

TeamObs PhD-Protocol:



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BACKGROUND

There is a lack of research targeting how assessment tools can be used for obstetric team members to improve their technical and non-technical skills in the clinic. There is abundant literature on the relation between patient safety, team science and human factors, but how we assess technical and non-technical skills in real obstetrical teams has not yet been clarified.

Optimal obstetrical emergency management depends on so-called technical (clinical medical) skills and non-technical skills. Non-technical skills are not directly related to high risk management control and standard operating procedures, but they include the cognitive (situation awareness and decision making) and social skills (cooperation, team leadership, communication) that are essential for effective and safe high risk management¹. Inadequate non-technical skills such as error-prone communication, deficient team coordination and poor leadership are leading causes of substandard obstetric care^{2,3,4}.

The obstetric team is especially interesting to study due to the fact that it is interprofessional with obstetricians, midwives, nurses, anaesthetist, and paediatricians collaborating mostly synchronously. Interprofessional teams are more prone to communication errors compared with other teams⁵. Furthermore, obstetric emergency work is dynamic with unpredictable sudden changes and organized into ad hoc teams, where members are unfamiliar with each other and furthermore often have different levels of experience, expertise and skills that need to be brought together in a coordinated manner to counteract threats to patient safety⁶.

This study has two aims. First is to test the usability of a validated assessment tool that measures obstetric medical technical skills and non-technical (i.e. social and cognitive) skills. This usability test will be conducted both in vivo (the clinic) and in vitro (simulation laboratory). Second is to contribute to the often disparate research on the coordination of technical skill performance and non-technical skill performance in teams^{7,8,9,10}. The overall clinical aim is to improve the obstetric staff's medical skills and non-technical skills in working in ad hoc teams.

Whereas some areas of medicine, including anaesthesia and surgery, to a large extent inspired by aviation and crew resource management, have developed metrics for assessing effective teamwork¹¹, there is a lack of such research on obstetric teams. Furthermore, there is the problem of training technical and non-technical skills to medical professionals in a systematic manner. There is evidence from meta-analyses that team training has a positive impact on team performance^{12,13,14}. However, it is generally agreed that team members' good technical skills are not sufficient for satisfactory team performance¹⁵. Medical team performance depends on coordination processes in the team^{5,16,17,18,19,20}. Team coordination is defined as 'the group task dependent management of interdependencies of individual goals, meanings, and behaviors by hierarchically and sequentially regulated action and information flow in order to achieve a common goal'²¹. Parallel team coordinated regulation processes have been demonstrated by DeShon et al.²² to emerge from team members' actions related to pursuing individual and team goals. The sub-processes related to the reiterative nature of goal behavior and coordination are most important: goal commitment, behavior strategies, effort, feedback and feedback loops²³.

Introducing and developing CRM (crisis resource management) in health care has led to a focus on interpersonal behaviours in crisis management and the need for training non-technical skills with the associated behavioural markers as a necessary supplement to technical skills²⁴. For assessing the performance of obstetrical teams, different non-technical assessment tools have been developed: AOTP (Assessment of Obstetrical Team Performance), GAOTP (Global Assessment of Obstetric Team Performance)^{25,26} and CTS (Clinical Teamwork Scale)²⁷. Perfect teamwork in obstetric emergencies is not only a matter of either assessing technical or non-technical skills, but it incorporates both²⁸.

Therefore, an integrated approach considering the interactions between technical and non-technical skills is needed when identifying the weak links in obstetric emergencies. Ellis et al.²⁹ studied eclampsia

management by comparing the effect of drills and training sessions when treating eclampsia at local hospitals to those performed at a simulation center. Further, Riem et al.³⁰ found in a retrospective analysis of performances of 50 anesthesiology residents managing a simulated crisis scenario of an intraoperative cardiac arrest that technical skills and non-technical skills significantly correlated with one another. The literature on obstetrical team training and emergencies is in part based on simulation studies; however, when identifying which skills produce effective team performance in an obstetric emergency, it is important to identify the actual skills used in real (in vivo) obstetric emergencies. Video-recording actual patient care has long been recognised as providing an important resource within medical education and research in particular³¹. We introduce video recording to analyse the technical and non-technical skills used in obstetric teams.

OBJECTIVES

The project has two interrelated objectives:

1. **TeamObs Tool development:** Development of a marker system for obstetrical teams' technical and non-technical skills.
2. **Relationship between Technical and non-technical skills:** Explore how technical and non-technical skills are related in real obstetrical teams on two maternity wards in a University Hospital and a Regional Hospital.

These two objectives will involve the following steps:

1. **Systematic review** of measuring tools used in evaluation of medical team technical and non-technical performance.
2. **Development of a TeamObs Tool.** Based on the review, develop a marker system of technical and non-technical skills in obstetric teams.
3. **Testing of the TeamObs Tool on video recordings of simulations use in obstetrical team training.** Test the usability of the TeamObs tool in simulation concerning inter-rater reliability and sensitivity.
4. **Testing of the TeamObs Tool on video recordings from live video recordings from delivery suites.** Test the usability of the tool in video-recorded situations on the maternity ward, concerning inter-rater reliability and sensitivity.
5. **Conducting a clinical study, exploring technical- and non-technical skills and team performance assessment by the TeamObs Tool.**
 - a. Association between the TeamObs Score and the Global assessment according to the Obstetrical guideline (GAG).
 - b. Association between non-technical skills and technical skills.

METHODS

Study 1: Literature review

The objective is to conduct a systematic review of a) tools used to evaluate medical team performance, and b) the association between technical and non-technical skills. The systematic review will be conducted according to the PRISMA statement³²

TeamObs Tool

Based on study 1, the objective is to develop a tool for measuring technical and non-technical skills in obstetrical teams: The TeamObs Tool

According to our present knowledge several assessment tools have been validated in the human factors literature³³. Non-technical assessment tools such as AOTP, GAOTP^{34,35} and CTS²⁷ will be evaluated by the expert group (supervisor group) from an obstetric viewpoint, and a dedicated tool will be developed by a Delphi process combining the positive results with the strengths of the previously validated tools. The scoring system will be built using the method described in Annett et al³⁶.

The Team Obs Tool will probably include the following six non-technical skills: Team communication, leadership, resource management, decision-making and situation awareness and patient communication and three technical skills: medical treatment, surgical treatment, fetus/new-born treatment. A pilot version of TeamObs Tool is found in Appendix 1.

Global assessment according to obstetrical guideline (GAG) used in study 3-4

The objective is development of a performance score according to the Danish national obstetrical guideline (GAG). The framework of the assessment is a 5-point likert scale that will code by one score the global assessment according to the obstetrical guideline. An expert group (supervisor group) will develop the GAG according to the Danish Obstetrical guideline visible on <http://www.dsog.dk/sandbjerg/>. A pilot version of GAG is found in Appendix 2.

Study population used in study 2-4

Participants in study 3-5 include working staff (junior and senior doctors, midwives and other health personal) in the maternity wards of two hospitals in Central Region Denmark: Horsens Regional Hospital and Aarhus University Hospital, Skejby. Video recording in simulation as well in reality will take place in both hospitals. Approximately 80 different teams each of 3-5 persons will participate in the study.

Video recording used in study 3-4

Professionals from the company Jysk Varesikring will install a video system in maternity suites. A chip will be incorporated in the obstetrician's phone. The chip will activate the video recording when it passes through the door of the suite and will terminate the recording when the obstetrician leaves the room.

The evaluators used in study 2-4.

The evaluators are approximately 4 junior/senior doctors and midwives. They will be trained in a two-day course in TeamObs Tool and GAG. The research group will have predefined video recordings of scenarios demonstrating various levels of performance, both in TeamObs Tool and in GAG.

An on-going calibration of the evaluators will be conducted to ensure high sensitivity according to different performance levels and a high inter-rater reliability score of the raters. The calibration will be performed by active feedback to the evaluators on their competences to rate various levels of performances in both TeamObs tool and GAG.

Training and calibration will be according to GIHRE recommendations²⁸.

Study 2: Testing of the TeamObs Tool on simulations used in obstetrical team training

The objective is to adjust the TeamObs Tool in simulation and to establish inter-rater reliability, sensitivity and usability. Interdisciplinary obstetrical teams will participate in high-fidelity in-situ simulation. Simulations will be video recorded for later assessment. To ensure high face validity in the simulation, the chosen scenarios must be 1) piloted scenarios 2) realistic and 3) limited to situations participants can be expected to comprehend. The five scenarios included in the study are the following:

1) Eclampsia, 2) Post-partum haemorrhage, 3) New-born resuscitation (Apgar $\leq 7/5$ min), 4) Shoulder dystocia and 5) Instrumental delivery. Simulation is high fidelity and in-situ, with a manikin placed in the actual delivery suite in the maternity ward, combined with an actor simulating the trustworthy patient. The surroundings as well as all the equipment are genuine, such as ampoules with medicine etc. Four trained evaluators review the video recordings of 35 different teams performances using the TeamObs Tool and GAG.

The inter-rater reliability and inter-scenario reliability is established by the calculation of Cronbach's alpha coefficient. To establish the test-retest reliability, a Pearson product moment correlation will be calculated. Usability is evaluated in terms of ease of training, simple framework, easy to understand, sensitive to rater workload and easy to observe³⁷ as described by Pezzolesi and Manser³⁷

Study 3: Testing of the TeamObs Tool on the delivery suites

The Objective is similar to that in study 3 to establish inter-rater reliability, sensitivity and usability. The study is similar to the study above and includes video recordings of 35 teams in the same five scenarios. The difference is that this simulation will be live video recordings of real team situations in the delivery suite. The validated and adjusted TeamObs Tool of the previous simulation study will be implemented on live recordings in the maternity suite, and a usability test will be performed²⁵. Four evaluators will review the video recordings, using the TeamObs Tool and GAG. The scores from the TeamObs tool and GAG will be tested for inter-rater reliability, sensitivity and usability similar to that in study 2.

Study 4: Clinical study, applying the TeamObs Tool in the clinic

The Objective is to explore the association between a) the TeamObs scores and the GAG-scores, and b) technical and non-technical skills. 50 recordings of obstetrical management from the maternity suite are included. The scenarios include management of every day situations as well as rare emergencies, with the inclusion criteria of obstetric teamwork: >2 healthcare personal present and one of them an obstetrician. Four raters will review the video recordings, using the TeamObs Tool and the GAG. The TeamObs tool will be tested for inter-rater reliability, sensitivity and usability similar to that in study 2-3. Comparisons of scores will be conducted at each category level in the TeamObs-tool; nontechnical and technical skills will be compared with the overall obstetrical treatment through regression analysis. Skills will be correlated with the best performance (score "5" in overall performance) and by faster time to task completion and change in performance over time is shown by a statistical process control chart.

STATISTICAL ANALYSES

Due to the lack of reliable presumptions, a proper Power calculation has not been conducted. Therefore, the volume of recordings is based on a convenient number and what has been used in comparable studies. Morgan et al. (2012)³⁸ used a total of 34 team sessions for their validation study. In TeamObs project 35 teams sessions will be included to implement the TeamObs Tool in simulation, as well as 35 teams to implement the TeamObs Tool in reality. Fifty teams will be included in the clinical study. The statistical analyses will be conducted in collaboration with Michael Wæth, from Department of Public Health, Institute of Biostatistics, University of Aarhus.

ETHICAL AND LEGAL ASPECTS

The local ethics committee will be approached for written exemption of this study since it is a non-invasive study using questionnaires and video data. The study will be reported to the Danish Data Protection Agency ("datatilsynet"). Video recorders will be placed to minimize perception of the

patient. The recorded material can only be used for research in relation to patient safety issues in this specific study and cannot be distributed to anyone outside the research group. The Central Regions Legal department has been informed of the project. Video recordings in similar studies have been used in the United States³⁹, and the head department of the involved hospitals have approved of the studies as well of video recordings. Anonymity of data is ensured during processing and publication so that no participant can be identified in the publication of the result. All participants will give informed consent, and all members of the research group will sign a confidentiality agreement.

PRACTICALBILITY

In-situ simulations: Obstetrical team training is mandatory in Horsens Regional Hospital and Aarhus University Hospital, Skejby, and 15 simulations have already been recorded. The heads of the department at the involved hospitals have confirmed team training and video recordings to continue through the study period.

Reality video recording: Based on records of the past years' clinical activity, the expected recording time for the selected scenarios could be reduced to 6 months. To avoid unforeseen issues video recordings will take place for 12 months.

Study environment involves journal club, disk at a research-office, and weekly meeting with the main.

PUBLICATION

The studies will result in 3-4 papers based on the literature review and studies to be published in peer-reviewed international journals.

PERSPECTIVE

The perspective of this project is to improve obstetric emergency management by providing an in-depth understanding of how obstetric technical skills and non-technical skills are interrelated to produce effective team performance. Knowledge from this project will guide the clinical field of obstetric health care in the future to adapt education and training of the staffs in maternity wards and teams, to increase safety and reduce unintended situations in the maternity ward.

TIME SCHEDULE

The research plan includes 3 years for PhD study with 1 year for clinical work, from 01.04.14 to 31.03.18 . The spring semester 2016 consists of a stay at the Stanford CAPE simulation Center as a visiting scholar for 3 months; see Appendix 4. See Appendix 5 for a detailed time line.

RESEARCH TEAM

The research team is interdisciplinary. The PhD applicant, is the prime collector and reviewer of data funded and supported by the supervisor group. The main supervisor and PhD applicant will schedule weekly meetings. Assisting supervisors will be called in when needed. All supervisors as well as collaboration partners have contributed to the study design as well the protocol. References

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APPENDIX 1 TEAMOBS TOOL

TeamObs Tool

Instructions: Complete as soon as possible after the obstetric emergencies. Fill out the form, check if yes.

Emergency situation: 1) Eclampsia, 2) post-partum haemorrhage, 3) new -born resuscitation (Apgar ≤ 7 /Ph), 4) Shoulder dystocia or 5) instrumental delivery.

Patients CPR:

Hospital, date and time:

Describe the situation in 10 words:

Technical Skills							
Assess the technical skills according to national guidelines							
Mother	Assessment: ABCDE, TOKS	Not relevant	1 Missing or wrong assessment harmed the patient	2 Assessment issues led to a potential risk	3 Assessment level was acceptable	4 Assessment level was good, with minor issues	5 Perfect Assessment
	Medication:	Not relevant	1 Missing or wrong medication harmed the patient	2 Medication issues led to a potential risk	3 Medication was acceptable	4 Medication was fine with minor issues	5 Perfect medication
	Obstetric/surgical treatment: cup, forceps, section, ect.	Not relevant	1 Missing or wrong treatment harmed the patient	2 Treatment issues led to a potential risk	3 Treatment was acceptable	4 treatment was fine with minor issues	5 Perfect treatment
Fetus/ Newborn	Assessment: ABCDE, TOKS	Not relevant	1 lack of assessment harmed the fetus/newborn	2 Assessment issues led to a potential risk of the fetus/newborn	3 Assessment was acceptable	4 Assessment level was good, with minor issues	5 Perfect Assessment
	Medication:	Not relevant	1 Missing or wrong medication harmed the patient	2 Medication issues led to a potential risk of the fetus/newborn	3 medication level was acceptable	4 Medication was fine with minor issues	5 Perfect medication
	Resuscitation of newborn	Not relevant	1 Missing or wrong resuscitation harmed the patient	2 Resuscitation led to a potential risk	3 Resuscitation was acceptable	4 treatment was fine with minor issues	5 Perfect resuscitation

Non-technical Skills							
Identify opportunities for improvement in non-technical skills (inspiration from Steinemann et al. Trauma Notechs)							
Leadership	Not relevant	1 Lack of leadership, most of the task was not completed.	2 Better than 1, not good enough for 3	3 Acceptable leadership, but the tasks was individual defined.	4 Better than 3, not good enough for 5	5 Clearly defined team leader, good time management, all tasks completed	
Communication	Not relevant	1 Unorganized or incoherent communication	2 Better than 1, not good enough for 3	3 Acceptable communication.	4 Better than 3, not good enough for 5	5 Clear communication with Team Leader as a hub	
Cooperation and Resource Management	Not relevant	1 Unable to discern, role identity members	2 Better than 1, not good enough for 3	3 Identity of all members not clear, some do not perform assigned tasks	4 Better than 3, not good enough for 5	5 All team members clearly fill a role and perform all designated tasks	
Assessment and Decision Making	Not relevant	1 Disorderly and incomplete surveys, plan not clear.	2 Better than 1, not good enough for 3	3 Assessment somewhat out of order, all major tasks complete	4 Better than 3, not good enough for 5	5 Orderly and complete (ABCDE), plan communicated to team	
Situation Awareness / Coping with Stress	Not relevant	1 Interruptions completely upset orderly assessment and task competition, not anticipatory.	2 Better than 1, not good enough for 3	3 Untoward findings caused disruption but did not preclude task completion.	4 Better than 3, not good enough for 5	5 Untoward findings and distractions did not upset systematic and orderly flow, team is calm and plans ahead.	
Communication with the patient	Not relevant	1 No or disruptive communication to the patient	2 Better than 1, not good enough for 3	3 Acceptable communication,	4 Better than 3, not good enough for 5	5 Focused, (empathic) communication	

APPENDIX 2 GLOBAL ASSESSMENT ACCORDING TO OBSTETRICAL GUIDELINE (GAG)

Global assessment according to National Obstetrical guideline.

Scoring system in overall obstetrical care:

In general a “5” is flawless treatment/obstetric care. A “1” indicates the team did not demonstrate any treatment:

- 5:** Perfect treatment according to guideline.
- 4:** Few missed actions, but overall good treatment.
- 3:** Acceptable treatment, with room for improvement.
- 2:** Few correct actions
- 1:** Overall poor treatment – in risk of harming the patient