questionnaire (Qualtrics[28]). Between December 2019 and July 2020, data were collected during a three-month period in each hospital.

Analyses of participants' characteristics are presented as numbers or means with percentages or SDs. Descriptive statistics (scale means) were used for the analysis of the questionnaire scores. Analyses of the NPS are presented as numbers with SDs, with minimum and maximum scores. To assess whether the reliability in a different area is sufficient, we also calculated the Cronbach α for the pooled data set. Moreover, the frequency distribution of item responses is presented as the percentage of respondents reporting strongly disagree, disagree, agree, or strongly agree, or respondents who chose to not rate a specific item (not relevant). The questionnaire data analyses were performed in RStudio[29] using psych (scores)[30] and ggplot2 (graphs)[31].

Focus Group

Participants of the focus group were triage staff and users of the DOTTS who had completed the questionnaire. A group discussion was held to triangulate and verify the score of the NoMAD questionnaire and the inhibitory and facilitating factors of DOTTS implementation. Participants were asked to discuss whether they recognized and agreed with subscale scores, and needed to come up with possible explanations about differences per construct. Topics were formed based on organizational context factors[12–14] and were structured following the four constructs of the NPT[20–22,26]. Context factors were culture and climate, readiness to change, support, policy, guidelines, benchmarking, organizational network, social relations and support, financial resources, leadership, time availability, feedback, and physical environment[12–14].

In April 2021, a digital focus group (Microsoft Teams) meeting was held, recorded, and transcribed verbatim. Atlas-ti[32] was used during template analysis[33] of the focus group results following the four constructs of the NPT[20–22,26]. Member check was performed by all participants. Peer-review template analysis[33] was performed with three researchers (BE, EMJW, and ANR).

Ethics Approval

All participants were informed about the study and provided digital informed consent prior to the use of the data for analysis. All data were anonymously processed. Participants were able to withdraw at any time, without any statement of reason. The study was approved by the boards of the Medical Research Ethics Committees United, the Medical Ethics Committee of Leiden University Medical Center, and Erasmus MC of Rotterdam (W.16.053 & P17.075/PG/pg & C1.20191125).

Results

Characteristics of the Participants

In total, 294 triage staff members from the nine hospitals were asked to complete the questionnaire. The overall response rate, after three reminders, for complete responses was 58.8% (173/294).

The participants who filled out the questionnaire had a mean age of 43.3 years (SD 11.6 years) and an average work experience in obstetrics of 17.9 years (SD 11.5 years). Participants in the focus group had a mean age of 46 years (SD 9.2 years) and an average work experience in obstetrics of 18.6 years (SD 9.9 years). An overview of the characteristics of the participants is provided in Table 1. In total, 156 of the 173 (90.2%) participants had used the DOTTS for over six months. The digital application of the DOTTS was used "as much as possible" or "always" by 137 of the 173 (79.2%) participants.

Characteristic	Questionnaire survey (N=173)	Focus group (N=8)
Age (years), mean (SD)[a]	43.3 (11.6)	46.0 (9.2)
Work experience in obstetrics (years), mean (SD)	17.9 (11.5)	18.6 (9.9)
Professional category, n (%)[b]		
Obstetrical nurse	148 (83.1)	7 (87.5)
Nurse	6 (3.5)	0 (0)
Doctor's assistant	11 (6.4)	1 (12.5)
Other	8 (4.6)	0 (0)
Hospital type, n (%)[b]		
Academic hospital	67 (38.7)	2 (25.0)
Teaching hospital	67 (38.7)	4 (50.0)
Nonteaching hospital	39 (22.5)	2 (25.0)
Time performing triage (average) per week, n (%)[b]		
≥16 hours	49 (36.8)	4 (50.0)
9-15 hours	50 (31.6)	1 (12.5)
≤8 hours	74 (31.6)	3 (37.5)
Number of consultations (average) per week, n (%)[b]		
50-100	6 (3.5)	0 (0)
20-49	20 (11.6)	2 (25.0)
10-19	55 (31.8)	3 (37.5)

0-9	90 (52.0)	3 (37.5)
0	2 (1.2)	0 (0)
Duration of use of the DOTTS[c], n (%)[b]		
≥24 months	29 (16.8)	5 (62.5)
13-24 months	75 (43.3)	3 (37.5)
6-12 months	52 (30.6)	0 (0)
≤6 months	17 (9.8)	0 (0)
Frequency of use of the digital application of the DOTTS, n (%)[b]		
Always	48 (27.7)	3 (37.5)
As much as possible	89 (51.4)	5 (62.5)
Regularly	21 (12.1)	0 (0)
Sometimes	13 (7.5)	0 (0)
Never	2 (1.2)	0 (0)

[a] Missing data (n=1) for age in the questionnaire survey group.

[b] Owing to rounding, the percentages do not add to 100%.

[c] DOTTS: Dutch Obstetric Telephone Triage System.

Table 1: *Characteristics of the participants.*

Results of the Questionnaire Survey

The overall NPS score was 3.77 (SD 0.36). The constructs coherence, cognitive participation, collective action, and reflexive monitoring scored 4.01 (SD 0.47), 4.05 (SD 0.45), 3.5 (SD 0.45), and 3.72 (SD 0.47), respectively (Table 2). On average, all participants agreed (score 4) with the statements associated with the constructs coherence and cognitive participation. For the constructs collective action and reflexive monitoring, the scores were between 4 (agree) and 3 (disagree). These results were also seen when each hospital was analyzed separately (Table 3). The scores for the constructs collective action and reflexive monitoring showed more variation compared to the scores for the constructs coherence and cognitive participation (Figure 1). All elements were recognized by most participants. The constructs coherence and cognitive participation had a high percentage of answers with "agree" and "strongly agree" (Figure 2). In the pooled data set, Cronbach α was .85 for the total NPS score and was .71 for coherence, .70 for cognitive participation, .67 for collective action, and .68 for reflexive monitoring (Table 2).

NoMAD[a] scale	Mean score (SD)	Score range	Cronbach α
Normalization process	3.77 (0.36)	2.5-5.0	.85
Coherence	4.01 (0.47)	2.5-5.0	.71
Cognitive participation	4.05 (0.45)	2.5-5.0	.70
Collective action	3.50 (0.45)	2.2-5.0	.67
Reflexive monitoring	3.72 (0.47)	2.2-5.0	.68

[a] NoMAD: Normalization Measure Development.

Table 2. *Overview of Normalization Measure Development scale scores (N=173).*

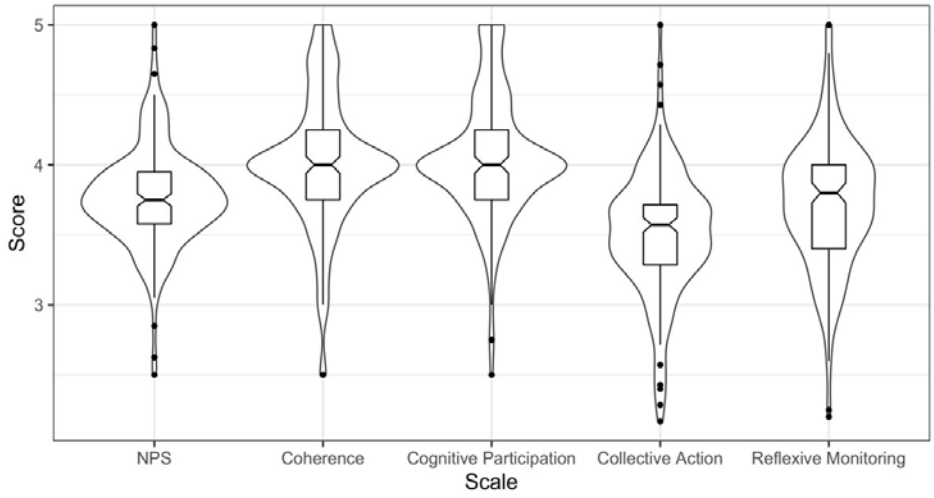


Figure 1. *Box plot of the scale scores of the questionnaires. The results are shown as scale scores (2, strongly disagree; 3, disagree; 4, agree; and 5, strongly agree). NPS: normalization process scale.*

NoMAD-scale scores **Number of participants per hospital***	**NPS Score, (SD)**	**Coherence Score, (SD)**	**Cognitive participation Score, (SD)**	**Collective Action Score, (SD)**	**Reflexive Monitoring Score, (SD)**
Hospital 1 - Academic n=39 of 79 (49)	3.68 (0.34)	3.99 (0.46)	3.91 (0.47)	3.42 (0.43)	3.63 (0.43)
Hospital 2 - Academic n=28 of 51 (55)	3.92 (0.4)	4.08 (0.51)	4.14 (0.45)	3.73 (0.48)	3.86 (0.55)
Hospital 3 - Teaching n= 25 of 38 (66)	3.75 (0.38)	4.01 (0.45)	4.01 (0.5)	3.53 (0.35)	3.64 (0.52)
Hospital 4 - Teaching n= 14 of 16 (88)	3.72 (0.32)	4.16 (0.43)	4.15 (0.29)	3.21 (0.52)	3.74 (0.43)
Hospital 5 - Teaching n= 12 of 14 (86)	3.66 (0.26)	3.71 (0.56)	3.92 (0.36)	3.56 (0.18)	3.55 (0.42)
Hospital 6 - Teaching n= 12 of 17 (59)	3.71 (0.21)	3.85 (0.29)	4.12 (0.34)	3.36 (0.62)	3.75 (0.26)
Hospital 7 - Teaching n= 6 of 10 (60)	3.38 (0.56)	3.54 (0.64)	3.83 (0.68)	2.9 (0.51)	3.53 (0.71)
Hospital 8 - Non-Teaching n= 20 of 29 (69)	3.82 (0.29)	4.05 (0.32)	4.18 (0.34)	3.52 (0.32)	3.77 (0.45)
Hospital 9 - Non-Teaching n=19 of 40 (48)	3.96 (0.3)	4.25 (0.4)	4.2 (0.48)	3.68 (0.33)	3.92 (0.35)
Pooled total n=173 of 294 (59)	3.77 (0.36)	4.01 (0.47)	4.05 (0.45)	3.5 (0.45)	3.72 (0.47)

*** n= participants of potentional participants (percentage of total participants per hospitals)**

Table3: *Subanalysis questionnaire findings per hospital.*
Total score of Normalization Process Theory expressed by Normalization Process Score (NPS). Score per construct of Normalization Process Theory: Coherence, Cognitive Participation, Collective Action and Reflexive Monitoring. Scale scores represented in Mean and standard deviation (SD), 2: strongly disagree, 3: disagree, 4: agree and 5: strongly agree. Participating hospitals were: 1. Erasmus MC Rotterdam, 2. Leiden University Medical Center Leiden, 3. Jeroen Bosch hospital 's Hertogenbosch, 4. Antonius hospital Utrecht, 5. OLVG Amsterdam, 6. Amphia Hospital Breda, 7. Elisabeth Tweesteden hospital Tilburg, 8. Tjongerschans hospital Heerenveen, 9. IJsselland hospital Capelle aan de IJssel.

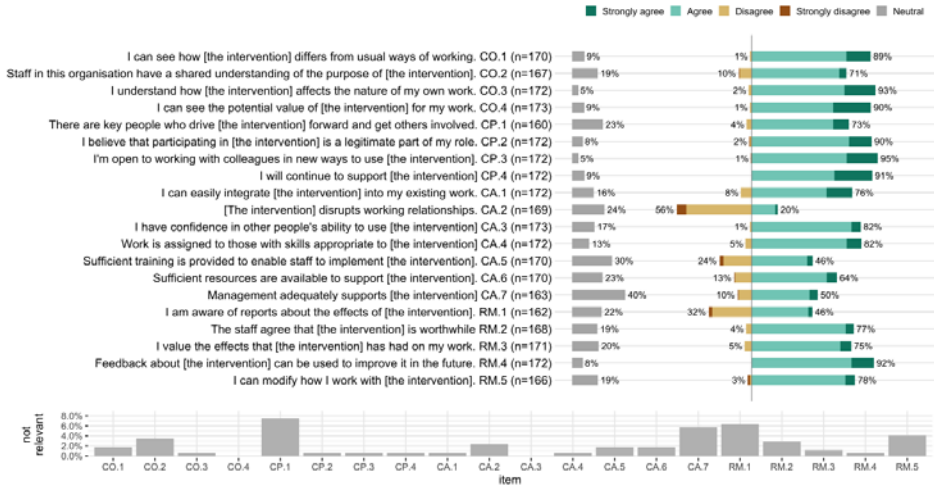


Figure 2: *Frequency distribution of item responses. The constructs are coherence (CO), cognitive participation (CP), collective action (CA), and reflexive monitoring (RM). The upper part of the figure shows the percentage of respondents reporting strongly disagree, disagree, agree, or strongly agree. The gray bar coupled to the y-axis indicates the percentage of participants rating an item as "neutral." The lower part of the figure shows the percentage of respondents who chose to not rate a specific item (not relevant).*

Results of the Focus Group Discussion

Eight participants (Table 1) discussed the implementation of the DOTTS in their hospitals and what lessons could be learned. The focus group discussion lasted 90 minutes. The focus group was highly valued by the participants and experienced as a reflection moment. Participants discussed whether they agreed with the NPS and construct scores, and came up with possible explanations.

Coherence

The added value achieved with the implementation of the DOTTS was considered the improvement of the quality of care services for pregnant women. This corresponds to the construct coherence of the NPT. Participants indicated that implementation of obstetric triage provides uniformity in obstetric emergency care, which underpins a quality improvement for the triage ward. This goal was realized with a dedicated and multidisciplinary implementation team, who, in close cooperation with all users, organized and supervised the implementation of the DOTTS. The multidisciplinary team should consist of representatives from the nursing and medical groups, and commitment and support from the manager are also considered important. The

implementation team should be able to create sufficient support and ensure joint ownership of the change. Participants indicated that, among other things, good preparation of the team, sufficient description and clarity of roles and responsibilities, and experience in facilitating implementation were important.

> *Colleagues already received these calls, only now everyone takes the calls in the same way and treats people in the same way. ..... Well, it is of course true that people have to take the step, you really have to sit behind that computer to fill in the digital triage application directly while you are making a phone call. (participant 2)*

> *In the end, it is documented; that's also a plus. (participant 5)*

Cognitive Participation

To achieve quality improvement, the competencies of triage staff (i.e. daily users) should align with the goal of implementation. Dedication, self-efficacy, goal pursuit, and multitasking were mentioned as important competencies to contribute to achieve the added value of the DOTTS. Facilitating factors were clear working agreements for all health care professionals, sufficient capacity of the outpatient clinic organized at the management level, and triage staff who continue to clarify roles and responsibilities of the triage ward with other health care professionals. This corresponds with the construct cognitive participation of the NPT.

> *..... From scratch, and that we all put our shoulders under the [new] triage together. Therefore we are a very well-functioning triage department. As a result, everyone becomes more and more enthusiastic and remains more involved, because we have built that together. I think this is really the strength with us. (participant 7)*

> *It is a change that has been handled very well, while that is still a point of attention for us. That you work out and implement something and then it fade again, and everyone starts doing their own thing again. But there really is a "before" and "after" here. (participant 1)*

Collective Action

The added value of the DOTTS was impeded when there was improper use of the obstetric triage ward. Regular outpatient clinic visits, as opposed to real emergencies, were occasionally allowed to be seen at the obstetric triage ward. The reason for perceived improper use of the triage ward by medical staff, referrers, and staff of the

outpatient clinic or labor ward, is associated with several factors, including ambiguity in policy between the triage ward and outpatient clinic or labor ward, a lack of capacity in the outpatient clinic, and a decision by medical staff in a hierarchical manner that a regular appointment is to be made at the triage ward. Where the support of medical staff was lacking, this was, in particular, experienced as an important barrier. However, when medical staff were strategically informed and involved by the representative of the implementation group, this barrier was no longer experienced. These reasons correspond to the construct collective action of the NPT.

> *As nurses, we can have a specific opinion and add structure to it, but then we heavily run into [routine of] obstetricians. We can say [to them] that there is a maximum of so many [patients] on our acute care department. But then again, entire outpatients' clinics are simply scheduled with us at the acute care department. (participant 2)*

> *And we haven't had any training either. Very unfortunate of course. We have done some sort of training on-the-job, so a small group has been trained, including X and myself. And we will then just work our services and while working you explain that we are now going to work with DOTTS. That went fine in itself, but I'm missing a piece, well, continuity. And such a refresher course after 2 years would also be very good for us. So that there is a little more structure in it. (participant 2)*

Organizing adequate training was perceived as supportive of success. Experiences with training varied among the participants, but on every occasion, training contributed to the understanding and implementation of the DOTTS. The participants stated that ongoing training is a facilitating factor in continuous stimulation of daily use. In addition, nurses who work as triage staff need to be well supported in their new task. In addition to performing obstetric triage, appropriate support services, such as administration and equipment, must be facilitated. Group responsibility for such tasks is necessary to foster ongoing ownership and improvement of the service. Developing a sense of responsibility or co-responsibility for the total organization of care and implementation among triage staff is necessary.

Reflexive Monitoring

The participants discussed the importance of and the amount of regular evaluation for all stakeholders before, during, and after implementation. Within the different hospitals, there were different experiences with the amount and frequency of evaluation. As users of the DOTTS, participants appreciated evaluation and indicated a

need for ongoing evaluation in relation to goal achievement. This corresponds to the construct reflexive monitoring of the NPT.

We also evaluated very often in the beginning; when it was started. And now the last year (1 ½ years) nothing more. (participant 3)

Well with us, if you run into problems, you can submit it at a general team meeting the [no specific evaluation]. (participant 6)

.....there is no evaluation. We work with it, and then it's done. (participant 2)

Discussion

This study aimed to evaluate the use of the DOTTS in daily practice after its implementation in a hospital. Evaluation focused on daily use and on the four constructs of the NPS. The DOTTS was used by almost all participants over a period of six months or more. The digital application of the DOTTS was used as much as possible or always by most participants. The overall score of the NoMAD questionnaire was 3.77 (SD 0.36). There were some differences per construct, where coherence and cognitive participation scored better and with less variation than collective action and reflexive monitoring. Outcomes of the focus group discussion confirmed the added value of the DOTTS. Use was stimulated by the presence of a dedicated multidisciplinary team and supported by medical staff, as well as proper use of the triage ward, adequate training, and official evaluation.

Our results are in line with and, in some aspects, better than the results of other evaluation studies with complex implementations using the NoMAD questionnaire[26,34,35]. While the Dutch questionnaire was previously applied to e-mental health interventions[26], this is the first time it was applied in obstetrics. To assess whether the reliability in a different area of health care is sufficient, we also looked at the Cronbach α. The results of Cronbach α showed good internal consistency for the total NPS score and acceptable findings for coherence and cognitive participation. However, the results were questionable for the constructs collective action and reflexive monitoring. Our findings are comparable to previous results when using the Dutch version of the questionnaire[26]. Triangulation of our results was facilitated via a focus group discussion. What emerged from this discourse was that triage professionals were able to see the added value (coherence) and were committed (cognitive participation), but struggled with collaboration (collective action) to use the DOTTS and did not always reflect on their efforts (reflexive monitoring) in a systematic manner. A plausible explanation for the favorable results of coherence and cognitive participation is the early and intensive involvement of stakeholders in the development and implementation of the DOTTS,

which supports implementation. Stakeholders were involved in the development and gave their commitment about the use of the DOTTS in daily practice. The innovation was created together and is therefore well suited to the needs of care providers[5,36-38]. The construct collective action showed the widest variation. One possible explanation for this variation is the tailor-made approach adopted for the implementation plan. The order, as well as the extent of the steps of the implementation plan, differed per hospital. Moreover, the context differed per hospital, which means that every implementation was also different[12].

The lesson learned from this study is that evaluation (i.e. reflection) of preplanned, systematic, and strategic implementation of an innovation in health care deserves more attention. In our study, we mainly evaluated whether the use of the DOTTS normalized after implementation (i.e. a state of affairs). Each hospital made a tailor-made plan per implementation, which retrospectively showed similarities with the process models of Kotter or Grol and Wensing[6,23-25]. The change management model by Kotter[25] and the model by Grol and Wensing[6] intended to support the planning and managing implementation efforts. In this study, there was no specific model used; therefore, it is difficult to compare the results with these well-known implementation models. However, evaluation of use, similar to the construct reflexive monitoring, is also an important step in these models.

Improving the quality of services for pregnant women was seen as important after the implementation of the DOTTS. Improvement of quality is mentioned in most implementation science research as a condition for success[14]. Improper use of the triage ward, which was considered by participants as a barrier, is also a well-known phenomenon in the organization of care within the hospital and specifically in triage wards[38-40]. Commonly, in planned hospital care, capacity is limited, causing nonurgent care events to be diverted to the emergency care department. Several factors leading to improper use were also mentioned in the scoping review of Bailey et al[41]. Improper use brings challenges, such as workload stress, which subsequently influence decisions during telephone triage[40,41].

In line with the constructs collective action, cognitive participation, and coherence, implementation by a dedicated multidisciplinary implementation team, which provides guidance during implementation and use of the tool afterwards, was mentioned as important. In our study, this referred to the importance of the involvement of all stakeholders. Preparing an innovation with all stakeholders creates the possibility of optimal support from the start and user friendliness for all stakeholders in daily practice[5,14,42]. Within the multidisciplinary team, special attention should be paid to the participation of the medical group. To change medical staff routines, leadership of the

implementation team is an important element[43]. Hierarchy is also a challenging factor here, which is in line with results from other studies indicating that in a hierarchical organization, normalization of an innovation is often more difficult[35]. If the organization of care is arranged by the nurse, it is necessary that it is supported by medical staff[40].

We found that training, which is part of the construct collective action, is an important element of change. This was also seen by existing triage systems[38,44,45]. If users themselves have a need for training because they want to be competent, this contributes to success[46]. After completing the training, it is important to provide continuous evaluation, which contributes to the construct reflexive monitoring, so that the implementation is further optimized and users receive confirmation that they are doing well[38].

Strengths, Limitations, and Recommendations

The NPT with its validated NoMAD questionnaire was used as an evaluation framework in this study. The NPT is an implementation theory and has been widely used as an evaluation framework[11]. There are also other tools that reflect the success of implementation, such as the Consolidated Framework for Implementation Research (CFIR); Nonadoption Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework; and Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework[11]. The NPT was used in this study because the context of the implementation of an innovation in obstetric care corresponded to the NPT[15].

The use of two complimentary research methods is valuable in the interpretation of data. A large group of users were given the opportunity to evaluate the use of the DOTTS, providing a general overview of implementation in several hospitals. The focus group gave the opportunity to triangulate the outcomes, thereby gaining more insight into the meaning of the answers and clarifying the context.

The results are from all hospitals that implemented the DOTTS before September 2019. There was an overall response rate of 58.8% (173/294) from these nine hospitals. A 50% response rate, which was obtained from all hospitals, can be considered representative[50] (Table 3). With an average age of 43.3 years and experience of 17.9 years, the sample composition was representative compared to other studies within this profession[47-49]. The participants of the focus group showed good representation of the total research group (Table 1).
To improve the questionnaire, it is recommended to look to the question collective action-2 of the construct collective action because it is the only negatively asked question. It is unclear if every participant interpreted the question correctly.

In this study, we chose to evaluate the degree of normalization after implementation among daily users in nine hospitals where the DOTTS is offered as usual care. This focus resulted in a lack of information about the theoretical approaches used for each implementation strategy. The tailored implementation strategy created space for context per hospital and the team of stakeholders. However, it limited the ability to evaluate effectiveness per implementation strategy. In addition, due to the current aim of this study, results on the expected quality improvement were lacking. Furthermore, this study only looked at the perspectives of the daily users of the DOTTS. The lack of perspectives of medical staff, outpatient clinic staff, management, and other related professionals is a potential limitation. In view of the importance of tailored implementation strategies, which was highlighted by our research, we recommend that a future study should include representation from the medical group to ensure an inclusive perspective.

Moreover, we did not evaluate the patient perspective. Not every patient will fit into the evidence-based system of the DOTTS, for instance, patients who do not understand self-care with advice. Customization per patient might need to be further developed. The current evaluation was not about these items and requires further research. Further insight into the experiences of patients who have received telephone and physical triage care based on the DOTTS is therefore recommended.

Conclusions

Normalization of the DOTTS was seen after tailored implementation in nine hospitals. Key factors in the normalization process of the DOTTS in obstetric triage were (1) the shared added value for stakeholders; (2) the dedication of the complete multidisciplinary implementation team with specific support from medical staff, as well as proper use of the triage ward (as designed) by all disciplines; and (3) implementation plans that are tailor made in the practical context of the hospital. Improvement can be achieved by structuring this process and incorporating implementation strategies, such as systematic training and evaluation, with users.

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6

Patients' experiences with an Obstetric Telephone Triage System:

a qualitative study

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Abstract

Background:
Telephone Triage Systems aim to provide a uniform and practical system for health-care professionals in order to prioritize urgency of care. A disadvantage of telephone triage system could be that the conversations are experienced as less personal, as it uses a uniform procedure for every patient. Therefore, aside from the clinical relevance, patient expectations, experiences and satisfaction were studied.

Objective:
The purpose of this study is to explore patients' experiences with telephone triage.

Methods:
A descriptive, qualitative design to explore experiences after triage with the DOTTS. Participants, recruited from two Dutch hospitals, were pregnant women who received triage by telephone. Semi-structured interviews were held. The following topics were discussed: expectations before triage, experiences with triage, waiting time, information and communication, approach of healthcare professional, and quality of treatment. Data were analyzed using open, axial and selective coding.

Results:
Overall, the participants experienced the telephone conversation as satisfactory. This was due to the perceived professionalism with high accessibility and perceived reassurance. The approach of the professional was experienced as friendly and empathetic. Participants suggested that triage services could be improved by looking specifically at information provision. Explaining in advance how the service works can be helpful to create more awareness and to align better with expectations.

Conclusion:
Participants reported that they could tell their own story and most participants realized that the professional asked extra questions in order to quantify the seriousness of the complaints. The level of involvement in the next steps of their care episode experienced by respondents lead us to conclude that the professional intended patient-centered care.

Keywords:
Antenatal care; Maternity, Midwifery; Patient Satisfaction, Quality of Care, Telephone Services, Triage

Introduction

Obstetric emergency care departments in hospitals receive many telephone calls from pregnant women every day. During these calls, care professionals can use an obstetric triage system to determine the severity of the complaints and the necessity and urgency for a physical consultation with an obstetrician or a midwife[1-3]. This telephone triage is a medical procedure that is increasingly performed in a uniform manner in The Netherlands after development of the Dutch Obstetric Telephone Triage System (DOTTS)[1]. Triage systems that prioritize care according to urgency are known to have a favorable effect on safety and efficiency of emergency care[4-7].

Implementation of a triage system might conflict with patient-centered care. Patient-centered care, as well as family-centered care, involves shifting away from the patient being the passive goal of interventions to the patient playing an active part in the care process[8]. Attention to patient-centered care has emerged as an effective method to improve quality of care and for improving patient satisfaction. A system such as the DOTTS has established five presenting symptoms and five urgency levels[1,9-11]. All patients should be treated according to one of these five presenting symptoms and urgency levels. DOTTS is intended as a guideline, and the professional can deviate from this based on contextual insights and own judgement[1]. At the same time, a possible disadvantage of telephone triage could be that the conversations are experienced as less personal, as it uses a uniform procedure for every patient[12-14].

Evaluation of patient care involvement have become important since the introduction of patient-centered care[8]. Patient satisfaction is an indicator for evaluation and assessment of quality of care[15-17]. The determinant's, communication and interprofessional collaboration, have strong positive associations with patient statisfaction[18-20]. To understand determinants of patient satisfaction, it is (first) important to evaluate patients' experiences. These experiences are partly shaped by expectations[19]. Factors that are known to contribute to patient expectations are: available options, past experiences, personal characteristics, norms and needs of patients. When patients have different expectations than healthcare professionals, it is challenging to provide good patient-centered care[19].

In an earlier, qualitative study, the satisfaction of pregnant women presenting at an obstetric triage department was studied by Evans, Watts and Gratton (2015). It was reported that women appreciated a human, caring approach from the healthcare professional, as well as adequate information and monitoring of their well-being and that of their unborn baby. In addition, effective collaboration between healthcare professionals within the team was valued[21]. Two other studies, using questionnaires,

revealed comparable results[22,23]. In general, patients were satisfied with the care they received[21-23]. These studies showed themes, which were consistent with the results of patients' experiences of care in general Emergency Departments (ED)[24-26]. The main themes that were found after visiting the general Emergency Department (ED) in these studies were: the environment of the ED, the waiting time, information and communication, the discharge from the ED, the extent of holistic approach of healthcare professionals, and perceived quality of treatment[27-29].

All the studies[21-29] described here relate to physical (face-to-face) triage. In practice however, it is usual for most pregnant women to first make a telephone call before deciding whether it is necessary to have a consultation at the (obstetric) emergency department. Therefore, in most instances the very first triage is performed by telephone and occurs before the pregnant woman is clinically assessed[2,3,5,30,31]. Implementation of a telephone triage system with prepared questions can be experienced as being less tailored to the patient. Also, patients vary in their ability to communicate about their complaints and professionals must rely on auditory rather than visual cues[6,32]. To our knowledge, whether implementation of a obstetric telephone triage system conflicts with patient-centered care has not been studied before. Our research question is therefore: How is care experienced by pregnant women when using a telephone obstetric triage system?

Materials and methods

This study had a descriptive qualitative design using semi-structured interviews.

Participants from two hospitals were included in this study. Hospital A is a general hospital, with approximately 1800 births a year. Hospital B is a teaching hospital with approximately 3100 births a year. DOTTS was implemented in 2018 and both hospitals have a triage department next to the labour ward. The DOTTS was developed to provide a uniform and practical basis for estimating the severity of symptoms for unplanned obstetric care requests by telephone[1,11]. The DOTTS is a reliable[10] and valid[9] evidence-based guideline in which five presenting symptoms are used to classify the level of urgency. The urgency levels are subdivided from acute hospital admission using transport by ambulance (U1) to self-care with advice to stay at home (U5)[1].

Purposive sampling of patients with differing urgency levels and presenting symptoms was used until data saturation was reached. Specifically, participants who had a self-care advice (U5) were also asked to participate. The participants were pregnant women who received triage by telephone. During this phone call the DOTTS was used, and registration of this call was recorded in the electronic patient record. Patients in

any trimester of pregnancy who agreed to participate were included. All participants had to be able to express themselves in Dutch or English and were over 18 years of age. To evaluate the triage related obstetric treatment as thoroughly as possible all pregnant women were eligible to participate, except those with acute life-threatening problems (i.e., resuscitation).

Data collection and statistical analysis

Potential participants were identified and retrospectively informed by triage staff about the study. Informed consent was obtained and phone numbers were given to the researcher. The study was conducted in hospital A between June and October 2020, and in hospital B between October and December 2021. All interviews were conducted as soon as possible after the telephone conversation and before the delivery. The interviews lasted no more than 60 minutes, were conducted at a place the participant preferred, with possibility of a face-to-face or digital interview (TEAMS©).

Participant characteristics collected were: age, educational level, profession, gestational age, gravidity/parity, presenting symptoms and urgency levels. Analyses of characteristics are presented as numbers (N) with percentages (%) or means with standard deviations (SD).

Interviews were conducted using the following topics: expectations before triage, experiences of triage, waiting time, information and communication, approach of healthcare professionals, and quality of treatment[21-29]. By using a topic list we were able to gain depth and insight into each interview. Data collection and analysis continued until saturation was reached. All interviews were tape-recorded with participants' permission and transcribed verbatim by interviewers BE or NH. After twelve interviews, interim analysis was performed with the research group (BE, NH, MW, EW, AR, FS). Based on this analysis, experienced empathy was added to the topic 'approach of healthcare professional'. Patients' perspective on the future of emergency obstetric care was also added to the topics after interim analysis.

Data were analyzed qualitatively with a Grounded Theory approach by interpretative phenomenological stance using an inductive, iterative coding process[33,34]. The researchers constantly compared codes focused the research question and topics. The codes were grouped into categories (axial coding) and final themes where set by the complete research group during discussion rounds. All transcripts were analyzed using Atlas-ti 22 (Version 22.1.5.0). Member checks were performed with the participants to verify the accuracy of the transcripts.

Ethical Approval

The study was approved by the daily Boards of the Medical Research Ethics Committees United (MEC-U) Act (W.16.053). All participants provided informed consent to use the data for analysis. Confidentiality was ensured. All data was anonymously processed. Participants were able to withdraw consent at any time, without statement of reasons.

Results

In total, twenty participants were interviewed, eleven in hospital A and nine in Hospital B. They were between 24 and 42 years old (Mean: 32 years, SD: 4.6) and had a varying level of education (Table 1). In total seven were primiparous and thirteen were multiparous. The gestational age varied between 16+6 weeks and 39+2 weeks (Mean: 31.3 weeks, SD: 7.4). Participants called the triage services with varying presenting symptoms and urgency levels (Table 1).

In general during the interviews participants spoke readily and openly about the care received during the telephone consultation. The telephone consultation was experienced as relevant and adequate. Participants indicated that the telephone conversation was seen as only a very small part of the total care they received during the pregnancy. Most of the participants (18/20) had a physical assessment within a few hours after the telephone conversation.

The decision to call the emergency department was made primarily due to the presence of physical complaints. The level of self-assessment of complaints varied between participants. Where the complaints were not acutely life-threatening, the conviction to call the emergency department was reduced by some participants. Almost all participants appreciated the opportunity to have had a telephone consultation with a professional. Not only to get reassurance, but also to have a shared responsibility for prenatal care.

	Hospital*	Age (years)	Education **	Gravidity/ Parity	Gestational age (weeks + days)	Presenting Symptom***	Urgency level****
1	A	33	2	3/0	21+4	5	3
2	A	39	2	2/0	16+6	1	3
3	A	42	1	3/0	19+2	2	3
4	A	37	2	3/2	36+4	4	3
5	A	34	2	3/1	36+5	5	2
6	A	35	2	4/2	38+6	3	4
7	A	34	2	2/1	38+5	4	2
8	A	34	1	3/1	33+0	5	2

9	A	27	1	1/0	36+1	3	3
10	A	37	2	3/2	36+6	4	3
11	A	29	1	1/0	39+2	1	3
12	B	31	2	2/1	27+4	2	2
13	B	33	2	2/1	37+5	5	3
14	B	27	1	3/1	33+3	1	2
15	B	34	1	2/1	22+0	2	2
16	B	28	2	2/1	26+6	1	2
17	B	27	1	2/0	33+3	5	2
18	B	24	1	2/1	34+0	2	3
19	B	38	2	6/5	37+1	4	5
20	B	30	1	2/0	19+0	1	5

* Hospital A is a general hospital, with approximately 1800 births a year. Hospital B is a teaching hospital, with approximately 3100 births a year.
** Education level: Low (secondary education or vocational education) and High (higher professional or scientific education).
*** Presenting symptoms: 1 Abdominal pain, 2 Vaginal bleeding, 3 Vaginal fluid loss, 4 Other physical symptoms 5 Anxious pregnant woman/non-somatic symptoms categorized by DOTTS.
**** Urgency levels: 2 Emergency (attendance within 1 hour), 3 Urgent (consultation within four hours), 4 Not-urgent (physical consultation within 24 hours), 5 Self-care advice (no physical consultation).

Table 1: *Characteristics of participants.*

After analysis three themes were found relating to the experience with telephone triage: 1) perceived professionalism 2) approachability 3) information and support.

Theme 1: Perceived professionalism
Most of the participants experienced the telephone consultation as being what they felt it should be. The conversation was perceived as professional as at the start of the discussion, personal details for identity verification were asked, and it was announced that the patient's file would be opened.

'The conversation itself was just fine.' (3)

'They started with: 'who are you and I'll take a look at your file' and then they asked what's going on' (20)

Then the opportunity was given to explain the reason for calling. Hence, the professional asked some questions. Most participants realized that this was done to assess the

seriousness of the situation. This was seen as logical since the participants realized that there are several telephone conversations per day, whereby the reason for contact can vary.

'So they asked really good questions, relative to what I had. And how bad it was, they always want to know. And to what extent the bleeding was.' (12)

'They always ask for my details. They also asked if I have a stomach ache. And they asked if it's bright red or brown? (…) and did I feel the baby?' (18)

The questions asked were perceived by participants as relevant and appropriate, demonstrating a level of professionalism related to the complaints. On the whole the length of time taken for questioning was not seen as unnecessarily long by the participants in hospital B. In hospital A some participants understood that certain questions need to be asked, but more explanation about the goal of this was welcome.

'Yes, just friendly, listened-to, it was not rushed. There was a quiet conversation with me. The (level of) clarification that was asked and the repetition that was asked, so all was fine.' (16)

'….. first my address and my telephone number and I thought: 'okay, but where are we going in this conversation? (….) I felt I wanted to urgently tell about that (the reason for calling) soon, so it would have been nice if they might give more explanation (about the questions)' (11)

Expectations of participants were different. Most participants expected to get reassurance about their current complaints. During the conversation participants felt caregivers listened to them calmly, which gave them reassurance. Some participants expected to be allowed to stay at home as their complaints were assessed as normal.

'Yes I just wanted to hear if it was normal (…) yes, so actually a kind of reassurance.' (8)

Most participants were informed by the professional that their current complaint(s) indicated a need for physical assessment at the triage department. Therefore for 18 participants an actual reassurance by telephone was not given and they were asked to physically attend.

'At least that women said, well, I can't judge it for you. Just come in.' (13)

Participants appreciated the immediate telephone access to the obstetric emergency department and that the right professional answered the phone. Participants expected to hear a choice aid menu by an (automatic) telephone answering machine or that their call would be transferred. This is because the participants have become accustomed to this through the organization of care at the outpatient clinic, general practitioners (GP's) or emergency departments (ED).

'Yes immediately, not a call queue or anything. I was immediately attended to (.....) So I thought it was good that they did it that way'. (13)

'Well, if it's the emergency line, I'm also glad it's answered quickly. I certainly experienced that with this one.
I have not experienced that I have had to wait long'. (16)

The experienced level of good accessibility was seen as an important factor for professionalism within obstetric emergency care. Some participants were not aware of the triage service. As a result, participants sometimes called the wrong telephone number, such as (calling) their primary care midwife, the general practitioner, or the regular outpatient clinic. The correct telephone number was usually then found via this route. The participants did not consider this to be a real flaw. They often blame this on themselves and did not experience this issue negatively.

'I initially called the outpatient clinic and they put me through to the emergency number.' (19)

'I called my own midwife and asked: yes, what should I do? And she told me that , I can do very little for you, you should call the labour ward. I was a bit panicked at the time, so I thought huh, the labour ward? I couldn't find that number so I called the GP and they said oh yes, but you have to have the labour ward. I said yes that's right. Well, I'll put you through, and that's how I ended up there.' (15)

Theme 2: Approachability
The attitude of the professional was experienced as positive by most participants. Communication was experienced as friendly and with enough space to tell their own story in their own words before specific questions were asked. A businesslike, resolute, friendly, to-the-point or down-to-earth approach was mentioned when participants were asked to describe the attitude of the professionals. They also reported feeling involved in the next steps. Participants experienced empathy during their telephone

calls. This is evidenced by sentences in which the professional indicated that she understood the situation.

'Pleasant, friendly, correct.' (12)

'A little business like okay, what's your name and date of birth, what's going on.' (13)

'Just kindly helped, quickly helped.' (14)

On the whole participants rated the quality of the telephone conversation as satisfactory. They also indicated that the approach varied between health care professionals who answered the calls. One participant reported feeling misunderstood by the professional. Most participants indicated that they did not feel any barrier in calling the obstetric emergency department. Due to the friendly manner or the help given by the professional, they did not hesitate to talk about their current complaints or call again if necessary. At the end of the physical assessment, this was confirmed again by the medical professional, this conformation was seen as supportive.

'She wasn't really that reassuring or anything, but more practical (…) I've talked to quite a few healthcare providers lately. I really notice the difference. Some who are (empathetic) and some who are not. And the person I spoke to was not necessarily very empathetic, but I don't mind that.' (13)

Theme 3: Information and support

Most participants perceived that clear information was given, when applicable, as to where the participants were expected for physical assessment. This was experienced as pleasant and reassuring. On the other hand, most participants had difficulty remembering information received about what to do if the complaints would worsen in the meantime. Participants also felt that they had received no further instruction or support regarding other additional complaints during the waiting period at home. In addition, during the telephone call most of the participants lacked information on what would happen during any (subsequent) physical assessment.

"Point of improvement? Uhm, yes what I said before, the information provision, so what will happen and what are we going to do at that moment, what are we looking at and what will be the next steps and I also think it is important that it is clearly indicated, what I should look for(signs/symptoms) for myself.' (6)

'She didn't necessarily say much about what they were going to do once I got there.' (16)

For two participants it was not necessary to come to the hospital for medical reasons. They also felt that they had had the opportunity to tell about their complaints and concerns. It was explained to them it was justified to stay at home without further clinical assessment. Participants indicated a lack information about the cause of their complaints and what they could do best to alleviate complaints. For one of these two participants, things only became clear when she started discussing it within her own family network. It was only then that she could figure out why, for medical reasons, it was not necessary to visit the hospital at that moment.

'And then my sister said: yes, but that's right, if you have a stomach ache and you take a bath or shower then it must have been ligament pain. And if you take a bath and relax and it gets worse, you could be having contractions. And then I thought… now I'm reassured.' (19)

Moreover, to support the improvement of obstetric emergency care, the participants found it desirable to have the ability of the option to send photos to the professional. As examples when determining the color or/and amount of blood loss were given. Participants felt that this might support the estimation of the urgency level the professional. There was not a great willingness to add more technology because they were satisfied with the current service and preferred human contact via telephone. Digital decision aids or a chat function with a healthcare professional or a robot were not seen as added valuable. Participants doubted whether they could express themselves sufficiently in writing.

'Taking photos and sending via whats app, for example. Well I once had blood loss and then I actually doubted it a bit. (…) And then (if I could) just take a picture of the toilet paper and app it and then she can judge based on that, (if she thought) 'well that's just a little bit, if nothing more is added then there is no reason from us for you to come by.' (13)

'In healthcare, people should be available (…) people should help people, not robots should help people.' (17)

'In my case I would not have done this via a chat function (…) I think it is very difficult, or I think it is difficult to estimate what is written. (….) You can say something much faster than you type.' (16)

Discussion

This study aimed to explore the experience with telephone triage with the DOTTS. Overall, the participants experienced the telephone conversation as satisfactory. This was due to the perceived professionalism with high accessibility and perceived level of reassurance. Participants experienced patient centered care due to being an active part in the care process. The approach of the professional was experienced as friendly and empathetic, with attention to personal concerns and medical history. Improvement of triage services involves looking specifically at information provision. Explaining in advance how the service works can be helpful to create more awareness and to align better with expectations.

Professionals using telephone triage were experienced as friendly, empathetic and attentive. Patient satisfaction is related to a professional who can listen, is friendly and can show empathy[35]. The results of our study show agreement with the results from the qualitative study of Evans et al. (2015), which studied physical triage. In this study also professionals showed respect, were friendly, and understood concerns of participants. In our study, related to telephone triage, patient-centered care[8] was encountered because participants experienced that they could explain their complaints in their own words and felt involved in the next steps of the triage. Even though the outcome of the conversation did not always match their own expectations, an appropriate degree of professionalism was experienced.

It has been previously researched that professional-patient relationship is an important factor influencing patient satisfaction[17]. However, this study confirms that communication is also an influential factor in patient satisfaction. One participant reported a negative experience, she felt that instinctively she was not listened to enough. Listening is an important part of communication between people, in this case it was expressed how important it is. The importance of communication relating to satisfaction when using a triage system following a visit the ED is also demonstrated in other studies[24-26].

The current approach of professionals as reported by participants in this study demonstrates the presence of holistic patient-centered care. In addition, two important items in contemporary healthcare[36], namely bridging the gap between evidence-based medicine and patient-centred care, were evidenced by the professional during the telephone calls. Participants reported that the added value of a 'human-touch' as well as the DOTTS was beneficial to the process of making evidence-based, appropriate decisions[6,8-11].

Satisfaction is also associated with being well informed about the treatment. In order to improve current obstetric emergency care, there is a need for better information provision about the triage services both before and after the conversation has ended. In studies following implementation of a physical triage system int the ED similar conclusions were made[13,25]. Storm-Versloot et al. (2014) found the patient satisfaction scored relatively low on information provision (before 76.5% satisfied, after 61.7% satisfied; $p<0,05$) after implementation[25]. While the method of information provision will necessarily need to be tailored to the different type of triage and patient category. Nevertheless, an integrated approach[37,38] with patient engagement is recommend to promote acceptance of information provision with perhaps some eHealth solutions. The current possibilities within digital technology were not well-known or trusted by the participants. Despite the challenges of privacy, liability, and coasts, eHealth solutions have the potential to deliver a revolution in obstetric care[39]. A first step could be to make video or photo observation and communication with healthcare professionals available[40,41]. However, in order for this to work, privacy and security concerns would have to be adequately addressed.

Strengths and limitations and recommendations

To the best of our knowledge, this is the first study about experiences of pregnant women with obstetric triage by telephone. The participants in this study spoke openly about the experiences they had. These results ensure that, in addition to validity[9], reliability[10], professional's perspective[11], the DOTTS has been assessed from patient's perspective. This is an important addition since patient satisfaction with their experiences is an important quality indicator within healthcare[18,20,42].

The similarities of our results with those from studies relating to physical triage[21-29], both in general nursing and obstetric ED's, suggests that our findings are generalisable and provides broader opportunity to further examine additional outcomes for the future developments of DOTTS. In addition, the participants are a reasonable reflection of the total population[43] with a spread of presenting symptoms and urgency levels.

A possible limiting factor of our study could be that only participants who were able to express themselves in Dutch or English were included. However, this was also the case, in all other research we located. It therefore remains unclear what experiences pregnant women have with triage systems if there is a language barrier. This is particularly important as there is evidence that non-western women experience challenges in accessing care and (that) this negatively affects birth outcomes [44]. The exclusion of women in a life-threatening situation and underage pregnant women also limits the

generalizability of these results for the total pregnant population. Further research within these populations is recommended.
This research was solely focused on patients experience with telephone triage. However, participants reported that the telephone conversation was experienced as only a very small part of the total care they received. We therefore recommend also studying patients' experiences with physical consultation, in relation to all received care during pregnancy. We also recommend repeating the study on a larger scale. In this study a small difference between the overall satisfaction in hospital A en B was found. Given the type of study with the small size of study population, we were unable to make a further analysis of this.

The role of the professional is crucial for appropriate telephone triage assessments[5,45]. Participants indicated that the approach varied between health care professionals. Systematic evaluation of this factor within the triage department should keep communication at a 'good' level or possibly even improve it further[5,7]. Attention to this within training and during implementation could be further professionalized within obstetric care.

Conclusion

Participants' experiences with an Obstetric Telephone Triage System was overall satisfactory. They experienced that they could tell their own story and most participants realized that the professional asked the extra questions to estimate the seriousness of the complaints. The experienced level of involvement in the next steps provides suggests that the professional intended patient-centered care in addition to use of DOTTS. Improving the provision of information during waiting times and about the accessibility of the service can increase the quality of obstetric triage care. Patient involvement is necessary to increase trust and to meet the needs of the patient.

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7

Summary, general discussion and future research ideas

Summary

In practice, every day obstetric emergency care departments in hospitals receive several telephone calls from pregnant women. During these calls, midwives, nurses or doctor's assistants use their obstetric knowledge and experience to determine the severity of the complaints and the necessity and urgency for a physical consultation with an obstetrician or a midwife. This triage is not always in the hands of optimally trained personnel. Moreover, this telephone triage is a medical procedure that is not performed in a uniform manner due to the lack of a specific obstetric telephone triage system. Therefore, there is a need in Dutch obstetric care for an evidence-based telephone triage system that provides a uniform and concrete basis for assessing the severity of the symptoms of obstetric emergency and other unplanned care requests, originating by telephone.

Summary of the findings

In **chapter two** the development of de Dutch Obstetric Triage System (DOTS) was performed in co-creation with a multi-phase multi-center study is described. The study was performed in ten hospitals in the Netherlands. The obstetric care professionals involved were gynecologists, midwives, nurses, doctor's assistants, team managers and application managers. Four focus groups, four observations of training sessions and two expert consultations based on the Delphi method gave feedback to the consecutive drafts of the triage guideline. After each focus group, each observation and each expert consultation, an interpretative analysis was undertaken. Based on these analyses, the obstetric telephone triage guideline was drafted. The designed DOTTS describe the primary symptoms presented, five prioritization categories and several descriptors. Consensus (>90%) was reached during the second expert consultation. Fifty-seven (91.9%) participants stated that the obstetric telephone triage guideline was clinically complete, correct, user-friendly and well-designed, and 61 (98.4%) participants judged that the newly designed triage guideline was ready to be used in daily practice. It provides a uniform and concrete basis for assessing the severity of the symptoms of obstetric emergency and other unplanned care requests, originating by telephone.

The purpose of **chapter three** was to determine the diagnostic and external validity of the DOTTS in obstetric emergency care. The validity of the Dutch obstetric telephone triage system was studied in a prospective observational study in four hospitals. Diagnostic validity of usual care was determined by comparing the assigned urgency level of the DOTTS with a reference standard. This reference standard was obtained by face-to-face clinical assessment in hospital, following the telephone triage. Clinical follow-up after assessment was also recorded. For statistical analyses urgency levels were dichotomized into high urgency (U1, U2) and intermediate urgency (U3, U4). Self-care advice (U5) could not be studied because these patients were not referred to hospital.

In total, 983 cases (U1-U4), across the four hospitals were included, 625 (64%) cases were categorized as high urgency and 358 (36%) as intermediate urgency. The DOTTS's urgency level agreed with the reference standard in 53% (n=525; 95%CI 50-57%). According to the reference standard the DOTTS had undertriage in 16% (n=160) and overtriage in 30% (n=298) of the cases. Sensitivity for high urgency was 76% (95%CI 72-80), specificity 49% (95%CI 44-53). Positive predictive value and negative predictive value was 60% (95%CI 56-63) and 67% (95%CI 62-72) respectively. After clinical assessment urgent care was needed in 8,7% (n=31) of the intermediate-urgency cases, none of these cases were life threatening situations. It was concluded that DOTTS shows an acceptable diagnostic validity with room for improvement.

Besides validity also reliability is an important component of a system such as DOTTS. In **chapter four** the determination of the reliability of DOTTS, by calculating the inter-rater- and intra-rater reliability was done. To evaluate the urgency levels, 90 vignettes of possible requests were developed. The five urgency levels and five presenting symptoms had an equal spread and had to be entered in accordance with DOTTS per vignette. Urgency levels were dichotomized into high urgency and intermediate urgency. Inter-rater-reliability was rated as degree of agreement between two different participants with the same vignette. Intra-rater-reliability was rated as agreement by the same participants at different moment in time. The degree of inter-rater- and intra-rater reliability was tested using weighted Cohen's Kappa and ICC.

The agreement of urgency level between participants in accordance with predefined urgency level per vignette was 90.5% (95%CI 87.5 – 93.6) [335 of 370]. Agreement of urgency level between participants was 88.5% (95%CI 84.9 – 93.0) [177 of 200] and 84.9% (95%CI 78.3 – 91.4) after re-rating [101 of 119]. Inter-rater-reliability of DOTTS expressed as Cohen's Kappa was 0.77 and as ICC 0.87; intra-rater-reliability of DOTTS expressed as Cohen's Kappa was 0.70 and as ICC 0.82. To conclude, inter-rater- and

intra-rater-reliability of DOTTS showed substantial correlation, and is comparable to other studies. Therefore DOTTS is considered reliable.

To achieve optimal effect, DOTTS should be adopted in the daily care process by triage staff. In **chapter five** the primary aim was to evaluate the degree of implementation (i.e., normalization) of the DOTTS, and the secondary aim was to evaluate which lessons can be learned from its current implementation in Dutch hospitals. An evaluation study with a mixed methods design was performed. All triage staff in nine Dutch hospitals that implemented DOTTS before September 1st, 2019, were invited to complete the Normalization MeAsure Development (NoMAD) questionnaire between December 2019 and July 2020. The questionnaire is based on the Normalization Process Theory. This self-report questionnaire provides insight into the work people do in order to integrate and embed a new practice in routine care. NPT is based on the following four constructs: coherence, cognitive participation, collective action and reflexive monitoring. Within the questionnaire, each construct is represented by 4-7 questions. Questions are scored on a 5-point scale. Descriptive statistics were used for analysis of questionnaire scores. Subsequently, analysis of questionnaires were discussed during a focus group. Template analysis following the four constructs of NPT was used for analyzing the results of the focus group.

In total 173 out of 294 (59%) triage-staff members completed the NoMAD questionnaire, and 90.2% (156/173) of the participants had used DOTTS for over six months. The digital application was used as much as possible or always by 137 out of 173 participants (79.2%). The overall normalization process score was 3.77 (SD 0.36). The constructs Coherence and Cognitive Participation scored 4.01 (SD 0.47) and 4.05 (SD 0.45) respectively. Collective Action scored 3.5 (SD 0.45) and Reflexive Monitoring scored 3.72 (SD 0.47). Analysis of the focus group discussion showed that participants appreciated the added value of DOTTS as a quality improvement for the care of pregnant women. Dedication of the complete multidisciplinary implementation team was considered important for facilitating normalization. Support from the medical staff, as well as proper use by all disciplines involved in the triage, were seen as facilitating factors. Participants appreciated training and evaluation and indicated a need for ongoing training and evaluation in relation to goal achievement. To summarize, the DOTTS had been integrated into normal care in daily practice. Evaluation by the NoMAD questionnaires provided a positive overall score. These results are in line with or, in some aspects better, when compared to other evaluation studies. Key factors in the normalization process of the DOTTS in obstetric triage are the shared added value for stakeholders, the dedication of the complete multidisciplinary implementation team and implementation plans that are tailor made in the practical context of the hospital.

Apart from the clinical relevance, patient expectations, experiences and satisfaction were studied in **chapter six**. A descriptive, qualitative design was used to explore experiences after triage with the DOTTS. Participants, recruited from two Dutch hospitals, were pregnant women who received triage by telephone. Semi-structured interviews were held. The following topics were discussed: expectations before triage, experiences with triage, waiting time, information and communication, perceived approach of healthcare professional, and quality of treatment. Data were analyzed using open, axial and selective coding.

Overall, the participants experienced the telephone conversation as satisfactory. This was due to the perceived professionalism with high accessibility and perceived reassurance. The approach of the professional was experienced as friendly and empathetic. Improvement of triage services involve looking specifically at information provision. Explaining in advance how the service works can be helpful to create more awareness and to align better with expectations. In conclusion, participants experienced that they could tell their own story and most participants experienced that the professional asked extra questions to estimate the severity of the complaints. The experienced involvement in the next steps provides the insight that the professional intended patient-centered care.

General discussion

The aim of this thesis was to develop a valid, reliable, and nationwide usable obstetric telephone triage system for unplanned care requests of pregnant women. Also, we wanted to evaluate the use of the system by healthcare professionals within different hospital settings and patients' experiences of the system.

This thesis contributes to the improvement of current obstetric care processes. This is necessary in view of the increased volume per obstetric emergency care department, the pursuit of high-quality interpretation and documentation of unplanned obstetric care consultations[1-3]. A telephone triage system adds to this need. As stated in the main findings it can be said that The Dutch Obstetric Telephone Triage System (DOTTS) achieved consensus of healthcare professionals after its development with relevant stakeholders (chapter 2)[4]. DOTTS consists of five presenting symptoms: fluid loss, vaginal bleeding, abdominal pain, concerned pregnant/non somatic symptoms and other physical symptoms. DOTTS consists also of five urgency levels: resuscitation & life threatening, emergency, urgent, non-urgent and self-care advice. This thesis showed that a valid (chapter 3)[5] and reliable (chapter 4)[6] estimate of the urgency levels can be made by using DOTTS and that the use of DOTTS can be safely encouraged in obstetric practice. Further, that the use of a valid and reliable telephone triage system contributes to the correct distribution of human and financial resources. In

addition, insight into professionals experiences provided valuable information regarding the aspects that support implementation of DOTTS (chapter 5) in practice[7]. Lastly, in an examination of patients' experience we found that patients perceived that professionals use DOTTS without losing the human touch (chapter 6).

In this general discussion four subjects will be discussed: 1) DOTTS as an example of a successful health care transformation, 2) Aspects of successful innovations that contribute to transformation, 3) Theoretical concepts of multidisciplinary stakeholder engagement and multidisciplinary learning, and 4) Limitations of this thesis and future research.

1) DOTTS as an example of a successful health care transformation

Transformation in healthcare

In general, there has been a desire and need for changes in care for many years now[8]. This so-called transformation in healthcare is necessary, on the one hand, due to the aging of society and the increase in the number of chronically ill patients. On the other hand, also due to the shortage of healthcare professionals and the expectations of technology, to at least partly compensate for this shortage[9]. This also applies to current practice in obstetric care, which is challenged by the increasing concentration of acute care in obstetrics[1,10,11]. It is essential to gain insights into what may contribute to the transformation of healthcare[12]. Implementation of DOTTS requires change in the care processes for pregnant women, as well as shifts in the roles and responsibilities and improvement of inter-professional collaboration. In this respect, DOTTS exemplifies a successful transformation in healthcare. Moving forward, the reflective question is if the use of DOTTS contributes to a more sustainable health care.

The DOTTS for example

Within this thesis, DOTTS has been developed as an instrument for professionals. This instrument is an evidence-based system that can serve as a decision aid to classify the level of urgency by healthcare professionals. DOTTS has a digital application that supports clinical decision-making suitable for use in every electronic patient record system.

During telephone triage a decision must be made in a very short time. Previously this was exclusively based on professional judgement. DOTTS contributes to a transparent, fair and consistent assessment. Decision tools like DOTTS, which is based on algorithms, support the expert. A system that is based on algorithms results in better judgements[13–15]. The opportunities within this digital revolution can be supportive in managing the increasing patient flow[16].

Rapidly expanding

DOTTS serves as an example of a successful health care innovation. In the context of this thesis ten hospitals participated. In addition, more than 30 Dutch hospitals have since implemented DOTTS in their own organization. Clearly, in the Netherlands, the use of DOTTS is rapidly expanding, which means that it can be considered as a successful innovation. However, many promising innovations, are not successfully and widely implemented in clinical practice. Our study shows that it is possible to use an inclusive framework to ensure that clinicians can work jointly to develop a high-quality, clinically correct and complete telephone triage system, with corresponding scientific evaluations and uptake by other hospitals. In recent years, the DOTTS was not only implemented within the obstetric care departments in Dutch hospitals. Primary care midwives have also started implementing DOTTS into their practice. The DOTTS was also added within the Dutch Triage Standard that is used in almost all Dutch GP-posts and a large part of the emergency departments. The addition of the DOTTS in the Dutch Triage Standard ensures uniformity in the chain in organisation of emergency care and obstetric care. This is necessary to achieve uniform cooperation and to give equal quality to every patient.

2) Aspects of successful innovations that contribute to transformation

Linking the innovation to professional needs

Some elements that are known to be important for accomplishing successful changes have been purposively applied in the development of DOTTS in this thesis. One aspect of success is linking the innovation to professional needs, which means that professionals themselves signal the problem[17]. DOTTS was developed at the request of these professionals because they experienced a problem in daily practice. They indicated that telephone triage is a medical procedure that is not performed in a uniform manner due to the lack of a specific obstetric telephone triage system. Moreover, the obstetric triage was not always in the hands of optimally trained personnel. This creates uncertainty among healthcare professionals, but more importantly, also creates a risk of healthcare inequality between patients. The cause of this is the lack of clarity regarding the content of care, logistical follow-up, the lack of digital support and quality-standard agreements[4,18].

Co-creation

A second aspect of accomplishing successful change is the use of co-creation as an inclusive apporach[19–23]. To develop an acceptable solution, it is important that users are involved in its creation. To summarize, discussions were held with all stakeholders, i.e. healthcare professionals and supporting parties. Also, those responsible for IT services, protocols, and personnel policy were also involved. Discussions with all these

professionals together provided an interdisciplinary understanding of the problem. Broad support from an interdisciplinary-stakeholder perspective can help to view the problem from various angles. In addition, the working method in various obstetric departments within different hospitals was also observed. DOTTS was developed together with all stakeholders, after observation and analysis of care as it was given at the time by professionals. This setup was important, because collaboration and insight in work procedures are important to create support for changing the current practice, but also for future implementation trajectories of an innovation. Finally, DOTTS was created in relation to evidence-based practice: professional expertise is based on scientific results, together with practice based knowledge[24]. Bearing all these aspects in mind, consensus was reached easily, and the DOTTS was, after several iterations, judged ready for transfer into obstetric practice (chapter 2)[4].

Embedding in digital systems

A third aspect of change in health care, is embedding an innovation into existing digital systems. In order to facilitate successful implementation of an innovation IT-professionals, policy personnel and management, as well as direct users are needed, as the new way of working needs to be embedded in already existing systems and working processes. The current transformation of care requires the use of digital technology. DOTTS was developed as a digital application that supports clinical decision-making with algorithms suitable for use in every electronic patient records systems. This is comparable to other triage systems that incorporate clinical decision support systems, to aid in the evaluation of patients' health conditions[18].

Case specific implementation pertaining to context

The fourth aspect of successful change is considering a case specific implementation pertaining to context. This means that local care procedures and conditions have to be taken into account in order to implement an innovation that has been developed in another context. Therefore, after the development of DOTTS, the implementation per hospital/ team was provided by a dedicated multidisciplinary implementation team. The team provided guidance during implementation, taking into account the specific context (Chapter 5)[7]. Each hospital made a tailor-made plan per implementation, which in retrospect, showed similarities with the process models of Kotter[12] or Grol and Wensing[25–27]. Change management models, such as those of Kotter as well as Grol and Wensing, are intended to support the planning and management of implementation efforts. In the evaluation study, which focused on daily use (Chapter 5), we concluded that DOTTS was used by almost all participants over a period of six months or more. Use was stimulated by the presence of a dedicated multidisciplinary team, supported by medical staff, but also by providing adequate training and planned evaluations. These findings are in line with the model of integrated approach to stakeholder engagement[19].

It is seen as an approach that can sustain the change in daily use. DOTTS has shown us the effectiveness of interdisciplinary stakeholder involvement.

Validity and reliability

In addition to the four aspects for the development of a successful innovation in healthcare described here, clearly validity and reliability(in addition to development and evaluation with users) are also important for the uptake of DOTTS. In chapter 3, we concluded the validity of DOTTS is comparable to, or slightly better than the results of well known systems of the Emergency Department[5]. Chapter 4 confirmed the internal consistency of DOTTS by testing inter-rater-reliability (IRR) and intra-rater-reliability (ITR) using vignettes[6]. The results confirm the systematic reliability of DOTTS.

3) Theoretical concept of multidisciplinary stakeholder engagement and multidisciplinary learning.

Early involvement of stakeholders

During the studies contained within this thesis, the important role of multidisciplinary stakeholder engagement was confirmed in all phases of development and implementation. Preparing an innovation with all stakeholders creates the possibility of optimal support from the start, and underpins user-friendliness in daily practice[4,20,28]. The early involvement of stakeholders in the development of DOTTS clearly supported implementation later. This can be understood by the theory described by Carr et al (2009). This theory explains what contributes to the adoption of innovations. The main aspects of adoption according to this theory are, firstly, to create awareness, secondly, to build support and finally to make the change real. The first aspect is creating awareness by engaging in communication with stakeholders about the purpose of the change. In each project, the communication activities must be customized to consider the unique project and to achieve the required level of engagement for all groups of stakeholders. It is important to balance customization and consistency in messages. Education can support the communication, which ultimately helps to get all stakeholders well informed. By doing this, it is possible to generate a good momentum to start with the new activity. DOTTS was implemented in all hospitals by implementation teams at the right moment for them, and communication activities were organized according to the specific local context.

Communication to support adoption

The second recommendation is to build adoption support for the innovation with stakeholders. In this second step the communication needs to be more specific. The project team is an essential part of the stakeholder group. Continued education by

the project team supports the adoption of the innovation[19]. In the integrated approach of stakeholder engagement, clinicians are also seen as an important group of stakeholders. In the evaluation study (chapter 5), we found that within the multidisciplinary team, special attention should be paid to the participation of the medical group of clinicians. When changing medical staff routines, leadership of the project team for implementation of the DOTTS was found to be an important element[29].

Training

Hierarchy is also a challenging factor here, which is in line with results from other studies, indicating that in a hierarchical organization normalization of an innovation is often more difficult[30]. Where the organization of care is arranged by the triagist, we found that it was necessary that the change was supported by the medical staff[31]. In order realize change, the concept of 'engagement' is essential. A hands-on training with practical interaction ensures that people learn about the new activity[19]. The results of the evaluation study (chapter 5)[7] confirmed that training is an important element of change. This was also seen in existing triage systems[32-34].

Cross-boundary learning

Multidisciplinary learning, as was the case in DOTTS, can also be explained as cross-boundary learning[35]. In this learning theory, not only the junior professionals develop into experts by gaining more knowledge and skills, but also that people learn from each other across disciplines, or 'across borders'. In newly developed working processes, the challenge is to create possibilities for participation and collaboration across a diversity of disciplines. As it is called in the theory of cross-boundary learning: a sociocultural difference leading to discontinuity in action or interaction[35]. All multidisciplinary stakeholders need to be engaged to learn together about the new activity in dialogue and as a collaborative process. The DOTTS can be seen as a boundary object, which bridges intersecting practices. In the evaluation study (chapter 5), the training was seen as a facilitating factor, especially if users themselves had expressed a need for training in order to improve competentence[36,37]. Previous studies also showed the importance of found that investment in the learning capacity of triage staff (chapter 2)[4,31,38-41]. During the initial implementation of DOTTS, this aspect was left to the individual practice area itself. This created inequality, in the sense that sometimes too many or sometimes too few professionals were trained. This ultimately led to a failing implementation due to the lack of knowledge or skills. After interim-evaluation improvements were made by sufficiently training the right professionals. In retrospect, the efficiency of DOTTS could have been improved had we given more attention to this beforehand. Future implementations could be enhanced by awareness of a customized integrated training together with all stakeholders.

4) Limitations of this thesis and future research ideas

Culture and trust

While investment in stakeholder engagement and training resulted in an improvement to knowledge and skills and therefore a learning organization. Further consideration of elements, such as the culture and trust within organizations, is however necessary, in order to successfully implement change in practice. These elements have not been further explored in this thesis. In general, a willingness-for-change culture within groups is an essential factor in order to change old habits. Schein's[42] definition of culture is: '*a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems'.* This requires vision and strategy, as well as trust from the organization in the innovation, and in the implementation team. At various levels it is essential that there is trust, i.e. trust in the correctness of the innovation, trust in each other, and trust in the final result. This is especially important when tasks and responsibilities are shifted, where, in order to succeed must be mutual trust. More research needs to be done in relation to these important aspects.

Leadership

In addition to culture leadership is also an important element for transformation in healthcare. Changing the existing organization with respect to their own culture and adding an innovation to an existing group of multidisciplinary professionals requires leadership[22,43,44]. In addition to the step-by-step action-oriented implementation, the implementation group needs to take the lead together[45,46]. However, if the implementation team consists of stakeholders only, it is unclear if there is sufficient expertise about how to support the willingness to change and to change the culture of the group. This can be a challenge when implementing DOTTS. The added value of having an implementation specialist per hospital needs to be studied further. Improvement of quality is mentioned in most implementation science research as a condition for success[28]. However, willingness to change is increased if a shared goal is set for the collaboration or innovation to be achieved. Improving the quality of services for pregnant women was seen, in this thesis, as the important added value after implementation of the DOTTS (chapter 5).

More research needed

Prior to the implementation of DOTTS there was a lack of registration of emergency calls. This resulted in a lack of insight into the real effect of using DOTTS. Hence, the best possible parameters were examined. The results showed that by using DOTTS an

estimate of urgency level can be made. In chapter 3 we concluded the sensitivity is higher compared to specificity[5]. Thus indicating that DOTTS is able to classify highly urgent cases better than intermediate urgent cases. This is of high clinical importance, as a triage system is meant to classify the need for highly urgent care. In studies on physical triage in general emergency care, the opposite was observed. Further research is essential to confirm a hypothetical explanation regarding factors such as the difference in number of cases examined in this study and the difference in the amount of presenting symptoms. To increase agreement of triage sensitivity and specificity follow-up research, with special attention for sub-analysis, is needed. Undertriage should be avoided in a triage system, as it can be assumed that this could cause irreversible health damage as a result of waiting time. Every single case involving undertriage can indicate factors, which can be used to consider improvement of quality in future[47,48].

Improvement of use of triage department

Moving forward, lessons from the experience of previous implementations could be put into practice. As a result of such cyclical learning, the use and further implementation of DOTTS can be improved. For instance, the triage system and triage ward should not be used for other purposes than triage. In chapter 5 this was considered by participants as a barrier, and also a well-known phenomenon in the organization of care within the hospital and specifically in triage wards[31,32,49]. In planned (outpatient) care, capacity is often limited, causing non-urgent care events to be diverted to the emergency care departments. Several factors leading to improper use of the triage ward were also mentioned in the scoping review of Bailey et al. (2017)[49]. Improper use brings challenges such as workload stress, which subsequently influences decisions during telephone triage[31,49]. More information regarding the quality of the telephone conversation is important. Better knowledge of which social skills and medical knowledge triage staff require, is of particular value for future improvements. Recordings of telephone calls for training purposes and audits could provide more insight[18,50,51].

Self-care advice and overtriage

In follow-up research, special attention should also be given to urgency level 5 (U5), which is self-care advice. In this thesis it was not possible to include this category in the validation study, which can be considered as a weakness[5]. More research should also be done into overtriage. Analysis of the relevant cases where overtriage was found could provide insight into the reasons for its' occurrance[5]. This is particularly important in the instance of overtriage, which can lead to incorrect distribution of patients. Further research is of particular relevance in the current climate of widespread reduction in care-capacity.

Quality evaluations

The biggest challenge for the upcoming years is that DOTTS remains appropriate to the demand for care. If DOTTS is used correctly, the system should not reduce professional autonomy or responsibility. Also over-regulation of registration due to too many rules for quality registration can become a challenge for appropriate care in relation to care with human touch and autonomy of the healthcare professional[52]. Given the current defensive culture within healthcare, any deviation from a system with a guideline can be experienced as an ethical dilemma[53]. For that reason, attention should be given to this aspect, as if expected, this system is on its way to become part of obstetric care. The chosen system should be used based on a combination of professional insight and patient preferences, in accordance with the concept of evidence-based practice[24]. Users' clinical insight and the feeling that something is 'not right' should be taken into account when making decisions[13,14,54,55]. Research on general emergency care departments has shown that this 'not-right' feeling is important and constitutes a legitimate reason for changing the prioritization category[56,57].

Digital technology improvements

In future, DOTTS algorithms may benefit from more supporting technologies of artificial intelligence. The DOTTS is now built in existing digital systems, but does not provide any probability calculations, for example. However, there is evidence that artificial intelligence can help to make digital decision-aids more supporting, which can also further improve DOTTS. Also, having a pre-triage done by patients themselves, might improve the efficiency of care. In addition, expansion of other technology opportunities need to be developed in the future. Examples, such as automatically calling of an ambulance and adding home-monitoring of vital parameters such as oxygen saturation, blood pressure and fetal assessment by cardiotocography (CTG)[58]. Finally, video observation and communication by healthcare professionals can provide additional information such as assessment of the clinical status of the patient and/or the observation of vital signs such as the amount of blood loss. Currently, this is not yet available within the application of DOTTS, which means that the professionals need to make assumptions exclusively based on the patient's self-report. Further research is recommended to further study and develop these possibilities[10,16,58-60].

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8

Nederlandse samenvatting

Aanleiding ontwikkeling telefonische verloskundige triage

Op een gemiddelde Nederlandse verloskunde afdeling komen doorlopend patiënten ongepland binnen na telefonische aanmelding. Op basis van persoonlijke kennis en ervaring en zonder een triagesysteem beoordeelt een verpleegkundige of doktersassistente hoe snel de patiënte met een zorgvraag moet worden gezien door een medisch-obstetrisch deskundige. De beoordeling van de mate van urgentie en de maximale medisch verantwoorde wachttijd is zonder triagesysteem niet uniform. Het vaststellen van de mate van urgentie is niet inzichtelijk en objectiveerbaar voor patiënt(en), zorgprofessional(s) en management. Doelmatigheid en patiëntveiligheid zijn daardoor niet optimaal.

Triage binnen de algemene spoedzorg en internationale verloskundige zorg

Triagesystemen worden al langere tijd gebruikt in de algemene spoedzorg. De algemene triagesystemen zijn echter niet geschikt voor de verloskundige spoedpatiënt, omdat er sprake is van twee patiënten, te weten: de moeder en het ongeboren kind. Bovendien presenteert de zwangere vrouw zich met specifieke klachten en symptomen. Voor de obstetrische spoedpatiënt zijn er de afgelopen jaren diverse triagesystemen ontwikkeld in Canada, de Verenigde Staten en Zwitserland. In Nederland werd het Rotterdam Obstetrisch Triage Systeem (ROTS) ontwikkeld. Al deze systemen zijn ontwikkeld voor fysieke triage, wat betekent dat het telefonische triagemoment niet werd beschreven. Om in de behoefte van eenduidige, inzichtelijke en objectiveerbare telefonisch verloskundige triage te voorzien, is daarom een verloskundig telefonisch triagesysteem ontwikkeld, en wetenschappelijk en in de praktijk geëvalueerd.

Samenvatting van de resultaten

In **hoofdstuk twee** wordt een multicenter studie beschreven met gecombineerde onderzoeksmethodes om de Nederlandse Triagewijzer Verloskunde (NTV) te ontwerpen met betrokken stakeholders. De stakeholders waren zorgprofessionals onderverdeeld in het medische team (gynaecologen, gynaecologen i.o., physician assistant-klinisch verloskundigen (PA-KV) en klinisch verloskundigen), het verpleegkundige team (gespecialiseerde obstetrie verpleegkundigen, algemeen verpleegkundigen en kraamverzorgenden) en de ondersteunende diensten (beleidsmedewerkers, ICT-ers en managers). In totaal participeerden er binnen alle fases van dit

onderzoek ruim 80 zorgprofessionals uit tien Nederlandse ziekenhuizen (twee academische centra, vijf opleidingsziekenhuizen en drie perifere ziekenhuizen). De onderzoeksmethodes betroffen focusgroepen, observaties van trainingen en digitale expertmeetings conform de Delphi-methode.

Tijdens de focusgroepen en observaties van trainingen werden er in samenspraak diverse concepten van de NTV doorontwikkeld. Internationale en nationale literatuur in combinatie met regionale protocollen en het eerder ontworpen ROTS waren daarbij de basis. De NTV heeft dezelfde systematiek als de algemene triagesystemen. Dit betekent dat het systeem bestaat uit ingangsklachten, indicatoren en urgentiecategorieën. De ingangsklachten zijn gebaseerd op het toestandsbeeld van een patiënt op dat moment. Het toestandsbeeld is de omschrijving van de conditie van een patiënt aan de hand van klachten en symptomen. De aard van de klachten bepaalt welke urgentiecategorie noodzakelijk is. De urgentiecategorie bepaalt vervolgens de maximale medisch toelaatbare wachttijd.

Tussentijdse analyses zorgden voor een continue verbetering van het ontwerp van de NTV. De vijfde versie werd voorgelegd tijdens de eerste digitale schriftelijke expertmeeting conform de Delphi-methode. Tijdens deze digitale feedbackronde werd op basis van open vragen feedback gegeven door de stakeholders, verdeeld in het medische team, het verpleegkundige team en de ondersteunde diensten. In de tweede ronde werd consensus (>90%) over de inhoud van de NVT behaald. Dit resulteerde in een triagewijzer bestaande uit vijf ingangsklachten te weten: vochtverlies, bloedverlies, buikpijn, andere lichamelijke klachten en bezorgde zwangere (niet-somatische klachten). Binnen elke ingangsklacht zijn discriminatoren geformuleerd welke de urgentie bepalen. De vijf urgentiecategorieën zijn: levensbedreigend (reanimatie), spoed, dringend, niet dringend en zelfzorgadvies. Door de wijze waarop het onderzoek werd uitgevoerd, is er in co-creatie met gebruikers, een onderbouwde richtlijn ontstaan voor telefonische ongeplande zorgvragen binnen de verloskunde.

Na afloop van de laatste digitale expertmeeting werd de NTV door de stakeholders beoordeeld als compleet, correct, gebruiksvriendelijk en goed ontworpen. De richtlijn geeft de mogelijkheid tot uniformiteit in beoordeling van de diverse klachten en werd beoordeeld als klaar voor implementatie in de praktijk. Voorwaardelijk in de implementatie werd digitalisering van de NTV binnen het elektronische patiëntendossiers gesteld. Landelijk heeft daarna een digitale standaardisering van de NTV in EPIC, Chipsoft-HIX en SAP plaatsgevonden.

Middels een prospectief observationeel onderzoek werd vervolgens de validiteit van de NTV **(hoofdstuk drie)** vastgesteld. De diagnostische validiteit werd bepaald door berekening van de overeenkomst van urgentiecategorie tussen triagist en medisch professional. De triagist stelde de urgentie vast in het triagegesprek met de zwangere vrouw. De medische professional deed dit tijdens het fysieke consult op de afdeling. Wanneer er geen gelijke overeenkomst was, werd gekeken naar de mate van overtriage en ondertriage. In het geval van overtriage gaf de triagist een hogere urgentie dan de medisch professional. Bij ondertriage gaf de triagist een lagere urgentie dan de medisch professional het achteraf wenselijk vond. Voor statistische berekeningen werden de urgentiecategorieën gepaard (dichotoom). U1 en U2 werden ingedeeld in de hoge urgentiecategorieën en U3 en U4 in de gemiddelde urgentiecategorieën. Ook werd onderzocht wat de uiteindelijke uitkomst van het spoedconsult was. Het onderzoek vond plaats in vier Nederlandse ziekenhuizen waar NTV was geïmplementeerd tot standaard zorg. Het vergelijken van de resultaten tussen de vier ziekenhuizen leverde inzicht in de externe validiteit.

In totaal werden 983 casus geïncludeerd, 625 in de hoge urgentiecategorie en 358 in de gemiddelde urgentiecategorie. De overeenkomst van urgentiecategorie was 53% (n=525; 95%CI 50-57%). Er was sprake van ondertriage bij 16% en overtriage bij 30% van de casus. Dit betekende een sensitiviteit voor de hoge urgentiecategorie van 76% (95%CI 72-80), met een specificiteit van 49% (95%CI 44-53). De positief voorspellende waarde en negatief voorspellende waarde waren respectievelijk 60% (95%CI 56-63) en 67% (95%CI 62-72). Na het fysieke consult volgde bij 8,7% (n=31) uit de gemiddelde urgentiecategorie een opname met klinische behandeling. Geen van deze casus betrof een levensbedreigende situatie.

De inzichten in de diagnostische externe validiteit van een telefonisch verloskundig triagesysteem werd voor het eerst onderzocht. Door gebrek aan gelijkwaardig onderzoek in het verloskundig vakgebied is vergelijking niet mogelijk. In vergelijking met internationale literatuur over algemene spoedzorg zijn de resultaten vanuit dit onderzoek gelijk of beter. De uitkomsten geven wel ruimte om onder- en overtriage de reduceren. De exclusie van urgentiecode 5 is een beperking in het onderzoek.

Naast validiteit is ook betrouwbaarheid een belangrijk component om de consistentie van een diagnostisch instrument zoals de NTV te evalueren. In **hoofdstuk vier** wordt inzicht gegeven in de inter- en intra- beoordelaarsbetrouwbaarheid van de NTV door middel van vignetten. Een vignette was een uitgewerkte casus uit de dagelijkse praktijk. Per vignette werd de interbeoordelaarsbetrouwbaarheid bepaald wat inzicht geeft naar de mate van overeenkomst tussen twee verschillende beoordelaars over

dezelfde vignette. De intrabeoordelaarsbetrouwbaarheid is de overeenkomst van dezelfde beoordelaar over dezelfde vignette op een ander moment in de tijd. De mate van betrouwbaarheid is onderzocht op basis van de onderzoeksmaten gewogen Cohen's Kappa en de interclass correlation coëfficiënt (ICC). Dit onderzoek is verricht met inzet van 90 vignetten, welke een gelijke verdeling van de vijf urgentiecategorieën en vijf ingangsklachten hadden. Bij analyse werden de urgentiecategorieën gepaard (dichotoom), te weten U1 en U2 samen, evenals U3, U4 en U5.

Als resultaat zagen we een overeenkomst van urgentiecategorie met de NTV van 90.5% (95%CI 87.5-93.6) (335 van 370). De overeenkomst tussen twee beoordelaars was 88.5% (95%CI 84.9-93.0) (177-200) en 84.9% (95%CI 78.3 – 91.4) (101 – 119) na herbeoordeling 3 maanden later. De interbeoordelaarsbetrouwbaarheid van de NTV is volgens Cohen's Kappa is 0.77 en de ICC 0.87. De intrabeoordelaarsbetrouwbaarheid van de NTV is volgens Cohen's Kappa is 0.70 en de ICC 0.82. Deze uitkomsten geven aan dat er sprake is van een goede correlatie, welke overeenkomt met internationale literatuur over triagesystemen. Er kan geconcludeerd worden dat de NTV voldoende betrouwbaar is.

Naast evaluaties van de diagnostische waarden, zoals de reeds beschreven validiteit en betrouwbaarheid, vond ook evaluatie plaats van de gebruikservaringen van zorgprofessionals. In deze evaluatie werd gekeken naar de normalisatie van het gebruik van NTV na implementatie **(hoofdstuk vijf)**. Een verloskundige triagesysteem kan gezien worden als een complexe innovatie in de zorg. Om de implementatie succesvol te laten verlopen werd er in elk ziekenhuis gewerkt met een multidisciplinaire projectgroep bestaande uit een wisselende afvaardiging van verpleegkundigen, physician assistants, klinisch verloskundigen, gynaecologen in opleiding, gynaecologen, ICT-medewerkers en vertegenwoordigers van het management. De implementaties van de NTV werden individueel per ziekenhuis verschillend maar (veelal) procesmatig vormgegeven. Dit was afhankelijk van de bestaande werkwijze en de teamsamenstelling. De leiding was in handen van de projectgroep binnen het ziekenhuis. Deze projectgroep beoordeelde ook welke scholing nodig was en welke ICT-toevoegingen gedaan moesten worden om te kunnen starten met het gebruik van NTV.

Binnen negen ziekenhuizen werd geëvalueerd in welke mate de NTV geïntegreerd was in de dagelijkse praktijk en welke bevorderende en belemmerende factoren daarbij een rol hebben gespeeld. De gevalideerde vragenlijsten Normalization MeAsure Development (NoMAD) ontwikkeld vanuit de Normalisation Process Theory (NPT) werden gebruikt voor de evaluatie. Vanuit deze theorie zijn vier items vastgesteld om

de normalisatie te beschrijven. Te weten: samenhang, betrokkenheid, samen doen en reflectie. In de gevalideerde vragenlijst zijn per item vier tot zeven vragen met een vijfpunts-schaalverdeling opgenomen waarbij de score 1 betekende niet relevant, en 2 helemaal mee oneens en 5 helemaal mee eens. Naar aanleiding van de kwantitatieve resultaten werd met een groep zorgprofessionals een focusgroep gehouden. Het doel van deze focusgroep was om de resultaten gezamenlijk te duiden.

In totaal werd door 173 van de 294 (59%) zorgprofessionals de vragenlijst compleet ingevuld. Van deze participanten gebruikten 90% de NTV langer dan 6 maanden. De digitale applicatie van de NTV werd door 137 van de 173 (79%) zo vaak als mogelijk of altijd gebruikt. De totaal score van de NPT-score was 3.77 (SD 0.36). De NPT-items samenhang en betrokkenheid scoorden respectievelijk 4.01 (SD 0.47) en 4.05 (SD 0.45). Dit was beter dan de items samen doen en reflectie, welke respectievelijk 3.5 (SD 0.45) en 3.72 (SD 0.47) scoorden. Door de focusgroep werd kwaliteitsverbetering als toegevoegde waarde ervaren. Het werd belangrijk gevonden voor een succesvolle implementatie, dat alle betrokkenen toegewijd deelnemen. Daarbij werd met name de rol van de medische specialist genoemd. Rechtmatig gebruik van de triage afdeling door alle professionals werd gezien als bevorderende factoren voor verdere normalisering van het gebruik van de NTV. De zorgprofessionals waardeerden de trainingen en evaluaties. Het werd aangemoedigd deze te continueren in de toekomst. In totaal gaf deze evaluatie een positief beeld van de integratie van de NTV binnen de dagelijkse werkzaamheden van de triagisten en aandachtspunten voor toekomstige implementaties.

In **hoofdstuk zes** worden de resultaten van de patiëntervaringen met de NTV beschreven. De NTV streeft kwaliteitsverbetering en doelmatigheid van zorg na. Patiëntervaringen met de NTV of een ander verloskundig telefonisch triage systeem werden niet eerder onderzocht. Inzicht in ervaringen is wenselijk, omdat dit eveneens een analyse is van de ervaren kwaliteit van zorg. Aangezien de NTV als richtlijn wordt geïmplementeerd, dient de zorgprofessional nog eigen autonomie te ervaren, zodat patiënten bij de toepassing nog voldoende menselijke maat ervaren. Met name als het te consequent wordt toegepast, kan het zijn dat de patiënt geen menselijke maat danwel patiëntgerichte zorg ervaart. Bij patiëntgerichte zorg wordt nagestreefd dat de patiënt actief betrokken is in diens zorgproces. Inzicht werd verkregen door middel van 20 semigestructureerde interviews waarbij topics werden gebruikt. De topics waren verwachtingen, ervaringen, specifiek ook ervaren van empathie, wachttijd, informatie, communicatie, houding van zorgverlener, kwaliteit van de behandeling en wenselijke toekomstgerichte verbeteringen. Analyse vond plaats op basis van de fenomenologische benadering.

Na analyse van de interviews werden drie thema's vastgesteld, te weten: ervaren professionaliteit, benadering door de professional, en informatie en begeleiding. In het algemeen waren de participanten tevreden over het gevoerde telefoongesprek waarbij de NVT werd gebruikt. Zij hebben ervaren dat er een professioneel telefoongesprek gevoerd wordt, waarbij de bereikbaarheid goed was en de professional de verwachte geruststelling gaf. Dit werd in de ervaring van de patiënten met name bereikt doordat zij de mogelijkheid kregen om het eigen verhaal te vertellen en er betrokkenheid was bij het vaststellen van de vervolgstap. De benadering van de zorgprofessional was veelal vriendelijk, empathisch en to-the-point. Extra informatievoorziening over de triagedienst en wat te doen in de tussentijd kan de huidige triage verder verbeteren. De huidige tevredenheid bij patiënten is er weinig aanleiding tot verandering van de zorg.

Als **algemene conclusie** kan worden getrokken dat de NTV bijdraagt aan de verbetering van het huidige zorgproces van een zwangere vrouw met ongeplande (spoed) zorgvragen. De NTV is binnen dit proefschrift ontwikkeld met stakeholders, onderzocht op validiteit en betrouwbaarheid en geëvalueerd door zorgprofessionals en patiënten. Het is een professioneel product dat dagelijks digitaal wordt gebruikt door professionals in ongeveer 30 (40%) van de Nederlandse ziekenhuizen. Door het gebruik wordt gelijkwaardige zorg aan elke patiënt bewerkstelligd en wordt de professional ondersteund in het uniform beoordelen van de klachten.

De NTV kan gezien worden als een voorbeeld voor succesvolle transformatie van de zorg. De aspecten die hier mogelijk een bijdrage aan leveren zijn belangrijk om mee te nemen naar volgende ontwikkelingen. Het eerste inzicht is dat de NVT werd ontwikkeld vanuit een duidelijk ervaren probleem in de praktijk. Vanuit de beroepspraktijk heerste een sterke vraag om de telefonische beoordeling van ongeplande zorgvragen te verbeteren. Hetgeen heeft betekend dat professionals bereidwillig en gemotiveerd waren gedurende alle fases van het onderzoek om bij te dragen aan een oplossing. Ten tweede zorgde de co-creatiesessies voor de ontwikkeling van de NVT met de beroepspraktijk voor een snelle ontwikkeling en snelle acceptatie. Het product sluit daardoor aan bij de behoefte en de wensen van de praktijk. De toevoeging binnen de bestaande digitale systemen hebben de implementaties en het latere gebruik verder ondersteund. Ten derde is er bij de implementatie van de NVT een hoge mate van flexibiliteit geweest. Er was ruimte om per ziekenhuis te kijken naar de startsituatie en het gewenste eindniveau. Leiding aan deze transitie werd gegeven door het eigen ziekenhuis, ondersteund door vroege betrokkenheid van de stakeholders. Communicatie met de eigen achterban verliep daardoor op een natuurlijke manier. Deze communicatie verliep via onderwijs, voorlichting en diverse berichten, dit is belangrijk om de uiteindelijk verandering te normaliseren in de praktijk.

Het ontwerp van de NTV met aansluitende evaluaties heeft afgelopen jaren plaatsgevonden, en heeft een goede basis gelegd voor verdere onderzoeken. Verbetering van de inhoud van de NTV en verdere evaluaties van de implementaties vraagt om meer onderzoek in de toekomst. Het is wenselijk, om bij de implementaties onderzoek te doen naar de rol van cultuur en leiderschap binnen de afdeling. Ook is het aan te bevelen om vervolgonderzoek te doen naar correct gebruik van een triage afdeling (met o.a. capaciteitsverdeling). Analyse van over- en ondertriage is nodig om de NTV inhoudelijk verder te optimaliseren. Ook kan gekeken worden naar uitbreiding van het onderzoeksgebied door ook de kwaliteit van de fysieke triage (met o.a. wachttijd) nader te onderzoeken.

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Over de auteur - Curriculum Vitae

Bernice Engeltjes werd op 25 april 1983 geboren te Elburg. Na de middelbare school ging zij verpleegkunde en vroedkunde studeren aan de Hogeschool van Zeeland te Vlissingen en Antwerpen. Vervolgens ging zij achtereenvolgend werken als verloskundige in Emmen en Harderwijk.

In 2006 ging zij werken in het Albert Schweitzer Ziekenhuis te Dordrecht waar zij gelijktijdig startte met de masteropleiding physician assistant (PA) aan de Hogeschool van Rotterdam. Naast haar baan als PA-klinisch verloskundige in het ziekenhuis, werd zij in 2009 aangesteld als docent binnen deze opleiding.

Als hogeschooldocent van toekomstige physician assistants verzorgt zij sinds 2009 onderwijs, onderzoeksbegeleiding en coaching. Van 2018 tot 2020 voerde zij binnen de opleiding managementtaken uit. Tevens bekleedde zij diverse nevenfuncties afgelopen jaren als bestuurder, adviseur, coauteur, trainer en coach, dit gebeurde zowel regionaal, nationaal als internationaal.

Door Bernice werd in deeltijd onderzoek verricht op het gebied van verloskundige triage. Vanaf 2017 ondersteunt met een promotiebeurs van Nederlandse Wetenschappelijk Onderzoek (NWO) als buitenpromovenda van de Vrije Universiteit van Amsterdam. Omwille van deze aanstelling heeft Bernice sinds 2017 het werken binnen de directe patiëntenzorg in de verloskunde (tijdelijk) gestopt.

Samen met Jorrit Willems is zij woonachtig in Everdingen.

Publications

Scientific publications:

These thesis:

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Diverse **voordrachten** tijdens diverse nationale bijeenkomsten: o.a. Jaarlijkse bijscholing Nederlandse Triage Standaard (NTS), Jaarcongres Nederlandse Vereniging voor Obstetrie en Gynaecologie (NVOG), Koninklijke Nederlandse Organisatie van Verloskundigen (KNOV) en Verpleegkundigen en Verzorgenden Nederland (V&VN)

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Abbreviations:

BSOTS, Birmingham Symptom specific Obstetric Triage System
CTAS, Canadian Triage and Acuity Scale
DOTTS, Dutch Obstetric Telephone Triage System
ESI, Emergency Severity Index
GP, general practitioners
ICC, Intraclass correlation coefficient
ICU, intensive care unit
IOTI, Iranian Obstetric Triage Index
IRR, Inter-rater-reliability
IT: information technology
ITR, Intra-rater-reliability
LR, Likelihood ratio
LUMC, Leiden University Medical Center
M, Mean
MEC-U, Medical Research Ethics Committees United
MFTI, Maternal Fetal Triage Index
MTS, Manchester Triage System
NoMAD, Normalization MeAsure Development
NPS, Normalization Process Scale
NPT, Normalisation Process Theory
NPV, Negative predictive value
NTS, Dutch Triage Standard
N, Numbers
OTAS, Obstetric Triage Acuity Scale
PPV, positive predictive value
ROTS = Rotterdam Obstetric Triage System
SD, standard deviation
SETS, Swiss Emergency Triage Scale
U, Urgency