

Master in Medical Education Degree

Obstetric skills training

Development, implementation and evaluation of a training program



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3 List of words and abbreviations

CI: Confidence interval

CTG: Cardiotocography i.e. the simultaneous monitoring of foetal heart rate and uterine contractions.

DK: Denmark

Eclampsia: A complication in previously diagnosed preeclamptic patient with onset of hyperreflexia, seizures or coma.

HELLP: Hemolysis, Elevated liver enzymes, Low Platelets count (a complication to preeclampsia and eclampsia)

IPE: Inter-professional education

KOS-test: Knowledge of skills test (se section 10.1.1.2)

MPE: Multi-professional education

PPB: Postpartum bleeding = PPH: Postpartum haemorrhage

Preeclampsia: A complication of pregnancy, characterized by a complex of symptoms including maternal hypertension and proteinuria. Symptoms may range between mild and severe.

RH: Rigshospitalet

SD: Shoulder dystocia i.e. a complication to vaginal delivery, where the baby's head is born and the baby's shoulders are impacted behind the mother's pubis.

UK: United Kingdom

4 Summary

Labour wards are high-risk areas for patient safety and labour ward work involves potentially stressful conditions for staff. The aim of this thesis was to design, implement and evaluate a multi-professional obstetric skills training program with emphasis on procedural skills in emergency obstetric situations.

Following a review of the literature, these research questions were generated 1) How does theory and previous research support the development of a multi-professional obstetric skills training program? 2) What is the educational impact of the obstetric skills training program? The study was divided into two separate studies.

Study 1: The designing of an obstetric skills training program at an organisational level. Data for this study were obtained through a literature search, questionnaires amongst the labour ward staff and data on prevalence of obstetric events obtained from the Danish Medical Birth Registry. Research methods were action research and descriptive research. The study involved 1) setting up an organisation responsible for obstetric skills training – “a steering committee”, 2) defining aims and objectives 3) deciding on an educational strategy and designing and manufacturing educational materials, and 4) the development of a plan of action. The study was initiated in June 2003 in the Obstetric department, Rigshospitalet. Based on data obtained through this process, it was decided that obligatory training using a multi-professional training approach was necessary in training in management of postpartum bleeding, shoulder dystocia, basic neonatal resuscitation and severe preeclampsia, and it should be carried out for all midwives, auxiliary nurses, nurses in ante- and postnatal wards and all doctors. In study 1 the process of developing the content of the obstetric training program are described in detail.

Study 2 Implementation and evaluation of the obstetric training program. During a 3-year study period, 220 staff members representing four health professional groups were eligible for the obstetric training. 95 % of the staff eligible for training participated in the training program. Research methods were action research and descriptive research.

Evaluation was in accordance with the model of Donald Kirkpatrick and was carried out before, just after and 9-15 months following the training. Evaluation included attitudes to training, self-assessment, evaluation on how stressful and unpleasant a skill was considered, written knowledge of skills test (KOS-test) in basic neonatal resuscitation to all staff and in management of severe preeclampsia to all doctors and specialised midwives plus furthermore data on how work-routines was influenced and changed.

Data confirmed that staff valued both training and the multi-professional approach to training. Management of shoulder dystocia, severe preeclampsia and neonatal resuscitation were considered stressful and unpleasant by the staff before training and the levels of discomfort with these skills were significantly less pronounced following training. No significant changes were observed for management of postpartum bleeding.

Self-assessed scores of confidence for all the trained skills improved significantly for all health professional groups when measured 9-15 months following training. Self-assessed score of confidence in basic neonatal resuscitation were still significantly higher 9-15 months following training compared to pre-training, however a significant reduction was seen from immediately after training to 9-15 months following training. This might indicate that this skill needs to be trained more often than the other skills trained. The numbers of correct answers in a written KOS-test in neonatal resuscitation, applied to all staffs significantly increased immediately following training. The number of correct answers had significantly dropped after 9-15 months, however not reaching pretest-levels and the numbers of correct answers were still significantly higher than pre-test level.

A significant association between self-assessment of confidence in basic neonatal resuscitation and numbers of correct answers in the KOS-test was revealed, which might indicate that staff were capable of self-assessing their own competencies in this skill. There was no association between many years of work experience and high numbers of correct answers in the KOS test, which might indicate that this skill was not learned or retained over time.

Almost all involved staff reported influences on work routines when asked 9 -15 months following training. Answers could be categorised in "Feeling of confidence and security, "Better coordination", "Common understanding" etc.

The need for organisational changes in the department became visible and lists of changes were made and implemented. Sick leave amongst midwives diminished after the training program was implemented.

The overall conclusions were that an obligatory obstetric training program in the Obstetric department, Rigshospitalet had an impact on both the individual and on the organisational level. Whether or not this has any direct or indirect effect on patient safety remains to be resolved.

4.1 Kort opsummering: Tværfaglig obstetrisk færdighedstræning (in Danish)

Projektet "Obstetric skills training" er en masterafhandling ved Centre for Medical Education, University of Dundee, Scotland. Det omfatter udvikling, implementering og evaluering af et træningsprogram på fødegangen på Rigshospitalet. I perioden 2003-2006 var 220 jordemødre, læger, sygeplejersker, social- og sundhedsassistenter tilgængelige for at indgå i træning i håndtering af skulderdystoci, postpartum blødning, svær svangerskabsforgiftning og den uventede dårlige nyfødte. Evaluering blev foretaget før, lige efter og 9-15 mdr. efter træning. Samlet konkluderes, at der skete individuel læring og ændringer i arbejdsgange og organisering på fødegangen.

5 Introduction

5.1 *The reason for the study*

The idea behind this thesis was to look at the needs for the development, implementation and evaluation of an obstetric skills training program in a labour ward. The focus of this thesis will be mainly on procedural skills used in obstetric emergency situations.

The labour ward has a dual function in both creating a relaxed atmosphere for normal childbirth and also dealing with life threatening emergencies. It makes the labour ward a challenging work place and labour ward staff need to be flexible. It is mandatory that labour ward staff have knowledge, skills and are competent in clinical problem solving, communication and cooperation with both the delivering women, her relatives and all the different health professionals involved in the labour ward and in back-up departments of the labour ward (Drife, 1995; Johansson et al, 2005; Sen and Paterson-Brown, 2004).

From medical litigation and data on clinical risk management we know that the labour ward is a high-risk area (Scholefield, 2005). Johansson et al (2005) reported from the UK that the National Health Service's litigation stands at more than £ 400 million, of which 50 % originates from obstetrics and gynaecology. In Denmark obstetric cases represented only 3.5% of all the cases dealt in with the Danish Patient Insurance Association during 1996-2004, but counted for the double amount of liability costs i.e. 7.6 % (118 million DKr) counted for the highest amount of compensation per case (423315 DKr) (National Board of Patients Complaints of the Danish Public Health Authorities, 2006; Danish Patient Insurance System, 2006). A committee under the Danish Society of Gynaecologists and Obstetricians went through 107 cases from the Danish Patient Insurance System, and 98 consecutive cases from the National Board of Patients Complaints. Cases with asphyxiated newborns, shoulder dystocia and complications to caesarean sections were most often compensated (Hvidman L et al, 2001).

The ongoing discussions about litigation, quality of care and patient safety enhance the necessity of making labour wards a safe and professional place for both patients and staff. Johansson (2005) argue that "those of us involved in training must think creatively" and "new training methods and more emphasis on team training may be part of the solution".

The working conditions in the labour ward may have influences on staff's well-being, training and competencies. Amongst midwives a high burnout score is found in an ongoing six-year prospective intervention study in the human services sector in Denmark (Kristensen et al, 2005). The interest to understand the relationship between motivation (engagement) and

burnout in a working group, with a meaningful primary task of “helping to give births”, is investigated in a Danish PhD study by Engelbrecht (2006). It was concluded that low resources at work were a stress factor and emotional demands and feelings in midwifery were described as having a significant impact in the relationship between motivation and burnout. Established procedures of debriefing and collegial supervision after traumatic birth incidences were viewed as being insufficient and were accused of sometimes leading to posttraumatic stress symptoms. In a British prospective semistructured observational study it was concluded that the intrapartum care could not operate safely and effectively when the number of midwives is inadequate. The midwives are poorly organised and are unable to engage in training and knowledge updating (Ashcroft et al, 2003).

Previous research on obstetric training is sparse. A literature review on obstetric skills training has been published in Denmark (Soerensen and Oestergaard, 2003). Almost at the same time in British Journal of Obstetrics and Gynaecology a systematic review (Black and Brocklehurst, 2003) was published. The conclusion in the British review was “few programs have been described and even fewer have been evaluated. Training methods need to be developed, described and evaluated; further well-conducted research for this important intervention is urgently required.”

5.2 Questions to the literature

This dissertation will address the following topics and in the literature review concentrate on the following questions:

1. What does the literature reveal about the need for systematic skills training programs and simulation?
2. What is the effect of skills training, simulation and multi-professional education?
3. What are the experiences with evaluation and how can the impact of skills training and retention of skills be measured?

6 Literature review - Background

6.1 What is in literature about the need for systematic skills training and simulation?

6.1.1 Definition of training, education and skills

In accordance to Patrick (1992) “training” can be defined as “a systematic development of the attitude/knowledge/skills behaviour pattern required by an individual in order to adequately perform a given job or task”. There is no sharp academic distinction between “training” and “education”. The aim of “education” has been viewed traditionally as broader than that of training. “Training” has a specific objective, which is to improve performance at a particular task, which contrasts with the more wide-ranging aim of “education”. Ideally training tries to create an optimal learning environment for skills that have to be mastered by the trainee (Patrick 1992).

Patrick (1992) summarises important key points about the term skill: 1) Skills are learned or trained. 2) Skills imply some coordinated physical or cognitive activity to achieve a goal. 3) Skills imply on adaptive performance.

In the literature skills, can be seen divided into: clinical skills, information skills, psychomotor skills, technical skills, procedural skills etc, but these words are often used interchangeably and often with a degree of overlap (Issenberg et al, 2004; Kovacs, 1997).

In this study the term obstetric skills are used when obstetric procedures are performed. Mastering skills is a prerequisite for safe performance of procedures. Many of the skills in obstetrics are covered by the traditional expression “obstetric manoeuvres”, and their history goes back many years (Ars Pariendi, 1964; Macedonia et al 2003; Williams, 2005).

6.1.2 Systematic training

The need for a systematic approach in medical education was introduced almost 20 years ago by Harden et al (1984). Factors encouraging a move towards a more systematic approach instead of an opportunistic approach, are summarised to take into consideration the following issues (Harden, 2001):

- The increasing complexities of specialist medical practice.
- The need to ensure that all participants have had comparable learning experiences.

- The move to “out-come based education” * where learning experiences and curriculum content are planned to correspond to the learning outcomes.
- The concept of a core curriculum which includes the competencies essential for medical practice.

The idea behind systematic training is, that training needs to take place in all situations and not only where coincidence gives an opportunity to learn a certain skill. This means that all participants in training, should experience an adequate range of clinical skills instruction and achieves an adequate level of performance throughout a course (Harden, 2001).

The opposite of “systematic” can be seen as the “opportunistic model”, also called the “apprenticeship-model” and can be seen in bedside clinical learning situations, which are difficult to plan and can be difficult to learn from. There will frequently be a time pressure that might cause a “non teaching–friendly environment” and competing demands with potential conflicting interests between trainers and trainees. These problems exist in all kinds of health professions. Essentially the teachers are clinicians and they often do not have protected time for their role as educators and clinical supervisors (Kilminster and Jolly 2000; Spencer, 2003). Harden et al (1984) have criticised the “apprenticeship model: “the teaching itself is largely opportunistic and in medicine it is based on unpredicted clinical situations as they arise. What is taught may depend on which patients are available and on the interests of the staff concerned. The hope is that students, over a period of time, see a representative sample of medical practice”. These characteristics of a challenging learning situation can be seen in all clinical settings, as well as in the labour ward.

Learning can take place in a clinical setting if it is the most convenient place to learn a skill. If it is not considered convenient e.g. because it is a rare event, a simulated setting can be the answer. Often a simulated and clinical setting for teaching / learning can be supplements for each other.

6.1.3 Definition of simulation

Definitions of simulation have been presented in the literature (Fincher and Lewis, 2002; Issenberg et al, 2004; Kneebone 2003; Patrick, 1992). In a review by Issenberg et al (2004) one of the definitions is extensive and seems to cover many of the others: “In broad simple terms a simulation is a person, device or set of conditions which attempts to present education and evaluation problems authentically. The student or trainee is required to

* Outcome based education specifies the outcome participants should be able to demonstrate upon leaving the system (Crosby, 2000)

respond to the problems as he or she would under natural circumstances. Frequently the trainees receive performance feedback as if he or she were in the real situation”.

6.1.4 The need for simulation

Simulation is increasingly used in training. Clinical governance upon which simulation may have an impact include risk management, life long learning, education, training and continuing personal and professional development, staffing and staff management, continuous quality improvement and management of poor performance (Bradley and Bligh, 2005; Bradley and Postlethwaite, 2003; Issenberg et al, 2004).

Evidence is sparse within this area. An opinion-based summary on the advantages of simulators mentioned in the literature is:

- 1) Risks to patients and learners are avoided. The training agenda is determined by the needs of the learner, not the patient.
- 2) Environment is safe. Learners have “permission to fail” and learn from such failure in a way that would be unthinkable in a clinical setting. This gives the opportunity to explore the limits of each technique.
- 3) Undesired interference is reduced.
- 4) Tasks/scenarios can be created according to demand.
- 5) Skills can be practised repeatedly. Learner can be focused on the whole procedures or specific components of a procedure.
- 5) Training can be tailored to individuals.
- 6) Retention and accuracy are increased.
- 7) Transfer of training from the teaching situation to a real life clinical situation is enhanced.
- 8) Standards against which to evaluate trainee’s performance and to diagnose educational needs are enhanced. Simulators can provide objective evidence of performance, even when there is still a range of psychometrics to be developed and validated.
- 9) The simulators offer the potential of providing feedback both for collaborative and for individual learning.

There is a growing pressure for the training process to be transparent. Use of simulation is described to be an option for objective measures of skill and for alternatives to patient-based training and assessment (Kneebone, 2003). Simulation is used in technical skills in anaesthesia (Fletcher et al 2002; Issenberg et al, 2004) and in laparoscopic and endoscopic surgery (Carter et al, 2005; Gallagher and Cates, 2004; Grantcharow et al, 2004; Issenberg et al, 2004; Morthy et al, 2003; Whitted et al 2003).

Also publications about non-technical skills can be found in anaesthesia (Yee et al, 2005), and a few studies in surgery have been published (Lingard et al 2002). Main findings in these studies tell us, that a single exposure to anaesthesia crisis using a high fidelity patient simulator can improve the non-technical skills of anaesthesia residents (Yee et al, 2005). In the operating room, team communication seems to follow observable patterns and is influenced by themes that suggest situations of tension. Tension in team communication affects novices, who respond with behaviours that may intensify rather than resolve inter-professional conflicts (Lingard et al 2002).

In the obstetric literature, it has been stressed that other medical specialities are ahead of the obstetric speciality in the use of simulation, checklists etc (Belfort, 2004; Johansson et al, 2005, Macdonia et al, 2003). The needs for a change in labour ward training to become systematic have been highlighted (Black and Brocklehurst, 2003; Lewis, 2004; Scholefield, 2005; Soerensen and Oestergaard, 2003).

6.1.5 Systematic training in the labour ward

Systematic training in the labour ward, can be described as training in accordance with evidence-based guidelines, checklists, algorithms or action cards to encourage safe practice. In the labour ward, some skills are often used and can be learned in the clinical setting. However some skills often practised may benefit from a more systematic training approach. For the novices on the labour ward more routine-like skills like vaginal exploration, instrumental vaginal delivery, suturing after delivery or foetal blood sampling would possibly improve from being learned through a systematic approach. Ideally, all skills should be trained systematically in a simulated setting, before being practiced in a clinical setting. Very little literature exists to support this hypothesis in the labour ward (Soerensen et al, 2003). Some events in labouring women happen rarely and are almost impossible to learn in a clinical setting. These events are life threatening to mothers, foetus or both, and these incidences are assumed to have potential consequences for staff (Engelbrecht, 2006). Events that only happen on rare occasions, can be identified in obstetric textbooks (Cunningham, 2005), in the literature and from The Danish Medical Birth Registry. Of all deliveries, the prevalence of shoulder dystocia is less than 2% (Baskett TF and Allen A C, 1995; Gherman, 1998); vaginal delivery of breeches is approximately 1-4% (Hickok et al, 1992; Krebs, 2005); severe postpartum haemorrhage 1-2 % (Rizvi et al, 2005); and severe preeclampsia and eclampsia less than 1 % (Andersgaard et al, 2005). Other rare events are newborn delivered in unexpected poor condition that require resuscitation, cord prolapse, vaginal twin delivery and others.

Due to low prevalence these skills will need to be trained systematically by skills training in a simulated setting because they can not be learned in clinical setting.

6.2 What is the effect of skills training, simulation and multi-professional education?

6.2.1 Simulators need to be integrated into training programs

Issenberg et al (2004) concluded in a review on simulation-based education that high fidelity medical simulations are educationally effective and complement medical education in patient care settings. The overall conclusion was that medical simulations facilitate learning under certain conditions. Among ten aspects, the three most commonly cited aspects were: 1) the importance of providing feedback; 2) learners should be given the opportunities for repetitive practice and 3) that it is essential to integrate simulators into the overall curriculum, also when used in postgraduate training. The last conclusion that simulators need to be integrated into training programs, is stressed in several editorials and reviews (Bradley and Bligh, 2005; Maran and Glavin 2003). Any simulator device can only be as good as the educational program in which it is embedded and very many simulators are bought every year and then underutilised due to the lack of educational goals to underpin their use (Maran and Glavin, 2003).

6.2.2 Classification of simulation devices

In recent years technological advances have led to the development of a variety of models and mannequins ranging from simple replications of body parts, to high fidelity patient simulators driven by complex computer models, developed to provide a highly valid replication of clinical environments (Bradley and Postlethwaite, 2003). Different classifications of simulation devices exist. One approach can be (Maran and Glavin, 2003):

- Part task trainers
- Computer based systems (Virtual and haptic systems)
- Simulated patients
- Simulated environment
- Integrated simulators
- Different genres of simulators can be combined to increase both engineering and psychological fidelity.

Other authors emphasise that any simulation is only a partial representation of a complete patient. They stress that it is important that the developer of the simulation decides which elements of the real patient that should be included and which that should be excluded. The teachers need to decide which elements to present to the learner (Fincher and Lewis, 2002).

Combinations of different kinds of simulators are in use. High-tech mannequin computer programs are used to produce realistic clinical environments and team setting within simulated scenarios to practice crisis management and other complex tasks (Kneebone et al, 2002; Kneebone, 2003). These combinations are not described in obstetrics.

6.2.3 Physical and functional fidelity of simulation

Fidelity is the extent to which the appearance and behaviour of the simulator / simulation match the appearance and behaviour of the simulated system. (Maran and Glavin, 2003). A distinction was made back in the 1950s between 1) engineering / physical fidelity and 2) psychological / functional fidelity (Patrick, 1992).

Engineering / physical fidelity is the degree to which the training device or environment replicates the physical characteristic of the real task. Increasing the engineering fidelity of a simulator inevitably leads to increase in the cost. Beyond a certain price, an increase in the fidelity of the training device will only produce a small improvement in performance compared to a simple device. Of greater importance is the concept of psychological / functional fidelity. This is the degree to which the skills in a real task are captured by the simulated task. Some studies have demonstrated that high transfer can be achieved with simple simulators and with little physical fidelity when training cognitive tasks and procedures (Maran and Glavin, 2003). The fidelity of the simulation must be matched with its educational purpose. The highest possible fidelity may be unnecessary or even undesired and may result in an unacceptable expensive simulation, making the methodology an unfeasible teaching tool (Fincher and Lewis, 2002).

6.2.4 Learning theories and simulation

Two trends for learning appear when looking at the classic learning theories and simulation. These two trends can be described under the headings "behaviourism" and "cognitive psychology". "Behaviourism" is a theory where the learner has a more passive role in contrast to "cognitive psychology", where the learner has a more active role.

"Behaviourism" dominated from the beginning of 1900 and to the Second World War. Training in the "behaviourist tradition" was seen as arranging the circumstances for

appropriate stimuli, responses and reinforcements to become linked and ensure inevitable learning. The responsibility of learning therefore fell upon the teacher to arrange the appropriate training situation, which was imposed on a relatively “passive” trainee (Egidius, 2003; Patrick, 1992). Nowadays, there are still training situations within simulation in which reinforcement principles are claimed to be useful in developing appropriate behaviour (Patrick, 1992). For instance, this stimulus-response principle influences over the design of many computer-aided programs. It is especially used in situations where repetitive technical drills are used to develop psychomotor skills in minimally invasive surgery. In this situation, the idea about behaviourism relates to the acquisition of specific manipulative skills, which, once mastered is expected to become part of the surgeons unconscious repertoire of skills (Kneebone, 2003). The “behaviourist tradition” lacks the cognitive and reflective approach and the team training approach, which is needed, when developing obstetric training.

Today the domain of cognitive psychology dominates. The role of the learner has changed and the learner is conceptualised as being active by bringing different strategies, perspectives and interpretations to the subject in the search for a coherent understanding. The teacher is no longer viewed as a transmitter of knowledge and skills, but as a guide who facilitates and engages their participants in their learning in an active way. Learning becomes to be seen as based on prior knowledge (Coles, 1998; Kaufmann, 2003; Patrick, 1992; Regehr and Normann, 1996; Schmidt et al, 1990). This “cognitive approach” focuses on internal mental processes that are within the learner’s control, highlighting the importance of perception, meaning and insight. The learning involves reorganising experiences in order to make sense of stimuli of the environment (Kneebone, 2003; Regehr and Normann, 1996; Schmidt et al, 1990).

A part of the cognitive approach can be seen as “constructivism” (Bradley and Postlethwaite, 2003). Constructivism focus on how people make sense of their experiences, interweaving external and internal influences to build meaning that is relevant for them selves. Kolb further developed this thinking in his theory from 1984 that “learning is the process whereby knowledge is created by the transformation of experience”. It is seen as an active process where a four-stage cycle translates experiences, through reflection into concepts. The constructivist theory might be helpful in understanding the development of clinical judgement and professionalism, where each learner must assemble a variety of learning experiences into a meaningful whole (Colin, 1998; Egidius, 2003; Kneebone, 2003; Maran and Glavin, 2003).

This approach to learning is meaningful to apply when simulation is applied to train more complex skills that also require problem solving and teamwork.

Learning needs to be seen as a two way process, where it is “the teachers responsibility to create the conditions in which understanding is possible and the students responsibility to take advantage of that”. New methods need to be properly embedded in the learning context of the institution in which they will be used or they will fail. From this, it is clear that managing simulator based learning must be an active process and that simply providing sophisticated equipment will not guarantee successful learning (Kneebone, 2003). Learning by simulation needs to be integrated into the organisation and clinical context into which it is going to be used. The context can include a multi-professional approach.

6.2.5 Multi-professional education

In 1988 World Health Organisation defined multi-professional education (MPE) as “the process by which a group of students or workers from the health related occupations with different educational backgrounds learn together during certain periods of their education, with interaction as an important goal to collaborate in providing preventive, curative, rehabilitative and other health related services” (Harden, 1998). A definition from 2001 is related more to the activities of MPE defined as professionals from different disciplines – medicine, nursing, social work and public health – coming together to identify and implement a community project or provide case management services as a team to the identified patient (Ohena et al, 2001).

Another term “inter-professional education” (IPE) can be seen as a subset of MPE, distinguished by its purpose and the methods that are employed to achieve this, and the relationship between the two concepts IPE and MPE is considered as overlapping. (Hammick, 2000). In other papers the terms inter-professional, multi-professional and multidisciplinary are used interchangeably (Ohena et al, 2001). Multidisciplinary teams consist of various disciplines, all interested in the same patient, but with different responsibilities, training and faculties. Interdisciplinary teams openly share decision-making, expectations for care, goals for the team, and mutual respect (Ohena et al, 2001)

Some argue that these definitions of MPE, IPE, interdisciplinary and multidisciplinary teams seem to be based more on intended rather than measured outcomes. A conclusion on the effect of multi-professional or inter-professional training is difficult (Hammick et al, 2002; Zwarenstein et al, 2004). It is assumed that training staff together should bring a higher level of the quality of care that patients are provided with. Such evidence can not be obtained in the literature, which might be due to methodological problems. In the Cochrane review on interprofessional education Zwarenstein et al (2004) concluded, that despite a large body of literature the studies lack the methodological rigour, which is a necessity in understanding the

impact of IPE on health care outcome. No studies have used randomisation to compare isolated training with shared training.

The literature, discussing team organisation in anaesthesia and emergency departments, seems to be related to literature written around the Airline Industry and the principles on crew resource management (CRM) (Sales et al, 2001). This is in contrast to the literature about MPE, IPE, interdisciplinary and multidisciplinary teams, which seems to relate to other health professions within other areas of medicine. It is beyond this thesis to further discuss this area.

6.2.6 Transfer

The effectiveness of training will be evaluated with reference to the transfer of skills (Maran and Glavin, 2003). Transfer occurs when a previously established habit or skill has an influence upon the acquisition, performance and relearning of another habit or skill. Despite that satisfactory levels of performance at the end of training do not automatically guarantee that positive transfer will occur in performance of the job or task in the real world or in the clinical situation (Patrick, 1992).

As with any training, the aim is to maximise positive transfer to the job/task after training. The topic of transfer is therefore central to the discussion of design of a simulated training situation (Patrick, 1992). However only very little research has been done on the transfer from simulation to a clinical setting (Bradley and Bligh, 2005). None of the obstetric studies summarised in table 1 and 2 in section 6.2.9, have studied transfer.

According to Kirkpatrick (1998) the “climate” in the workplace, where the change is going to be implemented, is also an important factor. Sometimes when transfer does not happen, it might not be a question about the training program, but the environment in the workplace. To try to overcome resistance for implementation in the workplace, it might be helpful to involve all professions. It can be seen as an argument for implementation of multi-professional training in a multi-professional organisation.

6.2.7 Planning a training program involving simulation

It is stressed in the literature, that simulators are only of value within the context of a total educational curriculum and that technology must support the training goals (Bradley and Postlethwaite, 2003; Bradley and Bligh, 2005; Issenberg et al, 2004; Kneebone, 2003).

Training by simulation involves all the normal stages of development of a training program i.e. specification of training objectives, analysis of job/task and design of a training program.

A classic article by Ronald Harden (1986): “10 key questions to ask when planning a course or a curriculum”, can be followed when planning a course, which includes simulation. The main points addressed in the article were 1) Needs, 2) Aims and objectives, 3) Content, 4) Organisation of content, 5) Educational strategies, 6) Teaching methods, 7) Assessment, 8) Communication about course, 9) Educational environment and 10) Process. This approach to planning was used in the present study.

Designing of educational material can be based on the ideas in Gagnes' theory (Okey, 1991; Stewart 2001). In design of educational material, the outcome to be taught and learned can be divided into: 1) Intellectual skills – concepts, principles and problem solving 2) Motor skills and 3) Attitudes. Furthermore the hierarchical task analysis, which was developed in the 1950s, can be applied in the design of educational material. In the hierarchical task analysis a task is usually broken down into a series of subtasks. It is well suited to the development of training material and can be used to identify training needs, specify training objectives and elaborating training contents. It provides a logical rather than a psychological analysis of a task (McLeod 2001; Patrick, 1992; Stewart, 2001).

6.2.8 Simulators in gynaecology and obstetrics

Mannequins and models have been used to teach aspects of physical examination, especially those that are particularly sensitive or cause discomfort to the patients, as for instance vaginal examinations. Mannequins and models can also be used in labour wards in situations, which are unpredictable and rare.

Obstetric simulators have been used many years back to the late seventeenth century. More recent pelvic models were introduced in the 1970s (Fincher and Lewis, 2002). These include pelvic trainers used for pelvic examination and delivery mannequins, and are mainly simple models and have been in use in many departments ever since.

Recently an obstetric birthing simulator, Noelle, has been introduced (www.gaumard.com). Whether these more sophisticated obstetric simulators have advantages, compared to more simple models have not been investigated systematically. Some investigators describe how they use them (Macedonia et al, 2003) and some question their advantages (Deering et al, 2006). Another recently invented mannequin with possibilities of force monitoring, is argued to reduce the peak force used in the management of shoulder dystocia and might potentially prevent severe foetal injury (Gurewitsch et al , 2005; Crofts et al, 2005, Crofts at al 2006). Further studies are needed to validate these results.

6.2.9 Skills training and simulation in obstetrics – a review of the literature

In this section skills training and simulation in obstetrics will be addressed. A British review (Black and Brocklehurst, 2003) and a Danish review (Soerensen and Oestergaard, 2003) demonstrate that only few and small studies have been published referring to this issue. The British review (Black and Brocklehurst, 2003) was based on a comprehensive literature search. All together 165 papers were identified and 44 of these were considered relevant. In this British review, 13 publications were considered relevant for the review. Of these 13 publications, six had descriptions of obstetric emergency training programs and four papers involved an evaluation of such programs.

In table 6.2.9-A a description of published training programs is presented. It is with permission* constructed on the tables from the British review (Black and Brocklehurst, 2003). In table 6.2.9-B an evaluation of published training programs is presented, and this table is also constructed from Black and Brocklehurst (2003). The figure is supplemented with an extra row to show the level of evaluation of the programs according to Donald Kirkpatrick's four levels (Kirkpatrick, 1998). Four further studies (Deering et al 2004; Deering et al 2006; Draycott, 2006; Sorensen et al 2003) are added to Table 6.2.9 –A and B.

Kirkpatrick's levels are:

1. reaction (i.e. participants reactions towards the training program)
2. learning (i.e. changes the participants attitudes, improvement of knowledge and/or increased skills)
3. behaviour (i.e. transfer of learning, transferred from an educational setting to real life)
4. results (i.e. final result that occurs as a consequence of the training program – such as quality improvement, decreased mortality or morbidity etc).

These levels will be described and discussed in detail in section 6.3.

In this literature review only studies that describe skills used in obstetric emergency situations and skills used for rare events in the labour ward were included. Studies on teaching, assessment, interpretation and action on electronic foetal monitoring by cardiotocography (CTG) were not included. Despite the fact that these are important topics and only ten studies exist (Young et al, 2001) this topic was found to be beyond this thesis scope.

* Figure 6.2.9-A and B are reproduced from Black SB, Brocklehurst P. A systematic review of training in acute obstetric emergencies. Br J Obstet Gynecol 2003; 110:837-841 with the permission of the Royal College of Obstetricians and Gynaecologists. Few information's are added to figures.

Table 6.2.9-A* description of obstetric training programs

Year of publication and Country	1999 UK (Johansson et al, 1999)	2000 UK (Draycott et al, 2000)	2001 US (Cro et al, 2001)	1998 UK (Patel et al, 1998)	1996 US (www.aafp.org/als)	2000Canada (www.sogc.org/alarms/scientific_e.shtml)	2003 ** Denmark (Soerensen et al, 2003)	2006 UK** (Draycott et al, 2006)
Name of course	Managing obstetric emergencies and trauma (MOET)	Management of eclampsia	Maternal emergencies and resus-citation course (MERC)	Critical event training course	Advanced life support in obstetrics (ALSO)	Advanced labour and risk management (ALARM)	Compulsory obstetric course in specialist training	Compulsory annual course for all staff in Soutmead Hosp.
Personnel being trained	Consultant anaesthetists Obs. consultants and registrars	Midwives, nurse auxiliaries, anaesthetists obstetrician	Midwives, trainee obstetricians	Senior residents in obstetrics and gynaecology	Midwives, obstetricians	Obstetricians, midwives, family physicians, nurses	Obstetric registrars	Obstetric consultants registrars, SHO, midwives
Individual / team	Individual	Team	Individual	Individual	Individual	Individual	Individual	Individual and team
On site / distant from labour ward	Distant	On site	On site	On site	Distant	Distant	Distant. National	On site
Local / national	National	Local	Local	Local	National	National	National	Local
Length of training	3 days	Not stated	One day	3 sessions of 4 hours each	2 days	2 days	1 ½ day	1 day
Personnel organising training	'Faculty' of obstetricians, anaesthetists and resuscitation officers	Staff at hospital	'Faculty' of staff at hospital	'Faculty' of staff at hospital	'Faculty' of midwives, general practitioners and obstetricians	Family physicians and obstetricians	'Faculty' obstetricians appointed by Danish Society of Gyn. and Obs	Faculty of 10 people in a multi-professional steering committee
Use of models	Yes	Not stated	Yes	Yes computer controlled mannequin	Yes	Yes	Yes	Yes
Description of training	Lectures, animal cadavers, moulage with actors, models	Real time scenarios	Lectures, course manual, real time scenarios, small group teaching	Clinical scenarios with the mannequin	Lectures, small group teaching, models	Case-based plenary sessions, workshops	Lectures, scenarios with mannequin	Case-based, small group, workstations
Methods of assessment of participants	Multiple choice questionnaire, real-time scenario with individual feedback	Observation and debriefing	Evaluation sheets, feedback from faculty	Video of event with feedback	Multiple choice questionnaire, real-time scenario with feedback	Written examination, skills assessment stations	Nil	Not stated
Current cost of training per participant (2003)	~£550	Nil	Nil	Not stated	~£350	~£260-650	Nil.	Nil. Course financed by departmental budget

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Table 6.2.9-B* Evaluation of obstetric training programs

	1999 UK (Johansson et al)	1994 US (Beasley et al)	1998 US Taylor et al)	1997 US (Bower et al)	2003 ** DK (Soerensen et al)	2004 ** US (Deering et al)	2006** US (Deering et al)	2006** UK (Draycott et al)	2006 ** UK (Croft et al)
Course being evaluated	Managing obstetric emergencies and trauma MOET	Advanced life support in obstetrics ALSO	Advanced life support in obstetrics ALSO	Advanced life support in obstetrics ALSO	Compulsory obstetric course in specialist training	Residents training at 2 university training programmes	Residents training in 2 university training programmes	Compulsory annual course for all staff in Soutmead Hospital, Bristol	A trial at six hospitals and medical simulation centre
Participants	Obstetric registrars (n=30)	Family physicians, obstetricians, residents, nurses (n=1012)	ALSO course participants (142 of 275 (51.6%) response rate at one year)	Family practice residents (n=55)	Obstetric residents (at least 1 year of training in obstetrics) (n = 44)	Obstetric residents (n=16 in trained group and n=17 in control group)	Obstetric residents N=20	All midwives, obstetricians, anaesthetist. =Outcome in this study not measured on staff.	Midwives (N=95) and obstetricians (N=45)
Method of evaluation	Evaluation form to delegates and postal surveys 4 months (for 2 nd course) and 10 months (for 1 st course) after course	Evaluation form to attendees during course	Survey of comfort in management of obstetric emergencies – pre-course, immediately, 6 months and 12 months post course	Questionnaire before and on last day of course	Questionnaire before and after the course in obstetric skills	Obstetric residents block-randomised by year-group: 1) trained group 2) control group in a program of management of shoulder dystocia	Pretesting without notice in a standardised simulation scenario of vag. breech delivery. After participants received a training session.	A retro-spective cohort observational study after introduction of mandatory obstetric emergency training courses	Randomised training on high fidelity training mannequin or traditional mannequin
Results	Course rated as 'good' or 'very good' by >90% of delegates. 19 incidents of obstetric emergencies felt to be handled better by participants after course	Significant increase in comfort level with obstetric emergencies. Increased likelihood of continuing to provide maternity care	Significant increase in comfort level with 15 obstetric emergencies. Maintained at 12 months	Significant increase in confidence in managing obstetric emergencies. No change in residents intent to provide maternity care on entering practice	Significant increase in confidence in managing vaginal breech delivery, shoulderdystocia, amnioninfusion, postpartum bleeding. No increase in ventouse, foetal blood sampling	Significantly higher scores in all evaluation categories at a standard-dised evaluation sheet in the trained group. Evaluation done 2 weeks after the training.	Significantly higher score at retesting 2 weeks after. Evaluation sheet tested in small group in the faculty.	Significant reduction in low 5 minute Apgar score reduced from 86,6 to 46,6 per 10000 births and hypoxic-ischemic encephalopathy reduced from 27,3 to 13,6 per 10000 birth	Before training 43 % could achieve delivery. All training with mannequins significantly improved performance. The high fidelity mannequin offered additional training benefit
Evaluation according to Kirk-patricks 4 levels **	Level 1 Level 2 on attitudes.	Level 2 on attitudes.	Level 2 on attitudes.	Level 2 with self assessment of confidence	Level 2 with self assessment of confidence	Level 2 Assessment of skills on valuation sheet	Level 2 Assessment of skills on valuation sheet	Level 4 Assessment on perinatal outcome	Level 2 Assessment on evaluation sheet, videos, measures an electronic mannequin

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6.2.10 Summary of the findings about obstetric skills training

For the first time an educational intervention, a compulsory annual course for all staff in a labour ward in Bristol, has been shown to be associated with clinical importance and sustained improvement in perinatal outcome (Draycott et al, 2006). It is an observational study that concludes there is an association between introduction of a training course in the hospital and the improvement in perinatal outcome. In accordance with Donald Kirkpatrick's (1998) four levels of evaluation (see section 6.3.1 for details about the level), all the other training programs were sparsely evaluated in terms of the impact of training programs.

Two of the studies (Deering et al 2004, 2006) assessed performance in a simulated setting using standardised checklists and an observer blinded to the participant's prior training. Checklists were in accordance with guidelines and were tested in a small group of faculties (Deering et al 2004,2006), but no validations of the checklists were carried out. One of these, a small study on training management of shoulder dystocia had a control group. From this study Deering et al (2004) found a significantly higher score in management of shoulder dystocia in an evaluation sheet. However in the study is concluded "although simulation in obstetrics intuitively seems beneficial, it is imperative to validate its use rather than simply endorsing it as effective". Black and Brocklehurst (2003) conclude in their review " There is a need to develop methods of training to all labour ward staff which is based on good scientifically based theory, and assessed in well-conducted observational studies or randomised controlled trials."

None of the studies compare one form of training with another. There are probably advantages and disadvantages of courses run on a local basis and on a national basis. To try to answer these questions, it could be helpful to gain more evaluation on how knowledge and skills taught on a course are transferred to the workplace and whether these skills have any direct effect on outcome data such as treatment, efficacy, morbidity and mortality.

In the “Best evidence medical education” guide on simulation (Issenberg at al, 2004), it is remarkable that amongst the 171 identified articles, no articles within obstetrics were identified. To be included in this comprehensive systematic review, the articles need to apply either experimental or quasi-experimental comparative research designs.

Other kinds of descriptive studies within obstetrics can be identified. Thomson et al (2005) described how the running of an eclampsia drill identifies and corrected potential deficiencies in the care of patients with eclampsia. Drills on obstetric haemorrhage are also described (Walpole and Clark, 2002). Other studies focus on the anaesthetic component of the labour ward work (Goodwin and French, 2001) and are not included in this literature review.

6.3 How can the impact of skills training and the retention of skills be measured?

6.3.1 Evaluation as part of a training program

Evaluation of a training program should be an essential part of the educational process (Morrison, 2003). Evaluation is described to be any attempt to obtain information concerning the effect or value of training in order to make decisions about any aspect of the training program, the persons being trained and the organisation responsible for offering / providing the training (Patrick, 1992). An ideal evaluation method should be reliable, valid, acceptable and inexpensive (Morrison, 2003). Establishing the psychometric properties of reliability and validity of instruments can take years and be costly and ideal methods for evaluation teaching in medical schools are sparse (Morrison, 2003). No doubt compromises must be sought and Morrison (2003) argues that the process of evaluation of a training program itself may produce a positive educational impact.

Different approaches are described in evaluation of training, some approaches are goal-based and some are system-based (Eseryl, 2002). One of the most influential frameworks came from Donald Kirkpatrick in 1959 (Kirkpatrick, 1998) and follows a goal-based evaluation approach.

6.3.2 Kirkpatrick's model for evaluation

Kirkpatrick's model for evaluation of training programs includes four levels of evaluation: 1) reaction 2) learning 3) behaviour 4) results.

1) Reaction-level means that evaluation measures the participants reactions towards the training program. It can also be called a "happiness score". A positive reaction is not a guarantee for learning, but it may increase the motivation for learning.

2) Learning-level defines learning as the extent to which a training program has changed the participants attitudes, improved their knowledge and/or increased their skills. For change in behaviour (level 3) to occur, at least one of these changes must occur.

3) Behaviour-level can also be called transfer of learning, transferred from an educational setting to real life. It is also called change in job-behaviour. One of the problems can be that there may be practical difficulties in assessing it.

4) Eventually the results-level, which is understood as the final result that occurs as a consequence of the training program. This can be measured in quality improvement, decreased costs, decreased mortality or morbidity etc. (Kirkpatrick, 1998; Patrick, 1992; Morrison, 2003).

The four levels are to be evaluated in a sequence, as each level has an impact on the next (Kirkpatrick, 1998). Training is evaluated too infrequently and even when it is, it is too often confined only to the measurement of trainees reactions equivalent with Kirkpatrick's level 1 (Patrick, 1992). Often only parts of the Kirkpatrick model are used, and when the level of evaluation goes up, the complexities involved increase (Eseryl, 2002).

6.3.3 Discussion and critique of the Kirkpatrick model

An idea behind goal-based models as Kirkpatrick's is that it may help practitioners about the purposes of evaluation. One criticism of the model has been, that because of its simplicity, the model could be involved without taking the time to assess needs and resources, or to determine how to apply the model and the results (Eseryl, 2002).

Reid (2004) brings a critical analysis of Kirkpatrick's model. Reid sees the limitations in Kirkpatrick's model because it was developed in an organisation built on a competitive profit orientation and it didn't involve ethical aspects as "beneficence", i.e. respond to the fundamental ethical question: "are we doing the right thing, and are we doing it well?" The Kirkpatrick model can lack analysis of what happened. The Kirkpatrick model asks the question "Was training effective?" A more analytical question could be "How can training be modified in ways that increase its potential for effectiveness?" The Kirkpatrick model does not involve the contextual factors such as learning culture, organisational unit goals, or values and other factors related to human resource development (Reid, 2004).

Further criticism is that the Kirkpatrick model has an assumption of causality that positive reactions lead to greater learning, which produce greater transfer and subsequently more positive organisational results. Other research (Reid, 2004) has failed to confirm such causal linkage and it is assumed that learning might also take place after a participant has been provoked or annoyed.

The linkage between individual-level training outcome and organisational outcomes is complex and difficult to map and measure, especially when it comes to complex intervention to improve health (Campbell et al, 2000).

The choice of Kirkpatrick's model, in this actual thesis, is based on a pragmatic view of the models systematic straightforward approach and the fact that Kirkpatrick's model is well known and implemented in evaluation of other training programs (Issenberg et al, 2004; Hammick et al 2002).

6.3.4 Skills retention

Evaluations of long-term retention of skills in medicine, are remarkably sparse. Retention can be viewed as a special case of transfer, since it requires a trained person to transfer his or her skills to the same task after a period of time (Patrick, 1992).

Evidence confirms the common sense impression that the longer the period of non-use, the greater the decay. The single most important determinant of skill and knowledge retention is the amount of over-learning or additional training beyond that required for initial proficiency (Kneebone et al, 2004). In military research it is demonstrated that the more steps involved in a procedure to be remembered, the worse the retention, and that safety steps tends to be forgotten (Patrick, 1992)

A comprehensive meta-analysis (Arthur et al, 1998) conclude that skills loss were greatest concerning cognitive, artificial and accuracy-based tasks and less in physical, natural and speed-based tasks. Skills loss over time can be reduced by the use of recognition tests, by using similar condition of retrieval and evaluation by behavioural criteria. This meta-analysis was based on 53 articles and only few of the skills included were performed within the medical field. In this meta-analysis is argued, that the use of more “real-world” tasks of complex skill acquisition and retention should be seriously considered in future research. Skills decay in individual versus team tasks, is also described to be important for future research. It is in this meta-analysis described, that for maximum retention, the conditions of retrieval suggest that training conditions should be as similar to the retention conditions as possible (Arthur et al, 1998). This could support the idea that when simulation is applied, it shall create conditions similar to real life clinical settings, for instance a multi-professional approach, if we want to enhance retention.

Retention of skills in medicine is mainly studied in the anaesthetic or neonatal fields of areas of resuscitation and management of airways (Hamilton, 2005; Trevisanuto et al, 2005; Vertongen et al, 2003; Wik et al, 2002; Woolward et al, 2004). The studies are on different populations and are difficult to compare, but the literature suggest that deterioration of the non-used skills seems to happen about 3–10 months after training. Less comprehensive refresher courses may be enough to reach the level above that recorded in the initial training, but little evidence exists in this area. Strategies that seem to improve performance include computer based teaching tools, video self-

instructions, simulation and scenarios (Hamilton, 2005). Another study (Kaczorowski et al, 1998) found that the effects of boosters with mannequin practices or video were less than anticipated.

Conclusions in the literature concerning retention are (Arthur et al; 1998; Patrick, 1992):

1) Level of retention is positively related to the level of learning at the end of training. One problem is that many training situations lack assessment of previous skills and skills acquired just after training.

2)“Over-training” may help retention. It was pointed out by Arthur et al (1998) that investigation of over-learning is methodologically weak and over-learning may just be a higher level of skills acquisition.

3) Retention gets worse, the longer the retention interval. The magnitude of skills loss is specific to both a given task and a given situation.

4) Re-practice of a skill or part of a skill seems to decrease the risk for skill loss during non-practice.

An interesting finding is that people reported individual use of different methods for learning the task, which included use of numbers, verbal spatial labels, visualisation and movement patterns (Patrick, 1992). In the meta-analysis by Arthur et al (1998) it was reported that skills loss were less in physical, natural and speed-based tasks. This could give theoretical background in medicine for the use of memory help as mnemonic rules and a more physical approach to learning on mannequin and models. This may be seen as a challenge in the development of future educational materials.

None of the obstetric studies reported in section 6.2.9 in table A and B study long-term retention of the trained obstetric skills.

7 Research questions

From this literature review I will address these two research question:

- 1) How does theory and previous research support the development of a multi-professional obstetric skills training program?
- 2) What is the educational impact of the obstetric skills training program?

8 Research methods

In the present study the research method “action research” was complemented by other research methods, such as a survey by descriptive design.

Action research is a research method founded approximately 50 years ago. It has been used in a variety of areas, for example in teaching methods, evaluative procedures, administration etc (Cohen et al, 2003). How action research was applied in the present project will be described in the following.

8.1 Action research

Action research is applied to solve a problem, and obtain information in order to improve local practice (Fraenkel and Wallen, 2006; Cohen et al, 2003).

Fraenkel and Wallen (2006) describes four basic stages in the action research method:

1. Identifying the research problem or question
2. Gathering the necessary information to answer the question
3. Analysing and interpreting the information
4. Developing a plan of action

8.1.1 The four stages in action research applied on the actual obstetric skills training program

8.1.1.1 1) Identify the research problem or question

Severe and rare events in labour wards are both life threatening for mothers and/or the foetus, as well as very stressful for the staff. Currently ongoing discussions among all health professions in labour wards are addressing this issue, seeking for means to reduce the occurrence and to act on these

events. In the project it was decided to approach this issue through a needs analysis¹.

8.1.1.2 2) Obtain the necessary information to answer the question

A needs analysis¹ was accomplished through A) A literature review; B) Data from the Danish Medical Birth Registry about the frequency of specific rare events; C) Questionnaires to staff to obtain individual information about the need for obstetric training on an individual level.

8.1.1.3 3) Analyse and interpret the information that has been collected

A triangulation of the three sources of information mentioned in 8.1.1.2 was executed.

8.1.1.4 4) Develop a plan of action.

A plan of action with regards to an obstetric skills training program was considered to involve:

- Establishing a responsible organisation for the training program.
- Defining aims and objectives
- Development of educational and learning strategies
- Design and production of teaching materials
- Development of a strategy to ensure information and to obtain feedback from staff involved in the training
- Development of a strategy to evaluate the training program

The strategy was to follow all the stages of development of a training program as specified by Harden (1986) (see section 6.2.7).

¹ Needs analysis also called needs assessment originates from the areas of social welfare, health programs, social policy research etc. It can be used to identify instructional needs, gaps in present programs, areas for educational development etc (Cohen et al, 2003)

8.2 A descriptive design and interventional study

8.2.1 A descriptive design

Data was obtained from questionnaires, data from the Danish Medical Birth Registry and from hospital statistics.

Descriptive research (a survey) was used to describe various aspects of the participant's level of knowledge and attitudes towards obstetric skills training and specific clinical work situations. In the survey a self-assessed score of confidence, their self reported change in work practice as well as KOS-tests were involved. This was performed at three different times related to the present obstetric skills training program: 1) before training, 2) immediately after training and 3) 9-15 months following training.

The study design can be seen as a pre-experimental design with an intervention on non-randomised group. The health professional groups in the department were the cohort, to be followed and the obstetric skills training program can be regarded as the intervention.

8.3 Statistical analysis

The quantitative data obtained from the questionnaires were analysed using SPSS Statistical Package for Social Sciences and SCD/DIGRAM (Kreiner, 2003).

Loglinear chain graph models (Lauritzen, 1996) were used to analyse the correlations among responses to the questions. The analysis resulted in a chain graph models (se appendix 14.1). Chain graph models are block recursive models with recursive blocks ordered according to temporal or causal structure.

In the analysis of the data from the present study, the recursive structure consists of five blocks ordered according to the time the questionnaires were administered, i.e. before training (=base line) → immediately after first period of training → 9-15 months following first period of training → immediately after second period of training → 9-15 months after second period training. (See section 14.1). A network characterises the chain graph model with nodes

representing variables. Details of the chain graph model can be seen and are explained further in the appendix section 14.1.

Most of the responses were measured on an ordinal 5-point rating-scale, a Likert-like scale. For this reason the strength of the correlation between variables is measured by partial gamma coefficients or partial rank correlations. The gamma coefficient is a non-parametric rank correlation similar to Kendall' rank correlation, but tailor made for ordinal categorical data. In 2×2 -tables, gamma is a function of the odds ratio statistics. The gamma coefficient is sometimes referred to as a "generalised odds ratio". The partial gamma coefficient is a weighted mean of gamma coefficients calculated in different strata of a multidimensional contingency table, which is a coefficient similar to the Mantel Haenzel estimates of the common odds ratio in a 2×2 -tables. For additional discussions of statistical methods for analysis of ordinal categorical data refers to Agresti (1984 and 1990). Data contained repeated responses to questions before and twice after training. Analyses by chain graph models manage the measurement of the strength of the correlation between repeated measurements. The questions on whether or not attitudes and experiences in relationship to the work have been influenced by training can however not directly be answered by the analysis of graphical models. To answer this question, tests of marginal and conditional homogeneity of measurements similar to paired T-tests and analysis of variance of repeated continuous variables were calculated. Performance of this analysis also used gamma coefficients to describe the association between responses to repeated questions. The significance of the p-values was assessed, taking the association between the repeated measurements into account as described by Agresti (1990). The associations between the knowledge of skills tests (KOS test) were also analysed by graphical models. Pairwise T-tests were used for the statistical analysis of the changes of KOS-test scores.

8.3.1 Analysis of qualitative data

Some qualitative data was included. The qualitative data consisted of open-ended questions included in questionnaires and information from meetings held before and after every training session. The qualitative data obtained from questionnaires was analysed by two investigators – the author of this thesis and another with no connection to the course and study¹. The two investigators simultaneously developed categories and categorised the answers to the open-ended questions. Categories were quantified to condense the results and to make them more comprehensible (Mays and Pope, 1995).

¹ Professor dr. med Knut Aspegren

9 STUDY 1: DEVELOPMENT OF AN OBSTETRIC SKILLS TRAINING PROGRAM

9.1 STUDY 1 Material

9.1.1 Material and setting

In June 2003 the present study “Obstetric skills training” was initiated and first training was completed December 2003. The present study took place in the Obstetric Department at Rigshospitalet University Hospital, Copenhagen in Denmark. The department at that time had approximately 3300 deliveries per year¹ with approximately two third referrals from the local community in Copenhagen and one third high-risk referrals from Eastern Denmark and in special cases nationwide referrals.

The participants recruited to the training program and participating in the present study were staff from the Obstetric Department i.e. specialised doctors, trainee doctors, midwives, specialised midwives², auxiliary nurses, and nurses in ante- and postnatal wards. It was estimated that approximately 160 staff members would be employed at a given time, but with a constant change and flow of staff, approximately 200 staff members were expected need training.

9.1.2 Data from the Danish Medical Birth Registry

Data on diagnosis and action diagnosis for the period of 2002-2003 about emergencies and rare events in labour were requested from the Danish Medical Birth Registry, National Board of Health. The Danish Medical Birth Registry receives from public hospitals mandatory records of all hospital

¹ Numbers of labour 2003: 3284; 2004: 3234; 2005: 3372

² Specialised midwives are understood as midwives in a position where they had functions as leaders of clinical work in labour wards, ante or postnatal wards or responsible for training of student midwives. Also included in this group were midwives that had the role of locum specialised midwives.

discharge diagnoses and all outpatients' diagnoses. The codes of diagnosis were in accordance with the international coding of Diseases Version 10 (ICD 10).

9.1.3 Questionnaires before training

The first questionnaire before training was administered to all the participants (N= 220) in the study. The questionnaire was designed with some identical questions to all four health professional groups represented in the study. Some questions varied for the four groups to take into account the differences in the learning objectives for the different health professional groups. In order to compare the data obtained in the questionnaires before and after training, each participant was given a project number. In an attached letter the participants were informed, that their questionnaires were labelled with a project number, which was only known to the project leader. The participants were ensured that during analysis and reporting, data would be treated as non-traceable information.

This first questionnaire was structured with closed questions. Questions about background data were in general dichotomous. Questions on attitudes about organisation of work etc. were obtained on rating scales, such as a Likert-like scale with 5 ranges of responses. All questionnaires were piloted amongst representatives from the different staff groups involved.

A list of all questionnaires involved the obstetric training skills training program can be seen in appendix 14.2

9.2 STUDY 1 Results: Development of an obstetric skills training program

9.2.1 Prevalence of obstetric events based on data from the Danish Medical Birth Registry

Data obtained from the Danish Medical Birth Registry before the training from 2002-2003 are presented in figure 9.2.1-A. These diagnoses are rare, as only 1-30 cases per year are reported (0.2-1.2% of all deliveries). These

diagnoses were reported with almost the same frequency at Rigshospitalet and in the rest of Denmark, apart from severe preeclampsia that are reported with higher frequency at Rigshospitalet than nationwide, because Rigshospitalet is a high-risk unit and receive referrals from all of east Denmark.

Table 9.2.1-A. Prevalence of selected obstetric diagnosis from Rigshospitalet and Denmark

Diagnosis + treatment code including ICD10	2002				2003			
	Number of cases		Number of cases in percentage of total number of deliveries		Number of cases		Number of cases in percentage of total number of deliveries	
	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark
Shoulder dystocia DO 660	6	401	0.2 %	0.7%	12	337	0.4 %	0.6 %
Severe preeclampsia DO141	27	193	0.9 %	0.3%	37	221	1.2 %	0.4 %
'HELLP' syndrome DO142	13	78	0.4 %	0.3%	8	86	0.2 %	0.2 %
Eclampsia DO15	1	15	0.03 %	0.02%	3	24	0.09 %	0.04%
Prolapse of cord DO690	7	57	0.2 %	0.1%	5	63	0.1 %	0,1 %
Vaginal breech delivery DO641 only vaginal	5	179	0.2 %	0.3 %	8	219	0.2 %	0.4 %
Vaginal twin delivery DO300 only vaginal	28	596	0.9 %	1.0 %	44	554	1.3 %	0.9 %
Deliveries per annum	3072	62315	-	-	3284	62812	-	-

In table 9.2.1-B data on the prevalence of postpartum bleeding is shown. Rigshospitalet had a lower frequency of women treated with medicine administered to contract the uterus in delivering women with postpartum bleeding. This lower number has been explained by incorrect coding by some hospitals, where the nationwide recommended administration of prophylactic oxytocin to all normal deliveries is incorrectly coded as treatment.

Table 9.2.1-B. Selected diagnosis and treatment codes from Rigshospitalet and Denmark.

Diagnosis and treatment code including ICD10	2002				2003			
	Number of cases		Number of cases in percentage of total number of deliveries		Number of cases		Number of cases in percentage of total number of deliveries	
	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark	Rigs-hospi-talet	Den-mark
Postpartum bleeding without specification DO 72 or DO721	103	2113	3.3. %	3.6 %	112	2097	3.4%	3.6 %
Medicine to contract uterus after delivery BKHD0	137	5168	4.5 %	8.7 %	150	5324	4.5 %	8.9 %
Blood transfusion BOQA0	21	470	0.7 %	0.8%	34	554	1.0 %	0.9%

9.2.2 Previous training and lack of training

Figure 9.2.2-A shows how many of the different group of professionals who had experienced obstetric skills training since they left the midwifery - or medical school. Many doctors had previous training experiences, whereas

only few of the other staff groups had experience with skills training. Amongst nurses 31 of 40 (78%) reported lack of practical training possibilities.

Table 9.2.2-A

Staff in the labour ward (n=207) answers to a question about experiences with obstetric skills training or practical training since they left the midwifery or medical school.

Staff in the labour ward (n=159) answers to a question about whether they had lacked obstetric skills training since they left midwifery- or medical school. Nurses not asked

	Have you had any experiences with skills training or practical training since midwifery or medical school				Have lacked obstetric skills training			
	Yes		No		Yes		No	
	N	%	N	%	N	%	N	%
Specialised Doctors	19	70%	8	30 %	21	84 %	4	16 %
Trainee Doctors	18	86%	3	14 %	14	74 %	5	26 %
Auxiliary Nurses	1	5%	19	95 %	19	95 %	1	5 %
Specialised Midwives	5	28%	13	72 %	13	76 %	4	24 %
Midwives	22	28%	58	73 %	61	78 %	17	22 %
Nurses	9	23%	31	77 %	Not asked			
All	74	36 %	132	64%	128	81%	31	19 %

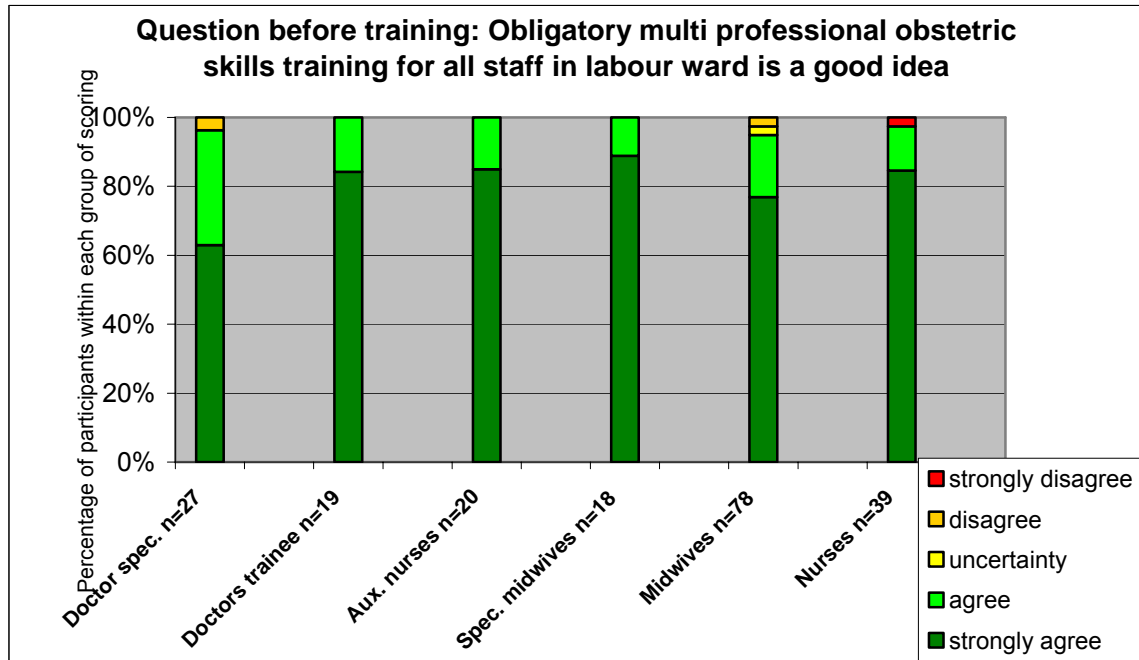
9.2.3 Attitudes towards the planned obligatory and multi-professional training

Before the training program was implemented, staff members were asked about their attitudes towards training organised as a multi-professional and obligatory program. Almost all staff agreed or strongly agreed to the idea about implementation of an obligatory obstetric training program. No significant differences between the different health professional groups were found (data not shown).

In figure 9.2.3-A data on the agreement to develop a multi-professional training can be seen. Almost all staff, except for a few, agreed on the idea.

There were no statistical significant differences between the health professional groups

Figure 9.2.3-A All health professional groups (N= 201) were asked before training whether they considered obligatory multi-professional training as a good idea. This was rated on a scale 1 to 5, where 1=strongly agree (dark green) to 5=strongly disagree (red).



9.2.4 Development of an organisation responsible for the obstetric training program

The management of the Obstetric Department, Rigshospitalet together with the project leader appointed a steering committee. The steering committee consisted of:

- The consultant responsible for clinical lead in education in the Centre for Children, Women and Reproduction at Rigshospitalet was appointed the project leader (and is the author of this master dissertation)
- The obstetric chief consultant
- The chief midwife
- The chief nurse

- A consultant in the Obstetric Department (in practice various obstetric consultants participated)
- A trainee doctor
- Three specialised midwives
- Two midwives
- An auxiliary nurse
- The midwife responsible for the training of midwife students.

The steering committee referred to the management of the Obstetrical Department, which referred to the management for the Centre for Children, Women and Reproduction at Rigshospitalet.

When relevant, doctors from the Anaesthesia department and the Department of Neonatology were involved.

The steering committee held three planning meetings and a further two meetings. In these meetings the completed training program to be implemented was discussed and in second meetings these were pilot-tested and revised.

The daily work was organised by the project leader and the three specialised midwives.

9.2.5 Aims and objectives of the obstetric multi-professional skills training program

These aims were defined for the project in conjunction with the steering committee:

- To improve the clinical skills in the obstetric department.
- To obtain increased understanding of the complexity of the work and the role of the different staff in the obstetric department.
- To improve the multi-professional effort in situations with obstetric events, which demands involvement of different health professional groups.

Objectives

- Ensuring the responsibility of the steering committee in the department for the multi-professional training for all midwives, auxiliary nurses, doctors in the labour ward plus nurses in the post- and antenatal wards.
- Defining objectives and detailed content in the programs of systematic multi-professional training in the chosen obstetric skills: management of postpartum bleeding, shoulder dystocia, basic neonatal resuscitation and severe preeclampsia. These training programs should be based on local guidelines and when possible on existing evidence. The objectives for the procedures to be trained were varied for each health professional group (and is not presented in this thesis).
- Design and production of systematic teaching materials for each skill to be trained.
- Writing and implementing of new clinical guidelines for the four topics involved in the obstetric skills training program.
- Appointing and training a group of specialised midwives and specialised obstetricians, in order to establish an exclusive group of teachers who could help run lectures and scenarios during the obstetric training program.
- The actual running of the multi-professional training program for all doctors, midwives, auxiliary nurses in the labour ward and nurses in the ante- and postnatal wards.
- Design and distribution of questionnaires to describe the different groups self-assessment and attitudes before, immediately after and 9-15 months after training.
- Design, production and implementation of the “knowledge of skills test” in chosen obstetric skills (management of basic neonatal resuscitation and severe preeclampsia).

9.2.6 Educational strategies, design and manufacturing of educational material

Every training session was scheduled for 2 ½ hours and involved:

- A systematic lecture with a Power Point presentation in plenum (10-20 minutes) for 12 persons from different health professional groups.
- A multi-professional workshop in groups of 6 that involved a scenario with skills training on mannequins and included relevant equipment.
- Discussion and feedback in plenum.
- For basic neonatal resuscitation, knowledge of skills tests (KOS-test) (see section 10.1.1.2) were applied to all staff members before, immediately after and 9-15 months after training. For the management of severe preeclampsia, KOS-test were applied all doctors and the specialised midwives.

The educational materials were primarily focused on motor skills and less on intellectual skills and attitudes. If intellectual skills were involved, the focus was mainly problem solving, communication skills and cooperation between staff involved in the training. The attitudes were mainly focussed on inter-professional communication involved in the scenarios.

Power Point presentations were made for each of the topics to be trained.

In the present study the idea about hierarchical task analysis was used to develop teaching materials and power point presentation (see section 6.2.7)

Each power point presentation contained of many photos of a delivery mannequin and other equipment. Simple illustrations were made to highlight important obstetric skill manoeuvres. Photos of real equipment, taken at the labour ward, were also used in the presentations. An example (in Danish) can be seen in the appendix section 14.3.1.

To support the instructional power point material a detailed framework or flowchart was developed for each topic (see example in Danish in section 14.3.2). Each flow chart consisted of columns with the following headings: 1) Aims; 2) Skills; 3) Knowledge (with relevant literature references and web paged); 4) Safety; 5) Evaluation.

For each workshop, scripts with scenarios with clinical cases were written. Scenarios were constructed on the fundament of rare events in clinical life. The scenarios were planned to include parts of simulated environments such as a delivery mannequin or a baby mannequin combined with scenarios containing drips, catheters, medicine, suction devices etc. Examples (in Danish) for the program in basic neonatal resuscitation can be seen at www.obstetrisktraening.rh.dk

9.2.7 Economy

All the training was planned to be obligatory. The training was planned free of charge for the participants. The participants were paid by the hour, if they could not be trained within normal working hours. A cost analysis for the obstetric training program was performed and the calculation was based on the assumption that no staff could be trained within normal working hours. The total price for the training of all staff members in 2003 was calculated to be approximately 190000 Danish crones (approximately 25000 euro). The salary for the staff who developed the training program and the teaching-staff were not included in the budget. All costs were covered by the departmental budget.

9.3 STUDY 1 Discussion: Development of the obstetric skills training program

9.3.1 Needs analysis of data the Danish Medical Birth Registry

Data from the Danish Medical Birth Registry (table 9.2.1-A and B) supplied us with frequencies of the rare events in the labour. Shoulder dystocia, severe preeclampsia from 2002-2003 were only recorded with a frequency of 0,2-0,9 % of the deliveries. In absolute figures it accounts for 6-39 per year only at Rigshospitalet. For eclampsia it was very few, 1-3 cases per year. The number of staff eligible for training in a given period would be approximately 160 and a constant alteration in the staff employed was

anticipated. It is evident that such rare incidences cannot be learned and retained through training in the clinical setting.

The data from the Danish Medical Birth Registry on postpartum bleeding (table 9.2.1-B) confirmed that bleeding as expected from the literature (see section 6.1.5), was a more frequently experienced, i.e. 3.3 – 4.9 % of all deliveries at Rigshospitalet, which accounts for 103-159 cases per year at Rigshospitalet. Postpartum bleeding occurs more frequently than the other analysed events; however it is only on average 1-2 per cases year, per midwife. For practical purposes this means that each midwife will experience this event on average once or twice a year. Therefore we decided that training in management of postpartum bleeding in a simulated setting was a constructive way to improve the multi-professional approach to this potentially dangerous clinical event.

The validity of data from the Danish Medical Birth Registry is controversial, and it is known that different departments have different traditions of coding, and incorrect coding is identified (see section 9.2.1). Validity studies tell us, that severe diagnoses seem to be correctly coded and it has been shown, that operations, procedures and diagnosis within well established areas seem to be valid, whereas validity problems have been found within categories as pain relief (Langhoff-Roos and Rasmussen, 2003). A recent Danish PhD study concluded that the diagnosis preeclampsia had a high specificity, which means that very few women were wrongly diagnosed with preeclampsia if they did not have the disease, whereas there was room for improvement with regards to sensitivity (Klemmensen, 2005). In accordance to this the frequencies on preeclampsia in table 9.2.1-A might be a little higher.

Andersgaard et al (2006) confirmed the same finding.

A Swedish study report that clinicians underestimate shoulder dystocia, and it might be underreported (Mollberg et al, 2006).

9.3.2 *Participants previous training experiences*

In the present study only a quarter of midwives and very few auxiliary nurses reported experiences with previous skills training. Though even many doctors reported previous skills training experiences in obstetrics, approximately three quarters of them answered that they had been lacking skills training (table 9.2.2).

We did not ask how the doctors experienced the previous training they had attended. According to another Danish study (Soerensen et al, 2003) the traditional skills training is often evaluated as being less well organised. More than three quarters of all staff members answered that they had been lacking skills training (table 9.2.2-A). It was seen as a good prerequisite for recruiting staff into an obligatory training program.

No data exists from Scandinavia on how many labour ward units run multi-professional obstetric skills training programs. In a survey from the UK (Anderson et al 2005) where 77 % (185 of 241) of the labour ward units were telephone interviewed; 151 of 185 units ran classroom-based emergency training. The content and frequency of training and “not warned” drills were very different and were not described in detail in the study.

9.3.3 *Attitudes towards planning obligatory and multi-professional training*

The staff members were asked about their attitudes towards the implementation of obligatory training, and almost agreed or strongly agreed that obligatory multi-professional training was a good idea (Figure 9.2.3-A). This is in accordance with the fact that a majority also reported that they had lacked skills training.

In the present study four different health professional groups were going to be involved. The objectives for the skills to be trained were varied for each group i.e. this can be seen in multi-professional teams with interest in the same patient but with different responsibilities (see section 6.2.5). The participants strongly agreed that the training should be multi-professional.

9.3.4 Conclusions on development of the obstetric skills training program

Rare obstetric events carry risks to the patients and to the staff involved, and we are therefore dealing with clinical situations which fulfil the needs for training in a simulated setting (see section 6.1.4). We cannot expect these rare obstetric skills to be learned in unpredicted clinical situations as they arise.

We planned and developed the obstetric skills training program in accordance with the ideas on systematic training (section 6.1.2) and included the normal stages of development of a training program (see section 6.2.7).

Concerning simulation the conclusion is that it is important to integrate simulators into the overall curriculum (see section 6.2.1). In the present study the obstetric skills training were obligatory and integrated into the working schedule for all health professional groups in the labour ward. We planned to work with changes in local guidelines and if required, changes in the departmental work routine during the training period.

We had an educational strategy (see section 9.2.6) that included lectures and workshops with scenarios involving mannequins (see section 6.2.2 and 6.2.8 and 6.2.9). The educational strategy and design of learning materials were based on the principles about hierarchical task analysis described in section 6.2.7.

The context in the present study was a multi-professional approach. These health professional groups work together and it was assumed in the steering committee that the only approach was to train them together. The multi-professional approach might support the idea that the simulation applied, could create comparable training conditions, as in real life clinical conditions. A hypothesis can be that involvement of a multi-professional approach might support the effect of training and enhance the retention of the learned skills (see section 6.3.4).

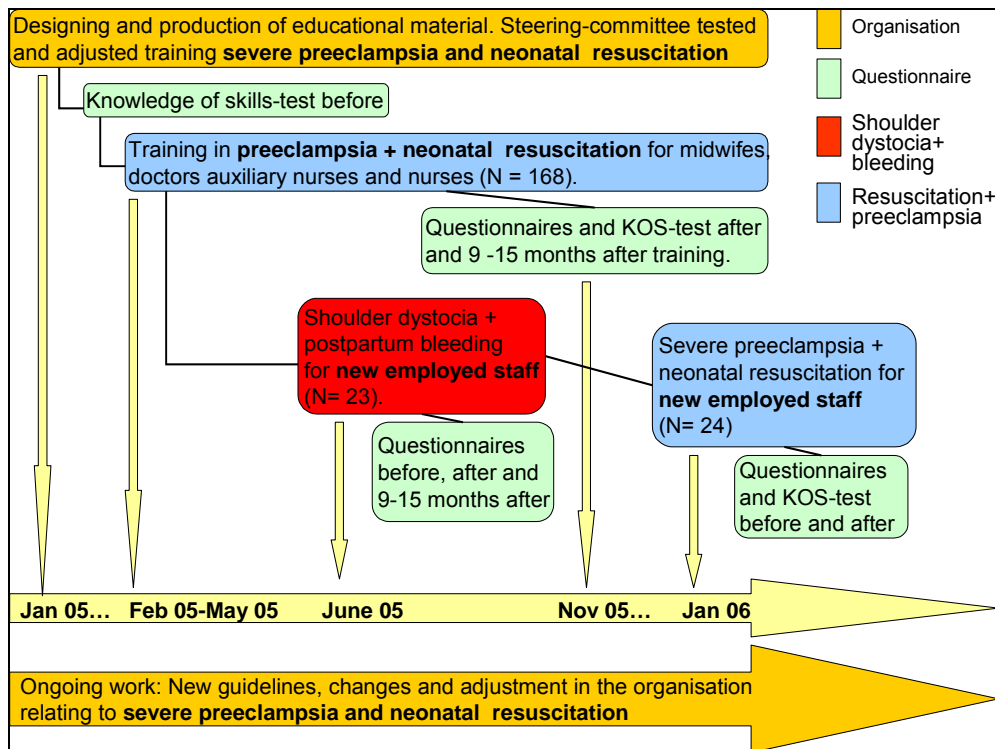
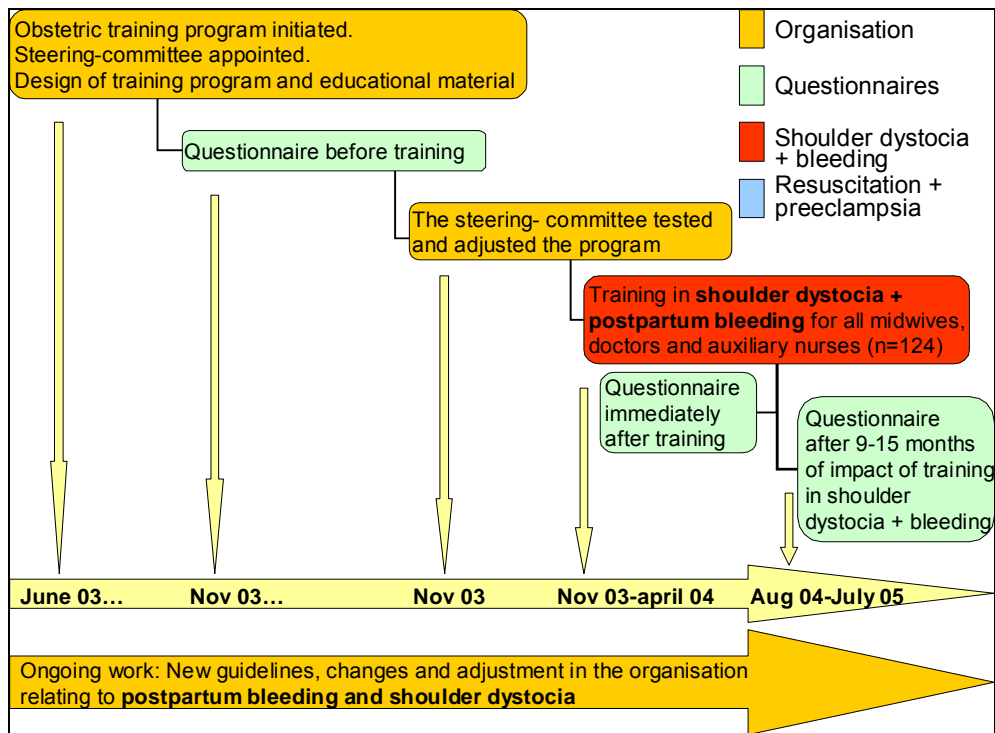
10 STUDY 2: IMPLEMENTATION AND EVALUATION OF THE OBSTETRIC SKILLS TRAINING PROGRAM

10.1 STUDY 2 Material

In the study period from June 2003 – June 2006, 220 staff from four different health professional groups working in the labour ward or ante- or postnatal ward were included in the study.

The setting is described in section 9.1.1 and figure 10.1-A shows details on the organisation, offered training and questionnaires. Two different training programs were undertaken consecutively. The first time period of the study focused on the management of postpartum bleeding and shoulder dystocia (red colour in figure 10.1-A). This involved all doctors (both junior and senior doctors) whom were on call in the labour ward and all midwives and auxiliary nurses in the labour ward. This program was not offered to nurses. The second time period of the study focused on management of severe preeclampsia and neonatal resuscitation (blue colour in figure 10.1-A) and involved the same staff plus nurses in the ante- and postnatal wards. Training in management of shoulder dystocia and postpartum bleeding was repeated for new employed staff during the second time period. In figure 10.1-A the yellow gives information on organisation and the colour green gives information about questionnaires and knowledge of skills test.

Figure 10.1-A: Flowchart of the organisation and structure of the obstetric skills training program at the Obstetric Department, Rigshospitalet June 2003- June 2006.*



* For KOS-test = knowledge of skills test, see section 10.1.1.2

10.1.1 Evaluation tools

Evaluation tools are presented in the following in accordance with the model of Kirkpatrick (1998) (see section 6.3.2):

- 1) Reaction: Questionnaires about attitudes to the training program immediately after and 9-15 months after training.
- 2) Learning: Questionnaires before, immediately and 9-15 months following the training including self-assessment of confidence and whether clinical events are considered stressful and unpleasant plus the knowledge of skills test (see section 10.1.1.2)
- 3) Behaviour: Questionnaire with open-ended questions on how work procedures may be influenced by training.
- 4) Results: A) Data collected during oral and written evaluation of the training program, about the need for changes in working procedures at the organisational level. B) Data on prevalences obtained from The Danish Medical Birth Registry before and after the intervention periods. C) Data from hospital statistics about midwives sick leave was collected from the Administration at Rigshospitalet

10.1.1.1 Description of questionnaires

Questionnaires were given to all the participants at the following point of measures: 1) Before training, 2) immediately after training and 3) 9-15 months following training. A detailed list of the 12 questionnaires used is presented in the appendix 14.2.

See section 9.1.3 for details about the design of the questionnaires, project number and information to participants.

All questionnaires except questionnaire number 3 were with quantitative questions. Questionnaire 3 was semi-structured with some open-ended questions (see appendix 14.2).

10.1.1.2 Description of “Knowledge of skills test”

“Knowledge of skills” is by Kramer et al (1997) defined as knowledge concerning the technical, procedural and knowledge assessing skills-related aspects.

In the present study the “knowledge of skills test” (KOS-test) in basic neonatal resuscitation and management of severe preeclampsia were constructed with 7-8 short cases based on clinical scenarios (2-4 lines) followed by 3-6 questions with a yes / no / do not know response format (see example in Danish 14.3.3). The KOS-test in neonatal resuscitation was constructed and piloted among neonatal and anaesthesiologist specialists. The KOS-test in management of severe preeclampsia was tested amongst experienced obstetricians and experienced midwives.

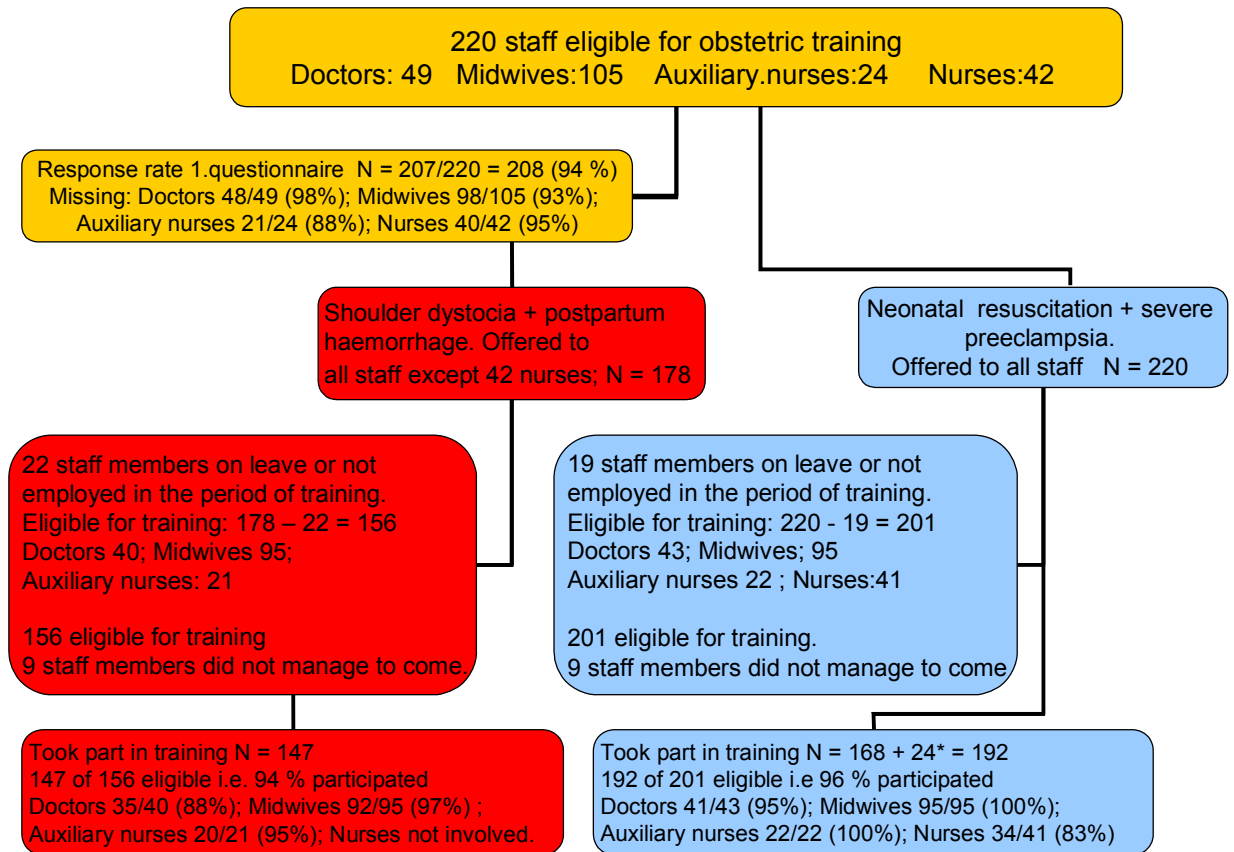
All the KOS-tests were administered before, immediately after and again 9-15 months after training. The KOS-tests were given without prior warning to the participants, and they were asked to answer immediately. The participants were not able to seek information in guidelines or other material when they answered.

10.2 STUDY 2 Results: Implementation and evaluation of the obstetric skills training program

10.2.1 Participants attendance in training

Figure 10.2-1A show in detail how many participants within the different health professional groups that were eligible for the obstetric skills training program, and how many that managed to participate in the training program.

Figure 10.2.1-A. Details of training offered and attendance in the different groups of health professionals.



* 24 participated late in the study period. They were not eligible for questionnaires and KOS testing 9-15 months after the training programme.

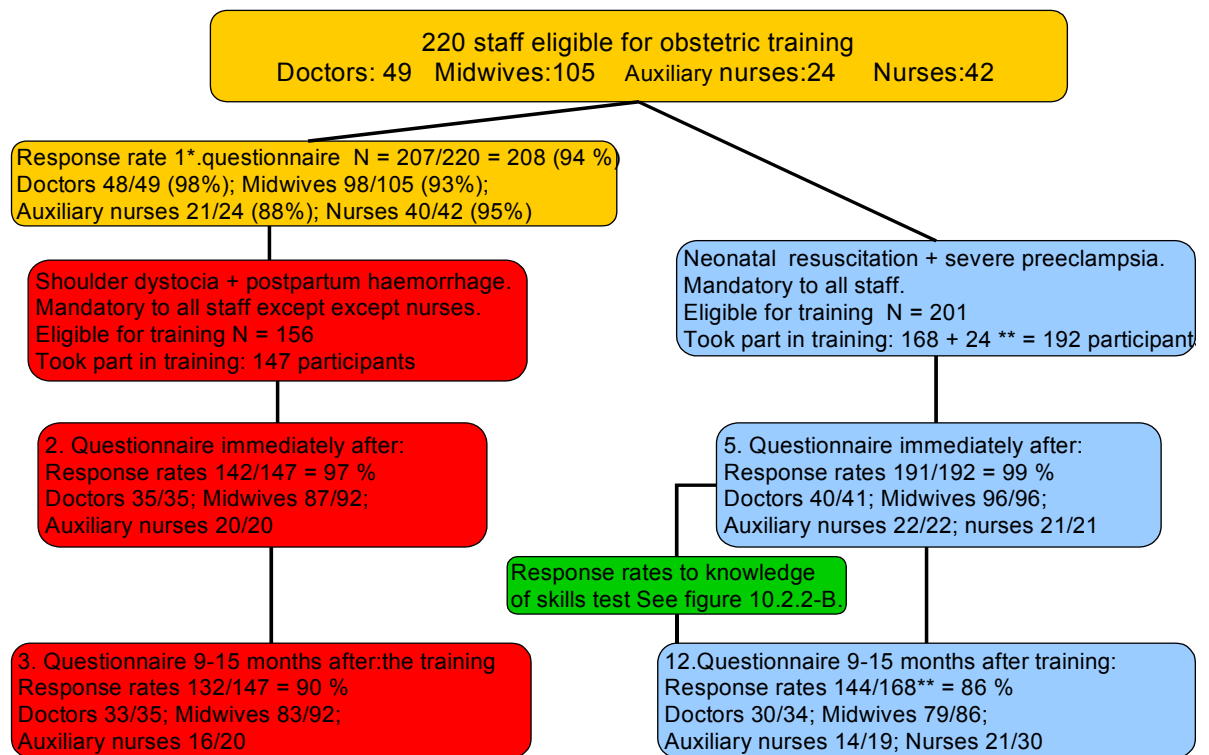
The attendance was high for staff eligible for training. For midwives 95-100 %, for doctors 88-95 %, for auxiliary nurses 95-100 % and for nurses 83 % of eligible staff participated.

At the time of collection of the last questionnaires, approximately 10-15 % of staff was no longer in the department. They were either on maternity leave, sick leave, on leave for education or were no longer working in the department. These figures were constantly changing. These participants were sent a letter or a mail and requested to answer the questionnaires.

10.2.2 Response rate to questionnaires

Response rates to the questionnaires, including the knowledge of skills test, can be seen in detail in figure 10.2.2-A.

Figure 10.2.2-A Details of response rates to questionnaires from the different groups of health professions.

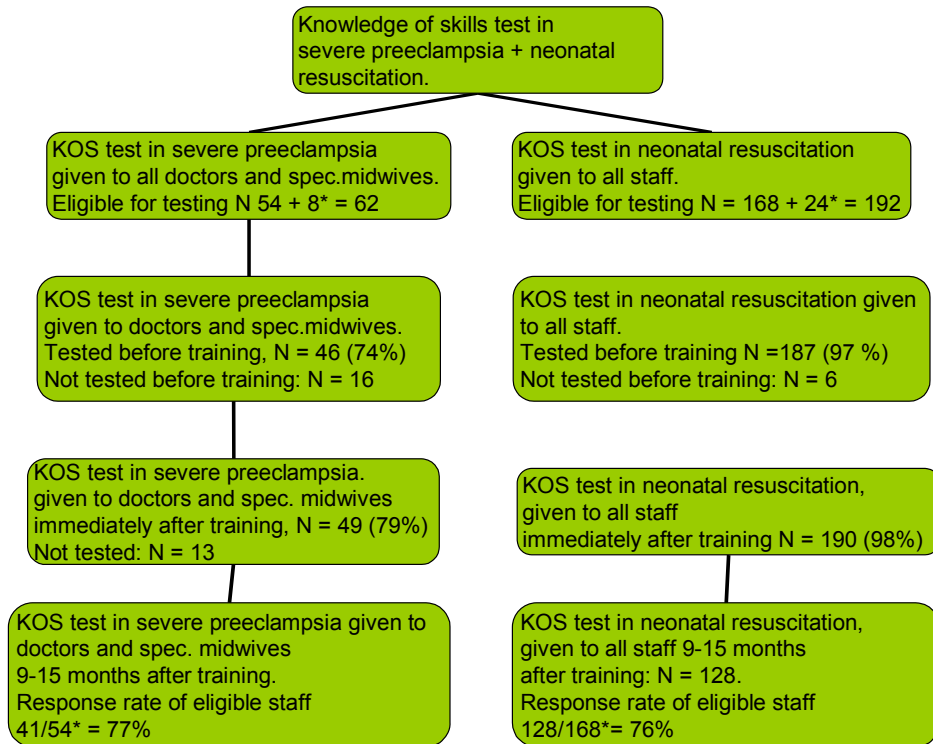


*The numbers at the questionnaires referred to the list of questionnaires in the appendix section 14.2

**24 participated late in the study period, and were not eligible for questionnaires and the KOS test 9-15 months after the training programme.

All response rates were over 90 % to the questionnaires delivered before training and immediately after training. The response rates were lower, 85-90% for the questionnaires to be answered 9-15 months after training. The response rate to the knowledge of skills test (KOS-test) can be seen in figure 10.2.2-B.

Figure 10.2.2-B Response rates to the knowledge of skills test



*8 and 24 participated late in the study period, and were not eligible for 9-15 month questionnaire and testing

Response rate to the KOS-test in neonatal resuscitation before and immediately after training were high, 93 % and 96 %.

The response rates to the KOS-test in severe preeclampsia were 74% before and 79 % after training. The KOS-test in management of severe preeclampsia was time scheduled to be immediately before and immediately after the scheduled time of training. The low frequencies were mostly due to some doctors arriving late and others leaving immediately after the end of training. The response rates to the KOS-test 9-15 months after training were in neonatal resuscitation 75 % and in management of severe preeclampsia 77 %. The KOS-tests were only applied to staff that were still working in the department. They were asked to answer immediately, to try to ensure standardised test conditions, however it resulted in a lower response rate.

10.2.3 Analysis of non-responders

To analyse whether the non-responders represent a selected subgroup in the data material, the non-responders were analysed and compared to the responders. There does not seem to be any selection in relation to years with obstetric work experiences, self-assessed confidence and numbers of correct answers in the first knowledge of skills test.

Neither did the participants who were eligible for training, but did not manage to attend the training, differ from the participants whose attended the training. (Data not shown)

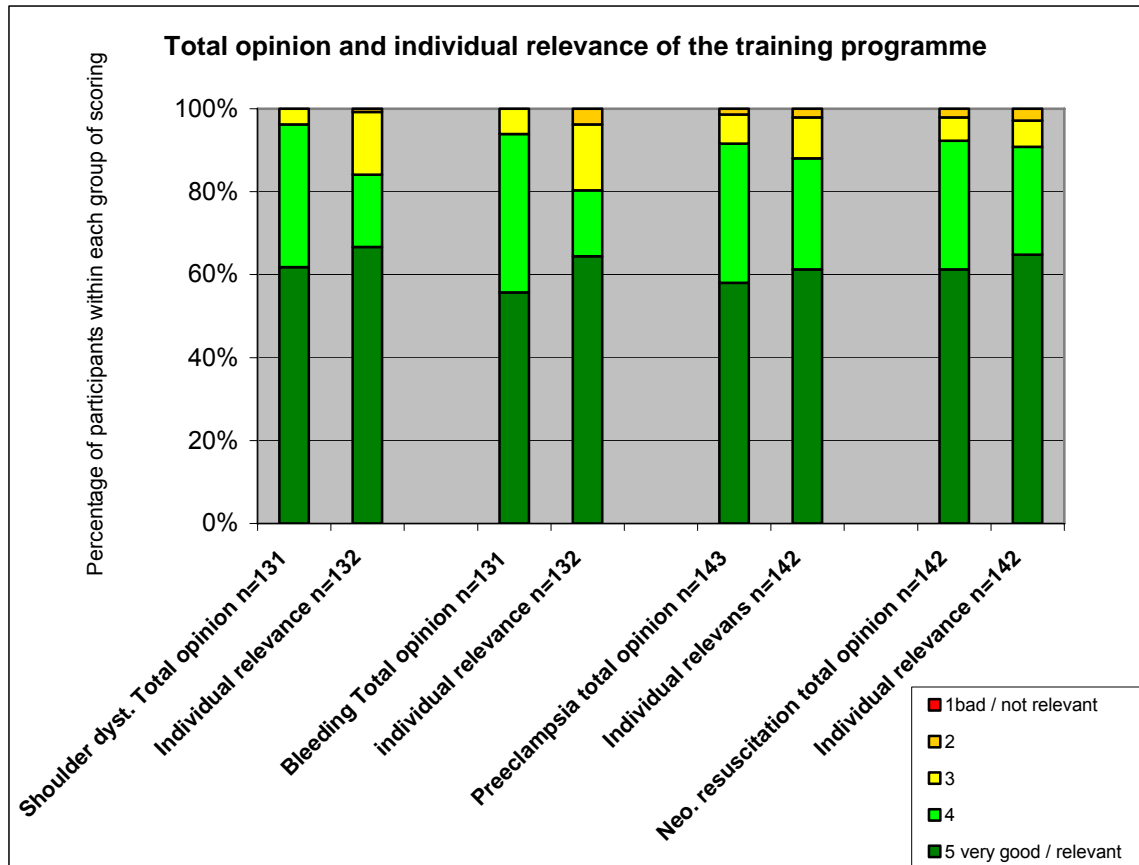
10.2.4 Reaction to training

Data about reaction to training was obtained after 9-15 months. Questions were about the participants total opinion of the training program and the participants individual relevance of the training in management of shoulderdystocia, postpartum bleeding, severe preeclampsia and basic neonatal resuscitation.

In figure 10.2.4-A it can be seen that more than 85 % of the participants agreed or strongly agreed that the four training programs were good and more than 80 % agreed or strongly agreed that they considered the training to be relevant for them.

Figure 10.2.4-A Participants attitudes 9-15 months after obstetric training. The first question was about their total opinion to the training program on a scale 1= bad (red) to 5=very good (dark green).

The second question was about how they consider their individual relevance to the different obstetric skills which were trained on a scale 1=not relevant (red) to 5=very relevant (dark green)



Statistical analysis did not reveal any statistical differences between the different health professional groups (Test of marginal and conditional homogeneity)

10.2.5 Attitudes to the multi-professional training and organisation

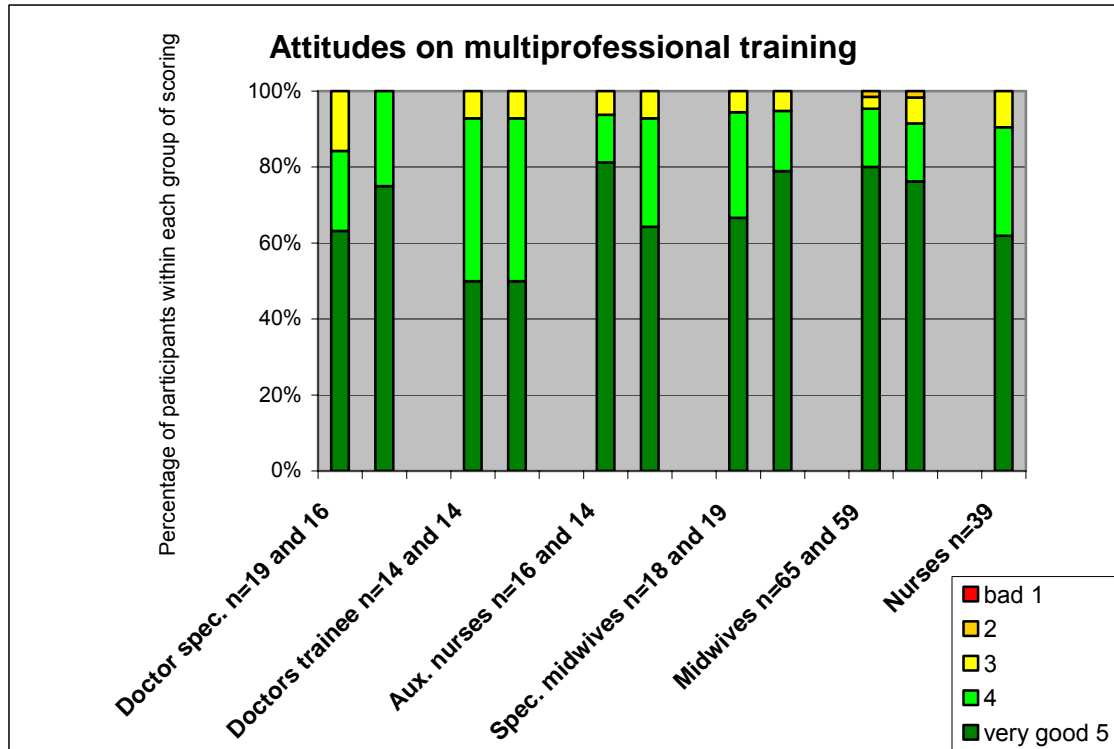
Nine to 15 months after training staff were asked about their attitudes to the multi-professional organisation. Results can be seen in figure 10.2.5-A.

Between 85-95 % of all staff consider the multi-professional organisation of training to be good or very good.

Figure 10.2.5-A The different health professional groups attitudes after training on how they consider the organisation with multi-professional training. It was rated on a scale 1= bad (red) to 5= very good (dark green).

Column 1: After training in management of shoulder dystocia and postpartum bleeding (nurses not trained).

Column 2: After training in management of severe preeclampsia and neonatal resuscitation.



Statistical analysis: Analysis between the two periods of training showed association $\gamma = 0.77$. There were no differences between the two periods of training $p = 0.363$ (Test of marginal and conditional homogeneity).

There were no differences between the different groups of health professions (data not shown) (Test of marginal and conditional homogeneity).

10.2.6 Obstetric skills considered stressful and unpleasant

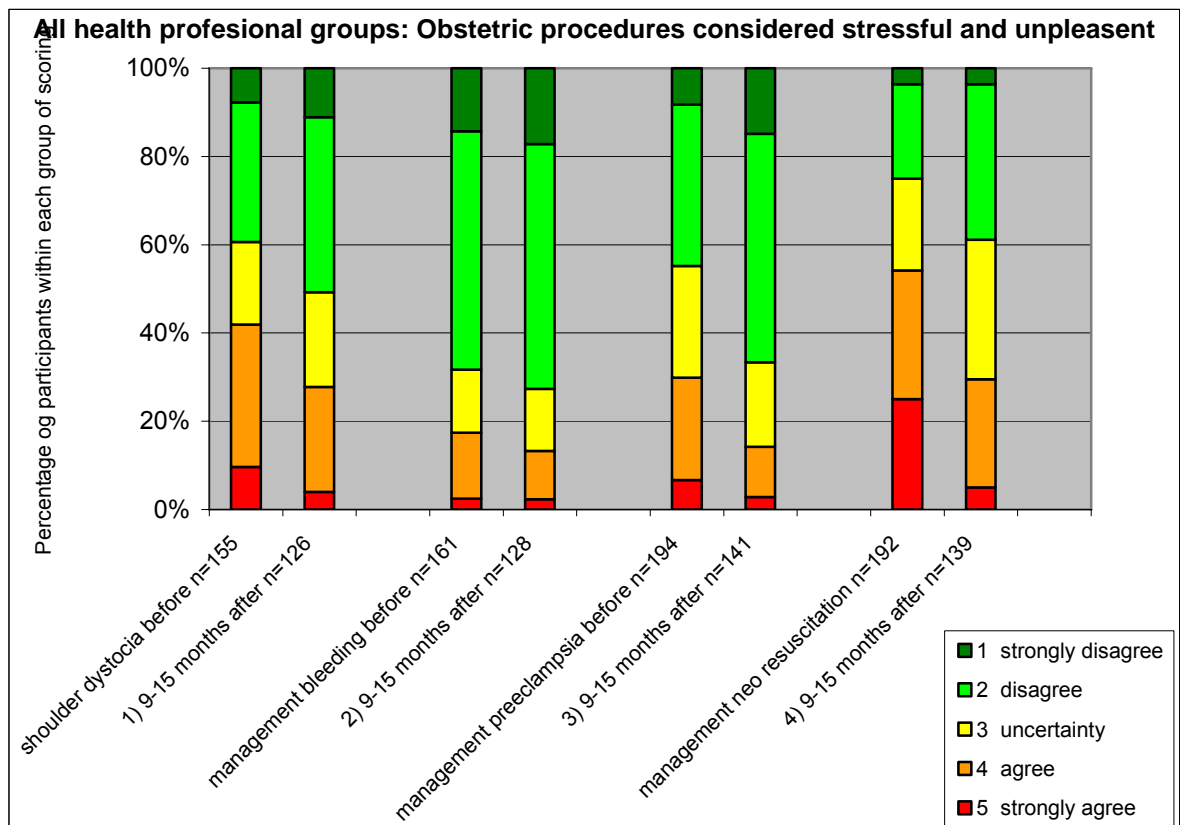
The different health professional groups in the labour ward were asked before training whether they considered management in different obstetric procedure to be unpleasant and stressful.

Data in figure 10.2.6-A showed that 42% of the staff before training agreed or strongly agreed that management of shoulder dystocia was unpleasant and stressful and 9-15 months after training this was significantly reduced to 28%.

There was an insignificant reduction in the numbers that consider postpartum bleeding stressful and unpleasant, from 18% before training to 13% after

training. For management of severe preeclampsia a significant reduction from 30% to 14% was seen; and for basic neonatal resuscitation a significant reduction from 54% to 29%.

Figure 10.2.6-A. Participants (data for all health professions) rated before and 9-15 months after training on whether management of **shoulder dystocia, postpartum bleeding, preeclampsia and basic neonatal resuscitation** were considered stressful and unpleasant. It was rated on a scale 1=strongly disagree (dark green) to 5=strongly agree (red).



Statistical analysis: Partial gamma coefficients showed association between measures obtained before and 9-15 months after training for all trained skills 1) $\gamma = 0.52$; 2) $\gamma = 0.29$; 3) $\gamma = 0.53$; 4) $\gamma = 0.4$. Significant changes to less stressful and unpleasant after training were seen for shoulder dystocia 1) $p = 0.003$; preeclampsia 3) $p = 0.000$ and neonatal resuscitation 4) $p = 0.000$. For postpartum bleeding 2) $p = 0.239$ (Test of marginal and conditional homogeneity).

Detailed data on how the different health professional groups considered the different skills as stressful and unpleasant before and 9-15 months following training can be seen in appendix figure 14.4 –A, B, C and D.

In general, reductions in how stressful and unpleasant staff considered a skill, can be seen for the auxiliary nurses, the trainee doctors, the midwives and

the nurses. Less or no reductions can be seen for the specialised doctors and the specialised midwives. For midwives all trained skills except for management of postpartum bleeding, were scored significantly less stressful and unpleasant 9-15 months following training.

Nurses were only trained in management of severe preclampsia and basic neonatal resuscitation. For both skills, a significant reduction was found in how stressful and unpleasant the nurses scored 9-15 months following training.

10.2.7 Self-assessed confidence before, immediately after and 9-15 months after training

Data about self-assessment was obtained before, immediately and 9-15 months after training. The questions to the different health professional groups were related to the objectives to be fulfilled in training.

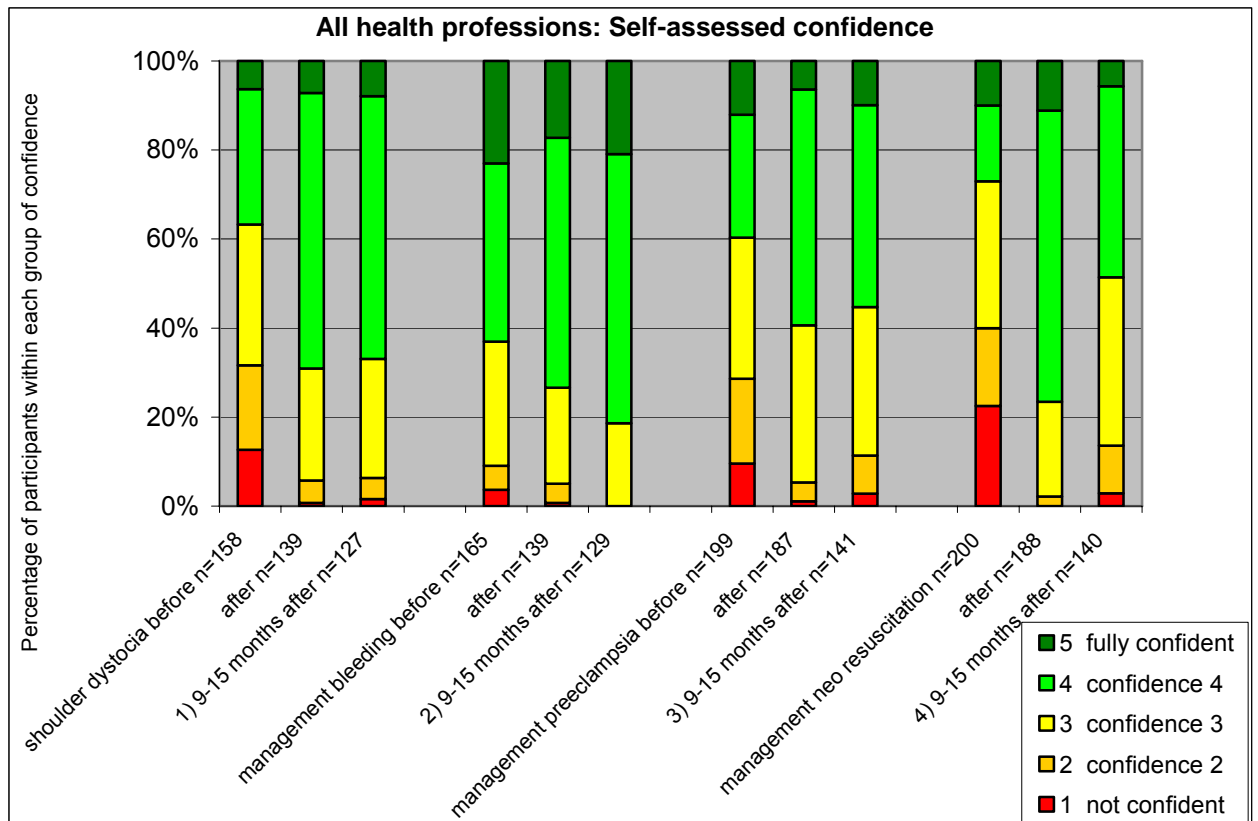
In figure 10.2.7-A data is presented for all health professions and in the appendix 13.5-A, B, C and D, for self-assessment for management of shoulder dystocia, postpartum bleeding, severe preeclampsia and basic neonatal resuscitation. The different health professional groups are specified. Data in figure 10.2.7-A shows, that for management of shoulder dystocia 32% of staff before training, self-assessed that they were not confident (score 1 or score 2) and 9-15 months after training their assessment was significantly decreased to 6 %. There was also a significant decrease in the numbers that self-assessed that they were not confident (score 1 or 2) in management of postpartum bleeding, from 9% before training to none after training. For management of severe preeclampsia a significant decrease from 29% to 11% was seen and for basic neonatal resuscitation a significant decrease from 40 % to 14%.

An analysis of how self-assessed confidence was retained, revealed that for management of shoulder dystocia and severe preeclampsia there was no significant (respectively $p=0.156$ and $p=0.223$) reduction in self-assessed confidence from immediately after training to 9-15 months following training.

However, for neonatal resuscitation, there was a significant reduction ($p=0.000$) in self-assessed confidence from just after training compared to 9-15 months following training.

The partial gamma coefficients give information about the strength of the correlation between the variables. The gamma coefficients, between score of confidence obtained just after training, only weakly ($\gamma < 0.15$) correlate to the measures obtained just before training and / or 9-15 months after training, such data obtained just after training must be interpreted with caution.

Figure 10.2.7-A. All health professionals self-assessment before, just after and 9-15 months after training on whether management of **shoulder dystocia, postpartum bleeding, preeclampsia and basic neonatal resuscitation**. It was rated on a scale 1=not confident (red) to 5=fully confident (dark green).



Statistical analysis: The partial gamma coefficient showed associations between the confidence of score obtained before training and 9-15 months after training. 1) $\gamma=0.5$; 2) $\gamma=0.21$; 3) $\gamma=0.24$; 4) $\gamma=0.39$. However, the score of confidence obtained just after training did not correlate to the measures obtained just before training and / or 9-15 months after training. Significant changes in self-assessment from before training to 9-15 months after, were significant for shoulder dystocia 1) $p=0.000$; 2) postpartum bleeding $p=0.007$; 3) preeclampsia $p=0.000$ and 4) neonatal resuscitation $p=0.000$ (Test of marginal and conditional homogeneity).

For the different health professional groups, the detailed data can be seen in appendix figure 14.5- A, B, C and D. In general there was a greater increase in the score for high self-assessment in confidence amongst the trainee doctors, auxiliary nurses, midwives and nurses and less amongst specialised doctors and specialised midwives.

Self-assessment and the assessment of confidence (score 4 and 5) in management of shoulder dystocia, was significantly increased from before training to 9-15 months following training. For trainee doctors a rise from 15 % to 50 %, for specialised midwives from 89 % to 100 % and for midwives from 22 % to 56 %. Self-assessment of confidence with management of postpartum bleeding was increased for trainee doctors from 48 % to 100 % and for auxiliary nurses from 22 % to 50 %. Self-assessment of confidence (score 4+5) in management of severe preeclampsia was significantly increased for trainee doctors from 33 % to 43 %. Finally, self-assessment of confidence (score 4+5) in management of basic neonatal resuscitation was significantly increased for trainee doctors from 20 % to 36 %, for midwives from 24 % to 53 % and for nurses from 13 % to 21 %.

10.2.8 Involvement in neonatal resuscitation or management of severe preeclampsia

In table 10.2.8-A and B, data is presented for the different health professionals involvement in neonatal resuscitation. Only a few auxiliary nurses and nurses have ever been involved in neonatal resuscitation. Within the last 9-15 months only a few, mostly doctors, were involved in basic neonatal resuscitation.

Table 10.2.8-A Specialised doctors, trainee doctors, auxiliary nurses, specialised midwives, midwives and nurses answers to whether they ever or within the last 9-15 months had been involved in management of basic neonatal resuscitation.

	Specialised doctors		Trainee doctors		Auxiliary nurses		Specialised midwives		Midwives		Nurses	
	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Yes	15 (71)	4 (36)	4 (22)	2 (15)	3 (14)	1 (8)	12 (57)	2 (12)	24 (33)	7 (13)	1 (3)	0 (0)
No	6 (29)	7 (64)	14 (78)	11 (85)	19 (86)	11 (92)	9 (43)	14 (88)	48 (67)	48 (87)	33 (97)	19 (100)
Total	21(100)	11(100)	18(100)	13 (100)	22(100)	12 (100)	21(100)	16 (100)	72(100)	55 (100)	34(100)	19 (100)

In table 10.2.8-B data is presented on doctors and specialised midwives involvement in management of severe preeclampsia.

Table 10.2.8-B. Specialised doctors, trainee doctors and specialised midwives answers to whether they ever or within the last 6-15 months have been involved in management of severe preeclampsia.

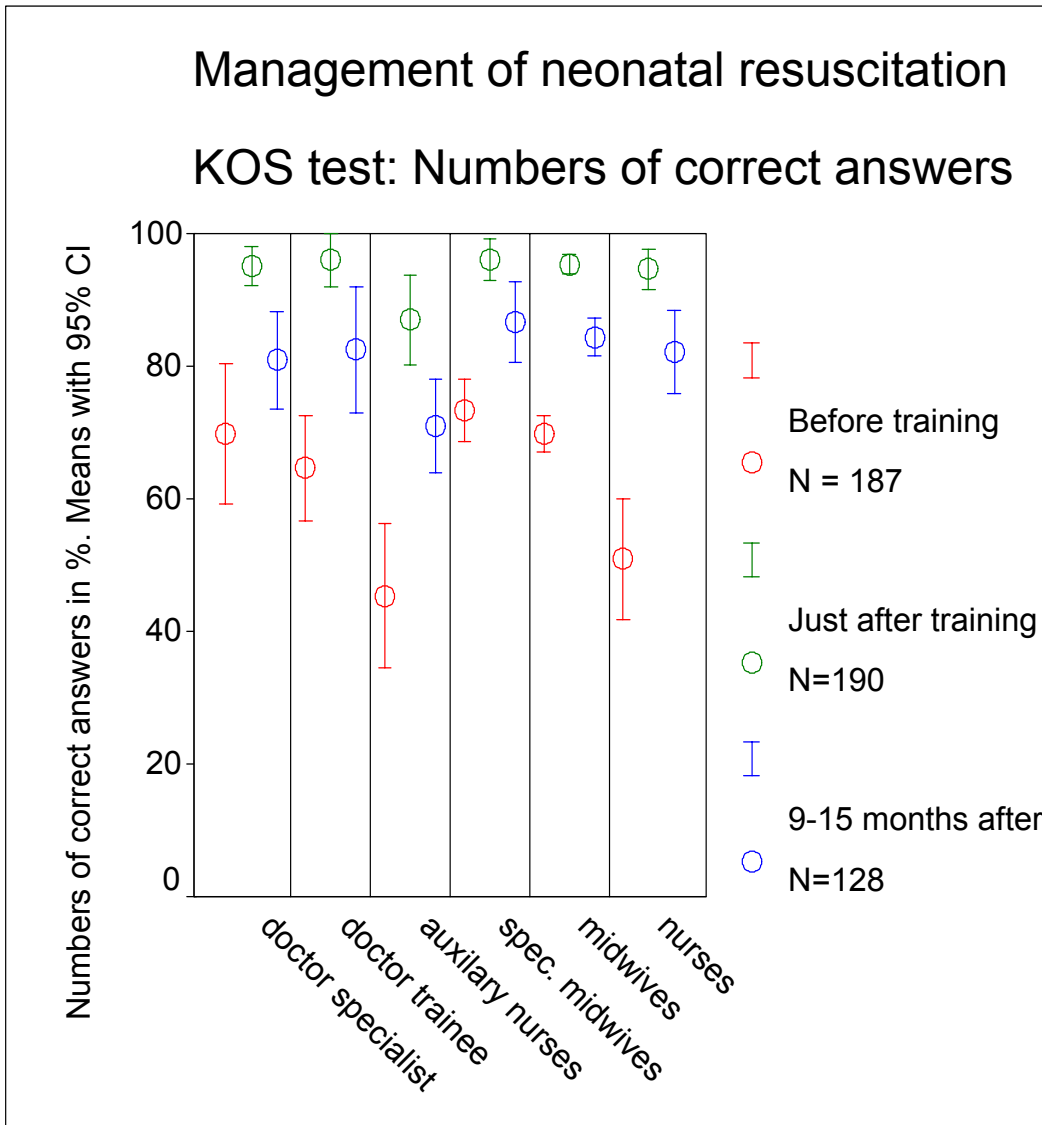
	Specialised doctors		Trainee doctors		Specialised midwives	
	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months	Ever involved	Involved within the last 9-15 months
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Yes	20 (95)	7 (50)	11 (73)	7 (54)	16 (94)	5 (38)
No	1 (5)	7 (50)	4 (27)	6 (27)	1 (6)	8 (62)
Total	21(100)	14(100)	15(100)	13 (100)	17(100)	13 (100)

10.2.9 Knowledge of skills test in neonatal resuscitation.

The same knowledge of skills test (KOS-test) was given to all staff before, immediately after and 9-15 months after training in neonatal resuscitation. Numbers of correct answers in the test were significantly ($p=0.004$) increased from 65 % correct before training to 94 % just after training. There was a significant reduction ($p=0.008$) of answers numbers correct immediately after training to answers correct 9-15 months after training, however the numbers correct 9-15 months after training were 83 % and still significantly ($p=0.000$) higher than the 65 % before training (Paired sampled T-Test).

Figure 10.2.9-A reveals the distribution of correct answers in percentage between the different health professional groups before training, just after and 9-15 months after training.

Figure 10.2.9-A. Means in percentage of correct answers in KOS-tests in management of basic neonatal resuscitation before training (red), just after training (green) and 9-15 months after training (blue). Means with 95 % confidence interval distributed for the different health professions.



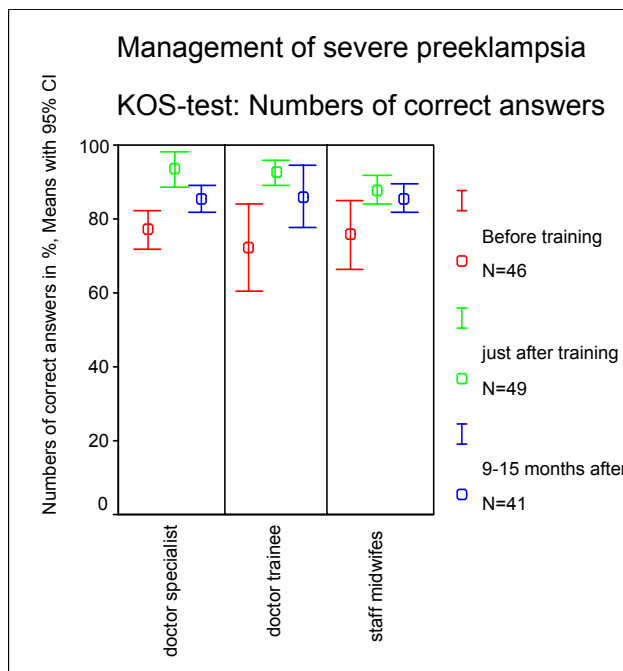
Statistical analysis not presented for the different group of health professions. For statistical analysis of all 6 health professional groups, see text.

10.2.10 Knowledge of skills test in management of severe preeclampsia.

Only doctors and specialised midwives were given the knowledge of skills test (KOS-test) in management of severe preeclampsia.

The numbers of correct answers in the KOS-test were significantly increased from 79% correct before training to 91 % immediately ($p= 0.000$) after training. Nine to 15 months after training the mean was 85 % correct, which was an insignificant increase ($p=0.314$) from before training. There was an insignificant reduction of correct answers from just after training to the numbers correct 9-15 months after training ($p=0.1$) (Paired sampled T-Test). Details on mean of correct answers in KOS test in management of severe preeclampsia can for specialised doctors, trainee doctors and specialised midwives can be seen from figure 10.2.10-A.

Figure 10.2.10-A. Means in percentage of correct answers in KOS-tests in management of severe preeclampsia (red), just after (green) and 9-15 months after training (blue). Means with 95 % confidence interval distributed for the different health professions.

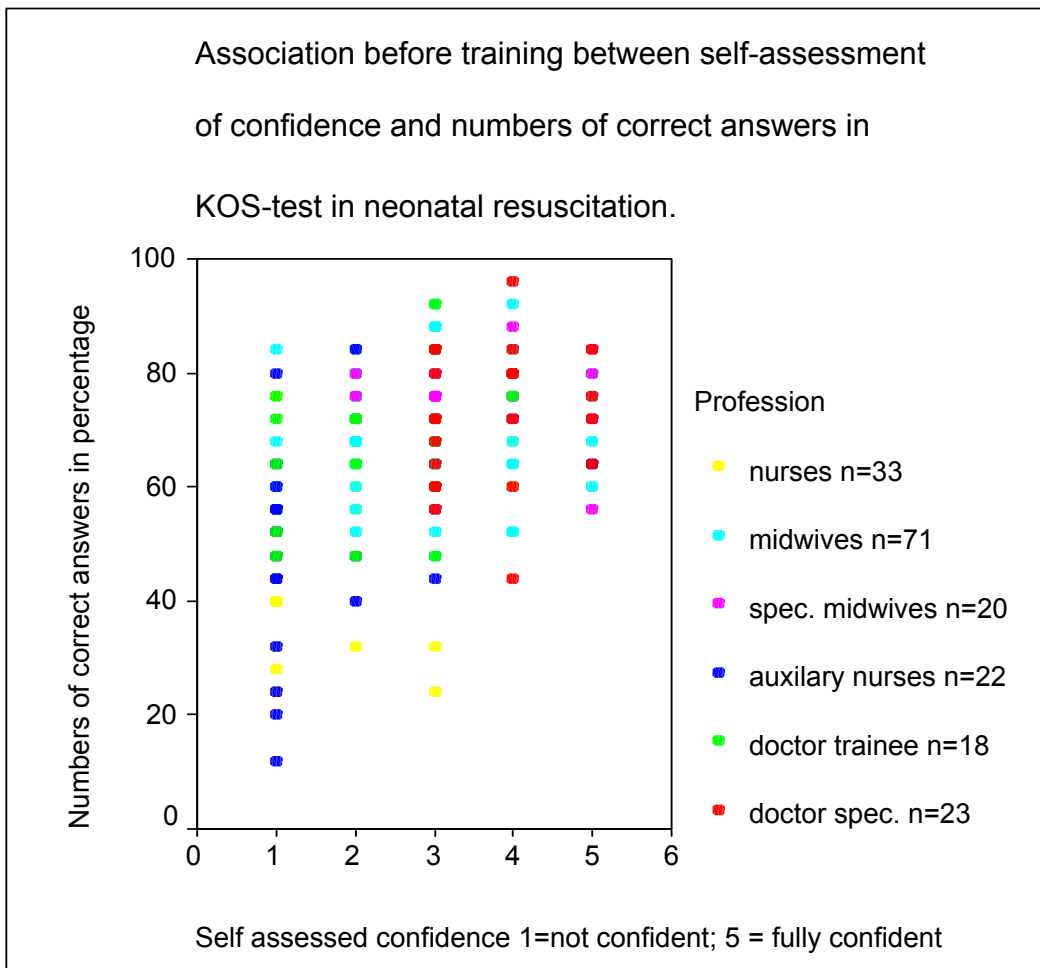


Statistical analysis is not presented for the different health professions. For statistical analysis of all 3 health professional groups, see text.

10.2.11 Association between knowledge of skills tests and self-assessments

Figure 10.2.11-A shows a significant association between self-assessment before training and numbers of correct answers in the KOS-test in basic neonatal resuscitation.

Figure 10.2.11-A. Association between self-assessment and numbers of correct answers in management of basic neonatal resuscitation.



Statistical analysis: Partial gamma coefficients showed association between self-assessment and answers in KOS-test in neonatal resuscitation $\gamma = 0.44$. A significant association was seen between self-assessment and the numbers of correct answers in KOS-test in neonatal resuscitation $p=0.000$ (Test of marginal and conditional homogeneity).

There was in the KOS-test in management of severe preeclampsia no statistically significant association ($p=0,21$) between self-assessment before

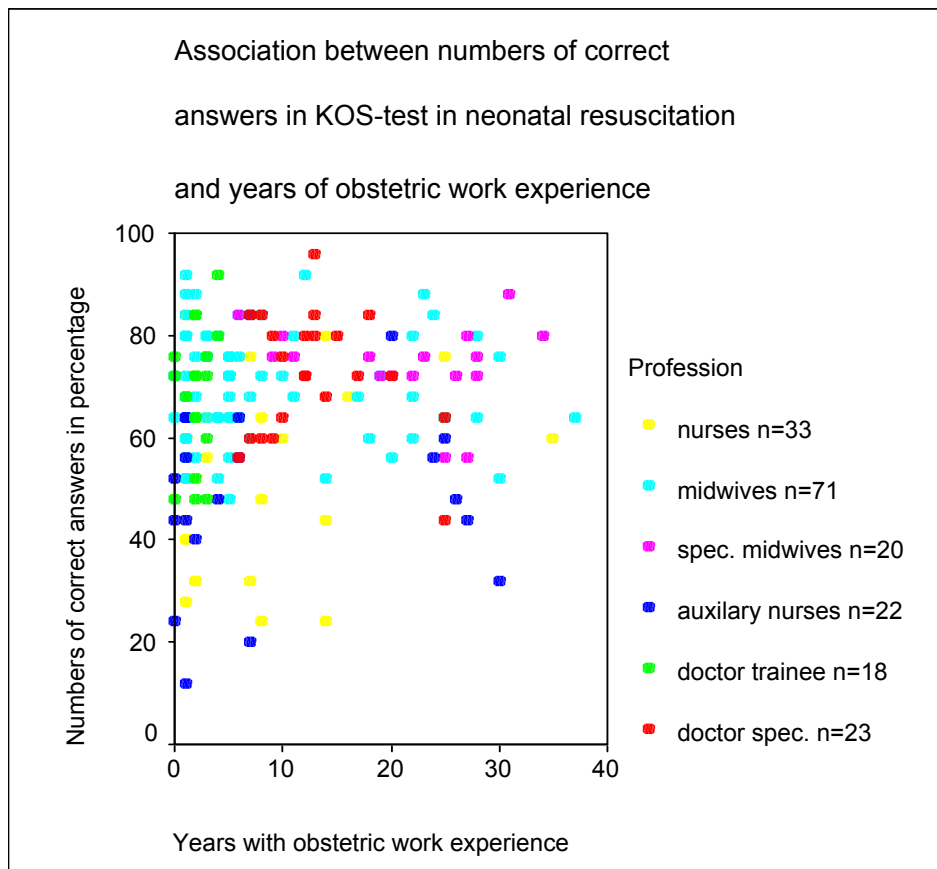
training and numbers of correct answers (Data was restricted to doctors and specialised midwives and are not shown).

10.2.12 Association between knowledge of skills test and years of work experiences in obstetrics and self-assessment.

The association between years of clinical work in obstetrics and numbers of correct answers in the KOS-test in basic neonatal resuscitation and in management of severe preeclampsia can be seen in figure 10.2.12-A. No significant associations could be established, thus many years clinical work experience did not associate with a higher numbers of correct answers in a KOS-test. In fact, the impression of the curve in figure 10.2.12-A seems to be a decrease of correct answers in the KOS-test in basic neonatal resuscitation after many years with clinical work experiences.

Neither could the association between years of clinical work in obstetrics and numbers of correct answers in the KOS-test in management of severe preeclampsia be established ($p = 0.17$) (Data not shown).

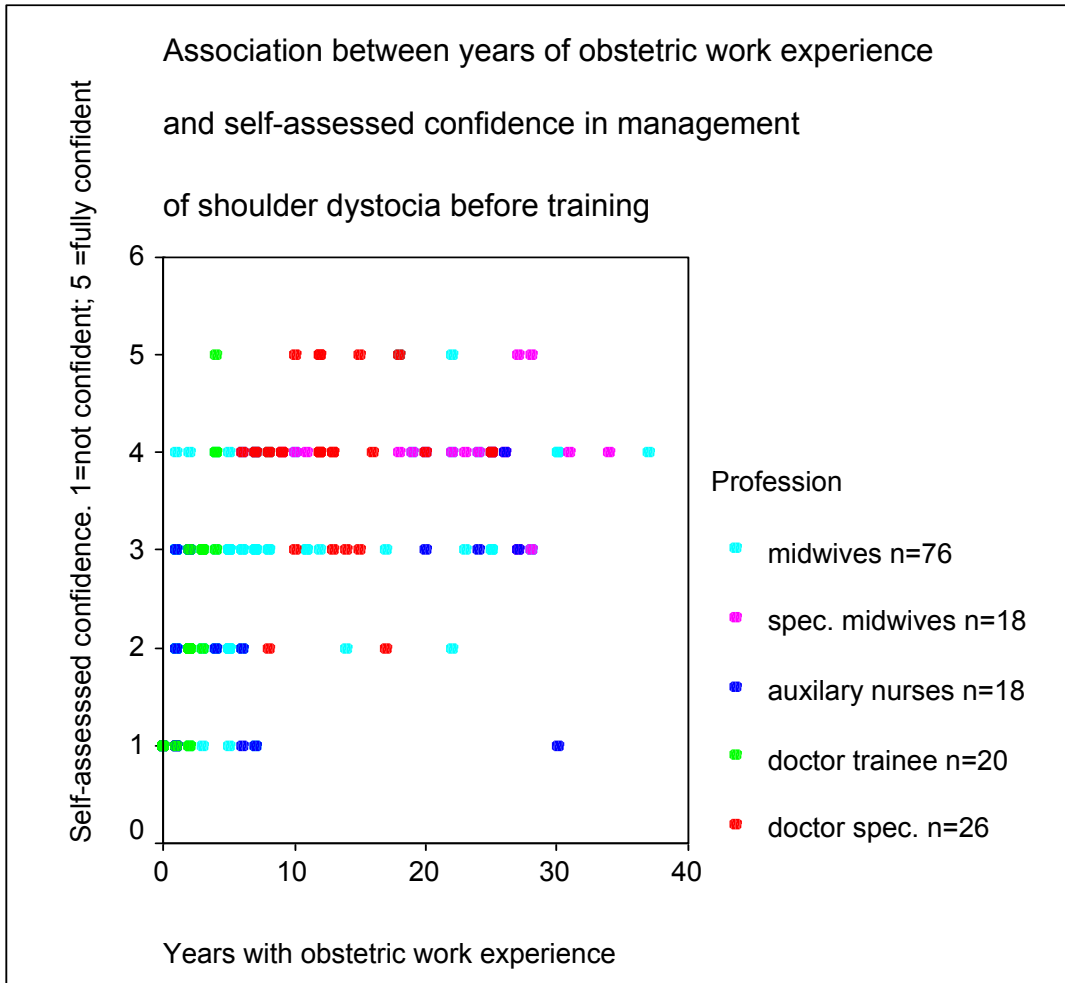
Figure 10.2.12-A. Association between correct answers in the KOS-test of neonatal resuscitation and number of years work experience in obstetrics.



Statistical analysis: Partial gamma coefficients showed no association between self-assessment and the KOS-test in neonatal resuscitation $\gamma = 0.04$ and no statistical significance $p = 0.286$. No further statistical analysis is performed

In figure 10.2.12-B association between years of obstetric work experience and self-assessed score of confidence of confidence with management of shoulder dystocia revealed a significant higher self-assessed score of confidence after many years of work, i.e. staff self-assessed them selves to have higher confidence after many years with clinical work experiences. A significant association could also be seen for the other trained skills - management of postpartum bleeding, severe preeclampsia and basic neonatal resuscitation. Data not shown.

Figure 10.2.12-B. Association between years of work in obstetrics and self-assessed confidence with management of shoulder dystocia with a score 1= not confident to 5=fully confident.



Statistical analysis: Partial gamma coefficients showed association $\gamma = 0.60$. The association was significant $p = 0.000$ (Test of marginal and conditional homogeneity)

10.2.13 ***Self reported impact on clinical work 9-15 months after training.***

Five open questions were part of questionnaire 3 (see appendix 14.2) and given to midwives, auxiliary nurses and doctors 9-15 months following the obstetric skills training in shoulder dystocia and postpartum bleeding (Concerning analysis see section 8.3.1).

Answers were returned from 90 % (132 of 147) of the participants, 25 % of doctors and 14 % of midwives did not answer the questions. Non-responders

gave explanations such as; that they were on leave, changed jobs and that they were not actually involved in labour ward work.

Two percent of the midwives, 6-9% of the doctors and no of the auxiliary nurses reported that training did not have an influence on their work.

Data on how training in shoulder dystocia and in postpartum bleeding influenced on work is reported in table 10.2.13-A. From this table it can be summarised that almost all the staff of those answering 9-15 months after the training, had positive comments about the training program in shoulder dystocia and postpartum bleeding. Influences on work were most commonly categorised in "Feeling of confidence, safety and security" (36-40%) and "Coordination of management, better multi-professional effort, staff taking responsibility" (26-27%) and "Change in concrete management in clinical situations" (23-24%) (see table 10.2.13-A).

Examples of quotations

Did the training in management of postpartum bleeding have any influence on your or your colleagues work, describe:

“ Yes, I feel greater security and find that it is easier to observe and act when the situation arises. Through the multi-professional training, all groups have become visible, and it really is an advantage for cooperation”. (Auxiliary nurse in labour ward)

“There is more a focus on treatment: The “bleeding-box” and everyone follows the same management sequences (Doctor)

” Yes, for sure. We have an organized cooperation and we have “sheets” with administration of medicine in the labor suite” (Midwife)

Did the training in management of shoulder dystocia have an influence on your or your colleagues work, describe:

“ We talk more about it – what did you do?” (Midwife)

“ Better coordination and we are more acquainted with this and that and in which sequence” (Midwife)

“ Yes, everybody talks about it, everybody knows what to do and take’s their responsibility and everybody appreciates the multi-professional coordination” (Midwife)

“ In general people seem more calm, because they have had this refreshert course. It is nice to know that the auxiliary nurse can help you” (Midwife)

Did the obstetric training influence the cooperation between midwives, doctors and auxiliary nurses in the labour ward - describe?

“Yes, it gives a better distribution of roles in emergency situations” (Midwife)

“ There is a larger community spirit when the situations are discussed among staff ” (Midwife)

Figure 10.2.13-A: Qualitative data collected 9-15 months after training in management of shoulder dystocia and postpartum haemorrhage. Data organised by quantification of qualitative data.

Question 1: Did the training in shoulder dystocia (SD) influence on your or your colleagues work, describe? Question 2: Did the training in postpartum bleeding (PPB) influence on your or your colleagues work, describe?									
Percentages are calculated on the number of subjects who answered the questionnaire.									
		Midwives N = 83		Ass. Nurses N=16		Doctors N= 33		Total N= 132	
		SD	PPB	SD	PPB	SD	PPB	SD	PPB
Positive statement		69 83%	74 89%	15 94%	15 94%	22 67%	23 70%	106 80%	112 85%
Negative statement	No. Training didn't influence on my work.	2 2%	3 4%	0	0	2 6%	3 9%	4 3%	6 5%
Don't know or not completed		12 14%	6 7%	1 6%	1 6%	9 27%	7 21%	22 17%	14 11%
Positive statement*	Feeling of confidence, safety, security	32 39%	30 36%	7 44%	8 50%	14 45%	8 24%	53 40%	46 35%
	Coordination of management, better multi-professional effort, staff taking responsibility	23 25%	20 24%	5 31%	4 25%	6 18%	11 33%	34 26%	35 27%
	Concrete management in a clinical situation reported	21 2%	23 28%	5 31%	4 25%	6 18%	4 12%	32 24%	31 23%
	Increase in professional communication	6 7%	4 5%	2 13%	0	0	0	8 6%	4 3%

*Within a positive statement, a participant could have more than one answer.

The third question was: *Did the obstetric training have influence on the routines, procedures, or the clinical guidelines in the labour ward - describe?*

The question was answered with a positive statement by a little more than half of the participants (N =74/132). About on third did not answer the question or answered do not know (N= 54/132) and very few (N=4/132) said that the training did not have an influence on routines, procedures or clinical guidelines in the labour ward.

The positive statement “Change and updating of clinical guideline” was mentioned by one fourth (N= 28/132). “Better communication or cooperation” was mentioned by one fifth (N=24/132). Additionally, the “accessibility to clinical guidelines” and “to identify relevant blood test to be taken” plus the “organisation to find medicine for emergency use” were mentioned as areas that were improved.

Question 4: *Did the obstetric training influence on the cooperation between midwives, doctors and auxiliary nurses in the labour ward - describe?* The question was answered by positive statement by almost two thirds of the participants (N=81/132) and a little less than one third did not answer or answered do not know (N=43/132). Few (N=8) stated that training was without influence on cooperation.

The positive statement “Better distribution of roles and responsibility” was mentioned by one fourth (N=23) and “Better coordination, cooperation, team feeling” plus “Common understanding” were also mentioned and from few “Standardised management” was pointed out.

Finally the last question 5: *“If you had ideas about changes in work after the obstetric training – was it possible”, describe:*

Only one fourth (N=30/132) found they were able to answer the question and almost all of them gave a positive statement (N=27/30).

The rest of the participants either did not complete the question or answered do not know (N=82), or did not find the question relevant or wrote that they didn’t understand the question (N=20).

10.2.14 *Organisational changes following the obstetric skills training program.*

A part of the present study involved a discussion after each training session amongst the participants and teachers, where information was collected and written on the need for changes in working procedures and the organisation in the labour ward. These suggestions were discussed at meetings in the steering committee and with the management of the Obstetric Department

along with considerations about implementation and resulting action, and thereafter acted upon.

Information about the need for change in work and the organisation were discussed and collected after every training session, i.e. altogether 13 sessions.

Based on discussions after every training session, discussions in the steering committee and in the management of the Obstetric Department the following changes were decided and implemented:

- Clinical guidelines in postpartum haemorrhage, shoulder dystocia and preeclampsia were composed or updated (<http://www.rigshospitalet-vejledninger.dk/>).
- In cooperation with the Anaesthesia Department and the Neonatal Department an algorithm for basic neonatal resuscitation was developed in accordance with the International guidelines (International guideline for neonatal resuscitation, 2004; Vain et al; 2004) (www.obstetrisktraening.rh.dk)
- Highlights were extracted from these guidelines and written in an easy available form. These highlights of guidelines were laminated and placed on open shelves in every labour ward suite, where they were accessible in emergency situations.
- Forms to order blood tests were made in a laminated form with information on which blood tests to order in cases with postpartum bleeding and preclampsia. These forms were placed on open shelves in every labour ward suite, where it was accessible in emergency situations.
- A new observation form was developed. This was done in accordance with information collected from the nurses in the postnatal wards. It was developed in an attempt to prevent the loss of observations that seemed to happen on transfer between the labour ward and the postnatal ward.

- “Bleeding boxes” with four important medications for treatment of postpartum bleeding were made. “Bleeding boxes” were placed in the labour ward, operating theatre and the postnatal ward.
- “Eclampsia boxes” with important medications for treatment of severe hypertension and eclampsia were made. “Eclampsia boxes” were placed in the labour ward and the postnatal ward .
- For neonatal resuscitation new self-expanding bags and masks (AMBU) were implemented. They were considered to be safer and more applicable for staff that rarely needed to use it.
- New watches were placed over the delivery bed in every labour suite to ensure and make time taking easier.
- The teaching materials used for the multi-professional teaching were organised as laminated papers in folders and placed in the labour ward available for all staff.
- All the cupboards in different labour ward suites were organised in the same way.

Under discussion:

- Implementation of swabs with X-ray marking in labour suites are under discussion, but are still not implemented.

10.2.15 *Changes in prevalence of emergency obstetric events based on data from data from The Danish Medical Birth Registry*

Data from the Danish Medical Birth Registry are presented in figure 10.2.15-A. For 2002-2005 diagnoses and action diagnoses for obstetric events, which were included in the obstetric training program, are presented in absolute figures and in percentages of the numbers of deliveries per annum. Training was introduced in December 2003. Detailed explanations about data can be seen in section 9.2.1 and 9.3.1.

Table 10.2.15-A Prevalence of the diagnose code for shoulder dystocia, severe preeclampsia, HELLP and eclampsia from the Obstetric Department at Rigshospitalet and all labour wards in Denmark.

	2002 +2003				2004 + 2005			
	Number of cases		Number of cases in percentage of total number of deliveries		Number of cases		Number of cases in percentage of total number of deliveries	
	Rigs-hospitalet	Denmark	Rigs-hospitalet	Denmark	Rigs-hospitalet	Denmark	Rigs-hospitalet	Denmark
Shoulder dystocia DO 660	18	738	0.3 %	0.6 %	21	653	0.3 %	0.5 %
Severe preeclampsia DO141	64	414	1.0 %	0.3 %	68	485	1.0 %	0.4 %
'HELLP' syndrome DO142	21	164	0.3 %	0.1 %	18	165	0.3 %	0.1 %
Eclampsia DO15	4	40	0.06 %	0.03 %	3	41	0.05 %	0.03 %
Deliveries per annum	6356	125112	-	-	6506	125325	-	-

Table 10.2.15-B. **Prevalence of postpartum bleeding and administration of medicine to contract the uterus at the Obstetric Department at the Rigshospital and at all delivery departments in Denmark.**

Diagnose and treatment code including ICD10	2002 +2003				2004 + 2005			
	Number of cases		Number of cases in percentage of total number of deliveries		Number of cases		Number of cases in percentage of total number of deliveries	
	Rigshospitalet	Denmark	Rigshospitalet	Denmark	Rigshospitalet	Denmark	Rigshospitalet	Denmark
Post-partum bleeding without specification DO 72 or DO721	215	4210	3.4 % *	3.4 %*	309	4527	4.7 %*	3.6 %*
Medicine to contract uterus BKHD0	287	10492	4.5 %**	8.4 %**	365	9538	5.6 %**	7.6%**
Deliveries per annum	6356	125112	-	-	6506	125232	-	-

*) **) Statistical analysis: see text

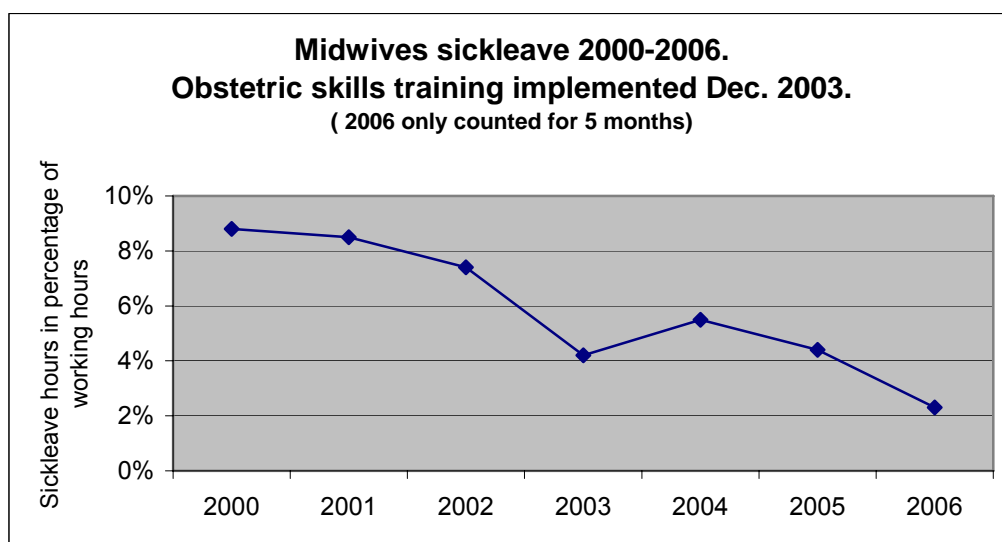
In table 10.2.15-B data on the diagnoses postpartum bleeding is shown. The diagnosis postpartum bleeding was at Rigshospitalet used 42 % more often in 2004-2005, than before implementation of the training program in 2002-2003 (Obstetric department, Rigshospitalet: Odds ratio 1.42; 95% confidence interval (CI) 1.19-1.70; p= 0,0002. The rest of the labour wards in Denmark: Odds ratio 1.07 95% CI 1.03-1.12; p = 0.001).

The administration of medicine to contract the uterus, which might prevent postpartum bleeding, was used 24 % more often at Rigshospitalet in 2004-

2005, than before implementation of the training program in 2002-2003 (Obstetric department, Rigshospitalet: Odds ratio 1.24 CI 1.07-1.42; $p = 0.0046$. The rest of the labour wards in Denmark: Odds ratio 0,9 CI 0.87-0.92) Data about blood transfusion (see section 9.2.1) are not included in the analysis, as it needs to be validated further. No data exists on how often basic neonatal resuscitation is practiced by staff in labour wards.

10.2.16 Sick leave amongst midwives

Figure 10.2.16-A Sick leave for midwives in the period 2000-2006.



Statistical analysis not performed

10.3 STUDY 2 Discussion: Implementation and evaluation of the obstetric skills training program

10.3.1 The present study compared to other studies within obstetric skills training.

The present study is the first Scandinavian study that reports obstetric skills training of labour ward staff. Seen in an international perspective the present Danish study is extensive and includes long term follow up and evaluation (other studies see section 6.2.9 and 6.2.10).

In recent years, it has been stated that obstetricians are lacking behind other specialities with regard to training with simulation (Macdonia et al, 2003, Belfort 2004, Johannsson et al 2005) (see section 6.1.4).

A British survey concluded that methods to assess and optimise obstetric training are urgently required in order for women and their babies to benefit from these expensive and complex interventions (Anderson et al 2005).

Results from the present study can hopefully contribute with information to benefit the future development, implementation and effect of obstetric skills training.

10.3.2 How did the program work in practice?

The implementation of the present training program was shown to be feasible as 94-96 % of the eligible staff participated in the training (figure 10.2.1-A).

We consider feasibility to be an important parameter for successful implementation. The training was popular and data did not reveal differences between the health professional groups (figure 10.2.4-A).

Staff eligible for training constantly changing (see section 10.2.1). For a training program like this, it is essential to have a database that continuously updates information on staff employed, so that training is offered to newly employed staff and staff returning from leave.

We did not obtain structured information on how often participants cancelled their planned training, but it happened only occasionally. Often, we managed even with short notice to find a substitute participant. Cancelling was mainly due to sickness and not due to clinical work.

The implementation of the program was considered demanding. A British survey on obstetric training described how “drill practice and other multidisciplinary training had only become possible after the appointment of a dedicated Professional Development or Risk Management midwife” (Anderson et al, 2005). Another British study (Draycott et al, 2006) describes how a Faculty of 10 people with the use of additional midwifery and medical staff ran their obstetric training program.

10.3.3 Needs assessment: Mapping of staff's previous involvement in management and severe preeclampsia and neonatal resuscitation

As a support to the need analysis carried out before the obstetric training program was implemented, staff were asked to report in the questionnaire if they had previous experiences with management of severe preeclampsia and in neonatal resuscitation (See section 10.2.8). Table 10.2.8-A tells us that management of neonatal resuscitation was very rarely practiced among nurses and auxiliary nurses. Amongst specialised doctors and special midwives 57-71 % had been involved, and among midwives 33 % had previous clinical experience resuscitation of a newborn. This confirmed that simulated training in this topic is essential. In the follow-up questionnaire the participants answered whether they had been using their newly acquired neonatal resuscitation skills during the 9-15 months after training.

Approximately 10 % had been using the resuscitation skills they trained and this further supports the fact that skills cannot be retained through clinical work alone.

Management of severe preeclampsia was practised more often (figure 10.2.8-B). Almost all specialised doctors and specialised midwives have been involved in cases with management of severe preeclampsia. However within a period of 9-15 months after training only half of the staff had been exposed to cases where it was necessary to practice the trained skills in management of severe preeclampsia. Whether this is sufficient to retain a skill can be discussed.

10.3.4 What is the educational impact of this obstetric training program?

The discussion concerning evaluation of the training program is structured to follow Donald Kirkpatrick's (1998) four levels according to the literature review (see section 6.3.2).

10.3.4.1 Reaction

From data in section 10.2.4 it is revealed that participants had a positive attitude towards the training program and they also considered that the training programs was relevant for them (figure 10.2.4-A). Data obtained 9-15 months after training was chosen, because data obtained immediately after training can overestimate positive reactions.

It is well known that implementation of postgraduate training on a large scale in a clinical setting can be very difficult and complex, because clinical work will always have the highest priority. The decision in the steering committee about making the training program obligatory raised discussion about whether it was feasible. The training program was successfully implemented with 94%-96% of the eligible staff involved. This may also indicate that the participants appreciate the training program. According to Kirkpatrick (1998) it is known that positive reactions are a prerequisite for participants to learn and to change behaviour, which will be looked at in the following sections.

Trainees' reactions are important, although these are not the most crucial criteria for evaluation of a training program (Patrick, 1992). This was the argument in the present project for involvement of a more comprehensive evaluation strategy (see section 6.3)

10.3.4.2 Learning

Learning can in accordance to Kirkpatrick (1998) be divided into 1) attitudes, 2) knowledge and 3) skills (Kirkpatrick, 1998). In the following the training programs impact on these topics will be discussed.

10.3.4.2.1 1) Changes in attitude: Attitudes to management of skills

Changes in attitude were in the present multi-professional training program chosen to be measured on whether staff found a procedure stressful and unpleasant and whether a change could be measured 9-15 months after the training program. See section 10.2.6.

Variations were seen within the different health professional groups. In general, less or no changes were found amongst specialist doctors. They revealed low frequency of stressfulness before initiation of the training program; therefore there was less room for improvement. The largest changes were observed among nurses and midwives.

The different skills involved in the training program also revealed varied attitudes. Management of postpartum bleeding seemed to be reported to be less stressful and less unpleasant. This might be explained by the fact, that it was the most frequently experienced procedure that was being taught (section 9.2.1).

It can be argued that even if staff are well trained and skilfully prepared for an obstetric event, some events will always be stressful, as they involve severe risks both for foetuses and mothers. However skills training in the present study seems to have some positive influence on how stressful and unpleasant the participants considered these events, as the staffs' reaction was to report them as less stressful and unpleasant following training. It must however be highlighted that the questions asked were not validated, and these results therefore should be looked upon with some caution.

Previous studies of obstetric skills training do not provide us with data on this topic. Only a few studies focus on the staffs stress in the labour ward. One study mainly focuses on the work-life balance ¹(Thangaratinam et al, 2006). A Danish thesis (Engelbrecht, 2006) concluded that emotional demands and feelings in midwifery were described as having a significant impact on the relationship between motivation and burnout. This thesis by Engelbrech (2006) does not focus on whether education may influence these parameters.

¹ Work-life balance is defined as people having a measure of control over when, where and how they work, leading them to be able to enjoy an optimal quality of life (Thangaratinam et al, 2006).

10.3.4.2.2 2) *Changes in knowledge (knowledge of skills test)*

A knowledge of skills test in neonatal resuscitation was administered to all participants. KOS-test in preeclampsia was only administered to doctors and specialised midwives. The data can be seen in section 10.2.9 and 10.2.10. An important question to address is when to reassess knowledge and skills, because immediate post-testing is reported to be insufficient (Patrick, 1992). In this program was performed a late second reassessment 9-15 months after training. Late retesting was however difficult to execute successfully, because staff were never gathered together. The KOS-test could not be posted or mailed, as it was necessary to ensure that participants answered the KOS-test under some degree of observation. However we managed to retest 72 % in neonatal resuscitation and 74 % in preeclampsia 9-15 months after the training.

The KOS-test of neonatal resuscitation showed a significant increase in the numbers of correct answers from in an average of 65 % immediately before to nearly 94 % immediately after the training. Correct answers decreased to 83 % 9-15 months after training. This was a significant decrease, but the numbers of correct answers 9-15 months following training was still significantly higher than the pre-test score. Auxiliary nurses and nurses' means for correct answers were 51 % and 52 % before training (see figure 10.2.9-A). Hence they had the largest room for improving their score.

The KOS-test in management of severe preeclampsia revealed a mean of correct answers of 79 % pre-test and it significantly improved to a post-test score of 90%. The test 9-15 months after training was 85 %, which was not a significant change from the pre-test level. This lack of significance may be due to a small numbers of participants in the KOS test, i.e. a type 2 error. The pretest level of numbers of correct answers in the KOS test in management of severe preeclampsia was also high - 79 %, which left little room for improvement (see figure 10.2.10-A).

There was not decided "a cut off level" to define when the number of incorrect answers were too low and therefore considered unacceptable. To decide "a

cut off level” it would be necessary to validate the test appropriately. The KOS-test was however only piloted in Rigshospitalet, it was never validated according to face, content, construct and concurrent validity (McAleer, 2001). To test the face and content validity of the KOS-test it would have been appropriate to involve obstetricians and neonatal specialists plus senior midwives from other large labour wards in Denmark and request them to appraise the content of the test.

To access information about construct validity, which means whether the test discriminates correctly, the KOS-test could have been tested in labour wards where no systematic training had ever taken place, to see whether it would discriminate between trained and untrained staff. Furthermore an investigation of the KOS-test’s ability to distinguish between novices and specialists by various approaches could have been an option. Likewise the test could have been applied to medical students before and after their clinical attendance in the obstetrics department.

The concurrent validity of the KOS-test can be discussed. It was not possible to test because no other existing objective tests have been developed. No “golden standard” exist within these areas.

The choice of assessment can also be discussed. The KOS-test was chosen because it is feasible to implement in large groups. In the literature it is reported that the KOS-tests are able to predict results in a performance-based tests such as objective structured clinical examination (OSCE) (Remmen et al, 2001) and that KOS-tests correlate better than general knowledge tests especially when there is a need for group testing, or a screening test for choosing appropriate training (Kramer et al 2002).

In the study the argument for applying the KOS-test was that it would be able to test many participants in a relatively short time and at low costs (Remmen et al, 2001; Van der Vleuten et al, 1989). The KOS-test was not developed to perform individual testing, but to test variations in different staff groups over a period of time (Kramer et al, 2002).

Consequently, information is lacking on how staff react in a real clinical situation, i.e. how were skills transferred to the clinical situation. In clinical situations with rare events, direct observation of clinical practice is almost impossible. Scenarios in a simulated setting with checklists might be a possibility; but it is time consuming. Validated checklists would be necessary and do not exist for obstetric emergency procedures. Within some obstetric procedures the first initiatives to design checklists had been taken (Deering et al 2004, 2006).

Whether the performance in the simulated setting is equivalent to the real setting can be discussed and need to be investigated.

10.3.4.2.3 3) Changes in skills: self-assessment of confidence

In the present program were skills evaluated by self-assessment of confidence. See section 10.2.7.

Looking at scores for self-assessment of confidence, the staff who participated in the obstetric skills training program, had a higher level following training than before, and self-assessed confidence seems to be retained over a period of 9-15 months for management of shoulder dystocia, severe preeclampsia and postpartum bleeding. For basic neonatal resuscitation there was a significant reduction in self-assessed confidence from immediately, post-test and 9-15 months after training.

Looking at the different kind of skills, the smallest changes were observed within management of postpartum bleeding, supposedly due to the fact that this skill is more frequently used in clinical practice, than the other skills that were trained.

Changes in self-assessed confidence among specialised doctors and specialised midwives seems less, compared to trainee doctors, auxiliary nurses and nurses, supposedly because a greater potential capacity for improvement exist in these groups. However for specialised doctors and specialised midwives improvement in self-assessment can be observed for

shoulder dystocia and for specialised midwives also for neonatal resuscitation.

In the literature the validity of self-assessment is under discussion. There is a difference between confidence and competence. Improvement in confidence is not necessarily translated into better competence and better outcome (Stewart et al 2000; Ward et al 2002).

In the present study however, a significant association was discovered between self-assessment in management of basic neonatal resuscitation (see figure 10.2.11-A) and an objective test like the KOS-test. This result might indicate that the participants in the training program were able to assess their own competence within basic neonatal resuscitation skill. Whether this can be generalised to other areas can not be answered from the present study. Interesting information about self-assessment can be obtained from Hannah's (2000) multi-centre, randomised, controlled study "Term Breech Trial". This study is famous among obstetricians. It is probably the only study in obstetrics that reports direct measures on outcome related to self-assessment. In this study it is concluded that

"it is noteworthy that having an experienced clinicians at birth was associated with a reduced risk of adverse perinatal outcome, only when a clinician was defined as a clinician who judged him or herself to be skilled and experienced at vaginal breech delivery. When an experienced clinician was defined as a licensed obstetrician or as a clinician with more than 10 or 20 years of vaginal breech delivery experience, there was no subsequent reduction in risk of adverse perinatal outcome. Thus in this study the analysis suggests that a clinician's self-assessment of his or her own skill and experience may be a more valid measure of clinical experience than either completion of training program in obstetrics or having many years of attending vaginal breech deliveries" (Su et al, 2003).

This large study (Hannah et al, 2000) on breech deliveries included 2088 women suitable for randomisation collected from 121 centres in 26 countries.

These figures give us an idea about how challenging it would be to carry out randomised studies in obstetrics with direct outcome on infrequent obstetric events such as vaginal breech delivery.

From this it can be concluded, that more work is necessary to address the methodological problem we face when wanting to define and validate direct obstetric outcome. It tells that we need to develop tools for measurement that use indirect measures in a simulated setting such as validated checklists etc. In the present study self-assessment was used, and it seems to be a relevant tool for measurement of skills in combination with other tools.

10.3.4.2.4 Association between knowledge of skills test, self-assessment and years of work experience

In section 10.2.11 an association between self-assessed score of confidence in management of resuscitation and numbers of correct answers in the KOS-test before training was found. There seems to be a tendency towards underestimation of own skills and only very few participants overestimate their own skill. However defining a “cut off level” further validation is required to make these decisions. Some has hypothesised that underestimating own skill may cause a risk for burn out.

Associations between correct answers in the KOS-test in management of severe preeclampsia and self-assessment before training did not however show a clear association. The total of participants tested was relatively small and it is therefore difficult to draw any clear conclusion.

There was no association between a high number of correct answers in the KOS-test in neonatal resuscitation and many years of work experience (see figure 10.2.12-A). According to this lack of association, the skills that are required in basic neonatal resuscitation do not seem to be learned and / or retained with years of work experinces. This is in accordance with the literature, where Choudhry et al (2005) in a systematic review of 62 studies reported that in half of the studies there seems to be an inverse relationship

between the number of years that a doctor has been in practice and the quality of care that the doctor provides. In the review it was concluded that subgroups of health professionals might need quality improvement interventions.

The KOS-test in our study was not performed to identify subgroups that needed further training, however looking at figure 10.2.12-A it appears that some participants might need training. To use a test to identify individuals in need for further training, it would be necessary to validate the KOS-test in an appropriate way and with this purpose in mind.

Staff self-assessed a high score of confidence after many years with obstetric clinical work experiences (figure 10.2.12-B). This is a contradiction to the findings in figure 10.2.12-A which inform that staff do not learn and retain a skill just by having many years of work experiences. It informs us that continuous professional development is a necessity.

10.3.4.3 3) Behaviour

Behaviour (see section 6.3.2) can also be called transfer of learning. This deals with how learning can be transferred from an educational setting to real life. Transfer of learning is generally considered difficult to measure (see section 6.2.6).

In this study information on transfer from an educational setting to real clinical life was obtained through questionnaires with open-ended questions and the results are presented in section 10.2.13.

From this self-reported information we can conclude that the training did positively influence on staff's work. The participants reported in the questionnaire that it influenced their clinical performance, cooperation and "spirit" towards colleagues. The participants also reported that the obstetric training program changed the organisations approach to clinical management of the trained skills and finally, that it influenced positively on the collaboration between staff groups.

This data is based on the participants self-reported information collected through questionnaires 9-15 months after training and not through direct observation. Hence, no direct observation was performed and these results should therefore be analysed with some precaution. It was in this study considered impossible to apply direct observation, as the events to be observed rarely happened.

10.3.4.4 Results

Results are defined as changes occurring as a consequence of the training program, (see section 6.3.2).

We analysed results by three approaches: 1) changes in the organisation (section 10.2.14) 2) changes in results recorded from data from The Danish Medical Birth Registry (see section 10.2.15) and 3) midwives sick leave (see section 10.2.16).

In section 10.2.14 a list of organisational changes implemented after discussions following every training session is presented. This part of the study can be perceived as important in bridging the gap between research and practice as considered in action research (Fraenkel and Wallen, 2006). It can be argued, that these changes might have been implemented whether or not the training had occurred. However without doubt, the need for important changes in the organisation became visible through the training and motivation at all hierarchical levels of the organisation to make changes became more evident.

Compared to traditional research, action research will involve participants more in the research. It is assumed that participants are well-informed individuals, capable of identifying problems that need solving, that they are seriously committed persons who continuously and systematically reflect (Fraenkel and Wallen, 2006). In this kind of research it is always a challenge to balance validity of data and the mixing of research and activism and to avoid the bias it may cause (Fraenkel and Wallen, 2006).

Teachers and others involved in action research will need to engage systematically in the research, to help identify problems and decide on investigative procedures. They will need to be involved in interpretation of data and in the development of plans of action to deal with problems. It means that teachers need to have the authority to undertake the necessary procedures and implement recommendations.

With regards to data from the Danish Medical Birth Registry (see section 10.2.15) there was not expected to be observed any changes, because rare events with a low frequency were trained. However the diagnose for postpartum bleeding, was used 42% more frequently following training (statistically significant). There is no obvious explanation as to why the number of cases with postpartum bleeding should increase and it can be suggest that the training resulted in a greater attention to cases with postpartum bleeding and that the staff, for this reason, more often used the diagnosis. The frequency with which administration of medication to contract the uterus was used, also increased (24%) following training. Validity of data from the Danish Medical Birth Registry can be discussed (see section 9.3.1). In obstetric cases with bleeding, troubles with validity do exist.

Midwives frequency of sick leave has for many years been under discussion in Danish Hospitals. Locally, at the Obstetric Department, Rigshospitalet, it has also been an issue for discussion as the figures for sick leave have been higher amongst midwives, than for all other staff groups. After the implementation of this training program, a reduction in sick leave among midwives was observed. The causal relationship between the implementation of an obstetric skills training program and a reduction in sick leave amongst midwives is not clear. However, the management of the obstetric department consider that implementation of the training program had an important positive influence on the observed reduction of sick leave.

10.3.5 Discussion about evaluation

In this study we gave evaluation a high priority. From the literature, we know there is in general a demand for evaluation of training programs and especially in obstetrics especially (Black and Brocklehurst, 2003) (see section 6.2.9 and 10). Evaluation should be integrated as an important part of all training activities, but it is reported that evaluations of training programs are often inconsistent or even lacking (Eseryl 2002; Patrick 1992) (see section 6.3.1). There are many possible explanations for this. One explanation might be that evaluation is not traditionally an integrated activity of training as it should be (Patrick, 1992). Another explanation could be that the process of evaluation is so complex in itself, that it is not implemented (Eseryl, 2002). The choice of evaluation instruments in this study, was to a large extent based on pragmatic choices rather than on previous experience with validated tools, as none existed in the field.

This study was to be implemented in a busy unit among postgraduate staff from different health professional groups and needed to be an integrated part of their daily work. It was not possible to expect the staff to spend excessive amounts of time on interviews or long open-ended questionnaires. These were the argument for choosing questionnaires with closed questions, even if the consequence was preclusion from more detailed data. Interviews might also have caused problems with bias if the project coordinator was required to perform the interviews.

Another possibility could have been systematic observation of the work. An example was described in a British work (Ashcroft et al 2003). We conducted training in rare events and therefore direct observation of these events would have been almost impossible to carry out, as it would require unrealistic amounts of time and huge amount of manpower.

Testing by direct observation with checklists in a simulated setting could have been an alternative. It can be discussed how well competencies in a simulated setting can demonstrate performance in the real clinical situations.

Another problem was, that it would have been a logistic challenge to collect staff and to get the opportunity to observe them in a simulated setting. These questions were under discussion, but it was in the present study decided to exclude observation in a simulated setting as an evaluation tool.

Another measure on training and testing can be “not warned drills” or “on site simulation” as described in a British article (Thompson et al, 2005). In the department it has been decided in the future to implement “not warned drills”.

A well-implemented training program seems to be a prerequisite for successful implementation of “not warned drills” (Anderson et al, 2005).

An indirect way to obtain outcome measures would be through audit of written materials like patient records. With explicit criteria it has been shown that audit can be valid and reproduced (Nieswander, 1984). But audit is a retrospective method and can only be based on the available written material, which in some studies has been shown to be incomplete as data materiel (Moran, 1988). Written material might, in these obstetric rare events, be insufficient and it will be difficult to develop an audit based on explicit criteria. Audit of patient records will not be sufficient in describing what happened, how the staff performed and how they cooperate. An audit will only be able to assess, how the event was described. An Irish study integrated audit into their methods (Rizvi et al, 2004). In that study (Rizvi et al, 2004) they reported how they managed to reduce the number of cases with massive postpartum bleeding from 1.77% to 0.45% following training and implementation of guidelines. In the same study they also described full adherence to guidelines and saw an effect on maternal morbidity.

The report system within “Clinical risk management”, with reports on “adverse event” and “near misses”, might be useful to evaluate the effect of training.

We were unable to include this report system, as the “Patient risk management system” with compulsory report on adverse events and near misses, was not introduced in the department before 2005.

11 STUDY 1 AND 2: Potential strengths and weaknesses in the present study

11.1 Potential strengths of the study

The present project did successfully develop and implement an obligatory obstetric training program in a large labour ward, involving 220 staff members from four health professional groups over a 3- year period. The action research method (Cohen et al, 2003; Fraenkel and Wallen, 2006) was in the present project successfully applied.

The aim of the project was to improve clinical practice in the labour ward by improving the staff's knowledge and managing skills on an individual level and through improvements in guidelines and work routines on an organisational level. A part of action research is "participatory action research" or "collaborative research" (Fraenkel and Wallen, 2006). In this study these principles were effectively applied by appointing a steering committee consisting of representatives from all groups of health professionals and through involvement of staff members at different hierarchical levels in the department. The success of the project was dependent upon the involvement of the participants and stakeholders. This was seen as a prerequisite, in order to ensure that information and decisions made on the need for organisational changes were made in a "multi-professional spirit". This was, for example, the need for changes in work routines, guidelines etc.

The original idea behind action research is that individuals and groups should experience improvements in their "working-lives" (Fraenkel and Wallen, 2006). One aim of the present project, was to provide the staff with an increased and more complex understanding of the role of the different professionals and hence to enhance the multi-professional approach and effort. Data collected in the qualitative part of the study (section 10.2.13) shows, that inter-professional communication was improved in the labour ward.

The present study involves all staff in a large obstetric department in a high-risk centre. It is one of the largest studies of its kind. The present study took place on a local basis in a labour ward. It is argued by Black and Brocklehurst (2003) that there are advantages in courses run on local basis, as they reduce costs and increase staffs access to training compared to courses run on a national or international level. Locally run courses can also have a greater potential for organisational impact. This was also revealed in the present study. The disadvantages of a local training program could in some cases be problems with poor organisation and poor quality of the content in the training program. Black and Brocklehurst (2003) suggested that locally organised training programs might be overseen on an national level to ensure quality. In Denmark is not developed national standards for obstetric training. It might be of importance, if many obstetric departments plan to implement obstetric skills training.

In the present study it was concluded, that this locally organised program gave good potential for making changes on the local organisational levels. Results from this study may also be applicable nationwide.

The educational and learning strategies applied in the present study, were in accordance with existing evidence and based on knowledge and modern ideas of teaching and learning. The content in the training program for neonatal resuscitation was based on international guidelines for basic neonatal resuscitation (Niermeyer et al, 2000; Vain et al, 2004), national and international guidelines for management of preeclampsia and postpartum bleeding and the best known internationally published traditions for management of shoulder dystocia.

The study involved the participants evaluation of the program as well as an individual assessment of the participants. Attempts were made to assess the participants by various kinds of outcome measures, such as self-assessment and objective tests. Both qualitative and quantitative data were collected and information about the impact on the organisation was sought. The program involved both evaluation and assessment before training, immediately after

and 9-15 months following training. Information on long term retention of skills in medicine are sparsely reported in the literature (see section 6.3.4) and the self-assessment and KOS-test administered after 9-15 months in the present study is of importance and reveals that knowledge was lost over time.

However, the level of knowledge did not return to pre-test level. There seems to be a greater loss of knowledge of skills in relation to basic neonatal resuscitation, than to the other trained skills.

The model of Kirkpatrick integrates evaluation of the training program with assessment of the participants at an individual level (Eseryl 2002; Kirkpatrick, 1998; Patrick 1992) (see section 6.3). In the present study this was seen as a useful evaluation model.

11.2 Potential weaknesses of the study

A major critique of the present study is the lack of randomisation and the lack of control groups. The present study design can be viewed as a “compromise design”, which is often seen in educational research where random selection is quite impracticable (Cohen et al, 2003). A design with randomisation and control groups, would have been more optimal from a scientific point of view.

A descriptive design like the present, will not be able to show causal relationships. During the training period a general trend focusing on quality assurance and competence development of staff, could be observed in the department. It can be argued, that some of the changes observed following the training program might have happened even without the training program. The project was only carried out in one hospital setting, which gave very standardised possibilities for the measuring of effects, but at the same time also rises the questions as to the external validity of the study and to whether the project and the conclusions will be applicable in other labour wards and other departments.

The outcome measures lack objective measures, such as direct observation of management in real emergencies in the labour wards or in a simulated

setting. It would have been impossible to obtain information in the clinical setting, as the trained events are rarely occurring. However, “not-warned drills” in the labour ward are planned in the near future in order to test skills on an individual and an organisational level.

The outcome measures, lack objective measures such as figures for maternal and foetal morbidity and mortality. Data from the Danish Medical Birth Registry reveals that the prevalence of the studied events are so low, that any significant changes in figures for maternal and neonatal mortality or morbidity in relation to these rare events could be expected to be observed.

One important question the study raises is, which outcome measures should be measured when evaluating systematic training in obstetrics. We know from other obstetric research, that in obstetrics, very high numbers of deliveries are required to measure direct outcomes. Mongelli et al (1997) calculated that in order to see a statistical significant reduction in low Apgar score it would require 5600 cases, even though Apgar score is an indirect measure of neonatal outcome. A direct outcome could be neonatal encephalopathy and a calculated number of 85000 cases are required in order to demonstrate a change.

From this we can conclude that studies focusing on the effect of systematic skills training, based on measures of direct severe neonatal morbidity as encephalopathy, would require study populations bigger than the total number of deliveries in Denmark per year (approximately 65.000 per year).

This might be the explanation as to why only one recently published British study from Bristol, managed to present outcome measures on neonatal outcome (Apgar score) (Draycott et al, 2006). The study is an observational study where neonatal data was obtained 2 years before and 3 years after implementation of obstetric training were collected. It showed a significant decrease in low Apgar scores after implementation of a local training program (see section 6.2.9).

Development of checklists with validated scales could be another way of overcoming the problem in order to try to develop useful surrogate measures.

An American study on training in shoulder dystocia introduced checklists (Deering et al, 2004). In an accompanying editorial in Obstetrics and Gynaecology the editor, Belfort (2004) argued for the use of checklists in the context of recurrent training exercises. The editorial was written with a parallel to the airline industry.

Audit focusing on training and improvement of competence, might also be useful as an integrated part of a method to evaluate a training program.

12 Conclusions and future perspectives

12.1 Conclusions

The overall conclusions were that an obligatory obstetric training program in the Obstetric department, Rigshospitalet had an impact on both the individual and on the organisational level.

From the present study on multi-professional obstetric skills training in a labour ward the following could be concluded:

- An organisation (steering-committee) responsible for multi-professional obstetric skills training was a prerequisite for successful implementation of a training program.
- A detailed program with aims, objectives, educational strategy and learning material was needed to be discussed and designed.
- An obstetric multi-professional training program in four obstetric emergency clinical skills (management of shoulder dystocia, postpartum bleeding, severe preeclampsia and basic neonatal resuscitation) could be implemented in a high-risk obstetric department.
- More than 95 % of the eligible doctors, midwives, auxiliary nurses and nurses in the obstetrical department participated in the training program
- Almost all of the staff members had positive attitudes towards the training program.
- Management of shoulder dystocia, severe preeclampsia and neonatal resuscitation were all considered stressful and unpleasant clinical skills, however significantly less so, 9-15 months following training.
- Self-assessed scores on confidence in the management of shoulder dystocia, postpartum bleeding, severe preeclampsia and neonatal resuscitation improved significantly and improvements in self-assessed confidence seem to be sustained after 9-15 months, except

for management in basic neonatal resuscitation. However, reduction in self-assessed confidence in management of basic neonatal resuscitation did not return to pre-test level.

- Less room for improvement in self-assessed confidence was seen with regards to management of postpartum bleeding, presumably due to a higher pretest levels.
- The number of correct answers in the knowledge of skills test in neonatal resuscitation rose significantly immediately after training and fell significantly 9-15 months after training, although not back to pre-test level.
- Correct answers in the knowledge of skills test in the management of severe preeclampsia rose significantly immediately after training and were reduced 9-15 months after training, and not significantly higher than pretest-level. Small numbers of participants and high pre-test score might cause methodological problems with regards to possible proven changes (The test was only administered to doctors and specialised midwives).
- The largest room for improvement of self-assessed confidence and reduction in score of how stressful and unpleasant a procedure was considered, were observed amongst auxiliary nurses, nurse in ante- and postnatal ward, midwives and trainee doctors. Less room for improvement was, as expected, observed among specialised midwives and specialised doctors, however in these groups improvements also could be observed.
- There was a significant association between numbers of correct answers in the knowledge of skills test and self-assessed confidence with regards to management of neonatal resuscitation. This could indicate that staff were able to correctly assess their own level of competence.
- On an individual level there was no association between numbers of correct answers in a knowledge of skills test and the number of years

of working experience in obstetrics. This could indicate that the staff did not learn or retain this skill even though they had many years of working experience.

- All groups of health professions reported changes in work practice after training. Reported changes were “Updating of the relevant clinical guideline”, “Better inter-professional communication and/or cooperation”, “Better accessibility to clinical guidelines“; “Better coordination and team spirit at the clinical setting”, “Common understanding”.
- Data from the Danish Medical Birth Registry revealed that the prevalence of the code for the diagnosis postpartum bleeding and the code for administration of medicine to contract the uterus were significantly increased after training. Even though there were problems with the validity of the data from the patient registry, it was concluded that this might be seen as a result, which showed increased focus on cases with postpartum bleeding in the department.
- Sick leave amongst midwives fell during the period of implementation of the obstetric training program. However, no causal relationship between implementation of the training program and the drop in sick leave can be proven.
- During the study period the need for important changes in the organisation were identified and at all levels of the organisation the motivation to make changes were present and changes were made.

12.2 Future perspectives:

The present study raises new questions and gives the following perspectives:

- The need to ensure that continuous training is implemented in the department as an integrated part of the departmental work in order to retain knowledge and skills and to improve staff self-confidence and patient safety.

- The present study provides us with some data on how often training needs to be repeated. Data from the present study seems to reveal, that it is not necessary to repeat training earlier than 9-15 months after, in management of shoulder dystocia, postpartum bleeding and severe preeclampsia.
- Data from self-assessment and the knowledge of skills test appears to show, that basic training in neonatal resuscitation may need repetition more frequent than every 9-15 months. The optimal frequency of training of this skill remains to be established.
- The time interval between obligatory training sessions is probably individual and more data on how to design an individual approach to training is required.
- An idea may be to develop “booster sessions” where only part of a training program is repeated to try to avoid loss of skills and knowledge that is rarely used. There is a need to obtain more information on how to oblige different individual learning strategies.
- “Booster sessions” can be flexible systems where staff can obtain information about rarely used skills ie. net-based informations, books, possibilities of individual training sessions. Ideas on “Booster sessions” need to be discussed, designed and evaluated.
- One idea can be to develop “non warned drills” as “on site simulation”, to test both the individual and the organisational level.
- The development of computer assisted learning programs may also be useful in the matter of certification of certain skills.
- The development of new simulation settings, which combine high tech mannequin with clinical realistic environments within simulated scenarios. Additionally, involvement of actors when the training is planned to focus on communication skills with patients and relatives.
- The development of training in cooperative skills with other medical specialities (anaesthesia, neonatal department, blood bank etc)
- The development of validated checklists.

- The application of data from the Danish Medical Birth Registry to obtain information on which skills need to be trained and if possible to obtain data on the effect of training.
- The continuous involvement of all staff to share ownership of the obstetric training program.
- The continuous promotion of responsibility and involvement of the management group in the department.
- The continuous integration of training into the clinical work in the department, to ensure that the needs for changes become visible and to ensure that changes are implemented in the organisation
- The collaboration with other departments and hospitals to ensure a critical mass of participants and rare events, important for future research.

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14 Appendix

14.1 Statistical analysis: Example of a chain graph model

Nodes: are representing variables.

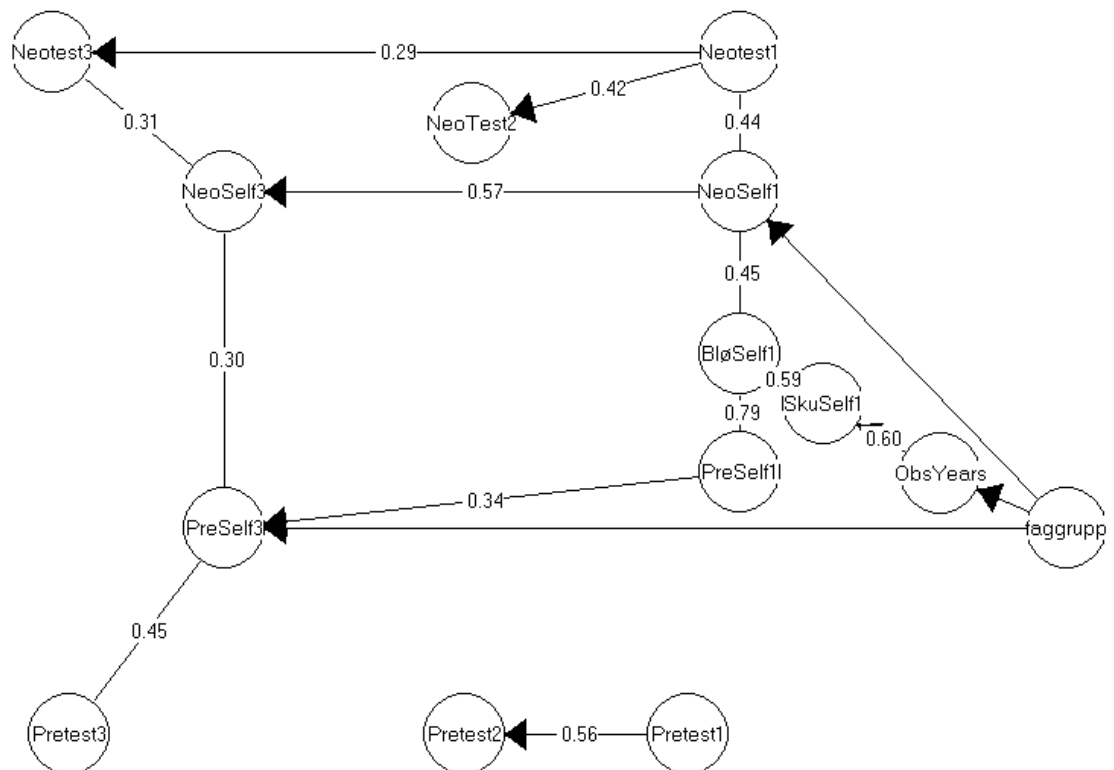
Arrows: connect variables in different blocks with the direction of the arrow corresponding to the temporal or causal structure

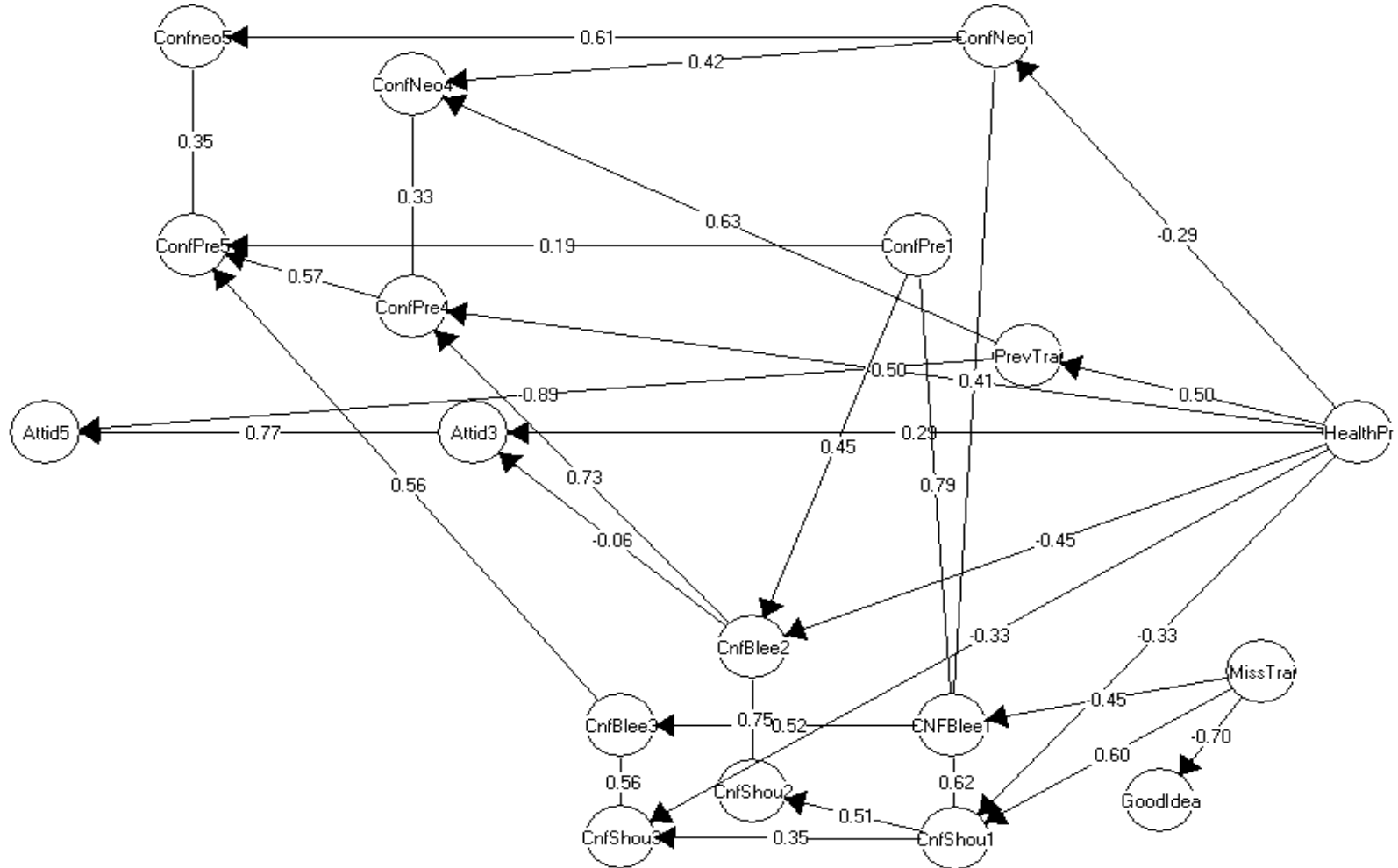
Undirected edges: Undirected edges are used to connect variables in the same block where the causal direction is unknown

Unconnected nodes: If there is no link between two nodes, it means that the two variables are *conditionally* independent given all the other variables in the concurrent and prior block according to the recursive structure.

The number is a partial gamma coefficients, which measures the strength of the correlation between variables. A high gamma ($= \gamma$) indicates high correlation between variables, and a low γ little or no correlation.

Gamma = $\gamma < 0.15$ means weak correlation. Gamma = $\gamma > 0.30$ means strong correlation. Signs can be ignored.





14.2 Details about questionnaires, knowledge of skills tests and response rates

Table 10.3.5-A List of all questionnaires.

	Response rate	Name and number of the questionnaire.	Questionnaire applied to * Questionnaires vary for the different professions	Time period
A1	207/220 94 %	1. Questionnaire 0 DMA	Before (=0) all training was initiated to doctors (D), midwives (M) and auxiliary nurses (A)*	Nov 03 initiated.
A1		1. Questionnaire 0 ns DMA	Data obtained during the whole study period when new staff (DMA) were employed (ns) (To obtain back ground information (=0))	Data obtained during the whole study period when new staff were employed
B1	142/147 97 %	2 Questionnaire 1 J DMA	Just after (=J) training in shoulder-dystocia + pp haemorrhage (=1)*	Dec 03 – Apr 04. During the training period + new staff June 05
C1	132/147 90 %	3, Questionnaire 1 L9 DMA	9-15 months after training (L9) in shoulder-dystocia + pp haemorrhage to all staff involved*. Included open-ended questions	Dec 04 initiated
A1	40/42 95 %	4. Questionnaire 0 N	To nurses (=N) before they were involved in training in preeclampsia + neonatal resuscitation* (To obtain back ground information's (=0))	January 05 initiated
D2	191/192 99%	5. Questionnaire 2 J DMAN	Just after training (=J) in preeclampsia + neonatal resuscitation (=2)*	January 05 – May 05. During the training period + new staff Jan 2006
E2	187/192 93%	6. Questionnaire 2n KB DMAN	"Knowledge of skills test" KOST (=K) to all staff (DMAN) before (B) training in neonatal resuscitation (=2n)	January 05 – May 05 During the training period
F2	190/192 98%	7. Questionnaire 2n KJ DMAN	"Knowledge of skills test" KOST (=K) to all staff (DMAN) just after (J) training in neonatal resuscitation (=2n)	January 05 – May 05 During the training period
G2	128/168* 76 %	8. Questionnaire 2n K L9 DMAN	"Knowledge of skills test" KOST (=K) to all staff (DMAN) 9-15 months after (L) training in neonatal resuscitation (=2n)	September 05 – May 06
H2	46/62 74%	9. Questionnaire 2p KB DsM	"Knowledge of skills test" KOST (= K) to doctors and staff midwives (DsM) before (=B) training in preeclampsia (2p)	January 05 – May 05 During the training period
I2	49/62 79%	10. Questionnaire 2 K J DsM	"Knowledge of skills test" KOST (=K) for doctors and staff midwives (DsM) just after training (J) in preeclampsia (2p)	January 05 – May 05 During the training period
J2	41/54* 77 %	11. Questionnaire 2 K L9 DsM	"Knowledge of skills test" KOST (=K) for doctors and staff midwives (DsM) 9-15 months after training (J) in preeclampsia (2p)	January 05 – May 05 During the training period
K2	144/168* 86 %	12. Questionnaire 2 L9 DMAN	9-15 months after training (L9) in preeclampsia + neonatal resuscitation to all staff*	September 05- May 06

*24 and 8 participated late in the study period and were not eligible for 9-15 months questionnaire and KOS-test

Detailed information about questionnaires can be obtained from the author. Questionnaires are written in Danish

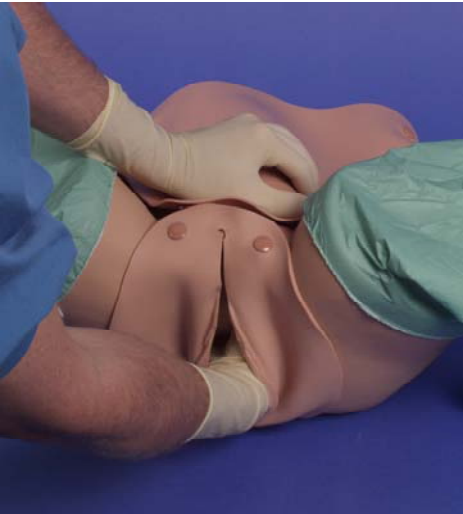
14.3 Examples from the teaching material and the KOS-test

14.3.1 PowerPoint presentation

A slide from the teaching material about postpartum bleeding.

Twenty slides were included in the teaching material about postpartum bleeding, this is one example.

Postpartum blødning




Uterus komprimeres bimauelt

- Den ydre hånd holder uterus anteflekteret mod symfysen

og

- Den indre hånd holdes knyttet op mod nedre segment i fornix anterior

(Credes håndgreb)



Next page is a detailed framework for management of severe preeclampsia.

The page is written in Danish.

<p>14.3.2 Flowchart for training in preeclampsia</p> <p><u>Mål</u></p> <p>Mål for SOSU, sygepl. jdm. læger: Stille diagnosen svær præeklampsia Angive navne på det medicin der anvendes ved svær præeklampsia Monitorere på observationsskema samt viderebringe information om afvigende BT, puls, respiration, timediurese</p> <p>Ved krampeanfald kunne kalde hjælp og sikre frie lufveje hos den gravide</p> <p>Mål for jdm. sygepl. læger: Angive administrationsmåder for det medicin der anvendes ved svær præeklampsia og ved eklampstiske kramper.</p> <p>Vide hvor medicin er placeret. I samarbejde med obstetriker og anæstesiolog iværksætte monitorering og opsætte væske. Starte fosterovervågning med CTG Bestille præeklampsiprøver (hb, trombocytter, elektrolytter, levertal, koagulationstal)</p> <p>Angive blodprovesvar, der kræver at information ojeblibkelig skal videre til obstetriker: trombocytter under 100, forhøjede ASAT/ALAT, LDH og creatinin.</p> <p>Mål for læger: Behandle svær præeklampsia og eklampstiske kramper. Anvende kliniske retningslinjer i medicinadministration. I samarbejde med anæstesiolog planlægge forløsning af patienter med svær præeklampsia. I samarbejde med anæstesiolog monitorere og ordinere væske, vælge anæstesiiform. Kunne diagnosticere komplikationer til svær præeklampsia og i samarbejde med anæstesiolog iværksætte monitorering og behandling af DIC, HELLP, lungeoedem, tromboemboli.</p>	<p><u>Handlinger</u></p> <p>VED SVÆR PRÆEKLAMPSI TÆNK: Planlægning af forløsning: Status: Identificere organsvigt – herunder HELLP? Klinisk: Kredsloeb: BT og puls CNS: Sensorium, reflekser Lever: Epigastrie oemhed Paraklinisk: Lever: ALAT/ASAT, P-albumin, evt. bilirubin Nyrer: S-creatinin, S-urat, S-carbamid, Koagulation: Trombocytter, koagulationstal, LDH og Haptoglobin U-protein, evt. doegnurin Obs. diurese. Evt. KAD og TD</p> <p>Stabilisere BT: Metyldopa, Trandate, Nifedipin, Nepresol</p> <p>Behandle/forebygge kramper Magnesium (se næste spalte og DOSERINGSSKEMA)</p> <p>Foster-overvågning Evt. Celeston, CTG, UL med tilvækst og flow Væske-terapi/timediureser Peripartum: Tilstræb 0-balance. Blodtab > 700 ml erstattes overvejende med kolloid / blod. Postpartum: Tilstræb negativ balance. Ved oliguri over 6-8 timer eller anuri i 2 timer påbegyndes Furosemid-beh. evt. vejledt af CVP (i samarbejde med anæstesiolog). Anæstesi: Epidural, spinal, (GA) SKRIV observationsskema!</p>	<p><u>Nødvendig viden</u></p> <p>Ved behov for akut antihypertensiv behandling (kun ved vedvarende BT >170/110 mmHg): Inj. Trandate 20 mg IV. Effekt efter 5 min. Ved suboptimal effekt kan dosis øges til 40-80 mg. Kan gentages efter 10 min. Max dosis 220 mg. Cave astma og Mb. cordis. Tbl. Nifedipin á 10 mg. Kan gentages efter 30 min. Cave korttidsvirkende kapsler eller sublingual administration → for hurtigt og kraftigt BT-fald. Inj. Nepresol 6,25 mg IV eller 12,5 mg IM. Kan gentages efter 30 min. Max x 3.</p> <p>Behandling af KRAMPER: Kalde hjælp, sikre frie luftveje (sideleje), ilt, behandle kramper, stabilisere og planlægge forløsning Magnesium-behandling: Bolus: 1 hætteglas = 5 gr (20 mmol) fortyndes med 100 ml NaCl (i 100 ml NaCl pose) og indgives IV over 10-30 min. Infusionshastighed ca. 500 ml/time. Vedligeholdelsesdosis: 5 hætteglas = 25 gr (100 mmol) (25 gr) fortyndes med NaCl i 500 ml NaCl-pose. Infusionshastighed 40 ml/time* til 1 døgn efter sidste krampeanfald ≈ 2 gr/time. Ved fornyet krampetilfælde gentages ½ bolus-injektion (2,5 gr). Monitorering: Ved bevarede reflekser er risiko for overdosering minimal. Ved arefeksi og fald i respirationsfrekvens CAVE overdosering. Ved nedsat nyrefunktion ½ dosis. Antidot: Calciumklorid (0,5 mmol/ml) 5-10 ml langsomt IV SE I OEVRIGT MAGNESIUM DOSERINGSSKEMA Ved mgl. IV-adgang: Stesolid-rectiole 5-10 mg eller Magnesium bolus opløst i 50 ml NaCl IM med ½ i hver balde.</p> <p>Krampeprofylakse kan overvejes i 1 døgn til kvinder med svær præeklampsia med samtidig forekomst af 1 eller flere af flg.: HELLP, svær hvp., synsforstyrrelser, epigastralgi eller hyperrefleksi Magnesium-infusion: Bolus: Som beskrevet ovenfor under kramper! Vedligeholdelsesdosis: 100 mmol (25 gr) fortyndes med NaCl til i alt 500 ml NaCl. Infusionshastighed 20 ml/time ≈ 1 gr/time (NB! ½ dosis i forhold til *). HELLP/DIC: Evt. medicinsk behandling skal ske i samarbejde med anæstesiolog og koagulations-lab. Ved HELLP kan kortikosteroid injektioner overvejes både ante-, peri- og postpartum. Ved DIC kan Antitrombin-infusion overvejes.</p>	<p><u>Baggrundsviden</u></p> <p>Se Sandbjerg-guideline om Hypertensive tilstande i graviditeten: www.dsog.dk under guidelines</p> <p>Referencer: The Eclampsia Trial Collaborative Group. Lancet 1995; 345: 1455-63 The Magpie Trial Collaborative Group. Lancet 2002; 359: 1877-1890</p> <p>Drugs for rapid treatment of very high blood pressure during pregnancy. Duley L, Henderson-Smart. Cochrane review 2002.</p> <p>National High Blood Pressure Education Program Working Group Report on High Blood Pressure in Pregnancy. AM J Obstetrics and Gynecology 2000; 183:1-22.</p>	<p><u>Sikkerhed/Risiko</u></p> <p>Cave: Methergin ved præeklampsia/hypertension → BT↑</p> <p>Overdosering af Magnesium → respirations-/hertestop. Antidot: Calciumklorid</p> <p>Cave Magnesium ved nedsat nyrefunktion, leversvigt og myestenia gravis</p> <p>HUSK kontinuerlig overvågning af foster ved intravenøse antihypertensiv behandling</p> <p>Cave for aggressiv blodtryksbehandling</p> <p>Cave sublingual eller kapsel-administration af Nifedipin</p> <p>Cave overhydrering</p> <p>Cave diuretika pga konditionel intravaskulær hypovolæmi</p> <p>Ved kramper antepartum boer patienten stabiliseres før forløsning; også selvom der er risiko for fosteret!</p> <p>CTG bliver "stille" ved Magnesium behandling</p> <p>Ved overflytning sikre stabil patient; også selvom der er foetal risiko.</p>
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14.3.3 KOS-test in neonatal resuscitation

An example of the mini-cases in the KOS-test in basic neonatal resuscitation.

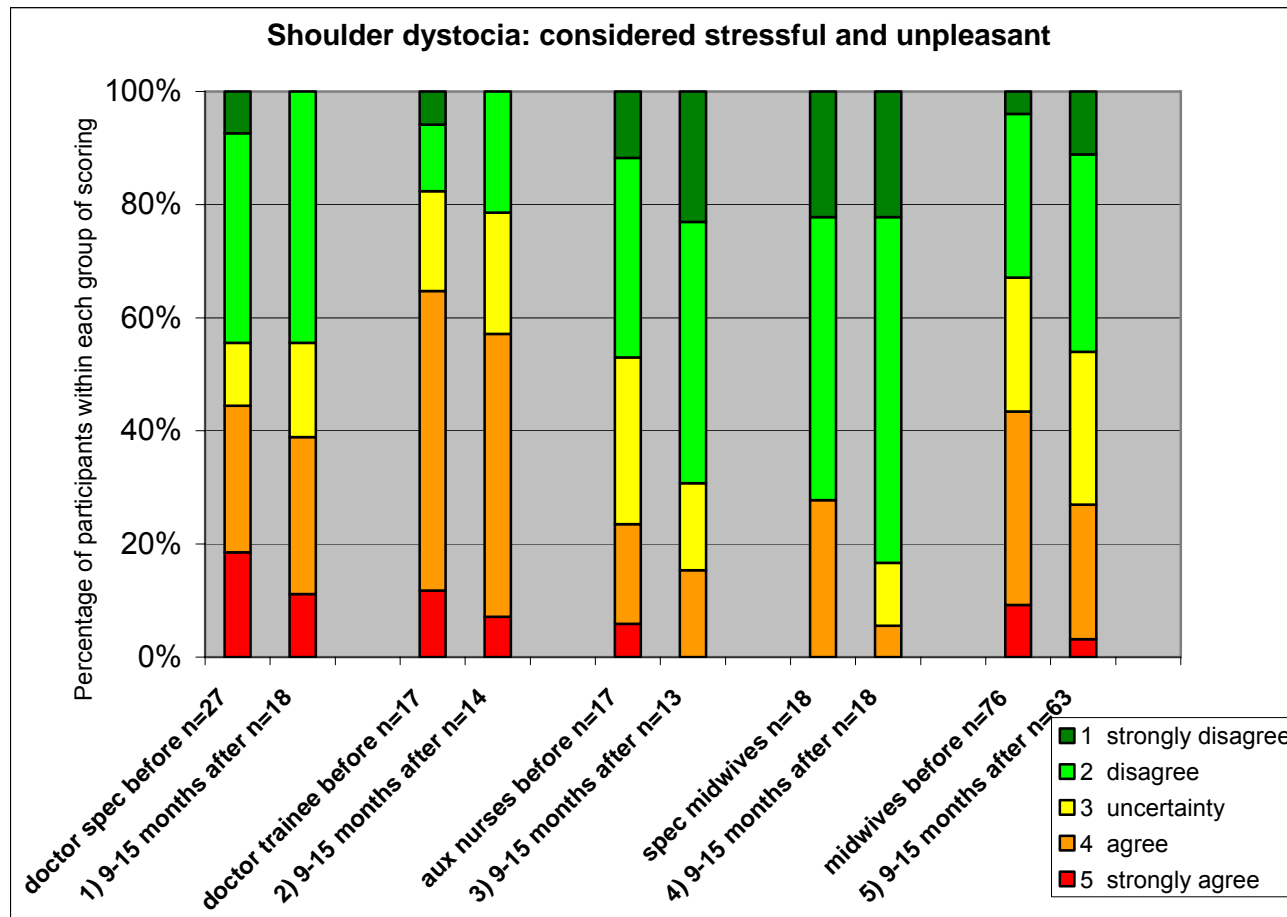
Case and question in Danish:

Du er sammen med en anden ansat på fødegangen i gang med at tage dig af en nyfødt, som er født efter besværlig forløsning. I har kaldt hjælp og venter. I har nu været i gang i få minutter med hjertemassage og ventilation på maske. Jeg vil sammen med en anden ansat på fødegangen foretage mig følgende:

SVAR PÅ ALLE FEM SPØRGSMÅL (ring om ja, nej eller ved ikke)			
a. hvis pulsen er 90 vil jeg kun ventilere barnet på maske	Ja	Nej	Ved ikke
b. hvis pulsen er 70 vil jeg udover at ventilere barnet på maske også give hjertemassage	Ja	Nej	Ved ikke
c. hvis pulsen er 30 vil jeg udover at ventilere barnet på maske også give hjertemassage	Ja	Nej	Ved ikke
d. pulsen skal være helt ophørt før jeg giver hjertemassage	Ja	Nej	Ved ikke
e. Når jeg ventilerer en nyfødt sætter jeg iltflow på 5 liter pr. min.	Ja	Nej	Ved ikke

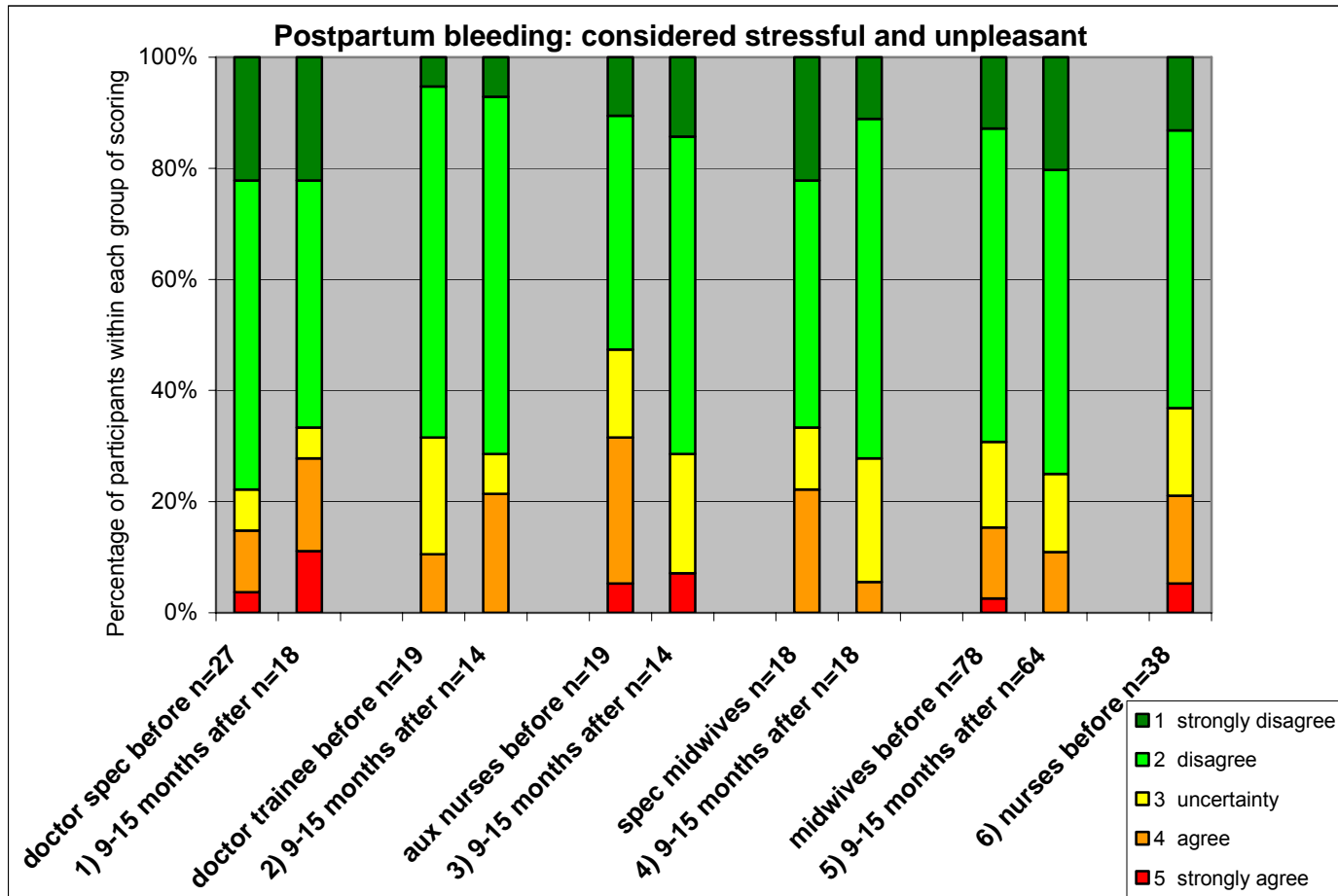
14.4 Data on obstetric skills considered stressful and unpleasant before and 9-15 months after training

Figure 14.4-A. Participants rated before and 9-15 months after training on whether **management of shoulder dystocia** was considered stressful and unpleasant. It was rated on a scale 1=strongly disagree (dark green) to 5=strongly agree (red).



Statistical analysis: Significant change to less stressful and unpleasant after training was seen for midwives: $p = 0.002$. For others: 1) $p = 0.763$; 2) $p = 0.705$; 3) $p = 0.317$; 4) $p = 0.739$ (Test of marginal and conditional homogeneity). Nurses not trained.

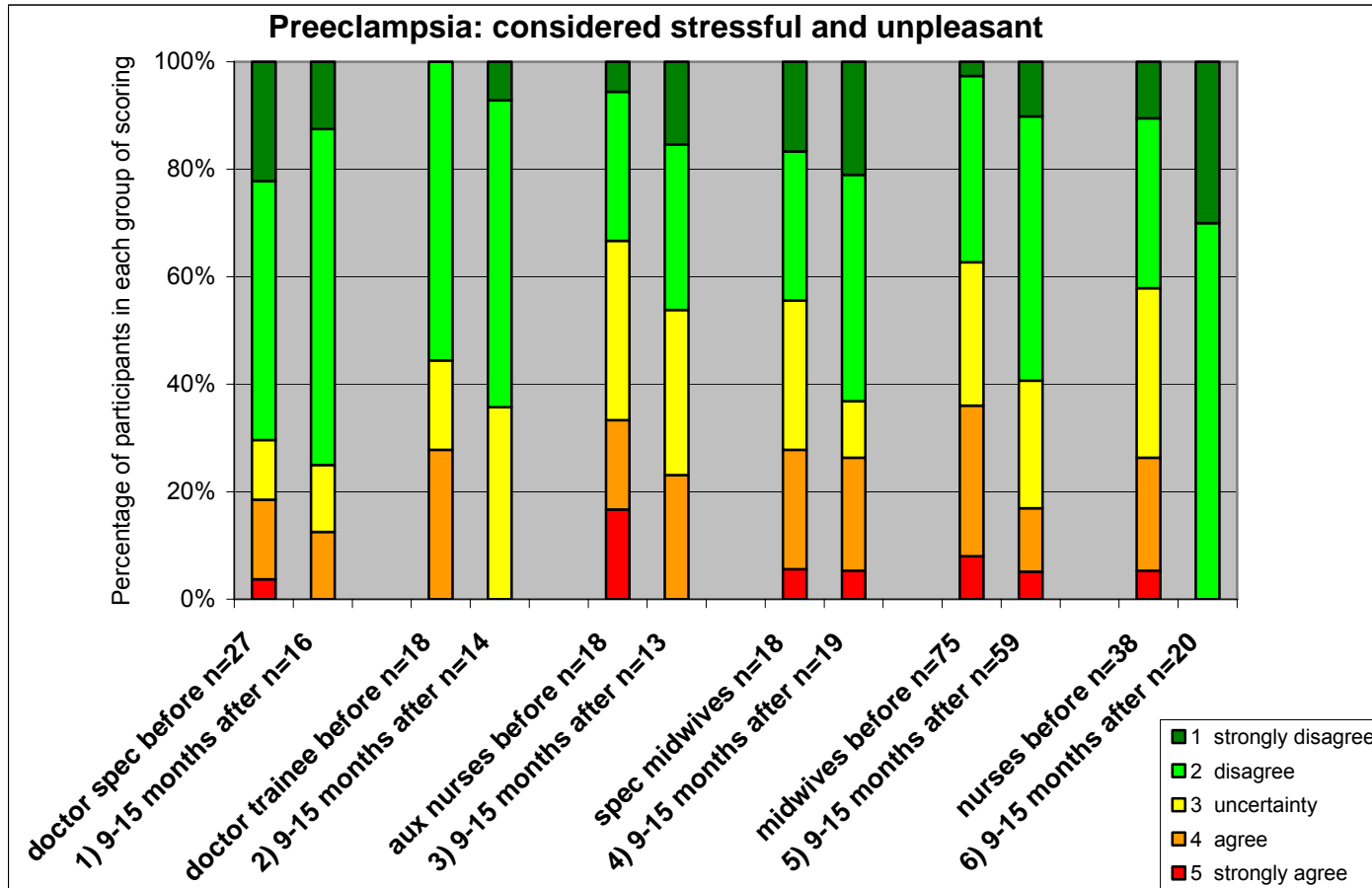
Figure 14.4-B. Participants were asked before and 9-15 months after training whether **management of postpartum bleeding** was considered stressful and unpleasant. It was rated on a scale 1=strongly disagree (dark green) to 5=strongly agree (red).



Statistical analysis: No significant changes were seen for any of the subgroups of health professions.

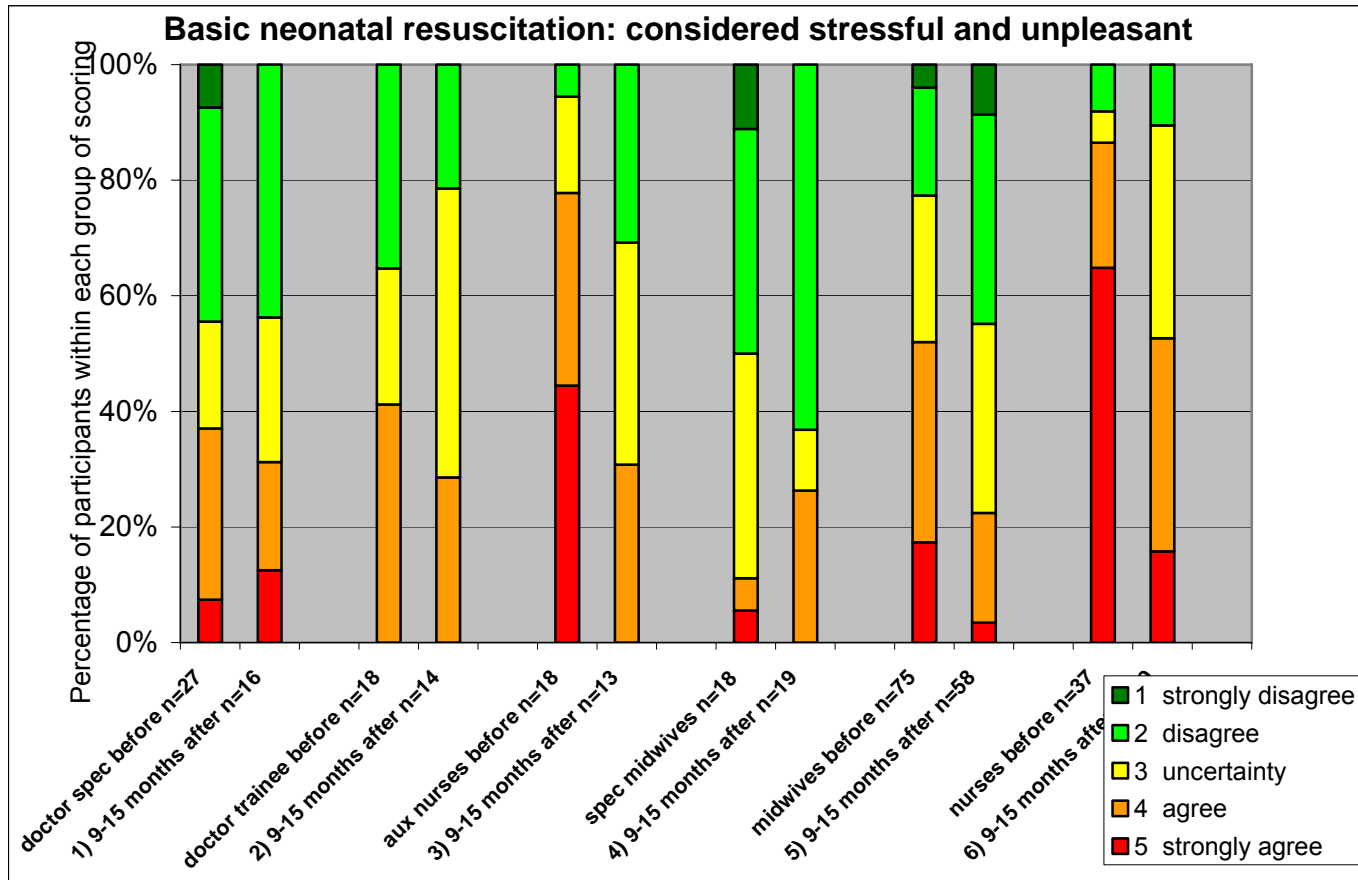
1) p= 0.317 2) p=0.655 3) p=0.480 4) p=0.739 5) p=0.086 (Test of marginal and conditional homogeneity). Nurses not trained.

Figure 14.4-C. Participants were asked before and 9-15 months after training whether management of severe preeclampsia was considered stressful and unpleasant. It was rated on a scale 1=strongly disagree (dark green) to 5=strongly agree (red).



Statistical analysis: Significant changes to less stressful and unpleasant after training were seen for midwives $p=0.001$ and nurses $p=0.004$. 1) $p=0.257$ 2) $p=0.655$ 3) $p=0.414$ 4) $p=0.317$ (Test of marginal and conditional homogeneity)

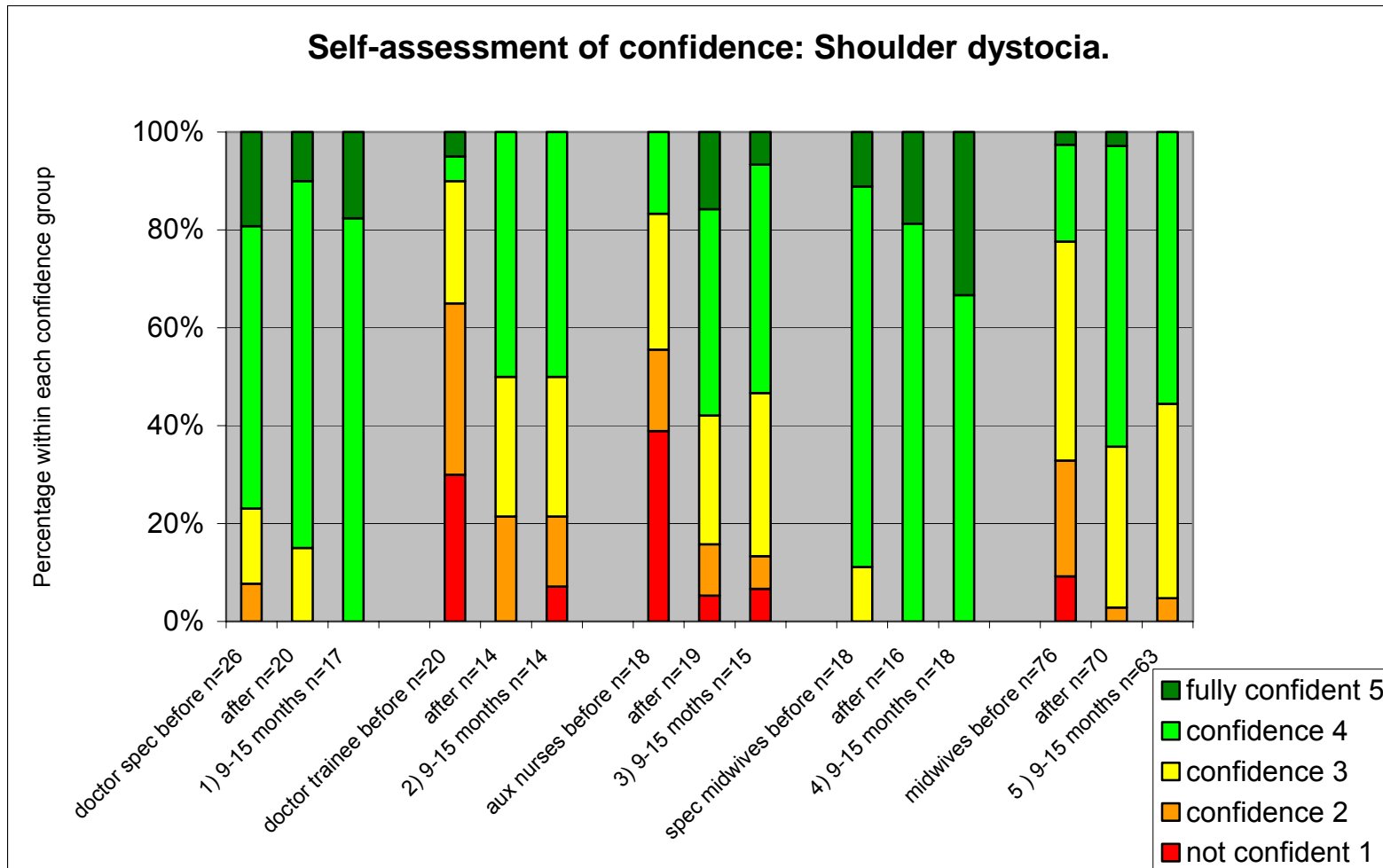
Figure 14.4-D. Participants were asked before and 9-15 months after training whether management of **basic neonatal resuscitation** was considered stressful and unpleasant. It was rated on a scale 1=strongly disagree (dark green) to 5=strongly agree (red).



Statistical analysis: Significant changes to less stressful and unpleasant after training were seen for midwives $p=0.000$ and nurses $p=0.004$. The others: 1) $p=0.206$ 2) $p=0.705$ 3) $p=0.132$ 4) $p=1.0$ (Test of marginal and conditional homogeneity)

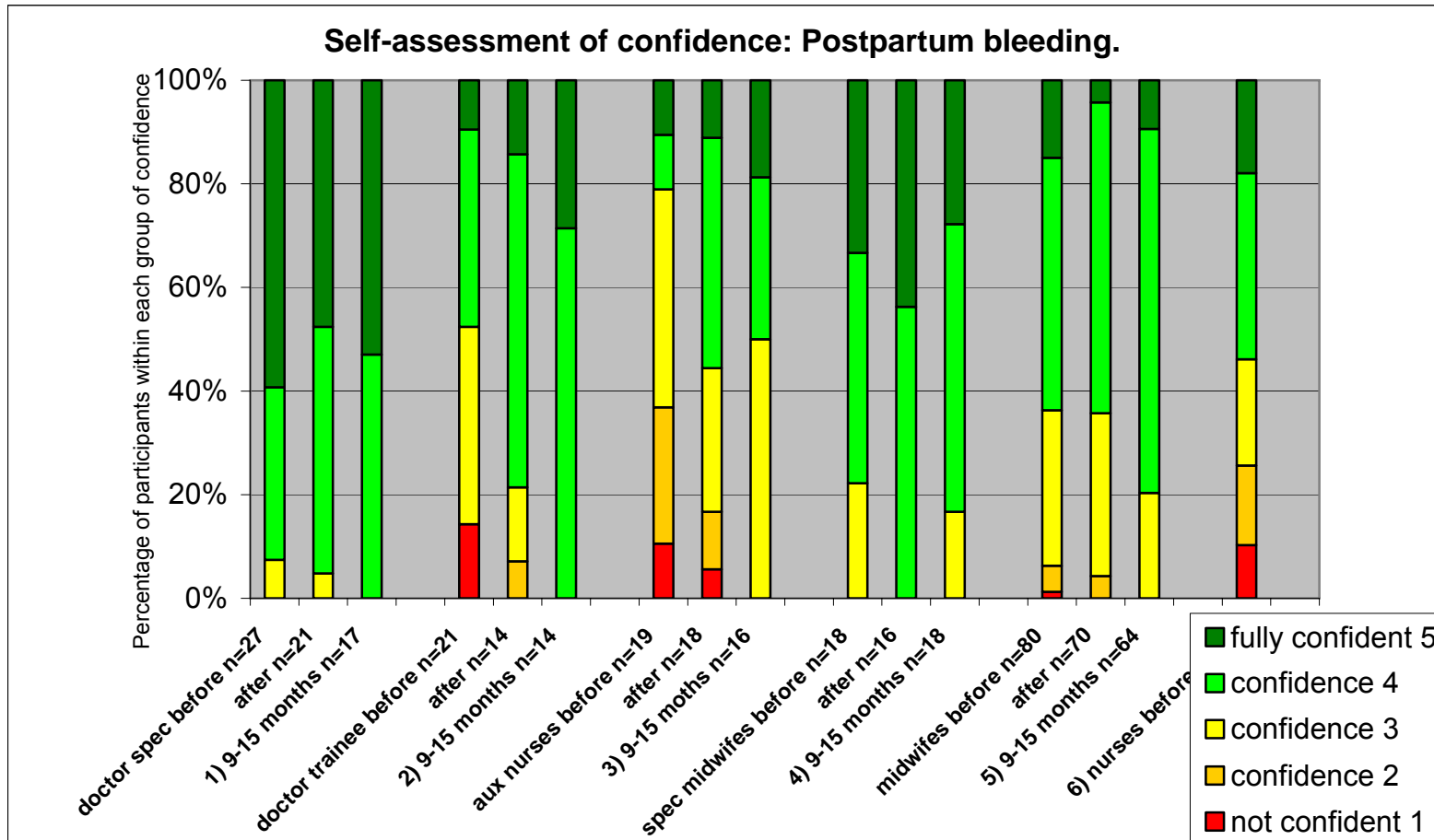
14.5 Data on self-assessed confidence before, immediately after and 9-15 months after training

Figure 14.3.3-A. Self-assessment before, immediately after and 9-15 months after training in management of shoulder dystocia. It was rated on a scale 1=not confident (red) to 5=fully confident (green.)



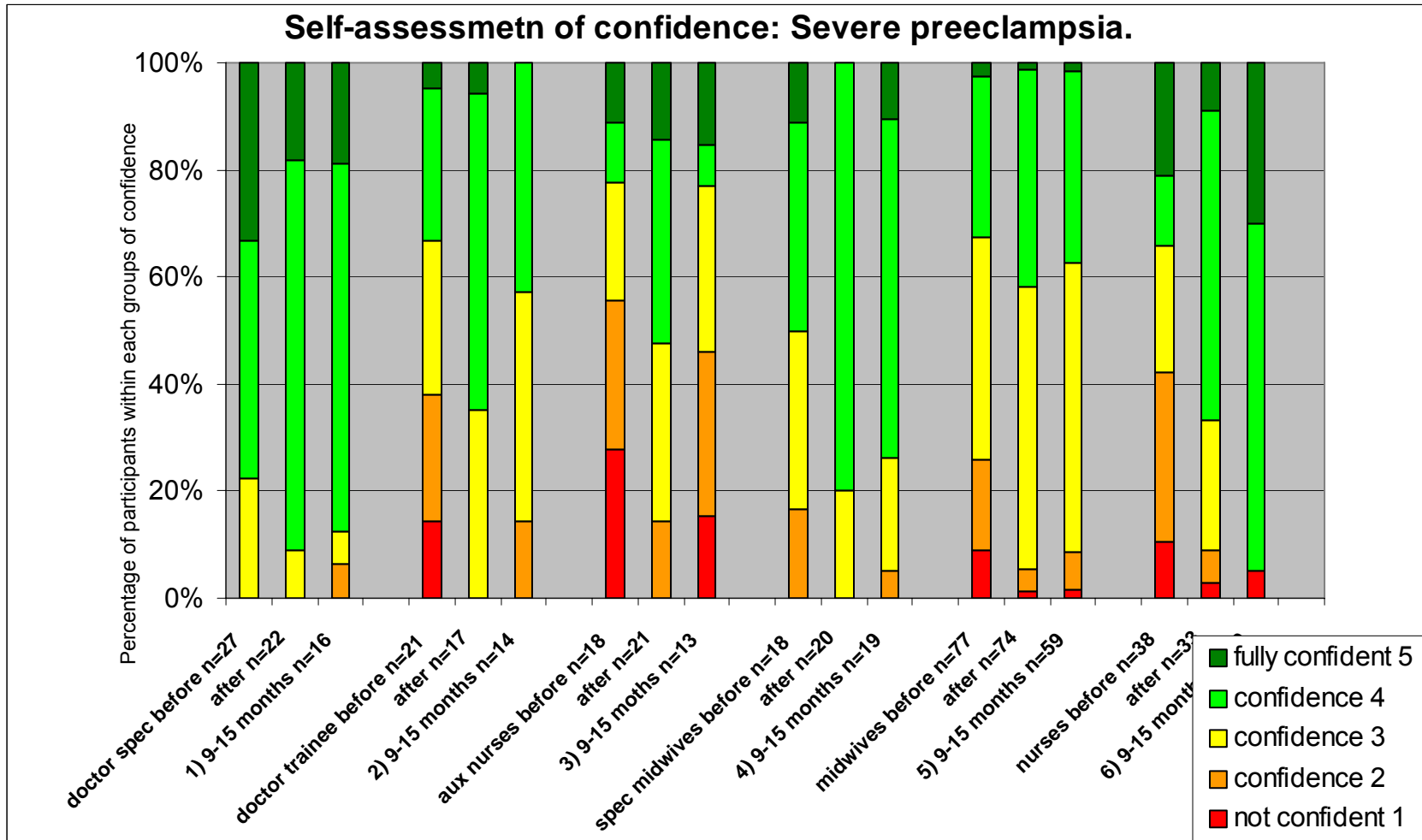
Statistical analysis: Significant higher score for self-assessment from before training to 9-15 months after for 2) trainee doctors $p=0.007$; 4) specialised midwives $p=0.014$; 5) midwives $p=0.000$. A not significant change were seen for specialised doctors 1) $p=0.157$ and 3) auxiliary nurses $p=0.096$ (Test of marginal and conditional homogeneity). Nurses were not trained.

Figure 14.3.34.5-B. Self-assessment before, immediately after and 9-15 months after training in **management of postpartum bleeding**. It was rated on a scale 1= not confident **Figure 14.3.3-B**. Self-assessment before, after and 9-15 months after training in **management of postpartum bleeding**. It was rated on a scale 1=not confident (red) to 5=fully confident (green).



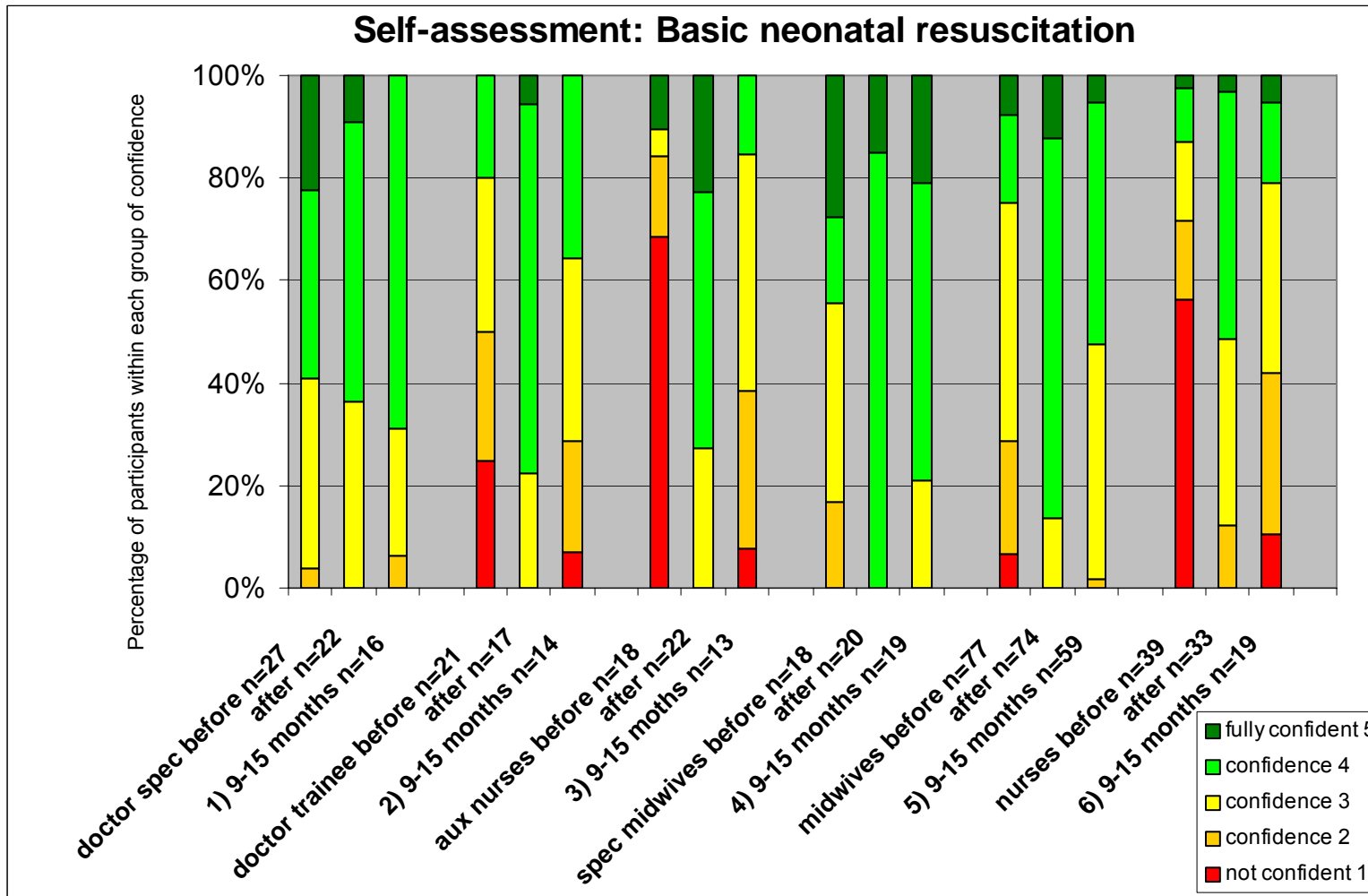
Statistical analysis: Significant changes in self-assessment from before training to 9-15 months after training could be found for 2) Trainee doctors $p= 0.005$; 3) auxiliary nurses $p=0.035$. No significant changes for 1) specialised doctors $p= 1.0$; 4) specialised midwives $p= 1.0$ and 5) midwives $p= 0.41$ (Test of marginal and conditional homogeneity). 6) Nurses were not trained.

Figure 14.3.3-C. Self-assessment before, immediately after and 9-15 months after training in management of severe preeclampsia. It was rated on a scale 1=not confident (red) to 5=fully confident (green).



Statistical analysis: Significant changes in self-assessment from before training to 9-15 months after training could be found for 2) Trainee doctors $p=0.005$. No significant changes for 1) Specialised doctors $p=0.739$; 3) Auxiliary nurses $p=0.655$; 4) Specialised midwives $p=0.132$; 5) Midwives $p=0.128$ and 6) Nurses $p=0.09$ (Test of marginal and conditional homogeneity).

Figure 14.3.3-D. Self-assessment of confidence before, just after and 9-15 months after training in basic neonatal resuscitation. It was rated on a scale 1=not confident (red) to 5=fully confident (green).



Statistical analysis: Significant changes in self-assessment from before training to 9-15 months after training could be found for 2) Trainee doctors $p= 0.003$; 5) midwives $p= 0.000$; 6) nurses $p= 0.001$. No significant changes for 1) Specialised doctors $p= 0.705$; 3) Auxiliary nurses $p= 0.132$; 4) Specialised midwives $p= 0.166$ (Test of marginal and conditional homogeneity).