Simulation-based team training of non-technical skills for anaesthesia personnel – Significance and transfer of learning to clinical practice

by

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Foreword

Already at the Army medical corps' officer candidate school in the Norwegian army, I was introduced to the simulation training. We used simulation manikins and simulated patients with makeup wounds in the scenarios, and always prebrief, facilitation during the scenario followed by debrief. Not so much focus on the non-technical skills then, but more and more in accordance to international service and especially with the Royal Norwegian Air Force – where the intrinsic motivation on human resource and crew resource management was on top. Valuable knowledge, which I have brought with me during work and civilian life moreover.

The PhD has given me the opportunity to research this more in depth in my civilian job as a nurse anaesthetist.

Train as you fight!
Train hard, fight easy!

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Finally, I wish to thank my husband Lasse, daughter Frida and son Fredrik together with my daughter in law Miriam and my grandchildren Ylva and Luna – the most important "troop" in my life. Thank you for always being there! I love you to the moon and back!

Rælingen, November 2023.

This thesis is dedicated to
my mother and father
Johanne and Magnus Strand

Sammendrag

Hensikt: hovedhensikten med dette ph.d. prosjektet var å studere anestesipersonells erfaringer med bruk av simuleringsbasert team trening (SBTT) av ikke-tekniske ferdigheter, og overføring av læring til klinisk praksis.

Metoder: avhandlingen er basert på tre studier, som bruker kvalitative og kvantitative metoder.

Studie I undersøkte hvordan anestesipersonell i Norge gjennomfører SBTT av ikke-tekniske ferdigheter med hensyn til fire kjerneområder: resultat og læringsmål, fasilitering, debriefing, og deltakerevaluering.

Det ble brukt et kvalitativt beskrivende design basert på individuelle intervjuer, og en kvalitativ deduktiv innholdsanalyse. Studie II undersøkte anestesipersonells erfaringer med tverrfaglig in situ SBTT av ikke-tekniske ferdigheter og nytten det har for overføring av læring til klinisk praksis. Det ble brukt et kvalitativt beskrivende design basert på fokusgruppeintervjuer, og et kvalitativt manifest og induktiv innholdsanalyse. I Studie III ble anestesipersonells ikke-tekniske ferdigheter observert før og etter SBTT for å måle overføring av læring til klinisk praksis. Det ble brukt et kvasi-eksperimentelt før- og etter-design basert på videoinnspilte observasjoner og vurdering av anestesiteamets ikke-tekniske ferdigheter før og etter SBTT. Anaesthetists' Non-Technical Skills System (ANTS) ble brukt for å score teamets utførelse. Paret t-test ble brukt for å evaluere effekten av intervensjonen. Data ble analysert ved bruk av SPSS Statistics 28 og beskrivende og komparativ statistikk ble brukt for å presentere resultatene. Samsvar mellom observatører ble kalkulert ved bruk av weighted kappa.

Hovedresultat: Studie I viste at bruk av læringsmål og fasilitatorer var vanlig, og alle deltakerne deltok i debriefinger, og nesten alle gjennomførte evalueringer, hovedsakelig formative. Forberedthet, struktur og tid til disposisjon, ble pekt ut som faktorer som påvirket SBTT. I Studie II erfarte anestesipersonellet at tverrfaglig in situ SBTT motiverte for overføring av læring og ga anledning til å bli bevisst egen praksis angående ikke-tekniske ferdigheter og teamarbeid. En hovedkategori, 'tverrfaglig in situ SBTT som et bidrag til å bedre anestesipraksis' og tre generiske kategorier, 'tverrfaglig in situ SBTT

motiverer for læring og forbedrer ikke-tekniske ferdigheter', 'realisme i SBTT er viktig for læringsresultat', og 'SBTT øker bevissthet om teamarbeid', illustrerte deres erfaringer. I Studie III viste anestesiteamene statistisk signifikant forbedret utførelse av ikke-tekniske ferdigheter etter SBTT. Samsvar mellom observatørene viste moderat samsvar.

Konklusjon: anestesipersonellets erfaringer i denne avhandlingen bidrar til evidens-basert kunnskap angående SBTT og overføring av læring fra SBTT til klinisk praksis. Anestesipersonellets SBTT i Norge møtte International Nursing Association for Clinical Simulation and Learning (INACSL) Standard of Best Practice: Simulation^{SM} til en viss grad, og forberedthet, struktur og tid til disposisjon ble fremhevet som påvirkningsfaktorer for SBTT (Studie I). Det var behov for mer bruk av mal for debriefing for å oppnå resultat og læringsmål og mer strukturert og summativ evaluering (Studie I). Anestesipersonellet var fornøyd med SBTT av ikke-tekniske ferdigheter (Studiene I og II). Anestesipersonellet i tverrfaglig in situ SBTT (Studie II) fikk erfaring med å håndtere følelser og krevende situasjoner, som kunne bli nyttig for overføring av læring som er nødvendig for klinisk praksis. Team kommunikasjon og beslutningstaking ble fremhevet som viktige læringsmål. Videre, anestesipersonellet fremhevet viktigheten av realisme og fidelity (naturtrohet) og tverrfaglige og faglige refleksjoner i debrief som er viktig for bevissthet om egen klinisk praksis. Observere og vurdere anestesipersonellets ikke-tekniske ferdigheter i klinisk praksis før og etter SBTT (Studie III), resulterte i forbedret utførelse av ikke-tekniske ferdigheter. Dette kan indikere overføring av læring fra SBTT til klinisk praksis.

Summary

Aim: The overall aim of this PhD project was to study anaesthesia personnel's experiences with the use of simulation-based team training (SBTT) of non-technical skills (NTS), and the transfer of learning from simulation to clinical practice.

Methods: The thesis is based on three studies, using qualitative and quantitative methods. Study I explored how anaesthesia personnel in Norway conducted SBTT of NTS with respect to four core areas: outcomes and objectives, facilitation, debriefing, and participant evaluation. A qualitative descriptive study design based on individual interviews, and a qualitative deductive content analysis was used. Study II explored anaesthesia personnel's experiences with interprofessional in situ SBTT of NTS and its significance for transfer of learning to clinical practice. A qualitative descriptive study design based on focus group interviews, and a qualitative manifest and inductive content analysis was used. In Study III anaesthesia personnel's NTS were observed before and after SBTT to assess the transfer of learning to clinical practice. A quasi-experimental before and after design based on video recorded observations and rating of anaesthesia teams' NTS was used before and after SBTT. The Anaesthetists' Non-Technical Skills System (ANTS) was used to score the teams' performance. Paired-samples t-test was used to evaluate the impact of the intervention. Data were analysed using SPSS Statistics 28 and descriptive and comparative statistic was used to present the results. Inter-rater agreement was calculated using weighted kappa.

Main results: Study I showed common use of objectives and facilitators, and all participants participated in debriefings, and almost all conducted evaluations, mainly formative. Preparedness, structure and time available were pointed out as issues affecting SBTT. In study II, the anaesthesia personnel experienced that interprofessional in situ SBTT

motivated transfer of learning and provided the opportunity to be aware of own practice regarding NTS and teamwork. One main category, 'interprofessional in situ SBTT as a contributor to enhance anaesthesia practice' and three generic categories, 'interprofessional in situ SBTT motivates learning and improves NTS', 'realism in SBTT is important for learning outcome', and 'SBTT increases the awareness of teamwork' illustrated their experiences. In Study III, the anaesthesia teams showed statistically significant increased NTS performance after SBTT. Interrater reliability showed moderate agreement.

Conclusion: The Anaesthesia personnel's experiences in this thesis contributes to evidence based knowledge regarding SBTT and transfer of learning from SBTT to clinical practice. The anaesthesia personnel's SBTT in Norway met the International Nursing Association for Clinical Simulation and Learning (INACSL) Standard of Best Practice: Simulation^{SM} to a certain extent, and preparedness, structure and time available were highlighted as affecting SBTT (Study I). There was a need for more use of debriefing template to achieve outcomes and learning objectives and more structured and summative evaluation (Study I). The anaesthesia personnel were satisfied with SBTT of NTS (Studies I and II). The anaesthesia personnel in interprofessional in situ SBTT (Study II) gained experiences in coping with emotions and demanding situations, which could be significant for transfer of learning essential for clinical practice. Team communication and decision making were highlighted as important learning objectives. Furthermore, the anaesthesia personnel emphasized the importance of realism and fidelity and interprofessional and professional reflections in debriefs crucial for awareness of their own clinical practice. Observing and rating the anaesthesia personnel's NTS in clinical practice before and after SBTT (Study III), resulted in improved NTS performance. This may indicate transfer of learning from SBTT to clinical practice.

Abbreviations

ACRM	Anaesthesia Crisis Resource Management
ANTS	Anaesthetists' Non-Technical Skills System
BEST	Better & Systematic Team Training
CRM	Crew Resource Management
ESAIC	European Society of Anaesthesiology and Intensive Care Simulation Committee
HSSOBP™	Healthcare Simulation Standards of Best Practice™
INACSL	International Nursing Association for Clinical Simulation and Learning
NASA	National Aeronautics and Space Administration
NTS	Non-technical skills
OR	Operation room
SBTT	Simulation-based team training
WHO	World Health Organization

Original papers

Paper I:

Finstad, A. S., Ballangrud, R., Aase, I., Wisborg, T., Romundstad, L. G., & Bjørshol, C. A. (2021). Is simulation-based team training performed by personnel in accordance with the INACSL Standards of Best Practice: Simulation SM?—a qualitative interview study. *Advances in Simulation*, *6*, 1-10. https://doi.org/10.1186/s41077-021-00186-w

Paper II:

Finstad, A. S., Aase, I., Bjørshol, C. A., & Ballangrud, R. (2023). In situ simulation-based team training and its significance for transfer of learning to clinical practice—A qualitative focus group interview study of anaesthesia personnel. *BMC Medical Education*, *23*(1), 208. https://doi.org/10.1186/s12909-023-04201-8

Paper III:

Finstad, A. S., Bjørshol, C. A., Aase, I., Røislien, J., Ballangrud, R. Assessment of anaesthesia team's non-technical skills in clinical practice before and after simulation-based team training - A quasi-experimental study. (Submitted)

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1 Introduction

Before anaesthesia induction, anaesthesia personnel often tell patients, "We will take good care of you". However, demanding situations sometimes escalate and may end in worst-case scenarios. Healthcare simulation-based team training (SBTT), which focuses on human factors and critically includes non-technical skills (NTS), has a crucial role in preventing such situations (Staender, 2010).

This thesis examines anaesthesia personnel's experiences with in situ SBTT of NTS and the transfer of learning to clinical practice. The main focus is on in situ SBTT, a crucial training method suitable for different healthcare teams. In Norway, anaesthesia personnel, consisting of nurse anaesthetists and anaesthesiologists, work individually or in an anaesthesia team, which is an integral part of the interprofessional surgical team in the operating room (OR), where NTS are important in preventing intraoperative adverse events (Flin, et al., 2008). Anaesthesia personnel perform anaesthesia induction, monitoring, observation and management of acute situations in the OR (Ringvold et al., 2018). Anaesthesiologists bear medical responsibility. At least two anaesthesia personnel are present during anaesthesia induction. Anaesthesia personnel, influenced by developments in the field of aviation, first implemented human factor focused SBTT in healthcare (Gaba et al., 2001). In situ SBTT is realistic because it is conducted in the actual patient situation/environment; it is particularly suitable for difficult work environments and is valuable in assessing, troubleshooting, or developing new system processes (Lioce L. (Ed.), 2020). Moreover, SBTT provides a familiar, safe and possibly time effective training (Bredmose, et al., 2021). According to Sørensen et al., in situ SBTT may also lead to organizational learning, wherein the healthcare personnel put their learning into effect upon returning to clinical practice (Sørensen et al., 2017). With respect to transfer of learning from training to practice, guidelines have been presented to help organizations directing their

focus (Grossman & Salas, 2011). A recent systematic review has concluded that research on the retention and transfer of human factor skills from SBTT to clinical practice remains insufficient, and further research is necessary to gain knowledge of its effects on patient safety (Abildgren, et al., 2022).

My interest in team work, SBTT and transfer of learning to the workplace is based on a long career as a nurse anaesthetist in the Royal Norwegian Air Force and in civilian hospitals in Norway. Clear communication, task management, decision making and situation awareness are crucial NTS for patient safety in anaesthesia. My experience from working in teams has inspired me to carry out this PhD project.

2 Background

This chapter describes the background, including a history of simulation and central constructs, followed by the rationale for this thesis. The central constructs are patient safety in anaesthesia, NTS, teamwork, teamwork training including in situ SBTT and transfer of learning. The rationale summarizes the necessity of the research project.

2.1 Simulation evolution

In this thesis, simulation is defined as *"a technique that creates a situation or environment to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions"* (Lioce L. (Ed.), 2020).

Simulation first dates to military war games in the sixth century (Rosen, 2008). Until the 1990s, the military provided substantial support regarding the modelling and simulation technology used in medicine, when its contributions were surpassed by the gaming industry.

The first "modern" simulator (around the year 1700), a teaching tool used in labour and delivery, when animals were used for development and teaching of surgical skills, contributed to decreasing infant mortality (Smith, 2021). The first doctoral thesis on simulation was written in the 18th century by Georg Heinrich von Langsdorf (Bienstock & Heuer, 2022). Edwin Link introduced simulation to the field of aviation and opened a flying school in 1930 to certify and license pilots. The Cockpit (later referred as crew) Resource Management (CRM) principles of the National Aeronautics and Space Administration (NASA) made important contributions to flight simulation, which were later used in the field of healthcare service, for intensive care, anaesthesia and surgical personnel (Ayaz & Ismail, 2022). In the 1960s, Peter Safar and anaesthesiologist Bjørn Lind, convinced toy maker Aasmund Lærdal to

design and produce the most widely used cardiopulmonary resuscitation (CPR) mannequin in the 20th century, Resusci Anne, a major event in medical simulation history. Concurrently, the neurologist Barrow trained healthy actors to mimic conditions to aid in patient examination training (Barrows, 1993; Barrows & Abrahamson, 1964; Smith, 2021). Later, Gaba et al. developed the Comprehensive Anaesthesia Simulation Environment (CASE), in which simulators were used as environment trainers (Gaba & DeAnda, 1988, 1989; Gaba & Lee, 1990).

Research in aviation in the1980s demonstrated that many aircraft accidents were associated with the crew's human factors. Anaesthesiologists pioneered the development and implementation of the methods in healthcare (Krage & Erwteman, 2015). On the basis of CRM principles (emphasizing decision making and teamwork), Gaba introduced Anaesthesia Crisis Resource Management (ACRM) (Gaba et al., 2001). On the basis of video analysis and practical experiences, Gaba et al. defined gaps in anaesthesiologists' training, described the reasons for the gaps and suggested strategies to close the gaps (Gaba et al., 2001). Moreover, they described ACRM as "training crews to work in teams," such as an anaesthesia crew working with a surgery crew in a surgical team. They trained single-discipline crews (e.g., anaesthesiologists), in a process called crew training, in which teamwork is an important component, to provide comprehensive teaching and practice of technical, cognitive, and behavioural skills for managing relevant crises. Training crews to work in teams provides opportunities to discuss other team members' views and provide a cross-disciplinary understanding. Crew training enables a focus on specific skills, knowledge and material that are relevant for the specific crew but might have little relevance for other crews (Gaba et al., 2001). Ideally, the personnel should participate in both types of training, to improve decision making and teamwork skills (Gaba et al., 2001). Gaba et al.'s ACRM Three Stage Curriculum has been used to focus training at many teaching institutions, also in continuing medical education for experienced practitioners. On the basis

of ACRM, several variant curricula have been developed within emergency and trauma medicine, and intensive care, e.g., Team Oriented Medical Simulation (TOMS) in Switzerland (Baker et al., 2006), Anaesthetists' Non-Technical Skills (ANTS) in the UK (Fletcher et al., 2003); and Medical Team Management (MTM) and Medical Team Training (MTT) in the USA (Baker et al., 2005; Dunn et al., 2007). Moreover, instructor training is provided, with a focus on debriefing (Gaba et al., 2001). Østergaard et al. (2008) implemented simulation-based training (SBT) (1991) in the education of anaesthesia personnel, limited to the anaesthesia team. SBT first occurred at local hospitals, where the environment and equipment were familiar; this aspect is considered a success factor for implementation. SBT was later implemented as part of national courses and curricula for nurses and physicians in Denmark (2004) (Østergaard et al., 2008). In 1997, the Norwegian nationwide training program Better & Systematic Team Training (formerly Better & Systematic Traumacare) (BEST) was introduced as a systematic approach to training trauma teams, in which anaesthesia personnel are an integral part. This one-day course at each hospital focuses on the interprofessional team's communication, leadership, and cooperation during simulated patient treatment, with a vision of: *«strengthening local level of mastery, reliable and realistic science based training methods, freely sharing methods and widely teaching of results»* (Wisborg & Brattebø, 2023, p. 2). BEST is a success project that has improved nationwide professional engagement, knowledge and practice in Norway (Wisborg & Brattebø, 2023; Wisborg et al., 2008). In the early 2000s, The Agency for Healthcare Research and Quality (AHRQ) through use of CRM, simulation and other learning strategies, developed a team building method called Team Strategies and Tools to Enhance Performance and Patient Safety (Team STEPPS), to improve team performance. This is currently the national program in the USA (Bienstock & Heuer, 2022; King, 2008). In recent decades, most healthcare professionals have developed a vision regarding the simulation role within training and education, and the provision and

maintenance of procedures, competencies and skills. Currently, simulation is well integrated in training and education within some healthcare domains, but has not become standard (Bienstock & Heuer, 2022).

The INACSL committee and the INACSL Board of Directors (BOD) introduced the fourth edition of Standards of Best Practice: Simulation℠ in 2021, changing the name to the Healthcare Simulation Standards of Best Practice ™ (HSSOBP ™). This evidence-based framework provides guidance in important areas of simulation: professional development, design, outcomes and objectives, prebriefing, facilitation, debriefing, evaluation and simulation glossary. HSSOBP™ "is the global leader in transforming practice to improve patient safety through excellence in healthcare simulation". Members can network with simulation leaders, educators, researchers, and industry partners. Moreover, it strengthens simulation as a state-of-the-science teaching and learning strategy that may improve the performance of simulations, learning outcomes, and compliance among clinical healthcare personnel. The standards includes background, criteria, and required elements (INACSL, 2016; Watts et al., 2021).

Simulation has become a rigorous tool for training and assessment, including teamwork and non-technical human factors. Among many disciplines, anaesthesiology uses simulation to improve and maintain skills and assess competency. Adverse events often arise from communication breakdown and poor teamwork; therefore, interprofessional team training and collaboration are critical for clinical practice and patient outcomes. This training is now known as SBTT (Bienstock & Heuer, 2022).

In 2009, Dieckmann presented a model of the simulation setting (Dieckmann, 2009). This model is intended to help structure simulation training programs, and contains seven phases: introduction, simulator

briefing, theory, scenario briefing, scenario, debriefing and ending. See Table 1 with description of the seven phases.

Table 1 Seven phases of the setting model (Dieckmann, 2009)

Introduction	Information on aims and objectives.
Simulator briefing	Presentation, explanation and demonstration of the simulator and simulation environment; provision of hands-on time for familiarization with the simulation equipment.
Theory	Background information, e.g., CRM (crew resource management) principles, procedures and algorithms.
Scenario briefing	Information about the scenario, e.g., patient history and problems, roles and advice.
Scenario	Action according to solving the case; provision of experience.
Debriefing	Analysis and discussion of scenario actions.
Ending	Summary of lessons learned; transfer of learning to practice.

The structure can vary among settings, and the order of steps may be changed (Dieckmann, 2009).

The period of the COVID-19 pandemic revealed several gaps in healthcare systems, including training. Simulation-based training might contribute to closing these gaps, and making healthcare safer and more efficient in the future (Bienstock & Heuer, 2022).

2.2 Patient safety in anaesthesia

Anaesthesia may still be considered risky, although it has never been safer. Knowledgeable, competent, careful and vigilant anaesthesia personnel are essential for delivering safe anaesthesia (Higham & Baxendale, 2017). Preventing possible adverse events is worth the effort, and investment of all available resources is necessary to increase safety in anaesthesia (Staender, 2010). A shift in focus from individual to system level is a common feature in quality and patient safety, which is a result of structures and processes in healthcare (Vincent, 2010). Donabedian's (1966) theoretical framework described the difference

between structure, process and result, and became a pillar within patient safety and quality. Moreover, the World Health Organization (WHO) has provided elements concerning insufficient patient safety from this framework (WHO, 2008). The WHO Global Patient Safety Action Plan 2021-2030 (WHO, 2021, p.1) has made a new definition of patient safety: "a framework of organized activities that creates cultures, processes, procedures, behaviours, technologies, and environments in health care that consistently and sustainably lower risks, reduce the occurrence of avoidable harm, make errors less likely and reduce the impact of harm when it does occur." This definition has a broader perspective regarding the complexity of the healthcare system in decreasing adverse events than the previous definition from 2009: "the reduction of risk of unnecessary harm associated with health care to an acceptable minimum" (World Health & Safety, 2010, p.22).

This thesis focuses on in situ SBTT, which is aimed at strengthening safety barriers to prevent adverse events and promote a patient safety culture (Ballangrud & Husebø, 2021; J. Reason, 2000).

Globally, one of ten patients experiences preventable adverse events when hospitalized (WHO, 2021). Even in high-income countries, 44–54% of peri-operative adverse events are preventable (Preckel et al., 2020). In Norway, a national report has indicated that the most serious events are caused by surgical complications and postoperative infections (Helsedirektoratet, 2017). In the OR, patient safety is an interprofessional responsibility, which depends, among all, on teamwork. In situ SBTT is a crucial activity to improve team performance, and consequently decrease harm when it does occur (Ballangrud & Husebø, 2021). In Norway, the patient safety program "In Safe Hands" was launched in 2011 and was replaced in 2019 by the new National Action Plan for Patient Safety and Quality Improvement (2019-2023) (Ihi.org., 2019), inspired by the "Framework for Safe, Reliable, and Effective Care," which includes a guide for teamwork and

communication (Frankel, et al., 2017). Although this program focuses on patient safety, it pays very little attention to in situ SBTT.

In 2010, the European Society of Anaesthesiology (ESA) and European Board of Anaesthesiology (EBA) effectuated the Helsinki Declaration on Patient Safety in Anaesthesiology, an agreement on actions to improve patient safety in Europe. Anaesthesiology was emphasized as having a key role in promoting safe peri-operative care (McCreedy et al., 2023; Mellin-Olsen et al., 2010). Staender et al. (2010) claimed that anaesthesiology was among the leaders in patient safety. The review further stated that, in addition to assessing outcomes, studying risks and errors, which are major challenges in healthcare, is important (Catchpole et al., 2008). Moreover, studying postoperative patient handovers is a critical process step (Nagpal et al., 2010; Reine et al., 2021). Tools and methods, such as checklists, evaluation of critical incidents and simulation, are implemented, mainly according to methods used in aviation, as in this thesis. Flin et al. introduced the term NTS, in the light of this knowledge, to anaesthesia practice (Flin & Patey, 2011; Flin et al., 2010; Flin et al., 2018). Interprofessional teamwork training is crucial for patient safety in anaesthesia, which is in line with this thesis. (Higham & Baxendale, 2017). Moreover, in 2014, Hollnagel et al. (2014) presented a shift in safety thinking: from "as few things as possible go wrong" (called "Safety I") to "as many things as possible go right" (called "Safety II"). This thinking considers humans as resources rather than only as threats, and emphasizes learning not only from failures but also successes (Hollnagel, 2014). This aspect is essential in this thesis focusing on transfer of learning to clinical practice. Adverse events are a combination of active errors from health personnel and latent errors from the system. Most errors result in no consequences and are captured by safety barriers in the system. While insufficient barriers enhance the risk of errors (Reason, 2004; James Reason, 2000). James Reason (1997), as a pioneer, developed the Swiss Cheese Model, which is a human factors model, with the goal of capturing errors, and where each single cheese

slice is a safety barrier. If this does not succeed, the error might pass the holes in the cheese slices and strike the patient. As in this thesis, SBTT may strengthen these barriers, and capture the errors or decrease their consequences.

In 2020, ESA and EBA evaluated achievements and future needs in anaesthesia. An expert opinion on peri-operative safety was published to stimulate implementation of the Declaration and a focus on patient safety. Eight points of agreement were identified regarding anaesthesiology's key role, patient education, delivery of appropriate resources by funders, patient safety training, human factors, industry partners' roles, research and innovation, and protection for safe care (Preckel et al., 2020). SBTT is recommended as a contribution to promote patient safety culture (Saunes et al., 2010). Patient safety culture is a part of the organization culture including how and to what extent the employees interact to improve patient safety. A positive patient safety culture includes a focus on the system, safety on all levels, teamwork, communication, learning when things go wrong, continuous training and patient care (Sammer et al., 2010).

In Norwegian healthcare, it is important to develop education based on national needs for competency. Health workers, like anaesthesia personnel, are educated with a view to prevent adverse events in the frontline of healthcare. As described in this thesis, their knowledge, skills and attitudes are crucial for safe patient treatment and promoting patient safety culture.

Studies have discussed whether simulation can help improve patient safety. For example, in situ SBTT has been reported to decrease mortality and morbidity (Goldshtein et al., 2020), and increased survival after in-hospital cardiopulmonary arrest (Josey et al., 2018). However, more studies are needed to demonstrate that simulation training improves patient safety (Smith, 2021).

2.3 Non-technical skills

NTS are associated with human factors, the study of interrelationships between humans and their environments (Kohn et al., 2000). Human factors, a broad discipline within science, may influence behaviour and have been aimed at improving safety among all in anaesthesia (Kelly et al., 2023) which is the focus in this thesis. Flin et al. (2008) have defined NTS as *"the cognitive, social and personal resource skills that complement technical skills, and contribute to safe and efficient task performance"* (Flin, et al., 2008). Technical skills are defined in healthcare as *"the knowledge, skill, and ability to accomplish a specific medical task"* (Lioce L. (Ed.), 2020). This is in line with this thesis' choice of clinical setting, anaesthesia induction in the OR.

Adverse events have been reported to arise from human factor breakdown, such as in interprofessional OR teams' insufficient NTS (Radhakrishnan et al., 2022; Schwendimann et al., 2018), and to cause intraoperative errors, adverse patient outcomes, and mortality (Zegers et al., 2011). Decreasing the probability of these problems in a complex system as healthcare, requires attention to NTS. Therefore, focus must be placed on effective teamwork including SBTT of NTS in the OR, in which anaesthesia personnel have a crucial role ensuring patient care and safety, e.g., resolving airway complications (Flin et al., 2012; Weller et al., 2014).

The current focus on patient safety has increased the interest in NTS among anaesthesia personnel and the use of in situ SBTT (Radhakrishnan et al, 2022). The skills required for the job must be identified to achieve successful NTS training (Flin et al., 2012), as in this thesis. NTS are divided into two groups, necessary for safe and effective performance in the operating theatre environment: cognitive or mental skills and social or interpersonal skills (Fletcher et al., 2002). NTS include situational awareness (knowing what is occurring in the surroundings), decision making (choosing options), teamwork (skills for

working in groups), leadership (direct and coordinated activities), and the management of stress and fatigue (ability to recognize causes, effects and strategies for coping with stress and fatigue) (Flin, et al., 2008).

In 2012, NTS was recommended, by an international expert group, as one of five topics (technical skills, NTS, system probing, assessment, and effectiveness) for in situ SBTT to improve patient safety (Sollid et al., 2019). In anaesthesia personnel's training of NTS, teamwork is an essential skill for preparing teams to manage challenging situations and for safe clinical practice (Boet et al., 2018; Flin et al., 2010). Therefore, anaesthesia personnel's experience with in situ SBTT and the significance of this framework for transfer of learning to clinical practice is important.

Assessing NTS is crucial to provide feedback regarding performance and to evaluate training (Flin et al., 2010). Aviation has developed behavioural marker systems; similarly, the widely used ANTS system was developed (Flin, et al., 2012) by industrial psychologists and anaesthetists during a collaborative research project in Scotland. Behavioural marker systems, such as ANTS, can provide a structured tool for making reliable assessment and a common language for discussing NTS, thus providing important support in anaesthesia personnel's in situ SBTT of NTS (Flin et al., 2010; Flin, et al., 2012). To achieve successful task performance and support the development of overall good practice, NTS and technical skills should be linked in all situations in clinical practice (Flin et al., 2010; Flin, et al., 2012).

The method, adapted from aviation assessment of pilots' NTS (NOTECHS) (Flin et al., 2018), has led to behavioural rating systems for anaesthetists' (ANTS) (Fletcher et al., 2003), nurse anaesthetists' (NANTS) (Flynn et al., 2017; Lyk-Jensen et al, 2014), surgeons' (NOTSS) (Yule et al., 2006), scrub practitioners' (SPLINTS) (Mitchell et al., 2013), and anaesthetic practitioners' (ANTS-AP system) (Rutherford et al., 2015). The method includes a framework and a

common terminology, which contribute to effective communication and development of skills in simulated settings and clinical practice.

A recent study, describing the importance of NTS in anaesthesia education, suggests that future research should explore available tools to assess NTS in various clinical settings (Radhakrishnan et al., 2022). This thesis may be a contribution to that.

2.4 Teamwork

According to the Norwegian standard of anaesthesia, which was followed in this thesis, an anaesthesia team normally consists of a team of anaesthetist and nurse anaesthetist, and the team may be strengthened when needed. The anaesthetist may be responsible for several anaesthesias simultaneously, when it is considered justifiable. The anaesthesia team is responsible for making agreements concerning the patient's perioperative period. When unexpected deviations occur during anaesthesia, the nurse anaesthetist's duty is to notify the responsible anaesthetist (Ringvold, et al., 2018). According to Salas et al. (1992, p. 4) *"A team consists of two or more people who have defined roles and depend on each other to accomplish a shared goal"* (Salas et al., 1992). In healthcare, team members include anyone involved in patient care and who takes action, and has a defined role and clear responsibilities regarding the team's actions (AHRQ, 2019a). For example, the anaesthesia personnel in the OR, as crucial team members in the interprofessional team taking responsibility for the patient's airway.

Teamwork can be defined as *"the interaction or relationship of two or more health professionals who work interdependently to provide care for patients"* (Oandasan et al., 2006, p.3). Teamwork is currently a central part of healthcare (Salas & Frush, 2012), both globally (WHO, 2018) and nationally in Norway (Ringvold, et al., 2018; Norwegian Directorate of Health, 2018), as shown in this thesis' studies. According to Sentinel Event Data, teamwork and communication failures are the main causes

of adverse events in healthcare in the USA (Commission, 2022, p.8). Teamwork depends on the members of the team and may affect patient safety, e.g., through communication during administration of medication (Syyrilä et al., 2022), a crucial task during anaesthesia induction, and through hierarchical structures preventing team members from speaking up, being attentive and taking action (Lemke et al., 2021; Peadon et al., 2020). Rapid response teams, which often include anaesthesia personnel, in hospitals may decrease the risk of mortality (Maharaj et al., 2015), and surgical safety checklists, which is an interprofessional responsibility, may improve situational awareness and create shared mental models for the operating team (Zegers et al., 2016). Moreover, shared understanding of each team member's role in the team may decrease the risk of adverse events (Sørensen et al., 2017). Salas et al. (2005) have highlighted a holistic perspective when they describing the effectiveness of team performance and how members interact to achieve team outcomes (Salas et al., 2005). Studies have reported that team training improves team performance (Gjeraa et al., 2014; Skåre et al., 2018), cultural attitudes and communication (Ballangrud et al., 2021; Kirschbaum et al., 2012). A systematic review of interventions to improve team effectiveness in healthcare in the past decade has shown that most studies focus on training, tools, organizational (re)design, and programs (Buljac-Samardzic et al., 2020). Training is most frequent, and the majority is related to the acute hospital settings, like in the OR, with a focus on NTS. The number of studies has increased, but the effects remain unclear (Buljac-Samardzic et al., 2020).

2.5 Teamwork training

Human factor focused in situ SBTT was first conducted in healthcare by anaesthesia personnel (Krage & Erwteman, 2015; Østergaard et al., 2011), and remains crucial (Radhakrishnan et al., 2022).

The European Societies of Anaesthesiology and Intensive Care medicine has acknowledged this training as a method to improve patient safety and as an integral part of high standard patient care (Jepsen et al., 2016). Achieving expertise is critical, and in anaesthesia it means delivering safe patient care. This is a result of learning, and Krage et al. (2015) describes three levels relevant for anaesthesia: cognitive outcome (basic and clinical knowledge), skill-based outcome (single skills and procedures, like intubation), and, a crucial focus in this thesis, effective outcome (transfer the knowledge to clinical practice). Healthcare SBTT was developed on the basis of CRM in aviation, with a goal of optimizing equipment, procedures and people to achieve patient safety, including avoiding adverse events, detecting tendencies toward adverse events, and mitigating the consequences of adverse events (Bienstock & Heuer, 2022; Helmreich, 2000).

The Helsinki Declaration on Patient Safety in Anaesthesiology Declaration (ESA 2010), states that education plays a key role in improving patient safety, and that OR team training should be conducted to enhance communication and teamwork (Mellin-Olsen et al., 2010). Huges et al. (2016) have described team training *as "a learning strategy in which a learner or group of learners systematically acquire(s) teamwork knowledge, skills and abilities to impact cognition, affect and behaviours of a team"* (Hughes et al., 2016). Salas et al. (2013) have claimed that the SBTT system should be guided, designed and implemented according to science to achieve effective learning, and that simulators are only tools, (Salas et al., 2013), as this thesis will show. When using SBTT, anaesthesia personnel are given an opportunity to learn and practice in safe environments without a risk of patient injury (Gaba et al., 2001; Krage & Erwteman, 2015). Interprofessional teams, may be prepared to successfully manage challenging situations and prevent patient injuries (Fletcher et al., 2002). The European Society of Anaesthesiology and Intensive Care (ESAIC) Simulation Committee, in 2022, conducted a survey of simulation-based education training in

anaesthesia during residency in Europe. Most European countries used high-fidelity simulation to improve technical and NTS according to critical medical performance. Unfortunately, only five countries had implemented mandatory SBT. Simulation in anaesthesia often remains based on local initiatives rather than national programs. Krage et al. (2015) have stated that anaesthesia and healthcare would benefit from the same types of regulations as those in aviation, which might result in provision of the funds necessary to establish a training culture beyond local initiatives (Krage & Erwteman, 2015).

Research in SBTT, where anaesthesia personnel often are an integral part of interprofessional teams, is mainly from in-hospital settings, and concerns emergency medicine. Results from systematic reviews show that anaesthesia personnel, among others, are satisfied with the SBTT (Gjeraa et al., 2014; Welsch et al., 2018). Their knowledge and skills improve (Gjeraa et al., 2014), together with improved learning, attitudes and teamwork awareness and performance (Weile et al., 2021; Welsch et al., 2018). Moreover the research shows that interprofessional SBTT of both technical and non-technical skills are effective (Armenia et al., 2018; Gjeraa et al., 2016; Weile et al., 2021). Transfer of learning to clinical practice occur, and contribute to changes in organizations and systems, and improved patient treatment (Armenia et al., 2018; Boet et al., 2014; Gjeraa et al., 2014; Welsch et al., 2018). It is claimed that SBTT, including systematic debriefing, is a key factor for improved teamwork among interprofessional teams, where anaesthesia personnel have a crucial role, as in this thesis (Buljac-Samardzic et al., 2020). Moreover, comprehensive randomised studies are needed to evaluate the impact on patient outcome (Gjeraa et al., 2014).

2.5.1 In situ simulation-based team training

Anaesthesia personnel participate in various interprofessional teams and settings, in which their competence is critical (Flin, et al., 2008; Radhakrishnan et al., 2022). Interprofessional in situ SBTT, as

investigated in this thesis, is often used and is particularly suitable for complex systems, such as healthcare, and the assessment and development of new systems; it additionally provides familiar, safe, feasible and time efficient training (Bentley et al., 2022; Bredmose, 2021; Lioce L. (Ed.), 2020). As further investigated in this thesis, in situ SBTT provides anaesthesia personnel with an opportunity to review their own practice and may lead to organizational learning, thus providing a practical and cost-effective solution (Kurup et al., 2017; Sørensen et al., 2017). In situ simulation is defined as "taking place in the actual patient care setting/environment in an effort to achieve a high level of fidelity and realism" (Lioce L. (Ed.), 2020). In learning theory, it is claimed that near transfer of learning refers to transfer between very similar contexts (Perkins & Salomon, 1992). Moreover, in learning science, Thorndike (1913) has stated that when a person learns something from one situation, and these learned elements are identical in the next situation, the chance of handling the second situation increases (Marton, 2006). Thus, training in situ appears to be beneficial in transferring learning to clinical practice. Rosen et al., in a systematic review (2012), have concluded that in situ simulation holds promise for individual and team learning, together with organization and system development (Rosen et al., 2012). However, Sørensen et al. (2017) have suggested that in situ circumstances do not influence individual and team learning, but result increase organization learning; furthermore, learning objectives may influence the choice of simulation setting (Sørensen et al., 2017). Moreover, Dieckmann et al. (2012) have emphasized functional interplay among the personnel involved, the equipment and organizational framework in the actual setting, to achieve success. Their study results have suggested adjusting the amount of content, optimizing the various interdependent parts, focusing on the valuable creativity, recognizing and using learning opportunities, and supporting instructors, according to their roles and the skills required. Moreover, strengthening further theory-based analysis and optimizing simulation practice (Dieckmann et al., 2012). The experience of anaesthesia personnel in in

situ SBTT might reveal organizational and even individual and team learning, and might be important in learning transfer. Research on in situ SBTT of NTS among anaesthesia personnel is limited, but anaesthesia personnel are often part of many different teams in healthcare, not necessarily specified as anaesthesia teams, particularly within emergency and trauma care. This thesis contributes to highlighting in situ SBTT of NTS among anaesthesia personnel.

2.6 Transfer of learning

Satisfaction with the SBTT and increased knowledge have little value if behaviour does not change in clinical practice (Kirkpatrick & Kirkpatrick, 2006). Transfer is a key part of learning theory, and the end of training, as in this thesis on in situ SBTT, is not achieved before transfer occurs. When anaesthesia personnel's improved performance is achieved from one setting to another, there is positive transference (Perkins & Salomon, 1992). Eraut (2004, p.212) described transfer of learning as *"the learning process involved when a person learns to use previously acquired knowledge/skills/competence/expertise in a new situation"* (Eraut, 2004, p.212). Moreover, learning can be described as a process, which includes a change in knowledge, behaviours and/or attitudes, and with an enduring impact on how to think and act. Learning is also a result of how to interpret and respond to experiences (Ambrose et al., 2010). A behaviouristic learning approach involves observation of communication and behavioural changes to determine outcomes (Husebø & Rysted, 2018), in line with the assessment of NTS among anaesthesia personnel after in situ SBTT in this thesis. Moreover, a cognitive learning approach focuses on experience from discussions, such as debriefing sessions in in situ SBTT, to solve new problems and support existing knowledge and skills, e.g., in clinical practice (Reeves et al., 2010). However, achievement of learning alone is insufficient to conclude that training has an effect, and van Wiijk et al. (2008) have found a gap between learning and behaviour (Van Wijk et al., 2008).

Grossman & Salas (2011) have reported that, despite substantial empirical research, uncertainty exists concerning the "transfer problem." Thus, on the basis of Baldwin and Ford's model of transfer (Baldwin & Ford, 1988), Grossman & Salas have identified the most critical findings regarding the transfer of learning and suggested guidelines regarding critical aspects of focus for organizations (Grossman & Salas, 2011). The authors highlighted three main categories: trainee characteristics, training design and work environment (Grossman & Salas, 2011). Furthermore, Kirkpatrick & Kirkpatrick (2006) have described that an evaluation of implementation and application is an extremely important assessment, and interview and observation are necessary evaluation methods. Changes in behaviour can occur immediately or several months after the training. Subtle and ongoing assessment is recommended, together with a design that decreases subjective judgement, when the reliability might be affected (Kirkpatrick & Kirkpatrick, 2006). Subjective judgement, such as self-assessment, is relevant, particularly according to situational awareness skills (Ballangrud et al., 2014), when not all behavioural markers are easy to observe. Quantifying behaviour changes may be challenging, and well-designed assessment tools, e.g., the ANTS system, are needed (Fletcher et al., 2003). Evaluation of behaviour among anaesthesia personnel may be complex and infeasible for organizations, but involving line managers from the beginning of the process may help make this important evaluation possible, thus conferring financial benefits and time savings (Reio et al., 2017). Boet et al., in a systematic review (2014), have illustrated that CRM skills are transferred from training to clinical settings and lead to improved outcomes, although more studies are needed to examine the true effects of simulation-based CRM training on healthcare personnel behaviour, like anaesthesia personnel; the review also discusses the frequency of retraining, skill retention and instructional design (Boet et al., 2014).

Abildgren et al. (2022) have described a holistic learning perspective including the individual, cognitive and physical aspects, and

surroundings. Moreover the authors have suggested a focus on human factor skills including NTS, in SBTT, to achieve deeper awareness of the effects of teams', like anaesthesia teams', human factor skills on patient safety and possibly increased learning potential (Abildgren, et al., 2022).

More studies are needed to examine learning transfer with a focus on anaesthesia personnel's experience regarding the significance of in situ SBTT and the assessment of their performance in clinical setting, as this thesis contributes to.

2.7 Kirkpatrick's evaluation model

With respect to learning transfer from in situ SBTT to clinical practice, Kirkpatrick's model was considered a suitable framework to evaluate learning levels 1, 2 and 3 in this thesis. Kirkpatrick developed the four-level model in 1959, to clarify the evaluation term. All four levels are important and are used in several fields, such as education and training, and by various organizations and professions (Kirkpatrick & Kirkpatrick, 2006). The model is among the most well-known, used, accepted and influential models. The four levels can be used to describe the level of the learning outcome, and to measure the outcome of SBTT in healthcare (Boet et al., 2014). The evaluation levels become increasingly challenging for organizations because of practicability and the required resources, but more valuable information is provided as the process proceeds. The model consists of the following.

Level 1, healthcare personnel's reaction: what they thought and felt about the training.

Example of methods: verbal reactions, feedback sheets and questionnaires.

Relevance and practicability: can be conducted immediately; easy, inexpensive, and important to know for others.

Level 2, healthcare personnel's learning: the increase in knowledge or capability.

Example of methods: assessment before and after, interview and observation.

Relevance and practicability: relatively simple to conduct, highly relevant for training technical skills, less easy for complex learning, more expensive than level 1.

Level 3, healthcare personnel's behaviour: extent of behavioural changes in the professional setting, e.g., learning transfer to clinical practice.

Example of methods: observation, interviews, 360-degree feedback and self-assessment.

Relevance and practicability: more challenging and time-consuming measurement than levels 1 and 2; importance of cooperation with line-managers, and evaluation of implementation and application.

Level 4, results: the effects of healthcare professional actions, e.g., improved patient outcomes.

Example of methods: statistical methods, e.g., randomized control trials (RCT) connected to registry data.

Relevance and practicability: more challenging across organizations than individually, reliance on line management, affected by external factors.

A single study can include several levels (Kirkpatrick & Kirkpatrick, 2006).

Level 3 is critical in learning transfer and in this thesis to clinical practice. No results can be expected if no changes in behaviour occur. Although, as highlighted by Kirkpatrick, levels 1 and 2 should not be skipped and are part of the process to achieve level 3. Behaviour is

described as more complex and time-consuming than reaction and learning evaluation, and may explain why levels 1 and 2 are more often evaluated. Lack of knowledge and expertise in conducting evaluation could be a limit, and many organizations are satisfied with positive reactions from the training, but are not willing to devote substantial effort, time and financial resources (Kirkpatrick & Kirkpatrick, 2006; Reio et al., 2017).

Few studies refer to levels 3 and 4. Moreover, the levels have been reported to be linked, such that participants' satisfaction with training is associated with their having learned and changed behaviours. Therefore, level 1 evaluation might be assumed to be sufficient (Reio et al., 2017). Despite the criticisms, Reio et al. have concluded that most evaluation models are generally based on notions of the original four levels, and Kirkpatrick's model continues to be widely used in national and international settings (Reio et al., 2017).

2.8 Rationale for the present thesis

Anaesthesia team are an integral part of interprofessional OR teams, and in situ SBTT of NTS is important to prevent intraoperative errors, adverse patient outcomes and mortality. A specific need exists for more research and evaluation of anaesthesia personnel's behavioural changes in professional settings, such as transfer of learning from in situ SBTT of NTS to clinical practice. Satisfaction with SBTT and increased knowledge are of little value if behaviours do not change in clinical practice. Therefore, it is interesting to conduct interviews to get an insight into how the anaesthesia personnel conduct simulation-based training around Norway. Moreover, it would be a contribution to the knowledge gap to interview anaesthesia personnel after SBTT in a longitude perspective to provide their experiences of the training and significance for transfer of learning to clinical settings. Finally, it would be interesting to rate anaesthesia personnel's NTS in clinical practice before and after SBTT, to see if there are any improved behavioural

performance. Research is limited regarding anaesthesia personnel's experiences, and the significance of simulation-based training of NTS and transfer of learning to clinical practice.

3 Aims

The overall aim of this PhD project was to study anaesthesia personnel's experiences with the use of SBTT of NTS, and the transfer of learning from simulation to clinical practice.

The specific aims of the three studies were as follows:

Study I aimed to explore how anaesthesia personnel in Norway conduct simulation-based team training (SBTT) of non-technical skills (NTS) with respect to four of these: outcomes and objectives, facilitation, debriefing, and participant evaluation.

Study II aimed to explore anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and its significance for transfer of learning to clinical practice.

The research questions were:

1) How do nurse anaesthetists and anaesthesiologists experience the in situ SBTT in NTS two weeks and six months after the training?

2) How do nurse anaesthetists and anaesthesiologists experience the significance for transfer of learning of NTS to clinical practice two weeks and six months after the training?

Study III aimed to assess the NTS of anaesthesia personnel before and after in situ SBTT in a clinical setting.

4 Methodology

The chapter presents the methodological foundation, design, sample and setting, the intervention, and data collection and analysis processes.

To address the overall aim, a multimethod research design was used, which combined qualitative and quantitative data and design (Polit & Beck, 2021). This design could be widely defined as using several methods or styles within the same study/program (Brewer & Hunter, 2006; Mishel, 1991). Unlike mixed methods research, which requires combined qualitative and quantitative methods, this design may include a variety of combinations (Hunter & Brewer, 2015). Consequently, the aims guided the studies of this thesis, in line with the paradigm called pragmatism, which is associated with this type of research. Qualitative research is associated with a social constructivist worldview, which usually involves collection of data in a variety of real world settings to study actual phenomena. Qualitative research can be cross-sectional, with one data collection point, or longitudinal, with multiple data collection points to observe the evolution of phenomena. Quantitative research is associated with a positivist worldview, with the goal of studying patterns and connections between social factors in one setting type, for the purpose of consistency and objectivity. Both an inductive and a deductive approach are important in the pragmatist paradigm, and generation and verification can be accomplished with adoption of a pluralistic view (Polit & Beck, 2021).

4.1 Design

The three studies in this thesis applied the following designs:

Study I had a qualitative descriptive design based on individual interviews.

Study II had a qualitative descriptive design based on focus group interviews.

Study III used a quasi-experimental before and after design based on video-recorded observations and rating (Table 2).

The combination of different designs and the collection of qualitative and quantitative data were in line with a multimethod research approach, and were necessary to achieve the necessary perspectives and more comprehensive understanding.

Table 2 Overview of studies included in this thesis

Study	Design	Data collection	Sample
I	Qualitative descriptive	Individual interviews with participants from hospitals	51 participants (Anaesthesiologists, nurse anaesthetists and registered nurses)
II	Qualitative descriptive	Focus group interviews (n=7) with anaesthesia personnel	Nurse anaesthetists (n=10) and anaesthesiologists (n=4)
III	Quasi-experimental before and after design	Video recording of observation and rating of anaesthesia personnel	20 teams (two anaesthesia personnel in each team) before SBTT and 20 teams after SBTT

4.2 Sample and settings

The participants were recruited from Norwegian public hospitals (Study I), primarily at the largest university hospital in Norway (Studies II and III).

Table 3 Overview sample and settings (N=number).

	Study I	Study II	Study III
Hospitals represented	Public hospitals (N=51)	University hospital (N=1)	University hospital (N=1)

	Non-university hospitals (N=42) University hospitals (N=9)		
Location for training	In situ Simulation centre In situ and simulation centre	In situ	In situ
Participants	N=51	N=14	N=16
Professions: Nurse anaesthetists Anaesthesiologists Nurses other specialists	 N=46 N=2 N=3	 N=10 N=4	 N=9 N=7
Gender: Female Male		 7 7	 9 7
Age		Mean= 44.5	
Prior experience with SBTT		Yes	

In Study I, 54 public hospitals were recruited through simulation networks and professional networks in Norway (Regjeringen.no, 2019). A total of 51 public hospitals chose to participate, and each hospital's training officer selected one participant according to the respondent's experience and responsibility for anaesthesia personnel's SBTT. The participants answered the questions on behalf of the local anaesthesia personnel. The participants consisted of nurse anaesthetists, anaesthesiologists and registered nurses. The hospitals represented different locations for SBTT (Table 3)

In Study II, anaesthesia personnel were recruited from an ongoing interprofessional in situ SBTT, suitable for focus group interviews with the aim of providing experience from the SBTT and significance for transfer of learning to clinical practice. The in situ SBTT took place in

an operation department in a university hospital in Norway employing 60 nurse anaesthetists and 22 anaesthesiologists. Five training sessions, in a scenario of emergency caesarean delivery were included in the study during 17 weeks (Table 3). A total of 14 anaesthesia personnel (ten nurse anaesthetists and four anaesthesiologists) provided consent and participated in focus group interviews 2 weeks (interview 1) and 6 months (interview 2) after the in situ SBTT. Their experiences soon after the SBTT and after having returned to clinical practice for a while were recorded to provide a longitudinal perspective. The interview guide was designed on the basis of Kirkpatrick's evaluation model levels 1, 2 and 3 (Kirkpatrick & Kirkpatrick, 2006).

In Study III, anaesthesiologists and nurse anaesthetists, employed in a selected operation department in the largest university hospital in Norway, were recruited. The anaesthesia personnel had given permission for video recording during anaesthesia induction with endotracheal intubation for patients undergoing ear-nose-throat (ENT) surgery in the clinic. A total of 20 different teams were constellated, based on 16 anaesthesia personnel who were asked and consented to participate (nine nurse anaesthetists and seven anaesthesiologists) during the research period. The participants were allocated to teams according to clinical shifts and availability. The same team constellations participated before and after SBTT (Table 3).

4.3 The in situ SBTT programme

The SBTT programmes (Studies II and III) were constructed interprofessionally according to the necessary learning objectives. In Study II, the interprofessional group planning the simulation developed the actual scenario and learning objectives. The researcher, contributed with simulation pedagogy and facilitation, and distributed information sheets to the participants (Appendix 3). The SBTT programmes (Studies II and III) were based on a model of the simulation setting adapted from Dieckmann (2009), which contains seven relevant phases in simulation-

based courses in healthcare, which are valuable for describing simulation practice in a process-oriented manner, and are suitable for courses in several domains. The practicability of the model provided an opportunity to modify the phases to the actual training programme (Dieckmann, 2009) (Table 4).

Table 4 The present studies' (Studies II and III) in situ SBTT programme phases

1	Introduction Theory Inputs	The participants received an information sheet before the in situ SBTT, with theory concerning general medical simulation and NTS.
2	Simulation and Scenario Briefing	The participants received information from the facilitator regarding the aim of the training, learning objectives, equipment, simulation environment, confidentiality, simulated patient, simulation safety and scenario.
3	Simulation Scenarios	The participants were enacted the actual scenario, which formed the basis of the debriefing; in Study II, the same scenario was enacted twice.
4	Debriefing	The participants attended a structured interprofessional (Study II) and professional (Study III) debriefing discussion of the scenario action(s). In Study II, participants attended debriefing after each scenario.
5	Ending/Evaluation	The participants took part in an evaluation session, regarding their satisfaction with the training and the knowledge to be transferred back to the clinic.

4.4 Data collection

The present thesis comprises three papers based on three studies. The data collections presented in this thesis was conducted between August 2016 and June 2021.

Interview guides were used in the qualitative studies (Studies I and II), and video recordings and a framework for observing and rating (Appendix 4) were used for the quantitative study (Study III).

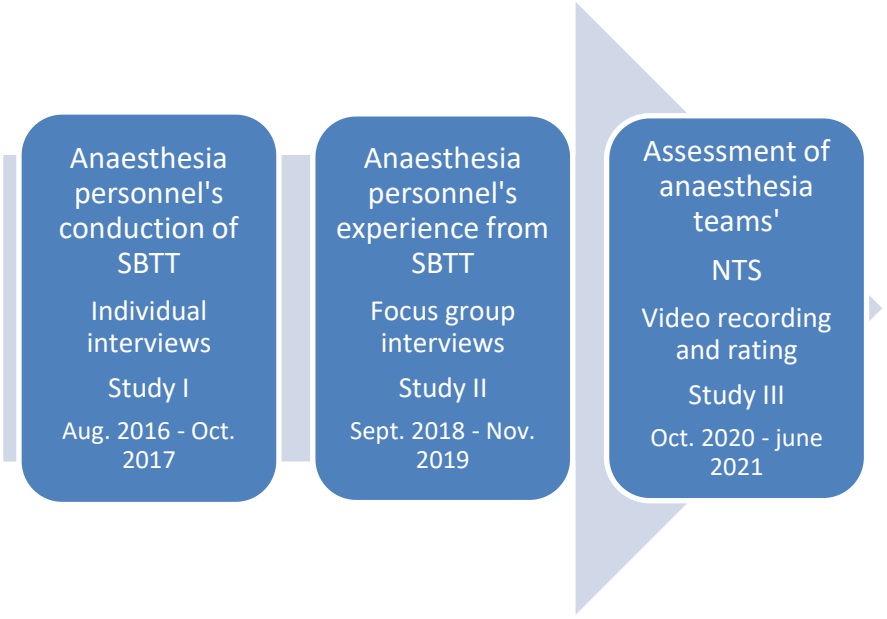

Fig. 1 Study phases and timeline

4.4.1 Qualitative data collection

4.4.1.1 Study I

A semi-structured interview guide based on open-ended and closed-ended questions (background questions) (see Appendix 1) was constructed to address the aim of the study. The open-ended questions were designed to gather new knowledge. Two pilot interviews validated the interview guide, and resulted in a question regarding the transfer of learning from simulation to clinical practice. The participants received the interview guide in advance. The first author (ASF) conducted, and collected data through, individual telephone interviews between August 2016 and October 2017. The participants were asked the same questions, and follow-up questions were used to encourage the participants to elaborate on or clarify their responses. The median interview length was 35 min (range 20–52 min).

4.4.1.2 Study II

A semi-structured interview guide based on open-ended questions (Appendix 2) was prepared to address the aim of the study. The questions were specifically designed to gain knowledge regarding the interprofessional in situ SBTT and provide an opportunity to holistically understand its advantages in clinical practice (Morgan & Guevara, 2019). A pilot interview was performed to validate the interview guide (Appendix 2), and no changes were made. The questions pertained to the anaesthesia personnel's experiences in SBTT and transfer of learning to clinical practice, including utility, transferability, outcome, implementation, challenges, and benefits. Data were collected via focus group interviews two weeks (interview 1), and six months (interview 2) after the SBTT program between September 2018 and November 2019. Generation of data at two time points, provided a longitudinal perspective of the sustainability of transfer of learning to clinical practice. Five focus groups consisted of nurse anaesthetists and anaesthesiologists and two focus groups consisted of only nurse anaesthetists, and with two to five participants per group. Three of the 14 participants were not available for interview 2. New constellations were inevitable, because of time availability and clinical shifts. All anaesthesia personnel in interview 2 also participated in interview 1. The interviews lasted approximately one hour. The moderator (ASF) and observer (RB), who made field notes, conducted all interviews. The moderator (ASF) introduced the study and led the discussions. A summary of the field notes was read aloud by the observer (RB) and was confirmed by the participants in each focus group. The moderator made audio recording of the interviews, transcribed them verbatim, and anonymized the data before conducting analysis. Information power, based on reflection on the data information richness and how that correspond with the study's aim and requirement, was considered to be sufficient. (Malterud et al., 2016).

4.4.2 Quantitative data collection

4.4.2.1 Study III

Video recording of anaesthesia teams in the OR in clinical practice was conducted in two sessions; before and after in situ SBTT. A total of 20 recordings were made before SBTT, between October 2020 and January 2021, and 20 recordings were made after SBTT, between May and June 2021. Anaesthesia personnel's NTS performance, which was shown in the video recordings, was rated according to the ANTS system framework for observing and rating (Flin et al., 2012).

The ANTS System was translated into Norwegian through back translation (Brislin, 1970), and was used with permission (Rhona Flin, University of Aberdeen, 2019) (Appendix 4).

ANTS

The ANTS system, is a framework/behavioural marker system for observing and rating anaesthetists' NTS (Fletcher et al., 2003), and consists of a level hierarchy comprising four categories at the highest level, then 15 skill elements, with definitions and examples of good and poor behaviour. These are the behaviour markers, which indicate the presence or absence of the elements (Table 5) (Flin, et al., 2012).

Table 5 The ANTS system categories, elements and examples of behaviour markers for good and poor practice (with permission Rhona Flin, University of Aberdeen, 2023) (Flin, et al., 2012)

Categories	**Elements**	**Example behavioural markers for good practice and poor practice**
Task management	• Planning and preparing • Prioritising • Providing and maintaining standards	Planning and preparing Good practice: • Communicates plan for case to relevant staff • Reviews case plan in light of changes • Makes post-operative arrangements

Categories	**Elements**	**Example behavioural markers for good practice and poor practice**
	• Identifying and utilising resources	for patient • Lays out drugs and equipment needed before starting case Poor practice: • Does not adapt plan in light of new information • Does not ask for drugs or equipment until the last minute • Does not have emergency/alternative drugs available that are suitable for the patient • Fails to prepare a post-operative management plan
Team working	•Co-ordinating activities with team members •Exchanging information •Using authority and assertiveness • Assessing capabilities • Supporting others	<u>Supporting others</u> Good practice: • Acknowledges concerns of others • Provides reassurance/encouragement • Debriefs and thanks staff after a difficult case • Anticipates when colleagues will need equipment/information Poor practice: • Asks for information at difficult/high workload times for someone else • Does not offer assistance to team members • Fails to recognise the needs of others requiring task reallocation • Uses a dismissive tone in response to requests from others

Categories	**Elements**	**Example behavioural markers for good practice and poor practice**
Situation awareness	•Gathering information •Recognising and understanding • Anticipating	<u>Recognising and understanding</u> Good practice: • Increases the frequency of monitoring in response to patient condition • Informs others of the seriousness of situation • Describes patterns of cues and their meaning to other team members Poor practice: • Does not respond to changes in patient state • Carries out inappropriate course of action • Silences alarms without investigation
Decision making	• Identifying options • Balancing risks and selecting options • Re-evaluating	<u>Re-evaluating</u> Good practice: • Re-assesses patient after treatment or intervention • Reviews situations, if the decision was to wait and see • Continues to list options as the patient's condition evolves Poor practice: • Fails to allow adequate time for the intervention to take effect • Fails to include other team members in re-evaluation • Is unwilling to revise the course of action in light of new information

Each category consists of three to five elements rating NTS performance on a 4-point Likert-type scale (1=poor, 2=marginal, 3=acceptable and 4=good), and with an opportunity is given to respond N=not observed.
In 2012, the Anaesthetists' Non-Technical Skills (ANTS) System Handbook v1.0 was published to provide a condensed guide with suggestions for how the system can be used. The system consists of principal skills that can be identified through observable behaviour. To use the system effectively, training is required, comprising background knowledge, principles for using psychometric tools, the ANTS system in relation to everyday practice, and observer and rater training in NTS with the ANTS system. Calibration is recommended to ensure standardized assessments and enable smaller groups of consultants to become ANTS trainers/assessors. Allocation of some time to become familiar with the system through training is recommended. The teaching and assessment should not interfere with clinical care. Assessment and feedback through the ANTS system should be conducted routinely in both simulation and clinical settings (Flin et al., 2012).

Two experienced and trained nurse anaesthetists familiar with the language and structure of the ANTS system accepted to participate as raters. Training in rating, in the preparatory phase, was organized by the researcher and conducted in order to increase agreement of NTS rating and to become familiar with the instruments. As rater training tools, video files from a pilot testing in clinical practice and video recordings from anaesthesia students' simulation settings (Flynn et al., 2021) were used. After video observation, each rater individually rated each team member and then they reconsidered their rating together in order to develop a common understanding. Next, the two trained and independent raters viewed each video of the anaesthesia team during anaesthesia induction and rated each team member individually according to NTS performance and by means of the framework ANTS system. (Flin, et al., 2012). The video camera was set up to record the anaesthesia team

during anaesthesia induction, and the recording was ended immediately after induction (defined as correct position of endotracheal tube).

4.5 Data analysis

4.5.1 Qualitative data analysis

Qualitative data analysis was performed in the original Norwegian language, and all authors approved the translations. The results are reported with respect to the COREQ Checklist (Studies I and II) (Tong et al., 2007).

4.5.1.1 Study I

Qualitative data were analysed via *deductive* content analysis based on Elo and Kyngäs (Elo & Kyngäs, 2008) to deepen the understanding of the anaesthesia personnel's experiences with the SBTT conduction. Data were analysed according to the INACSL framework (INACSL, 2016), including simulation design, outcomes and objectives, facilitation, debriefing, participant evaluation, professional integrity, simulation-enhanced interprofessional education and simulation glossary. Four core areas, on the basis of earlier research and theory (Dieckmann et al., 2018; Kirkpatrick, 1994; Kolbe et al., 2015; Lioce et al., 2013; Rudolph et al., 2008), were chosen in this thesis Study I: outcomes and objectives, facilitation, debriefing, and participant evaluation. A guide simplified the implementation, and with progress in simulation science, the standards continually evolved (Rutherford-Hemming, 2015).

The analysis was organized according to three phases: preparation, organizing, and reporting (Elo & Kyngäs, 2008). The content of each phase is presented in Table 6.

Table 6 Phases of deductive content analysis

Phase 1: *Preparation*	The interviews were transcribed verbatim and read through several times to gain familiarity with the text to understand the content and categorize the participants' statements. The interviews were individually analysed.
Phase 2: *Organizing*	A structured analysis matrix was designed according to four areas. Transcripts were reviewed. Highlighted text was coded using the areas. Suitable aspects were chosen, and the authors performed the analysis with no discrepancies.
Phase 3: *Reporting*	The authors agreed on the citations to be used to supplement the text and thereby illustrate the chosen areas. Original language was used in the analysis and was then translated and approved by all authors.

4.5.1.2 Study II

Qualitative data were analysed with the use of manifest and *inductive* content analysis (Elo & Kyngäs, 2008), to gain insights into anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and transfer of learning to clinical practice. The analysis of the content of the three phases is presented in Table 7.

Table 7 Phases of inductive content analysis

Phase 1: *Preparation*	The interviews were transcribed verbatim. All the authors read the interviews through several times to familiarize themselves with the text and understand the statements' content. The interviews were individually analysed.
Phase 2: *Organizing*	All the authors participated in the analysis process to identify codes. Data were split into smaller excerpts and coded according to relevance to the study aim. The codes were divided into sub-categories, then interpreted and aggregated into broader generic categories and finally a main category after discussion among the authors.
Phase 3: *Reporting*	The authors agreed on the citations to be used for illustrations in the text. The original language was used in the analysis and then translated and approved by all authors.

(Elo and Kyngäs, 2008)

4.5.2 Quantitative data analysis

4.5.2.1 Study III

IBM SPSS Statistics 28 was used to perform statistical analysis. On the individual level, the participants' score was calculated as the mean from the two raters, and then the team score was calculated as the mean of the two team members. When an element was not observed for one of the team members, the other team member's score represented the team. One NTS performance score was marked as missing in the SPSS file. In summarizing the ANTS scores, the mean (SD) across all teams were used. Paired-samples *t*-tests were used to compare scores pre- and post SBTT. The statistical significance level for all tests was p-value <0.05.

Interrater reliability was assessed with weighted kappa (Mandrekar, 2011), with the ANTS score for each element as the ordinal variable. The results were categorized as shown in Table 8.

Table 8 Weighted kappa values (Landis & Koch, 1977)

Weighted kappa values	**Strength of agreement**
< 0	None
0.01 - 0.20	Poor
0.21 - 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 – 1.00	Very good

5 Ethical considerations

All three studies were submitted and approved by the local Institutional Data Protection Officer (DPO), Oslo University Hospital (18/17582) (Appendix 8 and 9) and accepted by the department heads at the participating hospitals. The studies were reviewed and deemed to be outside the mandate of the Regional Ethics Committee (REK) (2016/642) (Appendix 10). All the studies were conducted in accordance with the principles of the Declaration of Helsinki and Code of ethics (Healthcare, 2018; WMA, 2018).

5.1 Study I

All the participants received an email with an invitation and information document including the confidentiality policy (Appendix 5). The participants were allowed to withdraw at any time without providing an explanation. All the participants provided written consent to participate by email to participate. Transcription files from audio recordings were treated without direct identifiable participant information and were stored on a secure server. Audio recording files were deleted. Field notes from the interviews were stored in a secured office cabinet.

All transcription files will be deleted within five years after the end of the research project.

5.2 Study II

Anaesthesia personnel recruited to participate in the study were given an invitation and information about the study in both written (Appendix 6) and verbal forms, and including the confidentiality policy, and a written consent was obtained before the focus group interviews. The participating anaesthesia personnel were informed that they could withdraw, without providing an explanation, at any time and with no

explanation until collected data were included in analysis or used in scientific publications. All the participants provided written consent. The audio recorded focus group interviews were stored in a secured office cabinet together with the field notes. The transcriptions were stored on a secure server. The audio files will be deleted after end of the research project.

5.3 Study III

Patients and personnel, either indirectly or directly involved, were asked to provide consent to the study observation. Written and verbal information, including the confidentiality policy (Appendix 7), were provided. The patients involved were in a vulnerable situation when undergoing surgery, and were carefully informed that the study was quality improvement research, and that their consent or lack thereof would have no consequences on their treatment.

In research involving clinical practice, autonomy for patients and personnel involved requires a careful and respectful approach (Beauchamp & Childress, 2019). Participants were able to withdraw, without providing an explanation, at any time until the collected data were included in analysis or used in scientific publications. All involved personnel provided written consent to participate. The researcher (first author, ASF) conducted the video recordings, and the participants were carefully informed about the technical issues, e.g., video camera placement and sound. The researcher started the recording and then left the OR, then waited outside until the anaesthesia induction session was completed. In this way, the participants (anaesthesia personnel) were not influenced when conducting their patient treatment.

After the video recordings were made, the files were stored on a secure server. The raters were given an access to this video files during the rating period. After three weeks, the files of each video recording, the files were deleted, in accordance with the consent schema. The filled up

scoring blankets from the raters were stored on the secured server, together with the SPSS files. Field notes were stored in a secured office cabinet.

6 Results

6.1 Study I

The aim of the study was to explore how anaesthesia personnel in Norway conduct simulation-based team training (SBTT) of non-technical skills (NTS) with respect to four of these: outcomes and objectives, facilitation, debriefing, and participant evaluation.

Outcomes and objectives

All the participants (N=51) indicated that they used learning objectives for the SBTT, and 73% (n=37) included NTS. Teamwork and collaboration were the main focus in training. In addition they highlighted leadership, decision making, problem-solving and situation awareness. Technical skills were the most common learning objectives, e.g., managing difficult airways. They emphasized the team to handle the whole situation. Some participants were more focused on the scenario conduction than the objectives, and some experienced colleagues who wanted too many learning objectives in the same simulation training session. Team members' preparedness was indicated to be an important pedagogical aspect and success factor for the SBTT.

Facilitation

Use of educated facilitators, who had conducted a facilitator course was common (61%, n=31). Participants who did not have an in-house facilitator, invited external instructors/facilitators e.g., from simulation centres or trauma centres, which were highlighted as structured and established. Sending personnel to expensive courses, but not having the capacity to use them in SBTT in the clinic, was indicated as a paradox. Flexibility, experience, systems and patience were described as important elements for conducting SBTT.

Debriefing

Debriefing was conducted by all participants, and 78% (n=40) of whom used a template, although some simplified the content after a while. Others used guidelines from BEST or the Norwegian Resuscitation Council, and 16% (n=8) did not use a debriefing template. A challenge in conducting debriefing was a lack of time. Video recording was sometimes used, and a specialist could serve as a consultant regarding medical issues. The team members were encouraged to describe their own experiences.

Evaluation

Formative and unstructured evaluation was usually used, and was conducted by 80% (n=41) of participants. A report or questionnaire could be used as a formative structured evaluation. In addition, some used observers. Most of the participants (82%, n=42) indicated that they could subjectively observe changed behaviour when returning to clinical setting after SBTT, e.g., more specific messages from team leaders and improved teamwork, but also being aware of personal changes.

6.2 Study II

The aim of the study was to explore anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and its significance for transfer of learning to clinical practice.

Data analysis from the transcribed material in the focus group study identified one main category, generated from three generic categories and seven sub-categories.

The main category, **"interprofessional in situ SBTT as a contributor to enhance anaesthesia practice,"** describes how anaesthesia personnel experience the SBTT and its significance for transfer of learning to clinical practice.

The first generic category, "i**nterprofessional in situ SBTT motivates learning and improves NTS,"** describes the anaesthesia personnel's experience of the in situ SBTT as a facilitator for coping, learning and improvement pertaining to clinical practice. This category includes three sub-categories: The sub-category *"provides the team an experience of coping"* describes the participants' opinion of the SBTT program as informative and prominent after failure in scenario simulation. Regarding significance for clinical practice, participants highlighted that the attention as affects situation awareness. Stress may result from challenges such as demanding technical skills and uncertainty, and may be expressed as mumbling and confusion in the situation. Under observation, the feeling of being tested and the fear of failure could lead to negative emotions, but, when a second scenario was conducted with the opportunity to improve performance, this could confer an important feeling of coping. The sub-category *"enables improvement of NTS for clinical practice"* describes the participants' experience of SBTT as positive, instructive and useful according to similar emergencies in clinical practice. After six months, some experienced improved NTS performance in the clinic, whereas others believed that the knowledge had declined. Frequency and participation from all professions in the surgical team, was suggested to be key to success. Moreover, a simpler scenario could result in a better situation awareness, and participants suggested that more theoretical knowledge before SBTT aids in preparation for the training. Some participants experienced that transferred learning of NTS inspired others to use them in clinical practice, e.g., closed loop communication. The third sub-category *"facilitates informative professional and interprofessional discussions"* describes debriefing as an opportunity to reflect on important details for improved behaviour, both interprofessionally and regarding the anaesthesia team's specific tasks. The participants suggested including more time for debriefing to increase the learning outcomes.

The second generic category, **"realism in SBTT is important for learning outcome,"** highlights that realism is important to evoke emotions, manage stressful situations, display practical challenges and perform patient treatment, and has significance in transfer of learning to clinical practice. The first sub-category, *"provides the opportunity to be aware of own practice,"* describes the opportunity to reflect on and change one's own practice, such as using equipment and managing time pressure. Muscle memory may be achieved through frequent SBTT, and may release energy for mental work. In the next sub-category, *"use of a simulated patient may increase or decrease realism,"* the participants appreciated the simulation patient, but indicated that visualization could be challenging, because the SBTT requires a certain level of imagination. Participants described losing "the feeling of thinking twice" during patient treatment. Time-out was considered a significant tool break to clarify misunderstandings, in both SBTT and clinical practice. The simulated patient provided the anaesthesia personnel with valuable feedback regarding the treatment.

The third generic category, **"SBTT increases the awareness of teamwork,"** focused on the professions and their roles in the teams, and the communication between them, regarding transfer of learning to clinical teamwork. The first sub-category, *"helps clarify the roles in the interprofessional team,"* refers to SBTT learning as transferable to different clinical team settings and awareness of each personal's role and action, thus making teamwork easier in clinical practice. The surgical team in this study consisted of three smaller teams, and it seemed unclear for the most participants that the interprofessional surgical team leader was the gynaecologist. The identification of the team leader was crucial for the team members' attention, and was clarified when he/she spoke "load and clear." The team leader was expected to comprehend the situation and encourage good communication. Teamwork depended on the personnel involved. The participants suggested separate training for the anaesthesia team in addition to the crucial interprofessional SBTT.

The last sub-category, *"precise communication contributes to clarity,"* emphasized communication in teamwork in communication, including a team leader who should "think aloud," thus enabling team members to plan and execute their own actions and provide feedback. The participants experienced improved communication in the second scenario. Noise in the OR is common, both in SBTT and clinical settings, and a time-out may be required. In this SBTT, the participants experienced the second scenario (after debriefing) as being quieter, and they were able to pay more attention to "whom and what to listen to" and "which messages to give." In addition, the team leader took more control and spoke more clearly. The participants indicated that the awareness of their roles and how the communication proceeded was significant for transfer of learning to clinical practice.

6.3 Study III

The aim of the study was to assess the NTS of anaesthesia personnel before and after in situ SBTT in a clinical setting.

The overall mean (SD) ANTS scores before and after the intervention (SBTT) were slightly higher after than before SBTT (Table 9). The mean (SD) scores of ANTS teams before and after SBTT were 3.48 (0.56) and 3.71 (0.45), respectively (p-value = <.001), and the corresponding mean (CI) increase in ANTS team scores was 0.23 (0.16 to 0.30) (Table 9).

Table 9 Statistically significant ANTS teams' category scores before SBTT to after SBTT

ANTS score categories	Before SBTT N= 20 Mean (SD)	After SBTT N=20 Mean (SD)	Paired differences Mean (95% CI)	*P* value
OVERALL	3.48 (0.56)	3.71 (0.45)	0.23 (0.16 to 0.30)	<.001
Teamwork	3.58 (0.25)	3.85 (0.12)	0.27 (0.14 to 0.39)	<.001
Situation Awareness	3.68 (0.27)	3.92 (0.16)	0.24 (0.11 to 0.36)	<.001
Decision making	3.44 (0.45)	3.79 (0.37)	0.34 (0.10 to 0.58)	.008

The mean (SD) ANTS team scores on the category level showed a statistically significant increase from before to after SBTT intervention in three of four categories (Table 9, Fig. 2). The mean (SD) team ANTS scores at the element level, showed a statistically significant increase in five of 15 elements (Table 10). Although not statistically significant, a tendency towards a slight increase in five more elements was observed.

Table 10 Statistically significant ANTS teams' element scores from before SBTT to after SBTT

ANTS categories	ANTS score elements	Before SBTT N= 20 Mean (SD)	After SBTT N=20 Mean (SD)	Paired differences Mean (95% CI)	*P* value
Task management	Providing and maintaining standards	2.48 (0.27)	2.91 (0.40)	0.44 (0.20 to 0.68)	0.001
Team working	Exchanging information	3.64 (0.32)	3.83 (0.18)	0.19 (0.05 to 0.32)	0.010
	Using authority and assertiveness	3,38 (0.57)	3.87 (0.23)	0.48 (0.13 to 0.83)	0.010
Situation awareness	Gathering information	3.81 (0.25)	3.96 (0.09)	0.15 (0.02 to 0.28)	0.024
Decision making	Re-evaluating	3.42 (0.43)	3.84 (0.34)	0.42 (0.16 to 0.68)	0.004

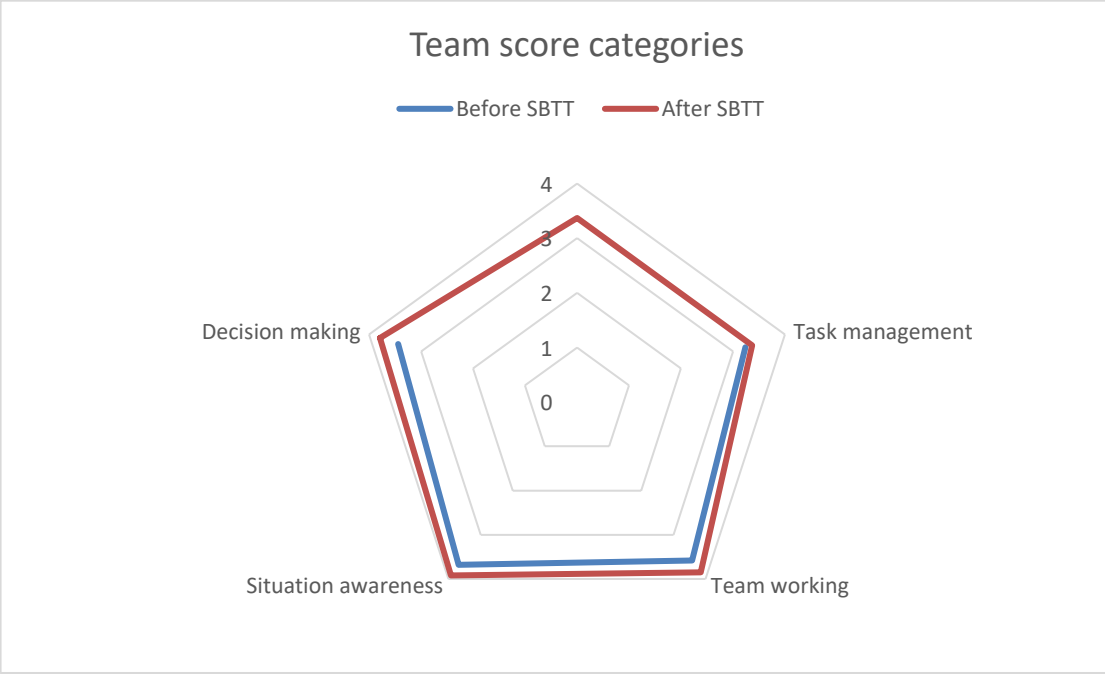

Fig. 2 Radar diagram of ANTS team scores for each category, from before and after the intervention (SBTT)

The interrater reliability, assessed with the weighted kappa, was 0.51, indicating only moderate agreement between raters (Table 8).

6.4 Summary of results

This thesis research indicated that anaesthesia personnel's SBTT at the national level met the INACSL Standard of Best Practice: Simulation[SM] framework regarding the areas of outcomes and objectives, facilitation, debriefing, and participant evaluation, to a certain extent. NTS were the main objective used, most used educated facilitators, all conducted debriefing, and most performed participant evaluation. More than half of the hospitals used simulations in simulation centres and in situ, slightly less than half used only in situ simulations, and only one hospital used only a simulation centre (Study I).

Anaesthesia personnel's experience with in situ SBTT indicated motivated transfer of learning, and an opportunity to be aware of their own NTS and teamwork in clinical practice. The analysis indicated one main category ("interprofessional in situ SBTT as a contributor to enhance anaesthesia practice") and three generic categories ("interprofessional in situ SBTT motivates learning and improves NTS," "realism in SBTT is important for learning outcome" and "SBTT increases the awareness of teamwork") (Study II).

Assessment of the anaesthesia team's NTS in clinical practice before and after SBTT intervention revealed a statistically significant increase in performance regarding overall scores at the category level. Inter-rater reliability showed moderate agreement between raters (Study III).

7 Methodological considerations

The three studies in the present thesis used different designs and methods of data collection to achieve greater knowledge regarding the significance of SBTT and transfer of learning to clinical practice. Study I used a qualitative descriptive design based on individual interviews to explore the participants' experiences with SBTT. Study II used a qualitative descriptive design based on focus group interviews to acquire various experiences of several respondents. Study III used a quasi-experimental before and after design, using video recordings of anaesthesia teams' NTS during anaesthesia induction in the OR.

The combination of different designs in this thesis, involving collection, analysis and integration of qualitative (Studies I and II) and quantitative (Study III) data, enabled deep perspectives to be obtained regarding the theme of this thesis. Several criteria to assess the quality of the studies are required. In qualitative studies, ensuring trustworthiness is a major concern, whereas in quantitative studies, validity and reliability are important (Polit & Beck, 2021).

7.1 Trustworthiness (Studies I and II)

Trustworthiness relates to whether readers can trust that the researchers' inquiry is accurate and insightful (Polit & Beck, 2021). To achieve trustworthiness, transparency regarding the research process and methodological choices made is important (Green & Thorogood, 2018).

To evaluate trustworthiness, the following criteria may be used: *credibility, dependability, confirmability and transferability* (Lincoln & Guba, 1985; Polit & Beck, 2021).

Credibility is associated with confidence in the truth and interpretations of findings in a study (Lincoln & Guba, 1985; Polit & Beck, 2021). In Study I, credibility was established by contacting simulation network

representatives, and interviewing the selected participants, who could answer questions on behalf of anaesthesia personnel regarding experience and responsibility after SBTT. This process provided a basis for obtaining the most optimal information from each hospital and enabled interviews to gain a deeper understanding of the responses. In Study II, anaesthesia personnel were asked to attend focus group interviews and report their experiences shortly after in situ SBTT and six months later, after having returned to clinical practice for a period. This design provided a basis for collecting data in a longitudinal perspective from an in situ scenario, to indicate the significance regarding transfer of learning to clinical practice. A strength of the study was that the participants' experience was obtained from the same simulation scenario, although having different backgrounds regarding previous experience with simulation training might be an influence.

The credibility of the findings was strengthened by validation of pilot tested interview guides (Studies I and II) including open-ended questions, which were specifically designed to gather new knowledge. The pilot interviews resulted in addition of a question regarding transfer of learning from simulation to clinical practice (Study I). All participants were asked the same questions, and follow-up questions were asked to encourage them to expand upon or clarify their responses. When some participants could not directly answer the questions (Study I), even though all participants received the interview guide beforehand, they were allowed to verify with others and send the answer to the researcher by email. This design might have contributed to information saturation, and as much data as possible was important to get the optimal snapshot. In Study II, a summary of the data was read aloud and confirmed by the participants in each focus group interview.

A total of 51 of 54 public hospitals in Norway participated (Study I), thus providing a national overview at that time, but the participating professions were not balanced and comprised 46 nurse anaesthetists and only two anaesthesiologists. This imbalance might have been due to the

single hospital's simulation arrangement, and perhaps the current staff. Three nurses who represented other specialities might have been selected for the same reason, but because of the selection made, each hospital's participant was likely to have provided the most credible picture. In Study II, nurse anaesthetists and anaesthesiologists participated in in situ SBTT as an anaesthesia team, similarly to the setting in clinical practice, thus providing a realistic picture according to this specific team. The credibility was further strengthened by a detailed description of the data collection and data analysis, organized according to the three phases: preparation, organizing and reporting (Elo & Kyngäs, 2008), and performed in consensus within the research team.

Dependability relates to the stability of the qualitative data over time and conditions (Lincoln & Guba, 1985; Polit & Beck, 2021). The same closed- and open-ended questions were posed to participants, and all interviews (Studies I and II) were conducted by the researcher. In Study II, a PhD supervisor was an observer who made field notes. The research team's familiarity with the methods was a strength regarding dependability.

Confirmability relates to the objectivity of the data, and whether they represent the participants' views and experiences, and the veracity of the interpretation of the data (Lincoln & Guba, 1985; Polit & Beck, 2021). Confirmability was strengthened through systematic treatment and reading of transcriptions several times to gain familiarity with the text, understand the content and categorize the participants' statements (Elo & Kyngäs, 2008; Elo et al., 2014; Graneheim, 2004, 2017). The authors agreed on the citations used to illuminate the categories' content, and conducted continued discussions during the analysis regarding whether the categories and sub-categories represented the participants' statements (Studies I and II).

Transferability relates to the applicability of the findings and whether they are generalizable to other settings or groups (Lincoln & Guba,

1985). Detailed descriptions of the setting and data gives the readers an opportunity to infer the extent to which the results are trustworthy and relevant in other settings. In Study I and II, transferability was demonstrated by describing the study sample and settings, data collections, analysis and interpretations, to provide readers with information. Citations were used to clarify the participants' views of the phenomena to give the readers an opportunity for self-reflection and further transferability (Polit & Beck, 2021).

The researcher's role

Reflexivity relates to how the researcher's background and preconceptions affect qualitative research (Polit & Beck, 2021). Researchers are part of the process of conducting interviews, posing questions and interpreting analysis, and therefore this influence is impossible to avoid. Researchers must stay in the background and report the participants' statements as reliably as possible. Moreover, awareness of one's role as a researcher, and considering and describing possible influences are crucial. Preconception may be a motivator for initiating a research project and may be important for the research process but may also limit perspectives (Alvesson, 2011; Malterud, 2017). As a nurse anaesthetist, facilitator and researcher, I had a triple status, which might have been both an advantage and disadvantage. Familiarity with the professions, and clinical and simulation environments might have been an advantage according to understanding the participants' viewpoints and situations; in this way, I was able to report a realistic and reliable picture. However, this familiarity could also have influenced the interview processes, follow-up questions and interpretations in the analysis process. Concurrently, our interprofessional research group might have prevented this to a certain degree (Malterud, 2017).

Studies II and III were conducted at my own workplace, a large university hospital, thus potentially introducing bias regarding data collection and analysis. However, the research group consisted of several

professionals from different organizations, and were extensively involved in analysis and interpretation of the findings. My own workplace might also have led to bias regarding positive consent from the participants, and the participants potentially answering questions in the interviews or performing in the video recordings in ways that they believed I would appreciate (Alvesson, 2011).

I have been aware of my professional background and that of my colleagues were participants in this research (Studies I and II), and have considered the possible effects of my preconceptions during data collection and analysis.

7.2 Validity and reliability (Study III)

7.2.1 Validity

The validity of a quantitative study relates to the degree to which the inferences drawn from the study evidence are well founded, correct, unbiased and well grounded (Polit & Beck, 2021).

The ANTS instrument was not validated for this study, which is a weakness, although it was previously tested and validated. The ANTS system prototype was developed in Scotland in 1998 by Flin and colleagues, on the basis of the framework of the European aviation marker system NOTECHS (Flin et al., 2018). Fletcher et al. (2003) have evaluated the ANTS system and indicated that it has a satisfactory level of validity (completeness and observability), reliability (interrater agreement, accuracy/sensitivity and internal consistency) and usability (acceptability and usability) (Fletcher et al., 2003). Moreover, the ANTS system has been tested and extensively used (Flin & Patey, 2011). The testing of the instrument in different settings is a study strength (Polit & Beck, 2021).

When instruments are used in other countries, e.g., with different healthcare organization, and translated to other languages, evaluating the differences in culture and contexts between the original and new setting is recommended (WHO, 2014) before data collection, to prevent the results from being affected (Polit & Beck, 2021). In this study, the Brislin back-translation method was used to translate the instrument ANTS system into Norwegian (Appendix 4), because the original language was not Norwegian (Brislin, 1970). The validity of the translated instrument was ensured by the research group, which had extensive experience within anaesthesiology and simulation A bilingual nurse anaesthetist contributed to the translation. However, an expert panel could have further strengthened the face validity and content validity.

The assessment of the NTS performance of anaesthesia personnel was conducted in line with the recommended ANTS system handbook (Flin et al., 2012), and the same target group (anaesthesia personnel) as in the original validation. The raters were trained beforehand, on the basis of recommendations in the handbook, to become familiar with the instrument and improve interrater agreement (Flin et al., 2012).

Statistical conclusion validity refers to the validity of inferences; the empirical relationship between variables (cause and effect) is tested with statistical methods (Polit & Beck, 2021). The selection of an appropriate statistical test for the study was based on the research design, the data level of measurement and the sample size (Pallant, 2020). In this study, a paired-samples *t*-test was used to compare scores before and after the SBTT with a two-tailed significance *p*-value <0.05. The rating scale was a 4-point Likert-type scale including a possibility of responding N=not observed. This can be regarded continuous ordinal scale when five or more response options are available, thus indicating that parametric statistics are appropriate (Harpe, 2015). The study used parametric statistics to reveal differences within groups at the dimension level and regarding the ANTS score. Parametric tests, such as the paired-samples *t*-test used, are considered more powerful than non-parametric tests

(Polit & Beck, 2021). The study sample comprised 20 teams, consisting of two team members, and each member was scored. A mean score represented the team score, and the teams was scored before and after the intervention. The amount of missing data was high for some elements, thus potentially influencing the results.

Construct validity, a key criterion for quality assessment of a study, refers to the degree to which a test measures what it is intended to measure (Polit & Beck, 2021). This study's construct validity was ensured through use of a validated instrument based on the literature regarding patient safety and anaesthesia SBTT. Moreover, construct validity was ensured through use of a well-planned SBTT program structured on the basis of the Simulation Setting Model by Peter Dieckmann (Dieckmann, 2009). The scenario of anaesthesia induction was not pilot tested, although such testing might have strengthened the validity. The research group designed the scenario setting to be a typical anaesthesia induction situation for the participants, because of the importance of realism, and the participants evaluated this as satisfactory. Threats to the construct validity might have been associated with the researcher's anticipation and the effects of novelty (Polit & Beck, 2021). The researcher was employed in the actual department, thus potentially influencing participants' positive attitudes regarding participation and their efforts in the study. However, this aspect might have had favourable effects on participants' emotions and feelings of safety, which have been reported to be crucial for learning and problem-solving (LeBlanc & Posner, 2022). The novelty might have influenced the results if participants were unfamiliar with being watched and video recorded in clinical settings, and might have caused an effect called the Hawthorne effect (Landsberger, 1958), defined as "the increase in the performance of individuals who are noticed, watched, and paid attention to by researchers or supervisors." Little is known about the consequences of the Hawthorne effect, but it may affect research participants (McCambridge et al., 2014). To prevent some of the Hawthorne effect in

the study, the video camera was placed discreetly in the OR, and the researcher waited outside the room during anaesthesia induction. Beyond those aspects, the research situation was identical to typical anaesthesia induction.

Internal validity means that the outcome is dependent on the independent variables, such as human factors and clinical organization (Polit & Beck, 2021). In this study, this was to a small extent, according to data collection. The first author conducted all video recordings, and every SBTT were conducted by the same facilitator (the first author), thus strengthening the internal validity.

External validity relates to the generalizability of inferences, and refers to the extent to which the study results hold true with variation in subjects, setting and time (Polit & Beck, 2021). In our study, the participants worked at the largest hospital in Norway. The study was limited to one department, but included both actual professions to achieve realistic clinical situations in accordance with Norwegian standards for anaesthesia (Ringvold, et al., 2016). A larger sample of participants and hospitals might have strengthened the external validity, although the research situation in clinical practice, anaesthesia induction, might be similar across national hospitals, because of the national standards, and thereby generalizable.

All three studies in this thesis provide knowledge regarding patient safety, NTS and SBTT, which may be transferred to other similar settings.

7.2.2 Reliability

Reliability relates to the accuracy and consistency of information obtained in a study, and the use of instruments; it describes the degree of consistency among instrument measurements of a specific attribute (Polit & Beck, 2021). The well-known instrument ANTS, with a satisfactory level of reliability, was used, thus preventing bias (Fletcher

et al., 2003). Fletcher et al. (2003) have measured the internal consistency with Cronbach's alpha, and reported sound results, and highly positive responses regarding usability (Fletcher et al., 2003). Several studies have tested the instrument for use in other professions, and countries with translation to other languages (Flynn et al., 2017; Graham et al., 2010; Jepsen et al., 2016; Lyk-Jensen et al, 2014). This aspect was an advantage of this study, e.g., spending more time in rater training before assessment of the anaesthesia teams, on the basis of recommendations from the studies described above. During rater training, the translated instrument was pilot tested by the raters, who were experienced nurse anaesthetists, and no changes were made. Expert rating is associated with interrater reliability, regarding the degree to which raters independently assign the same rating for the element being measured (Polit & Beck, 2021). To prevent bias, the two raters were trained in rating to become familiar with the instrument and increase agreement between them. However, the weighted kappa indicated moderate agreement (0.51) (Mandrekar, 2011), which might reflect, e.g., insufficient rater training, observability, subjectivity or rater fatigue (Abildgren, 2022; Kirkpatrick & Kirkpatrick, 2006).

8 Discussion of main results

The main results from Study I are discussed with respect to how anaesthesia personnel conduct SBTT in Norwegian hospitals. Subsequently, the main results from Studies II and III are discussed with respect to levels 1–3 of Kirkpatrick's four-level evaluation model, including anaesthesia personnel's reaction, learning and behaviour (Kirkpatrick & Kirkpatrick, 2006).

8.1 SBTT for anaesthesia personnel in Norway (Study I)

The reason for exploring anaesthesia personnel' SBTT in Norway, was to survey the current training with emphasis on recommended guidelines, to collect experiences useful for future SBTT and significance for transfer of learning to clinical practice and patient safety in anaesthesia. The study's individual interviews with anaesthesia personnel on a national level yielded substantial information regarding local SBTT. The results reported in the interviews involved information provided on behalf of the local anaesthesia personnel, as well as their own personal experiences. The anaesthesia personnel's SBTT met the INACSL Standard of Best Practice: SimulationSM framework, from 2021 called Healthcare Simulation Standards of Best Practice™ (HSSOBP™), to a certain extent regarding the following areas: outcomes and objectives, facilitation, debriefing and participant evaluation. These four areas are in line with Dieckmann's (2009) setting model, which emphasizes important phases in simulation settings for learning in acute medical care that are important for anaesthesia personnel's SBTT (Dieckmann, 2009). A simulation setting may be seen as a social practice, with human actors, equipment and procedures. Interactions follow rules, shared assumptions, values, functions and affordances, for the experience of meaningfulness in the social practice (Dieckmann, 2009). In the study, the majority of hospitals used in situ

SBTT, and more than half used both in situ and simulation centres. Learning theory indicates the importance of similar settings for learning transfer (Perkins & Salomon, 1992), and is in line with emphasizing familiar environments in implementation of SBTT programs in complex systems, where anaesthesia personnel participate, for transfer of learning to clinical practice (Dieckmann et al., 2012; Wisborg et al., 2008; Østergaard et al., 2008). Although, the benefits of in situ SBTT may be organizational learning and the opportunity to reflect on one's own practice, and not merely influence individual and team learning (Rosen et al., 2012; Sørensen et al., 2017). The combination of simulation settings may be a solution to achieve the outcome, depending on the learning objectives for the single SBTT (Sørensen et al., 2017). Learning objectives are strongly recommended and should reflect the needs of the personnel and departments, when realism and fidelity alone are not sufficient to achieve learning (INACSL, 2016; Krage & Erwteman, 2015; Watts et al., 2021). Although the study results indicated that the different settings used learning objectives, better designed objectives based on needs may enhance the chance of successfully achieving learning outcomes.

It is important to give the participants essential information and objectives in the setting of introduction (Dieckmann, 2009) to maintain psychological safety (INACSL, 2016; Watts et al., 2021), and for the participants' preparedness. The study's participants considered preparedness to be a success factor for SBTT, in agreement with the study participants in Sørensen et al. (2014), who experienced stress and unpleasantness associated with unannounced in situ SBTT (Sørensen et al., 2014). This was also confirmed in study II, where the participants reflected on the need for more simulation theory before SBTT (Finstad et al., 2023). In line with this, Dieckmann (2009) suggests establishing an open learning atmosphere in the introduction phase to achieve constructive debriefing. However, Walker et al. (2012) reported an unannounced SBTT to be more actual related to clinical practice, and a

further study has reported no significant difference between announced and unannounced SBTT (Freund et al., 2019). A suggestion may be for the facilitator to prepare the participants according to their professional and simulation competency and consider information about an expected in situ SBTT, but not when it will happen; then both needs (preparedness and timeliness) could be met with the purpose of achieving the expected outcomes.

In the results from study I, the structure was found to be depending on facilitation of SBTT, including flexibility and systematization, e.g., trauma-team training with anaesthesia personnel as an integral team member. This is in line with HSSOBP™, recommending facilitation methods based on participant needs for and learning outcomes, and with a structure and plan to achieve the expected goals (Watts et al., 2021). The anaesthesia personnel in Study I experienced that an experienced and educated facilitator was essential contribution to complying with guidelines, and orienting the participants in the simulation to the environment, training equipment and simulation patient care. Moreover, the participants in the study suggested clinical resources to achieve satisfactory frequency and available time for training in daily hospital running, in line with INACSL (2016). The earlier described paradox in which, after expensive facilitator courses, the competency is not used afterward may diminish the quality of SBTT. Consequences of not following recommendations may be limited engagement, decreased outcomes, experience and key competencies among anaesthesia personnel (Dieckmann et al., 2018; Krage & Erwteman, 2015; Watts et al., 2021). Facilitators with pedagogical competency, is recommended to have an ongoing reflection on and assessment of their simulation-based teaching skill, knowledge, and facilitation performance (Jeffries et al., 2015), and HSSOBP™ describes necessary criteria to meet the recommended standard (Watts et al., 2021), as a contribution for e.g., facilitators and line managers responsible for anaesthesia personnel's in situ SBTT.

All participants in the study reported use of debriefing, which is very satisfactory, given that debriefing is essential and a key factor in simulation (Decker et al., 2021). Debriefing gives the opportunity for discussions and reflections on anaesthesia personnel's NTS. Reflection may give the participants meaning to and make sense of the experiences, and the opportunity to identify knowledge gaps and understand the experienced scenario actions, which could result in experiential learning (Dieckmann, 2009; Jarvis, 1987; Kolb, 1984). Some of the study's participants used video-assisted debriefing, which may be time saving and capture valuable reflections on learning outcomes. However, some participants described shortening the debriefing template when time was limited, thus potentially resulting in poorer learning outcomes and behavioural changes (INACSL, 2016; Watts et al., 2021). These consequences could be prevented by the use of HSSOBP^{TM}'s criteria necessary to meet recommended standard (Watts et al., 2021), which could improve transfer of experiential learning to clinical practice and increased patient safety in anaesthesia.

Most participants reported use of formative unstructured evaluations, e.g., oral conversation, whereas very few used formative structured evaluations, such as questionnaires or reports. Dieckmann (2009) describes this phase as the ending and with the opportunity for participants to give feedback on the training as a whole. A suitable framework for the evaluation phase is Kirkpatrick's four level evaluation model (Kirkpatrick & Kirkpatrick, 2006). Evaluation of the participants' satisfaction (level 1) with the SBTT may be easy to conduct immediately after training, and is not time-consuming and not expensive, which may count in the hospital daily running. However, there is a need for more evaluation on level 2, 3 and 4 for the purpose of transfer of learning to clinical practice and valuable assessment of patient outcome (Kirkpatrick & Kirkpatrick 2006). Concurrently, the anaesthesia personnel's satisfaction, as in this study, indicates need for further SBTT, and may give valuable results regarding resource priority in hospital

organizations. Every training intervention requires feedback to ensure that it is relevant, appropriately designed and well executed, to enable assessment of individual progress and the results and outcomes (INACSL, 2016). The choice of evaluation tool might be based on factors including hospital organization, management, time available and facilitator competency. Considering SBTT from a patient safety perspective may be useful; for example, Sollid et al. have suggested that assessment and effectiveness are key factors in SBTT, and have highlighted the areas of technical skills, NTS, system probing, evaluation and effect measurement to solve patient safety problems (Sollid et al., 2019).

8.2 Anaesthesia personnel's reactions to SBTT (Study II)

The focus group interviews explored anaesthesia personnel's reactions to the interprofessional in situ SBTT in NTS.

The evaluation was important to provide information about to what extent the learning outcomes were achieved, with the view to future SBTT and patient safety in anaesthesia.

Evaluation of the anaesthesia personnel's reactions were positive and with some suggestions for further SBTT. With respect to Kirkpatrick, *"reaction evaluation is how the participants felt, and their personal reactions to the training or learning experience."* This process involves gauging participants' satisfaction, such as whether the method was effective and appreciated, and whether their opinions seemed to matter (Kirkpatrick & Kirkpatrick, 2006).

In Study II, the participants were given an opportunity to evaluate the in situ SBTT during the focus group interviews two weeks and six months after SBTT. This could provide a longitudinal and deep perspective.

All participants enjoyed the training; considered SBTT to be relevant; and highlighted realism, fidelity, debriefing and a need for more frequent SBTT. They welcomed a simulation patient to achieve realism, but were challenged by her low BMI; the scenario patient should have a high BMI, which was important according to the anaesthesia personnel's situation awareness and hence problem solving. Some visualization may be required, and high-fidelity simulation may be concurrently necessary to enhance learning outcomes, although Hoadley et al. (2009) could not find statistically significant correlation between learning outcome and high-fidelity, but the participants enjoyed the high-fidelity most.

According to high-fidelity, especially in situ and the use of simulation patient, it is important to be aware of simulation safety policy (Brazil et al., 2022) to prevent adverse events. In the study's debriefing the participants experienced that, the simulation patient was given the opportunity to explain how she experienced the treatment, which sometimes was less cordial due to intense simulation actions. This was experienced as valuable feedback for the participants.

Conducting the same scenario twice was prioritized by the participants, to facilitate a sense of coping. This emotion may influence performance, memory, motivation and learning transfer to the clinical practice (LeBlanc & Posner, 2022; Rusting, 1998). Although, spending time on two scenarios in the same SBTT may affect the time available for the anaesthesia personnel's debriefing. This aspect will require careful consideration by SBTT planning groups, while more time for debriefing was reported in the interviews as necessary and was seen as a challenge regarding management and daily work in clinical practice. Nonetheless, timing and planning may be considered key factors for implementing SBTT (Bredmose, et al., 2021).

These results related to Kirkpatrick's model level 1 indicated satisfaction and provided important feedback, which may contribute to transfer of learning to clinical practice. However, positive reactions from

anaesthesia personnel to in situ SBTT, do not, by themselves, guarantee learning of improved performance, and therefore Kirkpatrick emphasize the importance of this level 1 evaluation towards organizations and professionals (Kirkpatrick & Kirkpatrick, 2006). Moreover, positive reactions may encourage anaesthesia personnel to participate in future programs, while negative feedback can result in the opposite, but both reactions may be used to modify the SBTT for future success. (Kirkpatrick & Kirkpatrick, 2006).

8.3 Anaesthesia personnel's learning from SBTT (Study II)

The focus group interviews also explored the anaesthesia personnel's learning of SBTT. According to Kirkpatrick & Kirkpatrick (2006), interview style is among the recommended evaluation tools at level 2, although it requires more resources and is more time-consuming than level 1, and may be inconsistent, but can be limited by using assessment methods closely associated with the aims of learning. Evaluation on this level is crucial, because "without learning, no change in behaviour will occur" (Kirkpatrick & Kirkpatrick, 2006, p.50).

The focus group interviews determined participants' experiences with SBTT, and indicated learning improvements based on level 2, which relates to content evaluation of what the participants learned, e.g., changed attitudes, improved knowledge, and increased skills. This may be more challenging in complex learning, such as attitudinal development, as reflected in this study. Systematic reviews show that anaesthesia personnel learned and NTS improved, but more research is still needed (Gjeraa et al., 2014). According to Kolb (1984), learning results from a combination of earlier obtained experience and new experience. In anaesthesia personnel's SBTT, the participants could reflect on their experience from the scenario, draw conclusions, try out alternatives, and engage in new situations e.g., in a second scenario or clinical practice (Dieckmann, 2009).

The study's participants indicated that interprofessional in situ SBTT motivated learning and improved NTS. The dramatic scenario facilitated emotional involvement, thus increasing the ease of remembering and the potential for learning. However, the participants suggested using a less dramatic scenario to allow more attention to be paid to well performed NTS. This is in line with the perspective of learning from success (Hollnagel, 2014), which recommend to design scenarios containing daily events, and with focus on how well the scenario actions were handled and what these may lead to (Dieckmann et al., 2017; Hollnagel, 2014).

In the study, the anaesthesia personnel described emotional effects, which may improve motivation, approach and culture of learning (LeBlanc & Posner, 2022).

Emotions are crucial in decision making and in high stress scenarios in which situation awareness might decrease (LeBlanc & Posner, 2022; Minehart & Katz, 2021); therefore, this in situ SBTT appears to be crucial regarding a sense of coping. The participants highlighted the crucial sense of coping after conducting the scenario and subsequent debriefing two times.

The anaesthesia personnel indicated that interprofessional insight improved teamwork, but they wanted more internal discussions for the anaesthesia team. This finding is in line with Gaba et al.'s (2001) "training crews to work in teams", which focus on crew-specific cases. Moreover, they recommend conducting both individual crew training and team training to achieve cross-sectional perspectives crucial for the interprofessional team (Gaba et al., 2001). A follow-up debriefing may be required to meet the needs for more reflection and learning on level 2 (Gittell et al., 2013; Kirkpatrick & Kirkpatrick, 2006).

In Study II, interprofessional in situ SBTT was evaluated to promote role clarification and for acquaintance, which resulted in improved awareness and team complementation, and a possibility of learning, with a view to

transfer of learning to clinical practice and decrease in adverse events (Sørensen et al., 2017). The complexity of speaking up, e.g., the risk of unwanted answers, might be challenging for some team leaders (Lemke et al., 2021), also shown in the study results. In Salas et al. (2005)'s theoretical framework "the big five in teamwork", team leadership is described as one of the teamwork competencies, which provide the basis for effective teamwork This competence is coordinated through shared mental models, mutual trust and closed-loop communication (Salas, et al., 2005). Anaesthesia personnel in the Study II confirmed this, when experiencing team leaders speaking up, which resulted in more attentive and thus improved precise communication and clarity of the team structure. Moreover, and in line with Kirkpatrick's level 2 evaluation, the findings demonstrated increased awareness of teamwork, which may indicate increases in knowledge and capability (Kirkpatrick & Kirkpatrick, 2006) which could improve safe patient anaesthesia.

8.4 Transfer of learning from SBTT to clinical practice in anaesthesia (Studies II and III)

The assessment of anaesthesia teams' NTS in clinical practice before and after in situ SBTT (Study III) showed a statistically significant increase in NTS performance and might have indicated transfer of learning from SBTT to clinical practice. This assessment is in line with Kirkpatrick's evaluation model level 3, concerning measurement of learners' changes after returning to work, to determine whether they have applied acquired knowledge and skills (Kirkpatrick & Kirkpatrick, 2006). This result could indicate learning from the anaesthesia personnel's in situ SBTT to NTS teamwork performance during anaesthesia induction in their clinical setting after training, but could also have been affected by the video recording setting itself, due to the Hawthorne effect (Landsberger, 1958). Experiences from the debriefing discussions of scenario actions in SBTT, may have motivated the participants, similarly to Study II, to transfer the learning. Gaba et al. (2001) suggested crew training, e.g.,

anaesthesia teams, to work in teams, or interprofessional teams, which is in line with the simulation programs in Studies II and III. The clinical setting assessed after SBTT was similar to the SBTT setting, which is in line with Grossman & Salas (2011)'s focus on environment according to transfer of learning. In Study III we observed near transfer, which means transfer between similar settings (Perkins & Salomon, 1992). Behaviour change may occur immediately or several months later, as indicated in our focus group interviews (Study II), where the participants considered the learning from SBTT to be significant regarding clinical work. They experienced improved NTS and increased awareness of teamwork in clinical practice after SBTT. Debriefing with interprofessional discussions contributed to improving their behaviour after returning to work, and some participants stated that new learning inspired other personnel to change behaviour in clinical practice. This self-assessment can be a relevant indicator (Kirkpatrick & Kirkpatrick, 2006), and may imply consideration of one's own behaviour, team behaviour and team training program, and may indicate teamwork competencies, such as attitudes and opinions, which are subjective in nature (Baker et al., 2010). Although, it is recommended to reduce subjective judgement, a variable factor, to facilitate the reliability and consistency of measurements (Kirkpatrick & Kirkpatrick 2006). An argument is that overestimation of one's own performance and ability, seems to be higher among novices than experts (Kruger & Dunning, 1999). Despite its limitations, self-assessment appears to be crucial for understanding affective teamwork proficiency, such as mutual confidence and role structure (Rosen et al., 2013), as confirmed by participants in Study II where SBTT was experienced to helps clarifying roles.

Observation and interview over time are required at evaluation level 3 and are more time-consuming and resource-draining than level 1 and 2 measurements, but essential with the view to changing behaviour in clinical practice (Kirkpatrick & Kirkpatrick, 2006).

In Study III, three of four main categories and five of fifteen elements in the ANTS system, showed statistically significant increases. The behavioural changes were associated with elements related to safety and quality, such as "providing and maintaining standards." Encouragingly, several crucial teamwork elements, such as "exchanging information" and "using authority and assertiveness," showed increased behavioural changes, thus confirming teamwork as an important category for preventing adverse events and optimizing patient treatment (Kohn et al., 2000). Moreover, increased performance in situation awareness, such as "gathering information," was not unexpected, given that the category skills are associated with each other. Likewise, the element "re-evaluating" (category decision making), which may be essential for all categories relevant to control of the situation, team collaboration and task management for optimal patient care and safety (Flin, et al., 2012). Even though several elements did not show statistically significant changes, they were connected to each other, due to the categories, and may have certain correlations to each other. Concurrently, the difference between statistical significance, which indicates the study results' reliability, and clinical significance, reflecting the impact on clinical practice, must be considered (Ranganathan et al., 2015). A low increase in score does not necessarily indicate a large difference in patient treatment.

The findings (Study III) had a high number of missing scores, mostly because of responses of "not observable." According to Kirkpatrick, observation results depend on how noticeable and measurable the behaviour is (Kirkpatrick & Kirkpatrick, 2006), but some elements might not have improved, because of the anaesthesia personnel's characteristics (e.g., cognitive ability and motivation) (Grossman & Salas, 2011). In addition, simulation settings and clinical settings differ (Jepsen et al., 2016). Even if NTS are easy to measure for training personnel, it may be difficult for assessors, as in Study III. Moreover, the measurement could be more noticeable when it is experienced than observed (Abildgren et al., 2022). Thus, both observation and self-

assessment might be used in the same study to obtain a more holistic picture (Ballangrud et al., 2014; Jepsen et al., 2016). Although the validated and widely used ANTS system was used to score NTS at the individual and team levels, this instrument is an individual assessment tool, and the team scores were calculated as the mean score by the two anaesthesia team members. Østergaard et al. (2011) have questioned team evaluation in terms of which skills should be measured, who should be evaluated (individual or team) and which tools should be used (Østergaard et al., 2011).

A team assessment tool is needed, and ANTS might be developed as a team assessment tool, because it currently appears to be the most suitable instrument (Boet et al., 2018; Gundrosen et al., 2014; Rutherford, 2017; Sørensen et al., 2017). A recent systematic review (Petersen, 2023) has suggested a more well-defined role of assessment and search for the most effective methods to train and assess anaesthesia personnel (Petersen et al., 2023).

The results in this thesis (Study III) showed increased NTS performance within all ANTS categories and certain ANTS elements, thus indicating learning at level 3 in Kirkpatrick's evaluation model. This may indicate that anaesthesia personnel could change their behaviour in clinical practice after SBTT. However, an important additional consideration is that Study III involved measurement before and after just one SBTT. Most anaesthesia personnel have previous experience with simulation training, and extensive experience from daily practice has continual effects on their performance in clinical practice. These aspects might have influenced their performance in the study, because learning is an ongoing process.

8.5 Reflections on theoretical perspectives

The main results of Study I in this thesis are discussed in the light of Dieckmann's (2009) simulation setting model and the framework

INACSL Standards of Best Practice: Simulation℠ (INACSL, 2016) with the new edition HSSOBP™ (Watts et al., 2021). The Studies II and III were discussed in the light of three of four levels of Kirkpatrick's evaluation model (Kirkpatrick & Kirkpatrick, 2006). In Study I we related the participants' subjective judgements in relation to the simulation setting model (Dieckmann, 2009) and four core areas (INACSL, 2016). The opportunity to adapt the model's prototypical modules to the actual learning objectives for the SBTT, makes this model practical. The INACSL framework describes the four core areas, chosen for this thesis, with criteria and possible consequences when not adhering to them. The framework gives a systematic and structured perspective useful for SBTT, and is updated and evidence-based knowledge (INACSL, 2016; Watts et al., 2021). Study II provided deeper reflection, during focus group interviews, regarding the significance of SBTT and transfer of learning to clinical work aspects that seemed to be relevant for levels 1–3 of Kirkpatrick's evaluation model (Kirkpatrick & Kirkpatrick, 2006). Moreover, Study III had a specific focus on assessing NTS in clinical settings before and after SBTT in NTS, and thereby has a strong relation to the crucial level 3 of Kirkpatrick's evaluation model. Although the model has been used widely over decades, it has been criticized (Reio et al., 2017) for its hierarchical structure, use of only summative evaluation and lack of theoretical foundation and too much focus primarily on behavioural theory. Kirkpatrick has highlighted the importance of evaluating all levels, and not skipping levels 1 and 2, while assuming that levels 3 and 4 are more valuable. Kirkpatrick has argued that the summative evaluation may become formative, whereas evaluation of the training program to be continued could be based on the evaluation results (Kirkpatrick & Kirkpatrick, 2006). Moreover, the levels have been claimed to be casually linked and positively intercorrelated, which means that it would be enough to get a positive reaction on level 1, and then it could be assumed to reach level 2, 3 and 4 (Alliger & Janak, 1989; Hilbert et al., 1997; Kirkpatrick & Kirkpatrick, 2005, 2006).

Kirkpatrick's answer was that there is no guarantee that learning transfer will occur, and therefore evaluating every level is important. The strength of Kirkpatrick's model has been claimed to be its simplicity and practicality, and it is wide used despite criticism and the development of other models (Kirkpatrick & Kirkpatrick, 2006; Reio et al., 2017). This strength has been valuable for the in situ SBTT evaluation of this thesis and the discussion of the main results.

8.6 Reflections on the intervention

The intervention in this thesis was the two SBTT programmes. Findings from earlier studies on SBTT appear to be in agreement with respect to essential elements in training pertaining to training content and structure, and may be considered crucial support when creating SBTT (Dieckmann, 2009; Salas et al., 2013; Østergaard et al., 2008). Simulation is a complex intervention, and assessment of patient outcome and healthcare personnel's transfer of learning to clinical practice is challenging, because the healthcare system is complex, and because of many components and human interactions are influencing each other. This requires adapted evaluation design (Skivington et al., 2021). The thesis's in situ SBTT programme was structured on the basis of Dieckmann's Simulation Setting Model (Dieckmann et al., 2012; Dieckmann, 2009), which permits the essential phases to be modified into the actual simulation programme. The model was modified to SBTT in Studies II and III. The participants (Study II) reported a need for greater theory input beforehand. They received an information sheet, but it could have been supplemented with a teaching arrangement, although doing so would have been more time- and resource-consuming. In Study II, the planning group decided to conduct the scenario twice, at the expense of having less time for debriefing, but providing a greater opportunity to achieve a sense of coping. Debriefing is a key element in simulation training, and more time was reported to be necessary to achieve optimal reflection, both interprofessionally and specifically to

the anaesthesia team. Complex working days in hospitals might be challenging for line managers to organize, but might lead to improved systems and patient safety (Couper et al., 2015). In Study III, the intervention (SBTT) was adapted to the video recorded clinical setting (anaesthesia induction). Conducting the SBTT by considering key factors for transfer of learning, such as training design and work environments, was important (Grossman & Salas, 2011).

As an additional support for planning and creating SBTT, the INACSL Standard of Best Practice: Simulation[SM] was used. This standard and framework contains living documents needing addition and revision, which is a major advantage. Study I used the recommended guideline INACSL with the aim of determining whether the participants' SBTT programmes met the recommended elements for simulation training, which they did to a certain extent, but stricter adherence might have yielded better results. This may indicate the importance of following recommended guidelines based on evidence-based research to obtain quality and expected outcomes.

Level 1 evaluation (reaction to the training experience), which is not expensive or time-consuming, may display crucial elements and pave the way to a successful SBTT. The benefits of gathering evaluation information on this level provides crucial feedback for the trainer or training team/planning group in considering whether the training program should be continued, and the practical issue that data can be collected immediately. Moreover, most participants had positive experiences, because non-threatening information was given, and concern was shown for their feelings. When a group reports positive experiences, other potential participants are more likely to learn, e.g., participate in SBTT. Level 2 evaluation (learning) requires more investments, like the focus group interviews in this thesis, but is valuable for adapting experience from SBTT and significance for transfer of learning to clinical practice. Level 3 evaluation (behaviour), conducted in Studies II and III, requires even more investments, but is critical when

providing assessment of behaviour changes in clinical practice (Kirkpatrick & Kirkpatrick, 2006).

9 Conclusions

This thesis contributes to the evidence base of anaesthesia personnel's experiences regarding SBTT and transfer of learning from SBTT to clinical practice.

- Anaesthesia personnel were satisfied with SBTT of NTS, experienced increases in knowledge and capabilities and changed their behaviours after SBTT (Studies I and II).
- Recommended guidelines (INACSL) were met to varying degrees by anaesthesia personnel on a national level, with regard to the four areas outcomes and objectives, facilitation, debriefing and participant evaluation (Study I).
- Anaesthesia personnel used educated facilitators, conducted debriefings and participant evaluation, although there was a need for improved use of debriefing template to achieve expected outcomes and more structured and summative evaluation (Study I).
- Anaesthesia personnel highlighted the importance of preparedness and structure, and requested higher frequency of SBTT and more debriefing time in SBTT (Studies I and II)
- Anaesthesia personnel in interprofessional in situ SBTT in NTS gained experience regarding the roles of emotions, coping with demanding situations, importance of good team communication, realism and fidelity, which are critical for decision making, and crucial professional discussions during debriefing and interviews (Study II).
- Reflections, from both healthcare professionals and from interprofessional teams, have provided awareness of anaesthesia personnel's own clinical practice.
- All these experiences may be significant for transfer of learning to clinical practice (Study II).

- Anaesthesia teams increased NTS performance in clinical practice after SBTT. This result may indicate transfer of learning from training to the workplace (Study III).

10 Implications for clinical practice

The results in this thesis may contribute to closing the knowledge gap regarding anaesthesia personnel's experience with SBTT and transfer of learning from SBTT to clinical practice.

A stricter adherence to the four areas of previous INASCL, now HSSOBP™, may improve the transfer of learning needs into learning outcomes; maintain facilitator competency; and improve the use of debriefing templates to achieve expected outcomes, and achieve more structured and summative participant evaluations, to gain significance from SBTT with the view to transfer of learning to clinical practice.

The results, presented in line with Kirkpatrick's evaluation model levels 1, 2 and 3, may aid in improving the organization of in situ SBTT, highlight the significance for transfer of learning to the workplace, and contribute to preventing adverse events.

The results may indicate the significance of training in improving team performance (task management, teamwork, situation awareness and decision making), to ensure patient safety.

11 Suggestions for future research

- Further research is needed to explore whether a strict adherence to HSSOBP^{TM} might improve learning outcomes depending on learning needs.
- More research is required to explore the full experience of the interprofessional surgical team, to gain a broader perspective of the significance of in situ SBTT for transfer of learning to clinical practice.
- In future simulation research on anaesthesia personnel's NTS using ANTS, there should be more emphasis on rater training and preparedness.
- Further research should develop a suitable anaesthesia team assessment tool; the ANTS system might serve as a basis.
- Research on how in situ SBTT could improve learning outcomes should include new tools, e.g., virtual/augmented reality and artificial intelligence.
- Research should reveal how learning needs could improve learning outcomes. This could be based on healthcare investigation agencies.

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Appendices

Appendix 1 - Interview guide Study I

Appendix 2 - Interview guide Study II

Appendix 3 - Information sheet Studies II and III

Appendix 4 - Anaesthetists' Non-Technical Skills (ANTS) System, Norwegian translation

Appendix 5 - Information and consent Study I

Appendix 6 - Information and consent Study II

Appendix 7 - Information and consent Study III

Appendix 8 - DPO approval

Appendix 9 - DPO approval Study III

Appendix 10 - REK approval

APPENDIX 1

INTERVJUGUIDE til forskningsintervjuer om medisinsk simulering med representanter for statlige sykehus med anestesiservice i Norge, 2016.

Delstudie 1.

Personlig telefonintervju med representant**: Intervju nr.** (..min), lyttet x

Hva er din stilling/funksjon?	Profesjon:		Stilling/funksjon:		
Gjennomfører anestesipersonellet medisinsk simulering hos dere?	Ja:		Nei: Hvorfor ikke?:		
Når ble medisinsk simulering satt i gang hos dere?	Årstall:		Antall år:		
Hvordan er det organisert? (Stiftelse, offentlig, del av sykehus/høyskole/universitet?)	Stiftelse:	Offentlig:	Del av: SH: Høgskole: Univ.:		
Hvordan ble det etablert? – Utstyr, økonomi, lokaler.					
Hvordan finansieres simuleringstreningen? /Hvem dekker kostnadene?					
Hvilke evt. begrensninger (drift, økonomi) har dere?					
Hvem er ansvarlig for anestesipersonellets simuleringstrening? (stilling, profesjon).	Profesjon:		Stilling/funksjon:		
Hvem drifter den medisinske simuleringen for anestesipersonellet? (antall og titler/yrke)	Profesjon:	Stilling/funksjon:	Antall:		
Instruktører: egne faste og/eller kommer de med deltakerne? (Hvilken trening har de som fasilitatorer/pedagoger? TTT-kurs? Andre kurs?)	Egne faste:	Kommer med deltakerne:	Kurs/utdanning:		
Har dere teknisk, adm. og logistisk støtte? Evt. andre støttespillere?	Tekn.:	Adm.:	Logistisk:	Andre:	
Hvor mange trener totalt hos dere pr. år?					
Hvem er deltakerne hos dere?	SH:	Amb.:	Stud.:	Eksterne:	Andre:

(Grupper f.eks.: -sykehus -ambulanse -studenter høyskole/universitet -eksterne «kunder» -forskning)					

Hvor mange anestesileger og –sykepleiere er ansatt ved sykehuset?	Anestesisykepleiere:	Anestesileger:
Antall kursdager/år for anestesipersonell?		
Er det noen personellgrupper som sjelden simulerer/deltar i simulering? Hva er grunnen til det?		

Hvor lett/vanskelig er det å få anestesipersonell ut av drift for å delta i simuleringstrening?	Tiltak for deltakelse/Hvordan får anestesipersonell fri/anledning til å delta:			
	Fagdager i turnus:	Teamcalling:	Hvis driften tillater:	

Blir det mye/lite avlysninger? (Årsaker evt.)	Mye:	Lite:	Årsak:		
			Drift:	Prioritering:	Annet:

Hvilke komponenter har dere i simuleringstreningen? /Hvordan er treningen lagt opp?	Teamtrening:
	Teknisk ferdighetstrening:
	Ikke teknisk ferdighetstrening:
	Informasjon/Brief:
	Scenario (antall):
	Debrief:
	Evaluering (etter hver trening):

Pedagogisk opplegg og utarbeidelse av scenarioer – hvem gjør det?	Personell fra de som trener:	Eget personell på sim.senter/sim.arrangør:	Samarbeid mellom sim.arr. og pers. Som trener:	Andre:

Foregår simuleringen in-situ el. på sim.senter el. begge deler?	Sim.senter:	In-situ:	Begge deler:

Er evt. sim.senteret/rommet i sykehuset eller utenfor:	I sykehus:	Utenfor sykehus:
Hvilke læringsmål har dere for	Oppgaveløsning:	Annet:

simuleringen? (i h.h.t. ANTS?)	Teamarbeid:		
	Årvåkenhet:		
	Beslutningsprosess:		
Hvordan presenterer dere læringsmålene?	I forbindelse med info:		
	I forbindelse med brief til scenario:		
	I forbindelse med debrief:		
	Annet:		
Gjennomfører dere debrief? Evt. hvordan?	Ja:		Nei:
	Fakta gjennomgang:		
	Analyse:		
	Hva tar du med deg til neste scenario eller til klinikken:		
	Annet:		
Har dere noen teknisk ferdighetstrening i forbindelse med simuleringsdagen?	Se spørsmål over		
Måler dere effekten av simuleringstreningen? Evt. hvordan?	Ja:	Muntlig:	Nei:
		Skriftlig:	
		Annet:	
Evt. hvor mange simuleringer/simuleringskursdager per år evaluerer dere?	Se spørsmål over		
Deltar dere i et nettverk for medisinsk simulering? Evt. hvilket nettverk?	Ja:	Hvilket:	Nei:
		Hvilke:	

APPENDIX 2

INTERVJUGUIDE 1 TIL FOKUSGRUPPEINTERVJU Studie II
Intervju rett i etterkant av simuleringsbasert teamtrening (SBT).

Deltakere fra samme type SBT, dvs. samme info., briefing, læringsmål, debriefing.

Innledning: Informasjon til deltakerne om prosjektet:
- hensikt
- delstudier
- forskningsspørsmål for dette delstudiet
- fokusgruppeintervju som metode
- anonymitet og taushetsplikt

Intervjuet:
- Stilling, alder, kjønn
- Hvor lenge er det siden forrige SBT?
- Hvor mange ganger har du vært på SBT?

(deltakerne skriver ned de tre første svarene individuelt før intervjuet for å spare tid)

- Hvordan synes dere det var å delta på SBT?
- Hvilken nytte tror dere SBT vil ha for videre utøvelse i klinikken?
- Har dere tatt med dere lærdom fra SBT til praksis/klinikken?
- Har noen allerede opplevd at det fungerer?
- Evt. hvordan opplever dere at det fungerer?
- Evt. hvorfor fungerer det ikke?
- Hva skal til for at lærdommen blir implementert i klinikken?
- Eks. på positive situasjoner angående bruk av lærdommen?
- Hva kan være vanskelig i klinikken?
- Eks. på vanskelige situasjoner m.h.t. bruk av lærdommen?
- Kan det trenes på i simulering?
- Hvordan tror dere pasienten har nytte av denne lærdommen?

INTERVJUGUIDE 2 TIL FOKUSGRUPPEINTERVJU Studie II
Intervju 6 måneder etter simuleringsbasert teamtrening (SBT)

Deltakere fra samme type SBT, dvs. samme info., briefing, læringsmål, debriefing.

Innledning: Repetere informasjon til deltakerne om prosjektet:

- hensikt
- delstudier
- forskningsspørsmål for dette delstudiet
- fokusgruppeintervju som metode
- anonymitet og taushetsplikt

Intervjuet:

- Stilling, alder, kjønn
- Hvor lenge er det siden forrige SBT?
- Hvor mange ganger har du vært på SBT etter forrige SBT?

(deltakerne skriver ned de tre første svarene individuelt før intervjuet for å spare tid)

- Tok dere med dere lærdommen til praksis/klinikken?
- Hvordan opplever dere at det fungerer?
- Evt. hvorfor fungerer det ikke?
- Hva skal til for at lærdommen blir implementert i klinikken?
- Eks. på positive situasjoner dere har hatt angående bruk av lærdommen?
- Hva er evt. vanskelig i klinikken? (kultur, hierarki, hersketeknikker)
- Eks. på vanskelige situasjoner m.h.t. bruk av lærdommen?
- Kan det trenes på i simulering? Ev. forslag?
- Hvordan tror dere pasienten har nytte av denne lærdommen?

APPENDIX 3

INFORMASJON TIL DELTAKERE
SIMULERINGSBASERT TEAMTRENING

Anne Strand Finstad
Anestesisykepleier
Fasilitator/Simuleringsinstruktør/Ph.D-kandidat
OUS 2018

Pasientsikkerhet

Pasientsikkerhet er vern mot unødig skade som følge av helsetjenestens ytelser eller mangel på ytelser (Kunnskapssenteret 2011, WHO 2009)

Operasjonsteamet har en viktig rolle i å fremme pasientsikkerhet.

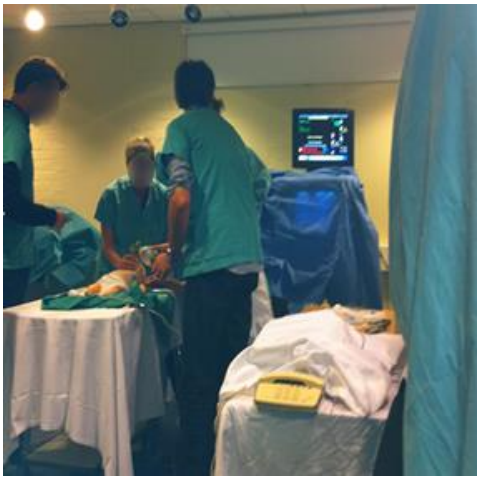
Dårlig teamarbeid og kommunikasjonssvikt er årsaken til en stor del av alle uønskede hendelser i helsevesenet.

Det er to typer menneskelige feil om ofte går igjen:

- Errors of commissions: Prøver å gjøre det som er ansett som god behandling, men skader pasienten likevel.
- Errors of omissions: Gjør ikke det som er ansett som god behandling.

Simuleringsbasert teamtrening

Forskning viser at simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant helsepersonell kan minske risikoen for uønskede hendelser hos operasjonspasienten(Robertson, Dias et al. 2017).



•Vi (gjen)skaper pasientbehandling for å ***trene*** helsepersonell så realistisk som mulig ***uten*** å utsette pasienter eller helsepersonell for ***risiko***.

•Ved teamtrening legges det vekt på ***oppgaveløsning, teamarbeid, situasjonsbevissthet, beslutningsprosess.*** (Fletcher, McGeorge et al. 2002).

Forventning og planlegging:

•Forvent alltid det uventede

•Tilkall hjelp før du trenger det

Å ta ledelse og bli ledet:

•For at et team skal fungere må det ha en leder

•Alle i teamet er ansvarlig for pasienten!!

•Leder oppsummerer regelmessig hvor en er i ABCDE.

•Teamet med lederen i spissen tar ansvar for pasienten til situasjonen er avklart

Kommunikasjon:

•Ment er ikke sagt

•Sagt er ikke hørt

•Hørt er ikke forstått

•Forstått er ikke gjort

•Bruk navn eller tittel/rolle.

•Vær direkte og høflig.

•Snakk høyt og tydelig, men ikke rop eller bruk kjeft.

•Kvitter for mottatt beskjed:"closed loop"

Eks: - "Gi 100 µg fentanyl."

- "Jeg gir 100 µg fentanyl."
- " 100 µg fentanyl gitt."
- "Bra"

Barrierer for god kommunikasjon:

- *Faglig usikkerhet*
- *Emosjonelle reaksjoner, sinne, frustrasjon, frykt*
- *Prosedyrefokusering*
- *Støy og avbrytelser*
- *Feilprioritering og skråsikkerhet*

•Vær deg selv og lev deg inn i rollen
•Utfør prosedyrer/tiltak som vanlig
•Følg algoritmer

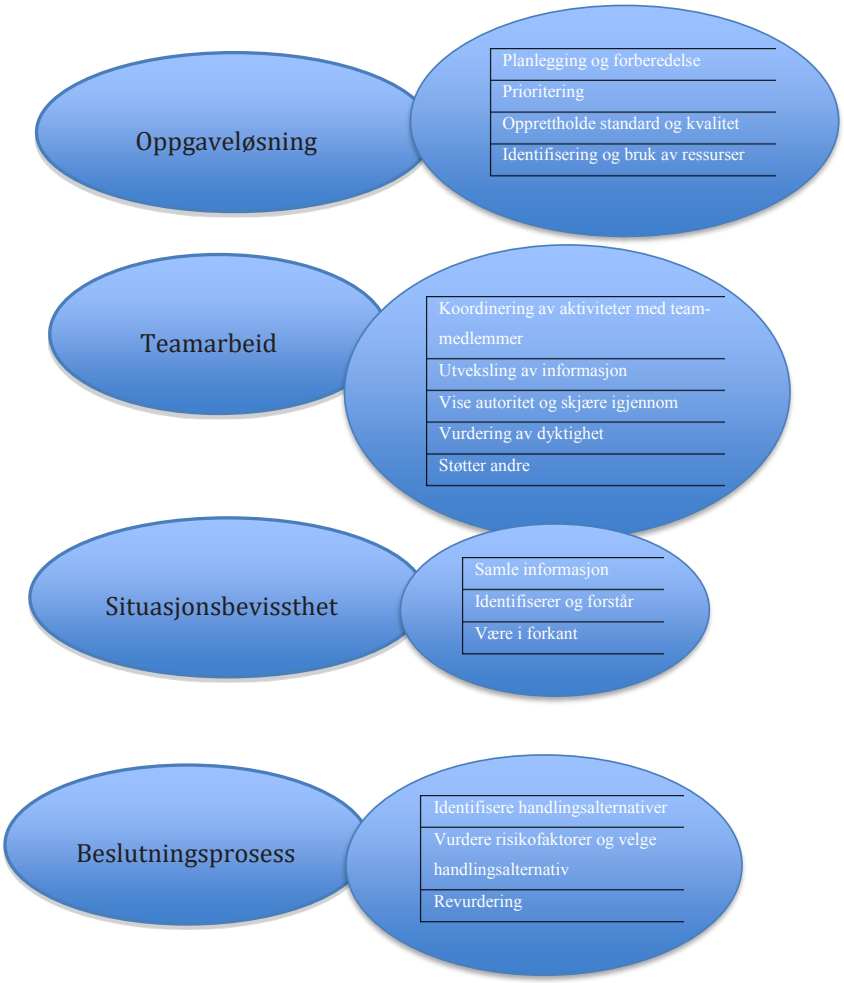
Hvordan kan vi bli bedre?

•Jobbe, øve, simulere
•Debriefing etter mottak av dårlig pasient.
•Debriefing og gjennomgang etter trening.
•Regelmessig trening.
–Individuelle ferdigheter.
–Samhandling.
•Endre rutiner etter erfaring og ny kunnskap.

Debriefing
•Læring, ikke vurdering
•Refleksjon, ikke evaluering

Generelle ferdigheter, som er i fokus under trening og debriefing i etterkant:

Ikke-tekniske ferdigheter:



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APPENDIX 4

ANTS

VURDERING AV IKKE-TEKNISKE FERDIGHETER

ANTS (Anaesthetists' Non-Technical Skills)

Vurderingsområder:

Oppgaveløsning
Teamarbeid
Situasjonsforståelse
Beslutningstaking

Oppgaveløsning: Ferdigheter i å organisere ressurser og nødvendige handlinger for å nå mål, det være seg individuelle caseplaner eller planlegging på lengre sikt. Kategoriene har fire elementer: planlegging og forberedelse; prioritering; gjennomfører og opprettholder standarder; identifisering og bruk av ressurser.

Planlegging og forberedelse - På forhånd utvikle primære og mulige strategier for å klare oppgaver, revidere og oppdatere disse hvis det trengs for å oppnå mål, iverksette nødvendige tiltak for planoppnåelse.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Kommuniserer plan for håndtering av situasjonen til relevante medarbeidere • Revurderer planen i lys av endringer • Planlegger videre forløp for pasienten • Finner fram nødvendige medikamenter og utstyr på forhånd.	• Endrer ikke planen i lyset av ny informasjon • Etterspør ikke medikamenter eller utstyr før i siste liten • Har ikke tilgjengelig relevante akutt/alternative medikamenter for pasienten • Planlegger ikke videre forløp

Prioritering – Tidsplanlegge oppgaver, aktiviteter, potensielle problemer, informasjonskanaler etc. i henhold til viktighet (for eksempel tid, alvor, plan). Være i stand til å identifisere nøkkelfaktorer og ha oppmerksomhet rettet mot dem og deres betydning, og unngå å bli distrahert av mindre viktige eller irrelevante forhold.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Diskuterer prioriterte områder for situasjonen • Forhandler med kirurgen om rekkefølgen på lista • Gir ordre om handlinger/tiltak i kritiske situasjoner	• Blir distrahert av å undervise/veilede andre • Er ikke oppmerksom på kritiske forhold • Endrer ikke lista (planen) ved endrede kliniske forhold.

Gjennomfører og opprettholder standarder – fremme sikkerhet og kvalitet ved å anvende anerkjente prinsipper; i den grad det er mulig følge god praksis, behandlingsprotokoller eller retningslinjer, og være i stand til å huske disse (mental huskeliste).

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Følger anerkjente protokoller og retningslinjer • Dobbeltsjekker medikamentetiketter • Kontrollerer maskin/utstyr før hver situasjon • Fører nøyaktig anestesidokumentasjon	• Sjekker ikke blod med pasient og journal • Bryter retningslinjer som f.eks, minimumsstandard for overvåkning • Bekrefter ikke pasientens identitet og samtykke • Følger ikke protokoller eller retningslinjer for krisehåndtering.

Identifisering og bruk av ressurser – Skaffe til veie nødvendig og tilgjengelig utstyr for å gjennomføre oppgaven (for eksempel personale, ekspertise, utstyr, tid) og anvende disse for å nå mål med minimale avbrudd, stress, og uten å pålegge individer eller teamet for store eller for små belastninger (fysisk og mentalt).

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Identifiserer tilgjengelige ressurser • Fordeler/delegerer oppgaver til rett(e) person(er) i teamet • Sikrer at det er disponibel tid med tanke på travle/kritiske perioder • Ber om ekstra ressurser hvis nødvendig	• Anvender ikke tilgjengelige ressurser • Overbelaster teammedlemmer med oppgaver • Innser ikke når arbeidsoppgaven ikke er gjennomførbar • Ber ikke om nødvendige ressurser på forhånd

Teamarbeid: Ferdigheter i å arbeide i team, i enhver rolle, for å sikre effektiv og felles gjennomføring av oppgaven med tilfredshet for teammedlemmene; fokus er på teamet mer enn på oppgaven. Kategorien har fem elementer: koordinering av aktiviteter med teammedlemmer; utveksling av informasjon; vise autoritet og tydelighet; vurdere evne; støtte andre.

Koordinering av aktiviteter med teammedlemmer – Samarbeide med andre for å løse oppgaven, både når det gjelder fysiske og kognitive aktiviteter; forstå roller og ansvar til de ulike teammedlemmene, og sikre en felles tilnærming

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Bekrefter roller og ansvar for teammedlemmer • Drøfter pasientsituasjonen med kollegaer • Vurderer behov for mer personale i forkant • Samarbeider med andre for å nå mål.	• Samarbeider ikke med kirurgen eller andre grupper • Stoler for mye på at teamet er kjent med hvordan de skal løse oppgaven – gjør antakelser, tar ting for gitt • Intervenerer uten å informere og involvere andre • Involverer ikke teamet i oppgavene

Utveksling av informasjon – Dele kunnskap og opplysninger som er nødvendige for samarbeid i teamet og gjennomføring av oppgaven.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Gir oppdateringer på situasjonen/rapporterer nøkkelfaktorer • Bekrefter felles forståelse • Kommuniserer plan og annen relevant informasjon til de rette personer • Opprettholder en tydelig dokumentasjon	• Informerer ikke teamet om planen eller endringer i planen • Gir ufullstendig briefing ved pasientoverføring • Inkluderer ikke relevante personer i kommunikasjonen • Mislykkes i å uttrykke bekymringer på en tydelig og presis måte

Vise autoritet og tydelighet – Leder teamet og/eller oppgaven (slik det kreves), aksepterer å ikke lede når situasjonen tilsier det; ytrer seg klart og konsist, bruker passende autoritet for å poengtere noe, og tilpasser dette til teamet eller situasjonen.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Sier tydelig i fra ved behov for hjelp • Tar over ledelsen når det kreves • Gir tydelige beskjeder til teammedlemmer • Er tydelig i lederrollen og rettferdiggjør denne.	• Bestrider ikke mer erfarne kollegaer • Lar ikke andre komme til orde • Forsøker ikke å løse konflikter • Står ikke på sitt når det kreves.

Vurderer evne - Vurderer ulike teammedlemmers ferdigheter og deres mulighet til å takle en situasjon, er årvåken for faktorer som kan begrense disse og deres evne til å effektivt utføre oppgaver (kompetansenivå, erfaring, stress, fatigue)

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Ber om hjelp når det er nødvendig • Spør nye teammedlemmer om deres erfaring(er) • Legger merke til teammedlemmer som ikke utfører oppgavene på en god nok måte • Tilpasser nivå for overvåkning/kontroll til andre teammedlemmers kompetansenivå • Legger merke til at et teammedlem er tilbake etter sykefravær og spør om deres helsetilstand	• Spør ikke/sjekker ikke om uerfarne er i stand til å utføre oppgaven • Tillater at teamet tar på seg oppgaver utover deres kompetansenivå • Ignorerer hvordan teammedlemmer utfører oppgavene • Går inn i eksisterende team uten å være klar over deres kompetansenivå • Er ikke oppmerksom på opplagte tegn på trøtthet – en person som gjesper, husker ikke enkle instrukser osv.

Støtte andre - Gir fysisk, kognitiv eller emosjonell hjelp til andre teammedlemmer

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Bryr seg om andre • Er oppmuntrende • Debriefer og takker teamet etter en vanskelig situasjon • Forutser når kollegaer vil trenge utstyr/ informasjon	• Ber om informasjon på tidspunkt med vanskelige eller krevende arbeidsoppgaver for andre • Tilbyr ikke hjelp til andre • Er ikke oppmerksom på andres behov som kan medføre endring og omfordeling av oppgaver • Svarer nedlatende på andres forespørsler

Situasjonsforståelse: Ferdigheter i å utvikle og vedlikeholde en helhetlig forståelse for arbeidssituasjonen basert på å observere alle relevante aspekter av operasjonsmiljøet (pasient, team, tid, skjermer, utstyr); forstå hva denne informasjonen betyr og være i forkant til det neste som kan hende. Kategorien har tre elementer: samle informasjon; identifiserer og forstår; være i forkant.

Samle informasjon – Innhente aktivt informasjon om situasjonen gjennom kontinuerlig observasjon av omgivelsene, monitorere alle tilgjengelige datakilder og verifisere opplysninger for å kunne bekrefte deres pålitelighet (dvs. at de ikke er gjort på feil grunnlag).

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Innhenter og dokumenterer pasientinformasjon pre-operativt • Har ”blikk” på omgivelsene hele tiden • Samler informasjon fra teamet for å identifisere problem • Observerer kirurgiske prosedyrer og verifiserer status når nødvendig • Dobbeltsjekker informasjon for å øke påliteligheten	• Reduserer overvåkningsnivået ved distraksjoner • Responderer på individuelle symptomer/signaler uten bekreftelse • Endrer ikke fysisk utforming på arbeidsområdet for å bedre oversikt/tilgjengelighet på informasjon • Stiller ikke spørsmål for å orientere seg om situasjonen ved (pasient)overlevering

Identifiserer og forstår – Tolke informasjon som er samlet fra omgivelsene (mht eksisterende kunnskap) for å identifisere om det overensstemmer eller ikke mellom tilstand og forventet tilstand, og oppdatere ens forståelse av den nåværende situasjonen.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Øker grad av monitorering som en respons på pasientens tilstand • Informerer andre om alvoret i situasjonen • Beskriver symptommønstre og deres betydning til andre teammedlemmer	• Responderer ikke på endringer i pasientens tilstand • Utfører uhensiktsmessig atferd/oppgaver • Deaktiverer alarmer uten å sjekke dem

Være i forkant - Spør ”hva om...” spørsmål og tenker i forkant på mulige resultater og konsekvenser av handlinger, intervensjoner, ikke-intervensjon etc., tenker høyt omkring den løpende situasjonen for å forutsi hva som kan skje i nær framtid.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Er i forkant av situasjonen ved å gi væske/ medikamenter • Vurderer effekten av en intervensjon/ handling • Beslutter og kommuniserer grenser for intervensjon • Gjør nødvendige tiltak for å unngå eller mildne potensielle problem	• Tar ikke potensielle problemer med i betraktningen • Øker ikke kontrollnivå i takt med pasientens tilstand til enhver tid • Er uoppmerksom ved kirurgiske (be)handlinger • Forutser ikke uønskede medikament-interaksjoner

Beslutningstaking: God til å ta beslutning om behandling eller stille en diagnose, både i normalsituasjoner og i krisesituasjoner med tidspress. Kategorien har tre elementer: identifisere handlingsalternativer; vurdere risiko og velge handlingsalternativ; re-evaluere.

Identifisere handlingsalternativer – Få fram oversikt over ulike handlingsalternativer som må tas i betraktning for å ta en beslutning eller løse et problem.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Får oversikt over handlingsalternativer for å kunne ta beslutning • Diskuterer ulike anestesiteknikker med pasienten • Spør annet anestesipersonell om forslag i vanskelige tilfeller	• Tar en forhastet beslutning uten å vurdere alternativer selv om man har tid til det • Spør ikke teammedlemmer om ulike alternativer når det kunne være aktuelt • Ignorerer forslag fra andre teammedlemmer

Vurdere risiko og velge handlingsalternativ – Kartlegger risikomomenter for å veie risiko og fordeler i en situasjon, vurderer fordeler og ulemper ved ulike handlingsalternativer, velger en løsning eller et handlingsforløp basert på disse prosessene.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Vurderer risiko ved ulike behandlingsalternativer • Tar hensyn til pasientens tilstand når faktorer vurderes • Tar hensyn til kritiske tidsaspekter ved vurdering av alternativer • Iverksetter den valgte handling	• Finner ikke ut om det er risiko forbundet med et ukjent medikament/ukjent forhold • Vurderer ikke handlingsalternativ i forkant med relevante personer for å vurdere om handlingene er passende • Sjekker ikke mulige alternativer med det teamet

Re-evaluere - Gjennomfører kontinuerlig en revurdering av de alternativene som er identifisert, kartlagt og valgt, og revurderer situasjonen etter å ha implementert en gitt handling.

Kjennetegn på god praksis	Kjennetegn på dårlig praksis
• Revurderer pasienten etter behandling eller intervensjon • Re-vurderer situasjonen, om beslutningen var å vente og se • Fortsetter å komme opp med alternativer ettersom pasientens tilstand utvikler seg	• Setter ikke av nok tid for at intervensjonen kan ha effekt • Inkluderer ikke andre teammedlemmer i revurdering • Er ikke villig til å revurdere handlingsvalg i lys av ny informasjon

Score – alternativer for ANTS

Skalaen under kan benyttes for å score ikke-tekniske ferdigheter basert på observert atferd. Dersom det ikke er relevant at et element er vist i en situasjon, benyttes "ikke observert".

Score	**Beskrivelse**
4 - Bra	Utførelsen var av gjennomgående høy standard, ivaretok pasientsikkerhet, kan brukes som et positivt eksempel for andre
3 - Akseptabel	Utførelsen var av akseptabel standard, men kan forbedres
2 - Marginal	Utførelsen gir grunn til bekymring, betydelig forbedring er nødvendig
1 - Dårlig	Utførelsen satte, eller kunne sette, pasientens sikkerhet i fare, omfattende opplæring/støtte er påkrevet
N - Ikke observert	Ferdighet kunne ikke observeres i denne situasjonen

Kategorier	Elementer	Score	Observasjon av utførelse/gjennomføring	Kategorivurdering og debriefing notat
Oppgaveløsning	Planlegging og forberedelse			
	Prioritering			
	Gjennomfører og opprettholder standarder			
	Identifisering og bruk av ressurser			
Teamarbeid	Koordinering av aktiviteter med team-medlemmer			
	Utveksling av informasjon			
	Vise autoritet og tydelighet			
	Vurderer evne			
	Støtter andre			
Situasjonsforståelse	Samle informasjon			
	Identifiserer og forstår			
	Være i forkant			
Beslutningstaking	Identifisere handlingsalternativer			
	Vurdere risiko og velge handlingsalternativ			
	Re-evaluere			

4 Bra; **3** Akseptabel; **2** Marginal; **1** Dårlig; **N** Ikke observert

APPENDIX 5

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

Evaluering av simulering blant anestesipersonell og observasjon av effekten denne treningen har i klinikken

Dette er et spørsmål til deg om å delta i et delstudie i forbindelse med et forskningsprosjekt. Hensikten med prosjektet er å undersøke hvordan medisinsk simulering gjennomføres og implementeres i klinikken for anestesipersonell, samt observere i hvilken grad anestesipersonell bruker ikke-tekniske ferdigheter i forbindelse med innledning av anestesi på operasjonsstuen.
Studien inngår i et forskningsprosjekt i Akuttklinikken OUS i forbindelse med Ph.d.-utdanning.
Du blir forespurt fordi du er en representant med kunnskaper om den medisinske simuleringen.

HVA INNEBÆRER PROSJEKTET?

Du blir oppringt av forsker, som foretar et telefonintervju med deg på ca. 45 minutter. Intervjuet omhandler spørsmål om hvordan medisinsk simulering gjennomføres hos dere.; Eks: Hvor mange timer pr. år brukes til simulering for anestesipersonell, hvor mange deltakere pr. avdeling, hvor ofte deltar den enkelte? Gjennomføres medisinsk simulering i simuleringssenter og/eller utenfor? Hvilke begrunnelser og læringsmål finnes for medisinsk simulering? Hvilke pedagogiske metoder brukes ved medisinsk simulering og hvordan organiserer og tilrettelegger dere treningen m.h.t. drift, tidsbruk, ressursutnyttelse og ansvarsfordeling? Måles effekt og resultat, og evt. hvordan? Intervjuet blir gjennomført ved hjelp av en strukturert intervjuguide og det blir gjort lydopptak. Din stilling og funksjon blir registrert, men ikke navn og dato. Dine opplysninger vil inngå i delstudie 1 i prosjektet.

MULIGE FORDELER OG ULEMPER

Deltakelse i studien kan oppleves som tidkrevende i en ellers travel hverdag, men studien vil foregå primært på dagtid og i din arbeidstid. Dersom du velger å delta i denne studien, får du mulighet til å bidra til økt kunnskap om medisinsk simulering for anestesipersonell og hvilken nytte det har i klinikken for pasientsikkerheten. Dette kan være nyttig m.h.t. til videre planlegging og gjennomføring av den medisinske simuleringen for anestesipersonell i Norge.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta uten at dette vil få konsekvenser for deg på noen måte. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte:

Anne Strand Finstad, Anestesisykepleier/fagutviklingssykepleier, Ph.d.-kandidat.
Tlf:92431829, epost: anne.sf@hotmail.com eller afinstad@ous-hf.no
Prosjektleder: Tone Rustøen, Sykepleier, Seniorforsker og professor,
epost: tone.rustoen@medisin.uio.no

HVA SKJER MED INFORMASJONEN OM DEG?

Informasjonen som registreres om deg skal kun brukes slik som beskrevet ovenfor. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Personopplysninger og lydopptak vil bli oppbevart utilgjengelig for andre enn studiens forsker og 4 veiledere; Forsker: Anne Strand Finstad, Prosjektleder/Hovedveileder: Tone Rustøen, Medveiledere: Torben Wisborg, Luis Romundstad, Conrad Bjørshol. Det vil ikke være mulig å identifisere deg i resultatene i forbindelse med publisering. Alle som er ansvarlige for studien har taushetsplikt. Prosjektleder har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte. Lydopptak og annen informasjon om deg vil bli slettet senest fem år etter prosjektslutt.

GODKJENNING

Regional komite for medisinsk og helsefaglig forskningsetikk har vurdert at studien ikke er fremleggingspliktig til REK (saksnr.2016/642). Studien er godkjent av Personvernombudet (saksnr. 2016/8203).

SAMTYKKE TIL DELTAKELSE I PROSJEKTET

JEG ER VILLIG TIL Å DELTA I PROSJEKTET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om studien

Sted og dato

Signatur

Rolle i prosjektet

APPENDIX 6

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

Simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant anestesipersonell

- kartlegging, opplevelse av nytte, etterlevelse

Dette er et spørsmål til deg om å delta i et delstudie, som inngår i et forskningsprosjekt i Akuttklinikken OUS i forbindelse med Ph.D-utdanning.
Mer fokus på nytte og etterlevelse etterspørres innen simulering, og det savnes mer måling og effekt av simuleringsbasert teamtrening. Hensikt med studien er å undersøke anestesipersonells erfaring fra simuleringsbasert teamtrening av ikke-tekniske ferdigheter og deres opplevelse av treningens betydning i klinisk praksis.
Prosjektet er viktig i forhold til forebygging av uønskede hendelser for operasjonspasienten.

Du blir forespurt fordi du har vært deltaker i simuleringsbasert teamtrening.

HVA INNEBÆRER PROSJEKTET?

Dersom du velger å delta i studien så innebærer det deltagelse i to fokusgruppeintervjuer, dvs. rett i etterkant av simuleringsbasert teamtrening og seks måneder etter.
Du blir kontaktet av forsker m.h.t. tid og sted for fokusgruppeintervju.
Fokusgruppen består av anestesileger og anestesisykepleiere. Det er ca. 6 deltakere i gruppen. Det er to fra forskningsgruppen som sammen vil gjennomføre intervjuet. Før intervjuet starter vil du få et skjema til utfylling som inneholder stilling, alder, kjønn og hvor lenge det er siden simuleringen. Intervjuet tar ca. 1 time. Det blir brukt lydopptak under intervjuet.

MULIGE FORDELER OG ULEMPER

Deltakelse i studien kan oppleves som tidkrevende i en ellers travel hverdag, men studien vil foregå primært på dagtid og i din arbeidstid. Dersom du velger å delta i denne studien, får du mulighet til å bidra til økt kunnskap om simuleringsbasert teamtrening med fokus på ikke-tekniske ferdigheter for anestesipersonell og hvilken nytte det har i klinikken for pasientsikkerheten. Dette kan være nyttig m.h.t. til videre planlegging og gjennomføring av den simuleringsbaserte teamtreningen for anestesipersonell i Norge.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta uten at dette vil få konsekvenser for deg på noen måte. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte:
Anne Strand Finstad, Anestesisykepleier/fagutviklingssykepleier, Ph.D.-kandidat/prosjektleder. Tlf:92431829, epost: afinstad@ous-hf.no eller anne.sf@hotmail.com
Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik,
epost: randi.ballangrud@ntnu.no
Biveiledere i prosjektet:
Ingunn Aase, Førsteamanuensis, Institutt for Helsefag, Universitetet i Stavanger.
Conrad Arnfinn Bjørshol, Anestesilege, Ph.d., Seniorforsker, Stavanger Universitetssykehus.

HVA SKJER MED INFORMASJONEN OM DEG?

Informasjonen som registreres om deg skal kun brukes slik som beskrevet ovenfor. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Personopplysninger og lydopptak vil bli oppbevart utilgjengelig for andre enn studiens Ph.D-kandidat/prosjektleder og 3 veiledere
Det vil ikke være mulig å identifisere deg i resultatene i forbindelse med publisering. Alle som er ansvarlige for studien har taushetsplikt. Prosjektleder har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte.
Lydopptaket og annen informasjon om deg blir oppbevart innelåst underveis i prosjektet og deretter anonymisert/makulert senest 01.08.24.
Behandlingsansvarlig institusjon er OUS.

GODKJENNING

Regional komite for medisinsk og helsefaglig forskningsetikk har vurdert at studien ikke er fremleggingspliktig til REK (saksnr.2016/642). Studien er godkjent av Personvernombudet (saksnummer 2016/8203).

SAMTYKKE TIL DELTAKELSE I PROSJEKTET

JEG ER VILLIG TIL Å DELTA I PROSJEKTET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om studien

Sted og dato

Signatur

Rolle i prosjektet

APPENDIX 7

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

Simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant anestesipersonell - kartlegging, opplevelse av nytte, etterlevelse

Dette er et spørsmål til deg om å delta i et delstudie i forbindelse med et forskningsprosjekt.
Overordnet hensikt med prosjektet er å få kunnskap om simuleringsbasert teamtrening og ikke-tekniske ferdigheter hos anestesipersonell, deres bruk av simuleringsmetoder, organisering, opplevelse av nytte og etterlevelse i klinikken i relasjon til pasientsikkerhet.
Hensikten med dette delstudiet er å få svar på i hvilken grad anestesiteamet benytter de ikke-tekniske ferdighetene i henhold til observasjonsverktøyet ANTS under innledning av anestesi på operasjonsstuen.
Du blir forespurt fordi du er anestesilege eller anestesisykepleier som i din stilling utfører innledning av anestesi til operasjonspasient inne på operasjonsstuen på sykehus.
Studien inngår i et forskningsprosjekt i Akuttklinikken OUS i forbindelse med PhD-utdanning.

HVA INNEBÆRER PROSJEKTET?

Du blir kontaktet av forsker m.h.t. informasjon om prosjektet.
Det vil gjennomføres videoopptak av anestesipersonell i forbindelse med innledning av anestesi i reelle situasjoner inne på operasjonsstuen i to omganger. Videoopptakene vurderes i etterkant med hensyn til teamets ikke-tekniske ferdigheter, ved hjelp av observasjonsskjema (ANTS). Simuleringsbasert teamtrening gjennomføres mellom de to omgangene.

MULIGE FORDELER OG ULEMPER

Dersom du velger å delta i denne studien, får du mulighet til å bidra til økt kunnskap om medisinsk simulering for anestesipersonell og hvilken nytte det har i klinikken for pasientsikkerheten. Dette kan være nyttig m.h.t. til videre planlegging og gjennomføring av den medisinske simuleringen for anestesipersonell i Norge.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Du informeres og samtykke innhentes i forkant av videoopptak.
Personell som evt. ikke har fått informasjon i forkant, kontaktes for samtykke i etterkant, før filmen sees på. Ved nei til samtykke, slettes videoen usett.
Videoopptakene blir oppbevart innelåst og slettes tre uker etter opptak. Ved nei til samtykke, slettes video usett.
Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Å trekke ditt samtykke vil ikke få konsekvenser for deg på noen måte.
Dersom du ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte:
Anne Strand Finstad, Anestesisykepleier/fagutviklingssykepleier, PhD.-kandidat/prosjektleder. Tlf:92431829, epost: afinstad@ous-hf.no eller anne.sf@hotmail.com
Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik, epost: randi.ballangrud@ntnu.no

HVA SKJER MED INFORMASJONEN OM DEG?

Informasjonen som registreres om deg skal kun brukes slik som beskrevet ovenfor. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Personopplysninger og videoopptak vil bli oppbevart utilgjengelig for ande enn studiens forsker, tre veiledere og de to fagpersonene som vurderer ved hjelp av observasjonsskjema (ANTS).
Forsker/prosjektleder: Anne Strand Finstad.
Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik.
Biveileder: Ingunn Aase, Førsteamanuensis, Institutt for Helsefag, Universitetet i Stavanger.
Biveileder: Conrad Arnfinn Bjørshol, Anestesilege, PhD., Seniorforsker, Stavanger Universitetssykehus.
Det vil ikke være mulig å identifisere deg i resultatene i forbindelse med publisering. Alle som er ansvarlige for studien har taushetsplikt. Prosjektleder har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte. Videoopptak blir slettet tre uker etter opptak og annen informasjon om deg vil bli slettet senest fem år etter prosjektslutt.

GODKJENNING

Regional komite for medisinsk og helsefaglig forskningsetikk har vurdert at studien ikke er fremleggingspliktig til REK (saksnr.2016/642). Studien er godkjent av Personvernombudet OUS (saksnr.18/17582), Avdelingsledere/Avdeling for anestesisykepleie OUS og Avdeling for anestesiologi RH, Klinikkleder og Forskningsleder/Akuttklinikken OUS.

SAMTYKKE TIL DELTAKELSE I PROSJEKTET

JEG ER VILLIG TIL Å DELTA I PROSJEKTET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om studien

Sted og dato

Signatur

Rolle i prosjektet

SAMTYKKE TIL BRUK AV VIDEOOPPTAK I FORSKNINGSSTUDIE

Simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant anestesipersonell - kartlegging, opplevelse av nytte, etterlevelse

Dette er et spørsmål til deg om å samtykke til bruk av videoopptak i forbindelse med en forskningsstudie. Overordnet hensikt med studien er å få kunnskap om i hvilken grad anestesiteamet (de som gir deg anestesi/narkose) benytter ikke-tekniske ferdigheter (som kommunikasjon, samarbeid osv.) med tanke på pasientsikkerhet.

Du blir forespurt fordi du skal gjennomgå et operativt inngrep inne på operasjonsstuen. I den forbindelse blir det foretatt videoopptak av situasjonen: innledning av anestesi. Videoopptaket er rettet mot anestesipersonellet på operasjonsstuen, men i og med at vi ikke kan garantere at du som pasient ikke kommer med på opptaket, spør vi deg om du samtykker til bruk av denne videoen.

Videoopptaket og vurdering av anestesipersonellets ikke-tekniske ferdigheter inngår i et forskningsprosjekt i Akuttklinikken OUS.

HVA INNEBÆRER PROSJEKTET?

Videoopptaket vurderes i etterkant med hensyn til teamets ikke-tekniske ferdigheter. Resultatene brukes til å få økt kunnskap om simuleringsbasert teamtrening og etterlevelsen av denne lærdommen i klinikken. Kunnskapen brukes til å forbedre pasientsikkerheten.

MULIGE FORDELER OG ULEMPER

Dersom du samtykker i bruk av videoopptaket, får du mulighet til å bidra til økt kunnskap om simuleringsbasert teamtrening for anestesipersonell og hvilken nytte det har i klinikken for pasientsikkerheten. Dette kan være nyttig m.h.t. til videre planlegging og gjennomføring av den simuleringsbaserte teamtreningen for anestesipersonell i Norge.

FRIVILLIGHET OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å samtykke i bruk av videoopptaket..

Videoopptaket blir oppbevart innelåst og slettes tre uker etter opptak. Ved nei til samtykke, gjøres det ikke videoopptak. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Å trekke ditt samtykke vil ikke få konsekvenser for deg på noen måte.

Dersom du samtykker, undertegner du samtykkeerklæringen på siste side.

Dersom du senere ønsker å trekke samtykket, kan du kontakte:

Anne Strand Finstad, Anestesisykepleier/fagutviklingssykepleier, PhD.-kandidat/prosjektleder. Tlf:92431829, epost: afinstad@ous-hf.no eller anne.sf@hotmail.com

Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik, epost: randi.ballangrud@ntnu.no

HVA SKJER MED INFORMASJONEN OM DEG?

Eventuell informasjon om deg som er kommet med på videoopptaket vil ikke brukes i studien. Alle opplysninger som fremkommer i videoen vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Personopplysninger og videoopptak vil bli oppbevart utilgjengelig for andre enn studiens forsker, tre veiledere og to fagpersoner som vurderer videoopptakene. Forsker/prosjektleder: Anne Strand Finstad,
Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik.
Biveileder: Ingunn Aase, Førsteamanuensis, Institutt for Helsefag, Universitetet i Stavanger.
Biveileder: Conrad Arnfinn Bjørshol, Anestesilege, PhD., Seniorforsker, Stavanger Universitetssykehus.
Alle som er ansvarlige for studien har taushetsplikt. Prosjektleder har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte. Videoopptak blir slettet innen tre uker.

GODKJENNING

Studien er godkjent av Personvernombudet OUS, Avdelingsledere/Avdeling for anestesisykepleie OUS og Avdeling for anestesiologi RH, Klinikkleder og Forskningsleder/Akuttklinikken OUS.

SAMTYKKE TIL BRUK AV VIDEOOPPTAK I FORSKNINGSSTUDIE

JEG SAMTYKKER TIL BRUK AV VIDEOOPPTAK

Sted og dato	Signatur
	Navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om studien

Sted og dato	Signatur
	Rolle i prosjektet

SAMTYKKE TIL BRUK AV VIDEOOPPTAK I FORSKNINGSSTUDIE

Simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant anestesipersonell

- kartlegging, opplevelse av nytte, etterlevelse

Dette er et spørsmål til deg om å samtykke til bruk av videoopptak i forbindelse med en forskningsstudie. Overordnet hensikt med studien er å få kunnskap om i hvilken grad anestesiteamet benytter ikke-tekniske ferdigheter med tanke på pasientsikkerhet.

Du blir forespurt fordi du har en profesjon som kan innebære deltakelse i det kirurgiske teamet i forbindelse med operasjon inne på operasjonsstuen. I den forbindelse blir det foretatt videoopptak av situasjonen: innledning av anestesi. Videoopptaket er rettet mot anestesipersonellet på operasjonsstuen, men i og

med at vi ikke kan garantere at du som medlem av teamet ikke kommer med på opptaket, spør vi deg om du samtykker til bruk av denne videoen.
Videoopptaket og vurdering av anestesipersonellets ikke-tekniske ferdigheter inngår i et forskningsprosjekt i Akuttklinikken OUS i forbindelse med PhD-utdanning.

HVA INNEBÆRER PROSJEKTET?

Videoopptaket vurderes i etterkant med hensyn til anestesiteamets ikke-tekniske ferdigheter. Resultatene brukes til å få økt kunnskap om simuleringsbasert teamtrening og etterlevelsen av denne lærdommen i klinikken. Kunnskapen brukes til å forbedre pasientsikkerheten.

MULIGE FORDELER OG ULEMPER

Dersom du samtykker i bruk av videoopptaket, får du mulighet til å bidra til økt kunnskap om simuleringsbasert teamtrening for anestesipersonell og hvilken nytte det har i klinikken for pasientsikkerheten. Dette kan være nyttig m.h.t. til videre planlegging og gjennomføring av den simuleringsbaserte teamtreningen for anestesipersonell i Norge.

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Videoopptaket blir oppbevart innelåst og slettes tre uker etter opptak. Ved nei til samtykke, gjøres ikke videoopptak.
Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner.
Å trekke ditt samtykke vil ikke få konsekvenser for deg på noen måte.
Dersom du samtykker, undertegner du samtykkeerklæringen på siste side.
Dersom du senere ønsker å trekke samtykket, kan du kontakte:
Anne Strand Finstad, Anestesisykepleier/fagutviklingssykepleier, PhD.-kandidat/prosjektleder. Tlf:92431829, epost: afinstad@ous-hf.no eller anne.sf@hotmail.com
Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik, epost: randi.ballangrud@ntnu.no

HVA SKJER MED INFORMASJONEN OM DEG?

Eventuell informasjon om deg som er kommet med på videoopptaket vil ikke brukes i studien. Alle opplysninger som fremkommer i videoen vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende

opplysninger. Personopplysninger og videoopptak vil bli oppbevart utilgjengelig for andre enn studiens forsker, tre veiledere og to fagpersoner som vurderer videoopptakene.

Forsker/prosjektleder: Anne Strand Finstad.

Hovedveileder: Randi Ballangrud, Førsteamanuensis, Institutt for Helsevitenskap, NTNU, Gjøvik.

Biveileder: Ingunn Aase, Førsteamanuensis, Institutt for Helsefag, Universitetet i Stavanger.

Biveileder: Conrad Arnfinn Bjørshol, Anestesilege, PhD., Seniorforsker, Stavanger Universitetssykehus.

Alle som er ansvarlige for studien har taushetsplikt. Prosjektleder har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte. Videoopptak blir slettet innen tre uker.

GODKJENNING

Studien er godkjent av Personvernombudet OUS, Avdelingsledere/Avdeling for anestesisykepleie OUS og Avdeling for anestesiologi RH, Klinikkleder og Forskningsleder/Akuttklinikken OUS.

SAMTYKKE TIL BRUK AV VIDEOOPPTAK I FORSKNINGSSTUDIE

JEG SAMTYKKER TIL BRUK AV VIDEOOPPTAK

Sted og dato

Signatur

Navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om studien

Sted og dato

Signatur

Rolle i prosjektet

APPENDIX 8

Oslo universitetssykehus HF

Postadresse:
Trondheimsveien 235
0514 Oslo

Sentralbord:
02770

Org.nr:
NO 993 467 049 MVA

www.oslo-universitetssykehus.no

Oslo universitetssykehus

PERSONVERNOMBUDETS TILRÅDING

Til:	Tone Rustøen Anne Strand Finstad
Kopi:	
Fra:	Personvernombudet ved Oslo universitetssykehus
Saksbehandler:	Helge Grimnes
Dato:	05.07.2016
Offentlighet:	Ikke unntatt offentlighet
Sak:	Personvernombudets tilråding til innsamling og databehandling av personopplysninger
Saksnummer/ ePhortenummer:	2016/8203

Personvernombudets tilråding til innsamling og behandling av personopplysninger for prosjektet:

"Evaluering av simulering blant anestesipersonell og observasjon av effekten av denne treningen har i klinikken"

Vi viser til innsendt melding om behandling av personopplysninger / helseopplysninger. Det følgende er personvernombudets tilråding av prosjektet.

Med hjemmel i personopplysningsforskriften § 7-12, jf. helseregisterloven § 5, har Datatilsynet ved oppnevning av personvernombud ved Oslo Universitetssykehus (OUS), fritatt sykehuset fra meldeplikten til Datatilsynet. Behandling og utlevering av person-/helseopplysninger meldes derfor til sykehusets personvernombud.

Databehandlingen tilfredsstiller forutsetningene for melding gitt i personopplysningsforskriften § 7-27 og er derfor unntatt konsesjon.

Personvernombudet tilrår at prosjektet gjennomføres under forutsetning av følgende:

1. Databehandlingsansvarlig er Oslo universitetssykehus HF ved adm. dir.
2. Avdelingsleder eller klinikkleder ved OUS har godkjent studien.
3. Behandling av personopplysningene / helseopplysninger i prosjektet skjer i samsvar med og innenfor det formål som er oppgitt i meldingen.
4. Data lagres som oppgitt i meldingen. Annen lagringsform forutsetter gjennomføring av en risikovurdering som må godkjennes av Personvernombudet.
5. Studien er frivillig og samtykkebasert. Innmeldte samtykke benyttes.
6. Eventuelle fremtidige endringer som berører formålet, utvalget inkluderte eller databehandlingen må forevises personvernombudet før de tas i bruk.
7. Kontaktperson for prosjektet skal hvert tredje år sende personvernombudet ny melding som bekrefter at databehandlingen skjer i overensstemmelse med opprinnelig formål og helseregisterlovens regler.

8. Data slettes eller anonymiseres ved prosjektslutt 01.08.2024 ved at opptak og identifikasjonsmuligheter i databasen fjernes. Når formålet med registeret er oppfylt sendes melding om bekreftet sletting til personvernombudet.

Prosjektet er registrert i sykehusets offentlig tilgjengelig database over forsknings- og kvalitetsstudier.

Med hilsen

Helge Grimnes
Personvernrådgiver

Oslo universitetssykehus HF
Stab pasientsikkerhet og kvalitet
Seksjon for personvern og informasjonssikkerhet

Epost: personvern@oslo-universitetssykehus.no
Web: www.oslo-universitetssykehus.no/personvern

APPENDIX 9

Oslo universitetssykehus HF

Postadresse:
Postboks 4950 Nydalen
0424 Oslo

Sentralbord:
02770

Org.nr:
NO 993 467 049 MVA

www.oslo-universitetssykehus.no

PERSONVERNOMBUDETS TILRÅDING

Til:	Anne Strand Finstad, Fagutviklingsykepleier AKU AVDELING FOR ANESTESISYKEPLEIE
Kopi:	
Fra:	Personvernombudet ved Oslo universitetssykehus
Saksbehandler:	Tor Åsmund Martinsen
Dato:	12.03.19
Offentlighet:	Ikke unntatt offentlighet
Sak:	Personvernombudets tilråding til behandling av personopplysninger
Saksnummer:	18/17582

Personvernombudets tilråding til behandling av personopplysninger for:

«Anestesipersonells etterlevelse av simuleringsbasert team trening av ikke-tekniske ferdigheter»

Formål:
Studiens hensikt er å vurdere etterlevelse av ikke-tekniske ferdigheter hos anestesipersonellet i klinikken, samt å teste
den norske oversettelsen av observasjonsverktøyet ANTS for validitet og reliabilitet.
Studien er en del av et doktorgradsprosjekt med tittel "Simuleringsbasert teamtrening av ikke-tekniske ferdigheter blant anestesipersonell - kartlegging, opplevelse av nytte, etterlevelse."

Tidsrom: 01.06.2023

Vi viser til innsendt melding om behandling av personopplysninger.

Med hjemmel i forordning (EU) nr. 2016/679 (generell personvernforordning) artikkel 37, er det oppnevnt personvernombud ved Oslo Universitetssykehus (OUS).

Den dataansvarlige skal sikre at personvernombudet på riktig måte og i rett tid involveres i alle spørsmål som gjelder vern av personopplysninger, jf. artikkel 38. Artikkel 30 pålegger OUS å føre oversikt over hvilke behandlinger av personopplysninger virksomheten har. Behandling av personopplysninger meldes derfor til sykehusets personvernombud.

Før det foretas behandling av helseopplysninger, skal den dataansvarlige rådføre seg med personvernombudet, jf. personopplysningsloven § 10. Ved rådføringen skal det vurderes om behandlingen vil oppfylle kravene i personvernforordningen og øvrige bestemmelser fastsatt

i eller med hjemmel i loven her. Rådføringsplikten gjelder likevel ikke dersom det er utført en vurdering av personvernkonsekvenser etter personvernforordningen artikkel 35.

Databehandlingen tilfredsstiller forutsetningene for melding etter forordning (EU) nr. 2016/679 (generell personvernforordning) artikkel 30.

1. Oslo universitetssykehus HF ved adm. dir. er dataansvarlig virksomhet.
2. Avdelingsleder eller klinikkleder ved OUS har godkjent databehandlingen.
3. Databehandlingen skjer i samsvar med og innenfor det formål som er oppgitt i meldingen.
4. Data lagres som oppgitt i meldingen og i samsvar med sykehusets retningslinjer.
5. Studien er frivillig og samtykkebasert. Det innmeldte samtykke skal benyttes. Studien har rettslig grunnlag i generell personvernforordning artikkel 6 nr. 1 bokstav a) og artikkel 9 nr. 2 bokstav a).
6. Den dataansvarlige har rådført seg med personvernombudet, jf. personopplysningsloven § 10.
7. Kryssliste som kobler avidentifiserte data med personopplysninger lagres som angitt i meldingen og i samsvar med sykehusets retningslinjer.
8. Publisering i tidsskrift forutsettes å skje uten at deltagerne kan gjenkjennes, hverken direkte eller indirekte.
9. Eventuelle krav fra tidsskrift om at grunnlagsdataene utleveres, skal behandles som en utlevering av helse- og personopplysninger, jf. sykehusets eHåndbok og dokumentet «Utlevering av personopplysninger», dokumentID 15408. Se http://ehandboken.ous-hf.no/. Denne tilråding dekker ikke slik utlevering.
10. Data slettes eller anonymiseres ved prosjektslutt ved at krysslisten slettes og eventuelle andre identifikasjonsmuligheter i databasen fjernes. Når formålet med registeret er oppfylt sendes melding om bekreftet sletting til personvernombudet.

Prosjektet er registrert i sykehusets offentlig tilgjengelig database over forsknings- og kvalitetsstudier.

Med hilsen

Tor Åsmund Martinsen
Personvernombud

Oslo universitetssykehus

APPENDIX 10

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst	Anne S. Kavli	22845512	19.05.2016	2016/642/REK sør-øst A
			Deres dato:	Deres referanse:
			30.03.2016	

Vår referanse må oppgis ved alle henvendelser

Tone Rustøen
Oslo universitetssykehus HF

2016/642 Evaluering av simulering blant anestesipersonell og observasjon av effekten av denne treningen

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden ble behandlet av Regional komité for medisinsk og helsefaglig forskningsetikk (REK sør-øst) i møtet 28.04.2016. Vurderingen er gjort med hjemmel i helseforskningsloven § 10, jf. forskningsetikkloven § 4.

Forskningsansvarlig: Oslo universitetssykehus HF
Prosjektleder: Tone Rustøen

Prosjektbeskrivelse (redigert av REK)

Formålet med prosjektet er å undersøke bruk og effekt av medisinsk simulering blant anestesipersonell i Norge

Forskning har indikert at menneskelig svikt relatert til mangelfulle ikke-tekniske ferdigheter er en medvirkende årsak ved inntil 80 % av uønskede hendelser i anestesi og intensivmedisin. Tidligere forskning har vist at medisinsk simulering styrker ferdigheter blant helsepersonell, men også at umiddelbart læringsresultat ved simulering kan være misvisende med hensyn til «virkelig læring».

Det planlegges derfor å undersøke hvordan medisinsk simulering gjennomføres blant anestesipersonell i

Norge, hvilke erfaringer og opplevelser personell som har gjennomgått medisinsk simulering har hatt med opplæringen og med implementering av denne i klinikken samt å undersøke effekt av medisinsk simulering ved observasjon av ikke-tekniske ferdigheter hos anestesipersonell.

I første del av prosjektet planlegges det å gjennomføre telefonintervjuer med anestesipersonell ansatt ved alle offentlige sykehus med anestesiservice som driver elektiv- og øyeblikkelig hjelp kirurgi, totalt 30-50 personer.

I den andre delen av prosjektet vil 261 anonyme evalueringsskjema som anestesileger og anestesisykepleiere har fylt etter gjennomført simuleringstrening ved Oslo universitetssykehus i perioden 2010-2014 inngå. Skjemaene består av 16 spørsmål og dreier seg om hvordan deltakerne opplevde treningen, forventet nytte og hva som eventuelt kan gjøres bedre. Det vil også gjennomføres fokusgruppeintervjuer med anestesipersonell tre til seks måneder etter gjennomført trening for å undersøke deres erfaringer med nytte

og implementering av simuleringen i deres kliniske arbeid. Det planlegges minimum 3 fokusgruppeintervjuer med ca 8 informanter i hver gruppe.

I den tredje delen av prosjektet planlegges det å observere anestesipersonells bruk av ikke-tekniske

Besøksadresse: Gullhaugveien 1-3, 0484 Oslo
Telefon: 22845511
E-post: post@helseforskning.etikkom.no
Web: http://helseforskning.etikkom.no/

ferdigheter i teamarbeid ved anestesiinnledning på operasjonsstuen. Opplysninger samles inn ved hjelp av kompetansevurderingsverktøyet ANTS for anestesileger og kompetansevurderingsverktøyet NANTS-no for anestesisykepleiere. Det planlegges en pilotstudie med ti observasjoner og en hovedstudie med 50 observasjoner.

Vurdering

Slik komiteen forstår prosjektet, er formålet med dette prosjektet primært å undersøke bruk og effekt av medisinsk simulering på ikke-tekniske ferdigheter hos anestesipersonell i Norge.

Prosjektet er dermed etter komiteens syn å anse som helsetjenesteforskning.

Helsetjenesteforskning er et flerfaglig vitenskapelig felt hvor man studerer hvordan sosiale faktorer, finansieringssystemer, organisatoriske strukturer og prosesser, helseteknologi og personellatferd påvirker tilgang til helse - og omsorgstjenester, kvaliteten og kostnadene ved helse og omsorgstjenester, og endelig helse og velvære.

Helsetjenesteforskning er også forskning på forbedring av helsetjenesten og effektiv bruk av ressurser for samfunnet. I helsetjenesteforskningen studerer man blant annet hvordan helsetjenester leveres, hvordan de er utformet, og hvordan helsetjenesten fungerer som system.

Helsetjenesteforskning omfattes ikke av helseforskningslovens virkeområde, som omfatter prosjekter med det formål å skaffe ny kunnskap om helse og sykdom, jf. helseforskningsloven § 2 og § 4 a, og er dermed ikke fremleggingspliktig for REK.

Vedtak

Prosjektet faller utenfor helseforskningslovens virkeområde, jf. § 2, og kan derfor gjennomføres uten godkjenning av REK.

Komiteens avgjørelse var enstemmig.

Klageadgang

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Papers

Paper I

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Is simulation-based team training performed by personnel in accordance with the INACSL Standards of Best Practice: Simulation[SM]?—a qualitative interview study

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Abstract

Background: Anesthesia personnel was among the first to implement simulation and team training including nontechnical skills (NTS) in the field of healthcare. Within anesthesia practice, NTS are critically important in preventing harmful undesirable events. To our best knowledge, there has been little documentation of the extent to which anesthesia personnel uses recommended frameworks like the Standards of Best Practice: Simulation[SM] to guide simulation and thereby optimize learning. The aim of our study was to explore how anesthesia personnel in Norway conduct simulation-based team training (SBTT) with respect to outcomes and objectives, facilitation, debriefing, and participant evaluation.

Methods: Individual qualitative interviews with healthcare professionals, with experience and responsible for SBTT in anesthesia, from 51 Norwegian public hospitals were conducted from August 2016 to October 2017. A qualitative deductive content analysis was performed.

Results: The use of objectives and educated facilitators was common. All participants participated in debriefings, and almost all conducted evaluations, mainly formative. Preparedness, structure, and time available were pointed out as issues affecting SBTT.

Conclusions: Anesthesia personnel's SBTT in this study met the International Nursing Association for Clinical Simulation and Learning (INACSL) Standard of Best Practice: Simulation[SM] framework to a certain extent with regard to objectives, facilitators' education and skills, debriefing, and participant evaluation.

Keywords: Anaesthesia, Simulation-based team training, Framework, Objectives, Facilitation, Debriefing, Evaluation

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Background

Simulation-based team training (SBTT) gives healthcare professionals the opportunity to learn and practice in safe environments without the risk of patient injury [1, 2]. Simulation is defined as "A technique that creates a situation or environment to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions" [3]. Anesthesia personnel was among the first to implement simulation and team training including non-technical skills (NTS) in healthcare [1, 4]. It has been stated that anesthesia has much in common with aviation and the nuclear industry, sharing safety as its primary goal [5]. Aviation introduced the term NTS as part of safety-related behavior. NTS are defined as "the cognitive, social, and personal resource skills that complement technical skills and contribute to safe and efficient task performance" [6]. These skills often include situation awareness, decision-making, teamwork, leadership, and the management of stress and fatigue [7]. In 2012, an international expert group recommended NTS as one of five topics
(technical skills, non-technical skills, system probing, assessment, and effectiveness) to focus on in simulationbased training for improving patient safety [8]. Within anesthesia the NTS are critically important in preventing undesirable events involving the surgical patient [9, 10]. Specialized team-training programs in different settings have been introduced to improve NTS, including task management, team working, situation awareness, and decision-making [5, 11, 12].

A systematic review and meta-analysis [13] showed that SBTT in anesthesia affects outcomes such as satisfaction, knowledge, skills, and behavior of anesthesia personnel. Several studies in anesthesia settings have shown that SBTT improves team performance, cultural attitudes and perceptions, and communication climate among anesthesiologists and obstetricians in teamwork [14]; technical skills and NTS during the management of malignant hyperthermia management [15]; NTS and clinical actions during weaning from cardiopulmonary bypass [16]; trauma team performance [17]; and resuscitation skills and team performance during neonatal resuscitation [18].

In recent years, standardized frameworks for simulationbased team training have been introduced [19, 20]. We are not aware of studies on the extent to which anesthesia personnel follows recommended frameworks in simulation to optimize learning outcomes. SBTT has been conducted for decades, but in 2016, a new standard of best practice was introduced.

The International Nursing Association for Clinical Simulation and Learning (INACSL) published Standards of Best Practice: Simulation[SM] [20], an evidence-based framework to guide important areas in simulation. It reinforces simulation as a state-of-the-science teaching and learning strategy that may improve the conduct of simulations, learning outcomes, and compliance for clinical healthcare personnel. We chose the INACSL Standard as an evaluation tool for the simulation-based team training (SBTT) because it stands as an essential framework and a core proficiency of simulation education [21].

Concurrently with the advancement of simulation science, the standard is continuously evolved [20, 22, 23] and a guide simplifies the implementation [21].

For this study, we hypothesized that anesthesia personnel largely follow the INACSL 2016. The INACSL covers eight areas: design, outcomes and objectives, facilitation, debriefing, participant evaluation, professional integrity, simulation-enhanced interprofessional education, and a simulation glossary. Based on earlier research and theory [24–28], the four areas outcomes and objectives, facilitation, debriefing, and participant evaluation are the core areas in simulation and therefore selected for this study. The result of this study will show on a national level, which is unique, to which extent anesthesia personnel follows recommended frameworks in simulation in order to optimize learning outcomes and contribute to close this gap in the literature.

The aim of the study was to explore how anesthesia personnel in Norway conducts simulation-based team training (SBTT) of non-technical skills (NTS) with respect

Table 1 Descriptions of samples and settings

	Number (n=51)	%
Hospitals represented:		
Non-university hospitals	42	82
University hospitals	9	18
Participant health personnel:		
Nurse anaesthetists	46	90
Anaesthesiologists	2	4
Nurses other specialists	3	6
Location for training:		
In situ only	21	41
Simulation centre only	1	2
Both (in situ and simulation centre)	29	57

to four of these: outcome and objectives, facilitation, debriefing, and participant evaluation.

Methods

Design

We used a qualitative descriptive study design, based on individual interviews with one key person at each hospital, to explore their experience with SBTT and the four areas of the framework. The use of both closed and open-ended questions gave the participants the opportunity to illuminate the various facets of SBTT in a complete way [29].

Sample and setting

Altogether, 54 Norwegian public hospitals were approached through simulation networks and other professional networks [30] and one participant from each hospital was selected based on his/her experience and responsibility for anesthesia personnel's SBTT and answered the questions on behalf of them. The participants were nurse anesthetists, anesthesiologists, and registered nurses. A total of 51 public hospitals participated in the study. Two non-university hospitals and one affiliated with a university hospital chose not to participate. The participating hospitals represented different locations of SBTT (Table 1).

Data collection

A semi-structured interview guide based on closed and open-ended questions (see Additional file 1) was prepared to address the aim of the study. The open-ended questions were specially designed to gather new knowledge [29]. Two pilot interviews were conducted to validate the interview guide; as a result, a question was added regarding the transfer of learning from simulation to clinical practice. The interview guide was sent to the participants in advance.

Data were collected by individual telephone interviews conducted by the first author (ASF). All participants were asked the same questions, and follow-up questions were used to encourage the participants to deepen or clarify their responses. The median interview length was 35 min (range 20–52 min). The first author conducted all the interviews from August 2016 to October 2017.

Data analyses

A qualitative deductive content analysis based on Elo and Kyngäs [31] was used to deepen the understanding of the

anesthesia personnel's experiences with the conduct of SBTT. Data were analyzed according to the INACSL framework [20] focusing on the four areas; outcomes and objectives, facilitating, debriefing, and participant evaluation (see Additional file 2). The deductive analysis was organized according to three phases: preparation, organizing, and reporting [31]. In the preparation phase, the first author (ASF) transcribed the interviews and read through them several times to gain familiarity with the text and to understand the content and categorize the participants' statements [32, 33]. The interviews were analyzed one by one. In the organizing phase, the authors (ASF, RB, CAB, and IA) established a structured analysis matrix designed in relation to the four areas [20]. The first author (ASF) reviewed the transcripts, the highlighted text was coded using the predetermined areas, and aspects that fit into the matrix were chosen (Table 2). The first author (ASF), with professional guidance from the three authors RB, CAB, and IA, completed the coding and analysis, together with viewpoints from TW and LGR. There were no discrepancies between the authors. In the reporting phase, the authors (ASF, RB, CAB, and IA) agreed on which citations to be used to supplement the text, to illustrate the four areas [31]. The analysis was done in original language and four authors (ASF, RB, CAB, and IA) approved the translation. The results are reported according to the COREQ Checklist [34]
(Additional file 3).

Results

The summarized data based on the closed questions are presented in Table 3. A description of the qualitative data according to outcomes and objectives, facilitation, debriefing, and participant evaluation follows.

Outcomes and objectives

A total of 73 percent (n=37) of the participants used objectives including NTS (Table 3). They focused above all on teamwork and collaboration, as one said:

Table 2 Codebook examples from the qualitative deductive content analysis

Outcomes and Objectives	Facilitation	Debriefing	Participant Evaluation
The main focus was communication and cooperation (4.2.1. C).	Flexibility and experience were mentioned as important (7.6.9. A).	How the debriefing was conducted could be up to the facilitator (16.8.1).	Verbal evaluation was conducted (3.9.1).
Sometimes the focus was on team work, the work itself, planning, or decisions (5.2.1. C).	It was important to make a system (7.6.11. A).	The limited time allowed could be a challenge (8.8.2).	The evaluation was not so structured (22.9.1.A).
Too many objectives could not be handled at the same time (36.2.1).	Facilitators should maintain facilitation skills (11.6.4. D).	Facilitators were good at organizing the debriefing (21.8.3).	A questionnaire was also used (1.9.2).
			It was difficult to measure the effect (2.9.3).

> Distinctive communication—that is what it mostly boils down to... (No. 28)

Leadership, decision making, problem-solving, and situational awareness were also highlighted and 98% (n= 50) had technical skills as objectives, for example, managing difficult airways. Their purpose was to enable the team to handle the situation to know what to do, where to acquire information from, where medical equipment is located, and who does what. As one mentioned:

> ...they should be able to act without panic... (No. 42)

Some were more concerned with the conduct of the scenario, but still discussed what to focus on:

> It [the objectives] can be read between the lines, to put it in a way. (No. 43)

One mentioned that their colleagues wanted to achieve too many objectives in the same scenario:

> It is like someone is too eager to train us in everything. I mean, when there are 30 training items, I don't think it will be a good training. (No. 36)

The team members' preparedness was highlighted as an important pedagogical aspect, and one of the success factors within the simulations:

> ... make it predictable, planned, provide information ahead of time and the exact information about what to practice, not exactly the setting, but all the information about the subject. (No. 12)

Facilitation

The results showed that 61% (n=31) of the participants used educated facilitators. Some sent personnel to a facilitator course, and others invited external instructors to conduct these courses locally in the hospital. It was pointed out as a paradox that institutions would send personnel to expensive courses yet not have the capability to use this resource afterwards because, for example, the same personnel was too busy running the clinics.

Four percent (n=2) had support from a simulation center or a trauma center to make the pedagogical arrangements for the team training. Several mentioned the trauma-team training and treatment as structured and established, with experienced facilitators.

Elements and attitudes that were mentioned as important were the following:

...flexibility ...experience...you can perform in spite of all distractions; ...a system is incredibly important...you must manage to have the required patience. (No. 7)

Table 3 Summarized data based on the closed questions

		No. of hospitals (n = 51)	%
Outcomes and objectives:			
Use NTS as objectives	Yes	37	73
	No	14	28
Use technical skills as objectives	Yes	50	98
	No	1	2
Facilitation:			
Educated facilitator[1] (including BEST[2])		18	35
Instructor course (ALS[3], TNCC[4], ATLS[5])		17	33
Both facilitator and instructor		13	26
External facilitator (from a simulation centre)		2	4
No facilitator		1	2
Debriefing:			
Debriefing conducted		51	100
Debrief template used	Yes	40	78
	No	8	16
	Missing	3	6
Participant evaluation:			
Evaluation conducted	Yes	41	80
	No	6	12
	Don't know /missing	4	8
Compliance (subjective evaluation from the participants)	Yes	42	82
	No	0	0
	Don't know /missing	9	18
Planned simulation cancelled	Often	7	14
	Seldom	44	86

1 Educated facilitators were defined as having participated in a course equivalent to the EuSim simulation instructor course level 1 [41], or been trained as a BEST instructor [42]

2 BEST Better and Systematic Team Training, [3] ALS Advanced Life Support, [4]TNCC Trauma Nursing Core Course, [5]ATLS Advanced Trauma Life Support

Debriefing

The result was 100% (n=51) conducted debriefings, and they regarded facilitators as essential, as one expressed:

> Educated facilitators are good at going through those questions, following the template... (No. 21)

A total of 78% (n=40) used a debriefing template, but some simplified the content after a while. Others used objectives or guidelines from BEST or the Norwegian Resuscitation Council as a debriefing template. Just 16% (n=8) used no template. One put it this way:

> ...we try to do the debriefing in a way that reflects the objectives; sometimes we lose the thread, but we try to catch up on the initial plan... (No. 4)

Lack of time was a challenge. Some prioritized debriefing. Others conducted a very short debriefing standing in the corridor. Video recording was sometimes used to save time: ...then we don′t take the time to make the round, because everyone has watched it on the screen, so that is an advantage... (No. 7)

Team members were given the opportunity to talk before the video was played back. Some thought using video was too technically inconvenient. Observers and patient-actors gave valuable feedback and some used a specialist (e.g., a consultant) to make comments on medical issues. Team members were encouraged to describe their own views of the scenario.

Participant evaluation

A total of 80% (n=41) completed a participant evaluation, which usually was formative and unstructured (often an oral conversation). Some used a formative structured evaluation (a report or a questionnaire). As one commented:

> We ask the participants about their technical and non-technical skills before...and ...after the course day...We see whether competence has developed during the day...Mostly we describe how well we think it has worked. (No. 1)

Observers could be useful in the evaluation process, but no structure or framework was reported. As much as 82 percent (n=42) said they could observe (subjectively) a connection between the simulation and behavior in a real situation afterwards; this could include more specific messages from team leaders and improved teamwork. Some expressed the following thoughts:

> I saw that he [a simulation trainee] was very calm and very clear in what to do next and so on, so then I saw the effect... (No. 29); ...when someone [a colleague] has been away from the hospital, comes back [after the training] and tells us...we haven′t seen this before, what has happened? (No. 12)

Participants also described their own experience:

> I′m aware of it myself as well, that I perform better and know what my options are. (No. 46)

Feedback from other departments and professions was expressed like this:

> ...there has been positive feedback from other medical staff: air ambulance and hospitals we admit patients to. (No. 31) I know that air ambulance teams prefer to come to our hospital with seriously injured patients, because things work well. (No. 28)

Discussion

The aim of the study was to explore how anesthesia personnel in Norway conduct SBTT of NTS with respect to four areas [20]: outcomes and objectives, facilitation, debriefing, and participant evaluation. By following these recommendations, it is supposed to transform learning outcomes [20] (Fig. 1). All four topics were addressed, but to different degrees.

Outcomes and objectives

Most participants reported the use of objectives, including NTS (Table 3). Nevertheless, 14 participants reported not using NTS as objectives, although some decided what to focus on. The INACSL framework recommends determining which objectives the participants should focus on in advance [20]. Not deciding outcomes and objectives in advance could result in failure to attain the intended quality and safety standards [20]. Despite the extensive use of objectives, improvement is needed in order to achieve the expected outcome for SBTT. Determining objectives in advance based on identified needs is recommended in the INACSL standard, as realism and fidelity alone do not necessarily produce more learning [1, 20]. In our view, the standard is of great importance in guiding facilitators and team members working with objectives to reach expected outcomes. Some of the objectives may not lead to improvement, as the real challenge could be something else

(e.g., culture), which can be addressed using a process called system probing [8]. In situ simulation was common (Table 1) and revealed workplace-specific challenges (e.g., the location of equipment). Revealing these challenges could be crucial for clinical work and further SBTT, especially system probing.

Including too many objectives was considered problematic. Interdisciplinary collaboration where other professions want their own specific objectives in addition to the team-specific objectives is common. According to the INACSL, limiting the number of objectives is essential for success [20].

Participants also mentioned preparedness as a success factor. An interdisciplinary, unannounced in situ simulation study reported that 33% of participants experienced stress and unpleasantness [35], while a cardiac-arrest simulation study reported positive reactions from participants to unannounced in situ SBTT, as it better represented actual behavior [36]. No significant difference between unannounced and announced in situ simulations was reported in an emergency department [37]. One solution is that team members in SBTT could be informed about a planned simulation without being given information about when it will be performed. Realistic actual behavior could then be included as a training element [36].

Predictability and well-designed objectives based on needs seem to be success factors and crucial to achieve expected outcomes.

Facilitation

A team member-centered facilitative approach is recommended, guided by the objectives, team members' experience, and expected simulation training outcomes. Facilitators with formal training in simulation-based pedagogy are required to lead team members through SBTT [20], by giving instructions, feedback, and soliciting reflections, often called debriefing [25]. More than half the hospitals used educated facilitators. Some used external crew to support the local facilitator or instructor. Participants in our study reported frustration as the facilitators' ordinary clinical work competed with the SBTT. Thus, implementation of simulation training with the intention of achieving expected outcomes requires both access to facilitators and additional clinical resources [20].

Participants pointed out trauma-team training as structured and established, with experienced instructors. A high frequency of this type of training could be a reason for this [38]. Facilitator experience is a prerequisite for flexibility and systematizing. To acquire sufficient experience and the recommended updating of their competence [20], the facilitators are dependent on managers' priorities.

The use of a consistent facilitative approach to achieve intervention fidelity is recommended [20], and it is necessary to use skilled educators, for example, in the debriefing, to close performance gaps [1]. Participants in the study reported using a shortened and simplified debriefing template. This was explained by the limited time available, lack of updating, or infrequent simulation experience. SBTT with qualified facilitators is a way to achieve and maintain key competence among anesthesia personnel [1, 25].

Debriefing

The intent of debriefing is to help team members to understand what they thought, felt, and did during the simulation and reflect on what knowledge to transfer into clinical practice to improve future performance [26]. Everyone in the study conducted debriefings. This was expected since almost all hospitals used educated facilitators or instructors who know that debriefing is an essential element in simulation [20, 26, 27, 39].

Debriefing should be congruent with outcomes and objectives [20], and some participants reported using objectives as a debriefing template, in line with the INACSL. A template (e.g., with descriptive, analytic, and reflective phases) is used in facilitator courses and used in the debriefing practice together with the objectives and outcomes. When the time was limited, some shortened the debriefing template. The consequences of this may be that fewer learning outcomes and behavioral changes are achieved and that the debriefing is perceived as deficient [20]. In order to successfully achieve the desired outcomes, it is crucial to use an experienced facilitator, who could prioritize important debriefing elements, especially when time is limited.

A video was mentioned as a time-saving tool as video playback replaced participants describing the event.

A systematic review showed that video-assisted debriefing has benefits comparable to verbal debriefing for learning outcomes, including experience, attitude, and performance, but not knowledge acquisition [40]. INACSL recommends using video if appropriate during feedback. The video has also been shown to improve clinical performance when used in clinical debriefing [18]. In our results, most users of video used verbal debriefing, followed by a video presentation to illustrate important elements. However, it is important to avoid the technical inconvenience that disturbs concentrated attention during debriefing.

Participant evaluation

Most participants conducted a formative evaluation, such as an oral conversation, to develop the team members professionally and personally and reach the intended goals; however, very few used a summative evaluation, such as a questionnaire or rating scale, to measure the outcome of the single training.

Those omitting an evaluation could lose valuable support to individuals' progress and the assessment of results and outcomes [20]. Educated facilitators should be aware of the recommended evaluation elements and prioritize them. Simulations led by uneducated facilitators can result in a lack of support for team members' clinical competencies and further that gaps in knowledge and skills are not revealed [1, 20]. Those who did use structured evaluation with, e.g., a questionnaire could demonstrate that these issues were addressed during SBTT. Several observations of improved technical skills and NTS among anesthesia

Fig. 1 Four areas of INACSL that will facilitate the transformation of learning needs into learning outcomes

personnel were made. While observation frameworks were not mentioned, unstructured subjective observations regarding the SBTT were described. There is a need to document that SBTT results have a clinical impact [8]. The participants expressed the value of evaluating team members' behavior, but the structured performance of this evaluation according to the INACSL seems to be lacking. Observations, individuals' personal experiences, and feedback from other professionals showed the team members' satisfaction with the SBTT and learning transformation in the study. Kirkpatrick described four levels of learning: (1) reaction, (2) learning, (3) behavior, and (4) results [28]. In our study, the participants reported about levels 1 to 3. However, we received no reports on level 4.

This study has revealed that the four areas of INACSL are followed to varying degrees in anesthesia SBTT. By stricter adherence to these four areas of INACSL, which is continuously evolved [20, 22, 23], we believe that anesthesia personnel can improve the transformation of learning needs into learning outcomes (Fig. 1). The framework is comprehensive, but could provide an awakening in addition to simplifying the implementation [21].

Limitations of the study

The study is limited to one country. The participants mainly consisted of nurse anesthetists. This is due to the hospitals' selection of contacts; finding healthcare professionals with the most extensive experience and responsibility for anesthesia SBTT.

A greater proportion of anesthesiologists could have given the study a broader perspective. Some participants could have been influenced by their previous involvement in SBTT and could have had more than one perspective, for example, if they had been both a facilitator and a member of a clinical team using SBTT.

With a survey, we could have included more hospitals and countries in our study. However, we chose interviews instead of a survey, as interviews give us a deeper understanding of the responses.

Of eight INACSL 2016 areas, the four most relevant areas were chosen with respect to the aim of the study, and to limit the study volume.

Future perspectives

Further research is needed to assess SBTT with respect to other frameworks. Future studies are needed to examine whether a stricter adherence to INACSL guidelines improves learning outcomes based on learning needs.

Conclusion

SBTT for anesthesia personnel in Norway meets the INACSL Standard of Best Practice: Simulation[SM] framework in relation to outcomes and objectives, facilitation, debriefing, and participant evaluation to a certain extent. NTS were the main objectives used and are important to achieve the aim of SBTT and thereby achieve simulation quality standards. More than half the hospitals used educated facilitators, but they needed more frequent simulation training. Everyone conducted debriefings, but an improved use of the template is necessary to achieve expected outcomes. Most accomplished participant evaluations, which could be more structured and summative. Further research is needed in order to document any improvement in clinical results following increased adherence to INACSL during SBTT in anesthesia.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41077-021-00186-w.

Additional file 1. Interview guide.
Additional file 2. INACSL frameworks – four areas.
Additional file 3. COREQ Checklist.

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Authors' contributions

ASF, RB, CB, and IA designed the study protocol. TW contributed to the interview guide. ASF and CB contributed to the study planning and conduction. ASF, nurse anesthetist/educated facilitator, conducted and transcribed the interviews. ASF, RB, CB, and IA accomplished the thematic analysis. TW and LR contributed with viewpoints. The authors contributed to the text revision and approved the final manuscript.

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Availability of data and materials

The study data and material are not available to anyone other than the authors, due to the participants' consent agreement and the confidentiality policy.

Declarations

Ethics approval and consent to participate

The study was submitted to the Regional Ethics Committee (REK) (2016/642), who evaluated the study to be outside REK's mandate. The study was approved by the local Institutional Data Protection Officer (DPO), Oslo University Hospital (18/17582), and accepted by the department head in every participating hospital. An invitation and information were given to all participants in written form and included the confidentiality policy. The participants could withdraw at any time and with no explanation. All the participants gave their written consent by mail to participate.

Consent for publication

The authors grant their consent for publication.

Competing interests

CAB is employed by the Regional Competence Centre for Acute Medicine in Western Norway (RAKOS), with financial support from the Norwegian Directorate of Health. He has participated in Global Resuscitation Alliance meetings sponsored by the Laerdal Foundation for Acute Medicine, TrygFonden, and EMS2018. The other authors declare that they have no competing interests.

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Publisher's Note

Paper II

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RESEARCH

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In situ simulation-based team training and its significance for transfer of learning to clinical practice—A qualitative focus group interview study of anaesthesia personnel

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Abstract

Background Anaesthesia personnel are an integral part of an interprofessional operating room-team; hence, teambased training in non-technical skills (NTS) are important in preventing adverse events. Quite a few studies have been done on interprofessional in situ simulation-based team training (SBTT). However, research on anaesthesia personnel's experiences and the significance for transfer of learning to clinical practice is limited. The aim of this study is to explore anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and its significance for transfer of learning to clinical practice.

Methods Follow-up focus group interviews with anaesthesia personnel, who had taken part in interprofessional in situ SBTT were conducted. A qualitative inductive content analysis was performed.

Results Anaesthesia personnel experienced that interprofessional in situ SBTT motivated transfer of learning and provided the opportunity to be aware of own practice regarding NTS and teamwork. One main category, 'interprofessional in situ SBTT as a contributor to enhance anaesthesia practice' and three generic categories, 'interprofessional in situ SBTT motivates learning and improves NTS', 'realism in SBTT is important for learning outcome', and 'SBTT increases the awareness of teamwork' illustrated their experiences.

Conclusions Participants in the interprofessional in situ SBTT gained experiences in coping with emotions and demanding situations, which could be significant for transfer of learning essential for clinical practice. Herein communication and decision-making were highlighted as important learning objectives. Furthermore, participants emphasized the importance of realism and fidelity and debriefing in the learning design.

Keywords Anaesthesia, Interprofessional, In situ simulation-based team training, Non-technical skills, Patient safety

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Background

Adverse events in hospitals are challenging. Adverse events may arise from healthcare teams' insufficient nontechnical skills (NTS) [1] and cause intraoperative errors, adverse patient outcomes, and even mortality [2]. Therefore, effective teamwork focusing on NTS is crucial to prevent these occurrences [3]. Integrating patient safety competencies, including NTS pertaining to teamwork and communication in continuing professional development, which emphasize interprofessional learning, could be critical [4]. Simulation-based team training (SBTT) prepares interprofessional teams to successfully manage challenging situations and prevent patient injuries [5].

According to the Healthcare Simulation Dictionary [6] simulation is 'a technic that creates a situation or environment to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions'. Furthermore, in situ simulation is 'taking place in the actual patient care setting/environment in an effort to achieve a high level of fidelity and realism' [6]. In situ training is particularly suitable for difficult work environments and is valuable to assess, troubleshoot, or develop new system processes [6], and provides a familiar, safe and possibly time effective training [7]. According to Sørensen et al. in situ simulation may also lead to organisational learning [8] where the healthcare personnel put their learning into effect when returning to clinical practice. Kirkpatrick's four levels of evaluation model can be used to describe the level of learning outcome and is a widely used framework to measure the outcome of SBTT in healthcare [9] The four levels cover: Level 1 – healthcare personnel's reaction, what they thought and felt about the training; Level 2 – healthcare personnel's learning, the resulting increase in knowledge or capability; Level 3 – healthcare personnel's behaviour – extent of behavioural changes in the professional setting, i.e., transfer of learning to the clinical setting; and Level 4 – results – the effect of healthcare professional actions, i.e., improved patient outcomes. Multiple levels are possible within a single study [10].

Human factor focused SBTT is introduced in healthcare by Gaba et al. [11], and anaesthesia personnel were the first to implement this training [12, 13]. 'Human factors refer to environmental, organisational and job factors, and human and individual characteristics, which influence behaviour at work in a way which can affect health and safety' [14]. Abildgren et al.'s systematic review [15] refers to several studies finding 'that adverse events often occurs in non-routine, complex environments due to interactions between humans and the systems in which they work', and that NTS are a limited part of these aspects [15]. Anaesthesia personnel work with an interprofessional team in the operating room and have a crucial role ensuring patient care and safety e.g. resolving airway complications to prevent adverse events [16–18]. NTS include the cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance [19]. Flin et al. (2008) describes seven basic NTS important for safe and efficient performance in high-risk settings: situation awareness, decision-making, communication, teamwork, leadership, and the management of stress and fatigue. Among anaesthesia personnel, these skills are regarded as essential for safe clinical practice [17, 20, 21].

Goldshtein et al.'s systematic review [22] reports that in situ SBTT has a positive effect on patient outcomes including reducing mortality and morbidity. Standardised in situ simulation mock codes have increased survival after in-hospital cardiopulmonary arrest [23]. According to Kurup et al., in situ simulation training allows teams to review their own practice and may be cost-effective; however, further assessment of its effectiveness on clinical outcomes is needed [24]. Lorello et al. report inconsistent outcomes after SBTT regarding anaesthesia personnel's satisfaction, knowledge, skills, and behaviour in a systematic review and meta-analysis [25]. Improved team performance, cultural attitudes, and communication among anaesthesiologists and obstetricians [26], trauma teams [27], and neonatal resuscitation [28] after SBTT are reported. LeBlanc et al. show in a narrative review of literature, the potential role of emotions during simulation-based education. Positive emotions increase cognitive flexibility, while negative emotions decrease the ability to form associations between events. This may be crucial for learning and problem-solving skills [29]. Bearman et al. highlight the usefulness of fallibility as a part of professional practice; hence, self-reflection in simulationbased education provides an opportunity to introspect and learn from failures [30]. Debriefing is a key element in simulation [31], which provides the opportunity to reflect on NTS, such as the importance of 'speaking up'. Lemke et al. assess experienced anaesthesia personnel's speaking up behaviours and its consequent reactions during anaesthesia induction and describe on the complexity of speaking up and its importance for patient safety [32].

However, exploring the transfer of learning from simulation to clinical practice remains uncertain [33]. A recent systematic review concludes that research on the retention and transfer of human factor skills from SBTT to clinical practice is insufficient and further research is essential to gain knowledge of its effect on patient safety [15]. In our study we primarily focus on the application of learning captured by Kirkpatrick's Level 1, what the anaesthesia personnel's thought and felt about the SBTT,

e.g. which emphasizes it's relevance for their clinical practice, Level 2, what they describe as increase in knowledge or intellectual capability from before to after the training, and Level 3, transfer of learning to clinical practice.

To our knowledge, there are no studies on anaesthesia personnel's experience of interprofessional in situ SBTT of NTS and its significance for transfer of learning to clinical practice. This qualitative study based on followup interviews during a six-month period will provide indepth knowledge which might contribute to strengthen the anaesthesia personnel continuing improvement with a goal for professional development and a safer practice.

The aim of this study is to explore anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and its significance for transfer of learning to clinical practice.

The research questions are:

1) How do nurse anaesthetists and anaesthesiologists experience the in situ SBTT in NTS two weeks and six months after the training?
2) How do nurse anaesthetists and anaesthesiologists experience the significance for transfer of learning of NTS to clinical practice two weeks and six months after the training?

Methods

Design

This qualitative descriptive study design [34] was based on focus group interviews, two weeks and six months after SBTT. Using focus groups give the opportunity to acquire viewpoints of several respondents in a short period of time. We expected the method, emphasizing group interaction and discussions, to give us rich and deep expressions of various experiences, opinions, and informative data [35].

Setting and sample

In a Norwegian university hospital's surgical department with 60 nurse anaesthetists and 22 anaesthesiologists employed, performing emergency caesarean sections as well as other operations, an interprofessional in situ SBTT was ongoing. Our study included five training sessions implemented during 17 weeks throughout the autumn of 2018 where a total of 14 anaesthesia personnel (ten nurse anaesthetists and four anaesthesiologists) participated. Anaesthesia personnel who participated were asked to attend focus group interviews two weeks after the training (interview 1) to get their experience close to the SBTT, and six months later (interview 2) to get their experience after having returned to clinical practice for a while. All fourteen anaesthesia personnel accepted to participate. Participants' characteristics (gender, age, and years of experience with SBTT) are presented in Table 1.

The interprofessional in situ SBTT programme

An interprofessional in situ SBTT programme was developed via the collaboration between the obstetrics, anaesthesia, and surgical departments in a university hospital. The SBTT planning group comprised representatives from each profession and an educated facilitator (ASF) for the pedagogical aspect [36]. The SBTT programme was based on the Simulation Setting Model by Peter Dieckmann [37, 38]. The model contains seven prototypical phases that can be modified in order and number according to the actual training programme [38] (Table 2 presents the modified model used in this study).

The duration of the interprofessional in situ SBTT programme was 17 weeks during the autumn of 2018. The on-duty surgical team (nine professionals: two obstetricians, one midwife, one paediatric nurse, two operation nurses, two nurse anaesthetists, and one anaesthesiologist) were recruited to the SBTT, and the scenario was an emergency caesarean section (Table 3 describes the scenario in detail).

A midwife acted as the simulated patient. In the introduction phase, a few days before the SBTT, the participants were provided an information sheet regarding medical simulation and NTS (Table 2). The SBBT sessions (each lasting one hour) (Tables 2, 3) were conducted according with the department's schedule. The briefing session included presentation of the facilitator and the observers (one representative from each profession in the planning group). The participants' previous experience with simulation training were registered, and information according to in situ environments in the operating room,

Table 1 Characteristics of the participants (n = 14)

Background	Subgroup	Mean (median)	N (%)
Professions	Nurse anaesthetist		10 (71.4)
	Anaesthesiologist		4 (28.6)
Age			
	29–39 years	44.5 (43)	5 (35.7)
	40–49 years		4 (28.6)
	50–61 years		5 (35.7)

Gender	Female	7 (50)	3–5 times	5
	Male	7 (50)	5–10 times	4
Prior experience with SBTT	Yes	14 (100.0)	> 10 times	2
	1–2 times	3		

Table 2 The present study's simulation-based team training programme phases. Adapted from Dieckmann, P. [37]

1	Introduction Theory Inputs	The participants received an information sheet before the SBTT with theory inputs regarding medical simulation and NTS
2	Simulation and Scenario Briefing	The participants received information about the simulation environment, equipment, simulated patient safety, confidentiality, learning objectives, and the scenario
3	Scenario – Simulation Number 1	The participants were enacting a scenario case, which formed the basis of the first debriefing
4	Debriefing	The participants attended a structured professional and interprofessional discussion of the scenario actions
5	Scenario – Simulation Number 2	The participants were enacting the scenario case for a second time, which formed the basis of the second debriefing and evaluation
6	Debriefing	The participants attended a structured professional and interprofessional discussion of the scenario actions for a second time
7	Ending/Evaluation	The participants took part in a summary and evaluation session of their satisfaction with the SBTT

Table 3 In situ SBTT programme's learning objectives and simulation scenario

SBTT learning objectives	• Shared responsibilities • Communicate clearly and concisely • Awareness of the situation • Make effective reports • Achieve acceptable response time • Performing correct medical treatment
SBTT scenario	A 36-year-old in first-time pregnancy close to term arrived at the maternity ward. Normal pregnancy, except gestational diabetes, control a week ago showed the foetus at the 90th percentile. The mother's body mass index (BMI) was 40 at start of pregnancy. Labour proceeding normally. Normal Cardiotocography (CTG). Continuous monitoring. Epidural labour anaesthesia. Oxytocin infusion. No progression during the last 30 min. Now foetal bradycardia, (pulse 80). On-call obstetrician is notified. Emergency caesarean section calling is activated. During transport from the maternity ward to the operation room, the mother is anxious, crying, in pain, and has tachycardia and high blood pressure

e.g. equipment, simulated patient, fidelity, participants' opportunity, were given. Learning objectives, based on experiences done by the planning group, were presented, with an opportunity to ask questions. The learning objectives covering the needs for anaesthesia personnel as key team members in an interprofessional surgical team in ensuring patient care and safety (Table 3 describes the chosen learning objectives). The scenarios were performed with the facilitator (ASF) and observers discretely positioned in the operation room. The facilitator (ASF) conducted debriefing including descriptive, analytic and reflective phases [31] and the observers provided feedback and professional support. A second debriefing ended with a summary and evaluation (Tables 2, 3).

Data collection

A semi-structured interview guide based on open-ended questions (Additional file 1) was used. The questions were specifically designed to gain knowledge on the various facets of the interprofessional in situ SBTT and provided the participants with the opportunity to holistically comprehend its advantage in clinical practice [39]. The interview guide was validated via a pilot interview and no changes were made. The open-ended questions pertained to the anaesthesia personnel's experiences of SBTT and transfer of learning to clinical practice, including usefulness, transferability, outcome, implementation, challenge, and benefit (see interview guide in Additional file 1).

Data were collected via focus group interviews two weeks (interview 1), and six months (interview 2) after the SBTT programme during the period from September 2018 to November 2019. The benefits for generating data at two time points, was to get a longitudinal perspective of knowledge sustainability of transfer of learning to clinical practice. Five focus groups consisted of both professions (nurse anaesthetist and anaesthesiologist) and two focus groups consisted of one profession (nurse anaesthetists) with two to five participants in each group. The participants were allocated to focus groups according to their clinical shifts and availability. A total of 14 anaesthesia personnel participated in interview 1 (four focus groups) and a total of 11 anaesthesia personnel participated in interview 2 (three focus groups), the remaining participants were not available. Due to time available and clinical shifts, new constellations were inevitable. The anaesthesia personnel in interview 2 also participated in interview 1 (Table 4).

The interview duration was approximately one hour. The moderator (ASF) and observer (RB), who made field notes, conducted all the interviews. The moderator (ASF) presented an introduction of the study and led the discussions. A summary of data from the interview was read aloud by the observer (RB) and was confirmed by the participants in each focus group. The interviews were audiorecorded, transcribed verbatim, and anonymised before analysis by the moderator. Data saturation was assessed to be sufficient according to information power [40].

Data analyses

A qualitative manifest and inductive content analysis, based on Elo and Kyngäs' method [41], was used to gain insights into anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and transfer of learning to clinical practice.

The analysis was structured into three phases: preparing, organising, and reporting [41]. In the preparing phase, the first author (ASF) transcribed the interviews and all authors (ASF, IA, CAB, and RB) read the interviews several times to gain familiarity with the text and understand the content of the participants' statements [41]; subsequently, the interviews were individually analysed. In the organising phase, all the authors participated throughout the analysis process to identify codes. Data was split into smaller data extract and labelled with a code which seemed to be relevant and meaningful considering the study aim. Based on similarities and differences, the codes were sorted into sub-categories, which were interpreted and, finally, aggregated into broader generic categories and finally a main category, after discussions among the authors.

The analysis generated one main and three generic categories, and seven sub-categories.

In the reporting phase, an overview of the abstrac-

Table 4 Participants in the focus groups

Interview 1: 2 weeks after SBTT (September 2018)		
Focus group	**Nurse Anaesthetist (n)**	**Anaesthesiologist (n)**
1 (*n* = 3)	2	1
2 (*n* = 3)	1	2
	3	0
3 (*n* = 3)	4	1
4 (*n* = 5)		

Interview 2: 6 months after SBTT (February 2019)		
Focus group	Nurse Anaesthetist (n)	Anaesthesiologist (n)
5 (*n* = 4)	2	2
6 (*n* = 2)	2	0
7 (*n* = 5)	4	1

Table 5 An overview of generation of categories

Sub-category	Generic category	Main category
• Provides the team an experience of coping	➢ Interprofessional in situ SBTT motivates learning and improves NTS	Interprofessional in situ SBTT as a contributor to enhance anaesthesia practice
• Enables improvement of NTS for clinical practice		
• Facilitates informative professional and interprofessional discussions		
• Provides the opportunity to be aware of own practice	➢ Realism in SBTT is important for learning outcome	
• Use of a simulated patient may increase or decrease realism		
• Helps clarify the roles in the interprofessional team		
• Precise communication contributes to clarity	➢ SBTT increases the awareness of teamwork	

tion process with the generation of categories was made (Table 5) and the results were described using the content of the sub-categories. The authors agreed on the citations to supplement the text.

The analysis was performed in the original Norwegian language and the authors approved the translation. The results are reported according to the COREQ Checklist [42] (Additional file 2).

Results

The main category 'Interprofessional in situ SBTT as a contributor to enhance anaesthesia practice' describes anaesthesia personnel's experience of the SBTT and its significance for transfer of learning to improve NTS in clinical practice. The selected quotes are used to illustrate results [43]. The main category was generated from three generic and seven sub-categories (Table 5).

Interprofessional in situ SBTT motivates learning and improves NTS

This generic category pertains to the participants' experience of the in situ SBTT as a facilitator for coping, learning, and improvement, with a view to clinical practice. This category has three sub-categories: 'provides the team an experience of coping', 'enables improvement of NTS for clinical practice', and 'facilitates informative professional and interprofessional discussions'. ***Provides the team an experience of coping***

The participants described in situ SBTT as a programme facilitating learning and training, including detecting failure. With regard to significance for transfer of learning, they stated that diverted attention affected situation awareness. Greater concentration on their own tasks, such as electronic documentation, affected the attention regarding the patient and surgical team.

Uncertainty and demanding technical skills were challenges that resulted in stress, 'an unsteady hand', and 'weird actions' (mental process) and was reported as important elements for simulation training. Mumbling and confusion in the first scenario were interpreted as uncertainty.

> *When you are unsure of the situation, then you become reserved. (No. 2.2).*

Some participants disliked being observed, and not performing as expected, led to negative emotions. After six months, some participants did not suppress the disappointment resulting from a bad performance in the first scenario. They suggested that the fear of failure and the 'feeling of being tested' influenced their performance; however, the second scenario was an opportunity to correct earlier mistakes and provided an experience of coping. Some expressed after two weeks:

> *Without the second scenario, I would probably gone home with a bad feeling of not coping with this teamwork in a real situation... (2.3) It is important to get the feeling of team coping. (2.2)*

The participants perceived the training as informative, and the learning was prominent after their mistakes. ***Enables improvement of NTS for clinical practice*** Most of the participants had the opinion that the SBTT was positive, instructive, and useful with regard to significance for transfer of learning to similar emergencies in clinical practice. As one said after two weeks:

It is better to make mistakes during the simulation training, better to be watched when almost doing something wrong, than actually doing it three weeks later (in clinical practice). (No.3.1).

Six months later, some participants experienced transfer of learning according to better NTS in clinical practice, e.g. get acquainted with the surgical team, while others stated that the knowledge had declined. Frequency and participation from everyone (in the team) were considered to be the keys to success. One expressed:

If it takes a year before next simulation training, then I can't say it has any effect on my behaviour in clinical practice (No.7.3) … it is fresh produce (No.5.3).

When some participants experienced transferred learning of NTS in clinical practice, it inspired others to adopt them, e.g., closed loop communication.

The participants suggested including more theoretical knowledge prior to SBTT to be better prepared for learning. The scenario, an emergency caesarean section, was considered emotionally dramatic, which may improve recall. However, one participant said: *The more complex the scenario is, the more you focus on your own team [anaesthesia team]. (No.4.5)*

The participants stated that in a simpler scenario, it could be easier to open up, communicate, and observe everyone in the surgical team.

Facilitates informative professional and interprofessional discussions

The participants stated that debriefing provides the opportunity to discuss the scenario-case performance and speak up in a structured way.

They suggested allocating more time to reflect on details, which would increase the learning outcome. They had less time during the second debriefing because they had to return to work immediately. After two weeks, one participant said:

> *The most relevant discussion is here [in the interview] … (No.4.2)*

In clinical practice, debriefing was usually related to serious cases and personnel had an opportunity to reflect on their performance. They emphasised that debriefing with interprofessional discussions, both in SBTT and as significance for transfer of learning to clinical practice, improved their behaviour. There was a need for the anaesthesia team to have a short debriefing according to their specific tasks, with regard to transfer of learning. Some participants considered this to be of no interest for the others, while others disagreed. One said:

> *To find the key to good collaboration in team, you*
>
> *have to know what is important for the other professions in your team. (No.4.4)*

Realism in SBTT is important for learning outcome In a longitudinal perspective (two weeks and six months after SBTT), this generic category pertains to the importance of realism in SBTT to provoke emotions, manage stressful situations, disclose practical challenges, and conduct patient treatment, with a view to transfer of learning to clinical practice.

This category has two sub-categories: ''provides the opportunity to be aware of own practice'' and ''use of a simulated patient may increase or decrease realism''.

Provides the opportunity to be aware of own practice

The participants experienced interprofessional in situ SBTT as an opportunity to reflect on and change their own clinical practice, such as replacing equipment and managing stress. Participants were aware of emotions in the scenarios, and after two weeks and six months respectively, they explained:

> *…simulation can initiate so many physical and psychological processes in the body, like actually being there. (No.1.2) In a successful simulation scenario, you can feel an increased pulse rate… (No. 7.1)*

Participants suggested a need for realism and frequency to obtain a type of muscle memory, which could release more energy for mental work in clinical practice. Some reported that the SBTT situation was similar to an earlier clinical experience, for example time pressure. They meant that it was significant for transfer of learning in managing frustration and stress in an interprofessional team in clinical practice.

Use of a simulated patient may increase or decrease realism

The participants appreciated a simulated patient; however, some found visualising a full-term pregnant patient with physical problems difficult, when the simulated patient was 'small and thin'. As two participants said:

> *It was a bit disturbing with a simulated patient with a pillow on her stomach – you are not in real life anymore (No. 2.3) …forgot that it was an obese patient (No. 7.3).*

They could lose the 'feeling of thinking twice' before inducing general anaesthesia. Others said that SBTT requires imagination to some extent, and it depends on the ability to visualise.

On the other hand, one said:

> *In simulation you easily focus on what to do, to do*

a good job, ...perhaps mainly on technical issues, not to make mistakes, ...so you can end up with the opposite, that you forget the patient because you are so occupied with what to do… (No. 6.2).

A short break ('time-out') to clarify misunderstandings was conducted during the SBTT and was considered as significant for transfer of learning to be applied in clinical practice.

According to the participants, the simulated patient perceived the anaesthesia personnel's treatment as rougher when the situation became more intense and serious; however, she felt safer, calmer, and more cared for in the second scenario. The participants considered this as significant for transfer of learning, to clinical practice.

SBTT increases the awareness of teamwork

This generic category pertains to the professions and their roles in the surgical team, and the positive and challenging communication situation, regarding transfer of learning to clinical teamwork.

This category has two sub-categories: 'helps clarify the roles in the interprofessional team' and 'precise communication contributes to clarity'.

Helps clarify the roles in the interprofessional team

After two weeks and six months the participants reflected on the interprofessional team and emphasized that the SBTT learning was transferred to different clinical team settings. Awareness of each person's role and action in SBTT was experienced as significant for transfer of learning and made teamwork easier in clinical practice. The surgical team was described as containing three smaller teams: the anaesthesia, gynaecologic, and operating nurse teams. Though the surgical team leader was the gynaecologist, this seemed to be unclear for most participants ahead of the training. The participants stated that it was easier to be attentive and act when the team leader was identified, and he or she spoke 'loud and clear'. The team leader was expected to comprehend the situation and encourage good communication. Therefore, teamwork apparently depended on the persons in the team. An example:

In the scenario, the midwife took some space, and she was the one who communicated with the patient … and gave good instructions too, then I thought she should be allowed to keep on doing that and not being interrupted by another one (me) … (No. 2.2).

Despite having different personnel in anaesthesia teams, both in clinical practice and SBTT, the participants experienced a similarity in the team situation and a feeling of safety. During combined training programmes, depending on the frequency, they stated that they become better acquainted, with a view to transfer of learning. Depending on the learning objectives, the participants suggested separate training for the anaesthesia team, even though the interprofessional teamwork was crucial regarding clinical practice.

Precise communication contributes to clarity

The participants emphasized teamwork communication and the necessity of the team leader to 'think aloud' to enable the team members to plan and execute their own actions and provide feedback. The participants reported disagreements between team members' opinion of good or bad communication; precise communication could have solved a critical situation that occurred in the SBTT. Several participants experienced improved communications in the second scenario, which could be crucial for transfer of learning to clinical settings. One anaesthesiologist said:

In the second scenario, the gynaecologist on-call gave specific messages to me and understood the point, so that helped a lot. (No. 2.1).

The participants described that the noise in the simulated operating room varied from highly disturbing to low and inaudible, which could be essential for nervous patients. In an unsettled surgical team situation (with a lot of noise) in the clinic, for example when an alarm was aroused, the nurse anaesthetist could choose to pay attention to only the anaesthesiologist. The need for time-out to clarify misunderstandings in SBTT was highlighted as significant for transfer of learning. The participants perceived the second scenario as less noisy, and they focused more on 'whom and what to listen to' and 'which messages to give'. The team leader took more control and spoke clearly. The participants described the communication within the anaesthesia team as good, and they said respectively after two weeks and six months:

When there are messages, about what to do, then you get things done, which could relieve some available time for communication with the patient to calm down and increase safety. (No. 2.2) The use of closed loop communication improves awareness and is a good recall for information already present. (No. 5.3)

Being aware of the roles and how the communication went on, was experienced as significant for transfer of learning to clinical practice.

Discussion

We aimed to explore anaesthesia personnel's experience from interprofessional in situ SBTT in NTS and its significance for transfer of learning to clinical practice. The exploration was conducted in a longitudinal perspective (two weeks and six months after SBTT) to achieve information richness [40]. The results revealed interprofessional in situ SBTT as a contributor to enhance anaesthesia practice. SBTT creates motivation for learning and improvement of NTS, where realism is important for learning outcome and SBTT also increases the awareness of teamwork. The point of time for interviews is mentioned when relevant.

Interprofessional in situ SBTT motivates learning and improves NTS

The anaesthesia personnel who participated in the study experienced the dramatic scenario similar to cases in actual clinical practice with emotional involvement; thus, it was easy to remember, and hence highly relevant for transfer of learning. Emergency-based scenarios are relevant for SBTT [3], in this context interprofessional in situ SBTT. Le Blanc et al. proclaimed though, that knowledge of a situation may be inferior in high stress rather than in low stress scenarios [29]. The participants in our study stated that a less dramatic scenario could have focused their attention more on NTS, such as communication and teamwork, with the opportunity for transfer of learning. However, simulating a less dramatic emergency caesarean section, which is in reality dramatic, is challenging. Being observed was unpleasant for the participants, although a recent study reported observation, both in actual situations and during in situ training, as a useful way of learning; this was dependent on the facilitator's skills [7]. Emotions are essential in decision-making [29, 44]. The participants described a reserved behaviour and 'an unsteady hand' in unsure clinical situations, in accordance with the influence of negative emotions on situation awareness [29]. Some of the participants mentioned the disappointment, the negative emotion, even after six months. This could happen after clinical experiences as well, which indicates the need for debriefings both in SBTT and clinical practice [45]. Planned and announced simulations, and well-known safe environments, like in our study, could be crucial for learning [7, 8, 25, 46, 47]; hence, this SBTT programme focused on managing challenging clinical situations.

The first scenario performance had resulted in a feeling of failure; however, the first debriefing and second scenario (similar to the first scenario) afforded an opportunity to get a sense of coping, which was confirmed by the participants, in line with Bearman et al.'s 'learning from self-reflection', and Jirativanont et al.'s 'self-assessment of NTS [30, 48]. This experience of coping could be significant for transfer of learning in clinical practice, e.g. in decision-making, where, as mentioned, emotions are essential [29]. A randomised controlled trial has suggested that stress management training improves performance in demanding situations and reduces long-term stress-related effects, such as sleep disorders and burnout [49].The participants requested realistic and frequent SBTT to obtain muscle memory [50]; this may provide more energy for mental work and provide an opportunity for improving NTS, which in turn would be advantageous in demanding situations such as emergencies in clinical practice. This requires frequent in situ SBTT, which may be a challenge for management to prioritize. SBTT reduces stress and promotes team coping strategies, which is beneficial in clinical practice for the personnel, and contributes to patient safety [49]. Implementing this knowledge in clinical practice may be challenging [51]; however, the participants encountered colleagues who inspired others with NTS and this could be a contribution to implementation.

The participants indicated that the post-SBTT discussion (in the interviews) was most relevant, confirming a need for increasing the SBTT debriefing time. Debriefing, an essential element in simulation, facilitates informative professional and interprofessional discussions [31], and according to the participants, it provides the opportunity to speak up, and may disclose crucial human factors [14]. Although lack of time was reported, debriefing is a key to successful SBTT [52]. Time constraints in clinical practice could be a challenge for the facilitator since each phase is time-consuming. Timing and planning are key factors in implementing in situ SBTT [51], and the participants emphasized the presence of an educated facilitator who could use his or her competence for time management. Although there was a need for more internal discussions within the anaesthesia team, the participants highlighted the necessity of interprofessional insight to improve the teamwork, in line with Gittell et al.'s 'improving healthcare through relationships' [53]. The one-hour duration of the SBTT may not be adequate to accommodate both interprofessional and anaesthesia team and a follow-up debriefing immediately after SBTT may be required for optimal transfer of learning to clinical practice. The participants considered debriefing both in in situ SBTT and clinical practice as essential. Debriefing in SBTT, could be used as training for debriefing in actual clinical practice

and encourage its use in the clinical practice. It requires an observant department manager and an educated facilitator [51], among others, and can lead to system improvements [54].

What the anaesthesia personnel thought and felt about the relevance of in situ SBTT itself and their experiences of the possibility for transfer of learning, may be linked to their experience of learning at Kirkpatrick levels one, two and three [10].

Realism in SBTT is important for learning outcome In situ simulation provides realism and the opportunity to be aware of one's own practice. The participants experienced physical and psychological changes during in situ training. Sørensen et al. suggest that the choice of setting for simulations does not seem to influence individual and team learning, but that in situ simulation could gain organisational learning [8]. This could reveal workplace-specific challenges, such as equipment, guidelines, culture, and communication systems or something unexpected; this is known as system probing. Awareness of these challenges could be crucial for further SBTT and significant for transfer of learning to clinical practice [55, 56]. Emotions may be an advantage or a disadvantage, as mentioned; therefore, being aware of emotional effects and opportunities could be a valuable contribution to the culture of learning. Emphasising psychological safety could result in more open and honest communication and prevent failures in teamwork and potential threats to patient safety in clinical practice [57].

The participants welcomed a simulated patient; the midwife, who displayed great sensitivity to the situation. However, her body mass index was not comparable to the simulated patient's body mass index, which was an important factor in the scenario aimed at managing the demanding situation. They (participants) also claimed that visualization is important in simulation training and depends on the participant's imagination to some extent. High-fidelity simulations could enhance learning outcome, but little is known about the correlation between fidelity and learning [58]. According to Sørensen et al. the semantic and motivational context could be more important than physical fidelity [8]. Nevertheless, the participants reported fidelity as a crucial prerequisite for simulation-based problem-solving and learning outcome, regarding significance for transfer of learning to clinical practice.

Training in a realistic and safe environment, a characteristic of SBTT [25], was appreciated by the participants. Adverse events have occurred during in situ simulation training; hence, there is a need to develop a simulation safety policy. The difference between simulated and actual practice could sometimes be unclear [59]. According to the participants, the simulated patient in our study reported less cordial treatment when the situation became intense. This could both be a case for debrief discussion and significant for transfer of learning to clinical practice; however, it was an unpleasant experience for the simulated patient. The participants' sensitivity was sometimes overwhelming and may have harmed the simulated patient. An educated facilitator is required for enforcing strict guidelines, including emergency call systems, orientation to the environment, training equipment, and simulated patient care.

The participants experienced realism as significant for transfer of learning, which is in line with Kirkpatrick's level one and two [10].

SBTT increases the awareness of teamwork In situ SBTT could help in role clarification in the interprofessional team, as confirmed by the study participants. They became better acquainted during briefing, scenario, and debriefing, [38] resulting in an improved awareness, and they complemented one another in the team. This could be significant for transfer of learning to clinical practice. A shared understanding of each other's role could decrease the risk of making errors [8]. In the present study, the surgical team leader provided an opportunity for the team members to be more attentive and they responded when he or she spoke up. Precise communication and speaking up, which depended on the team members, was highlighted as a contribution to the clarity of team structure, and significant for transfer of learning to daily clinical practice. Lemke et al. describes the complexity of speaking up, e.g. the risk of unwanted answers and oblique hints [32]. This could be a reason why one team leader in our study did not speak up. A positive example from the in situ SBTT`s scenario – simulation number 2, where they were enacting the scenario case for a second time (Table 2), was the anaesthesiologist who received a specific message from the gynaecologist (team leader), which resulted in better communication. In this way the second scenario gave an opportunity for correction of potential misunderstandings, a risk factor for undesired events. This resulted in improved NTS among the team members and could be significant for transfer of learning to clinical practice.

The participants' experiences with increased awareness of teamwork may indicate increase in knowledge and capability, in line with Kirkpatrick's level two of learning outcome [10].

This study has some limitations, which may have influenced the results. Although the entire surgical team participated in the in situ SBTT, only the anaesthesia personnel were asked to participate in focus group interviews. Due to time available and clinical shifts, not every anaesthesia personnel who took part in interview 1 participated in interview 2. One focus group had two participants, three groups had three participants and remainder had four to five participants, and the limited number of participants in the focus group size may have influenced the results. Although a small group also provide important discussions related to the topic. The literature recommends 4–12 informants, but claims that quality of the data is more important than the quantity. Every voice counts, and small groups could be more comfortable according to speaking up, but it depends on the moderator (interviewer), who plays a critical role for the success [35, 40, 41, 60, 61].

Two professions participated in the same focus groups, which could impact the results due to e.g. hierarchical ranking. The fact that the first author is a nurse anaesthetist and both facilitated the in situ simulation and conducted the focus group interviews may have influenced the results.

Conclusion

Anaesthesia personnel gained considerable experience from the interprofessional in situ SBTT in NTS, which could be significant for transfer of learning essential for clinical practice. This included the role of emotions in coping with demanding situations, importance of good communication within the interprofessional team, including a defined team leader, the importance of realism and fidelity, which is crucial for decision-making. In conjunction with interprofessional discussions in SBTT debriefing and professional discussions in interviews two weeks and six months after SBTT, this led to awareness of their own clinical practice, with possible significance for transfer of learning. However, the participants requested a higher frequency of SBTT and more debriefing time both in SBTT and in clinical practice. The study's results, which seem to be in line with level one, two and three in Kirkpatrick's evaluation model [10], may help in improving the organisation of in situ SBTT, draw attention to significance for transfer of learning to clinical practice and contribute to avoiding adverse events and prevent patient injuries.

Further research with observing and rating of anaesthesia personnel's' NTS in clinical practice before and after SBTT could be a valuable contribution to study transfer of learning to clinical practice. Further research is needed to explore the entire surgical team's experience to gain a broader perspective of in situ SBTT, and to what degree it transfers into clinical practice.

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Abbreviations

NTS N on-technical skills SBTT
S imulation-based team training

Supplementary Information

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Additional file 1. Interview guide.

Additional file 2. COREQ(COnsolidated criteria for REporting Qualitative research) Checklist.

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Authors' contributions

All authors (ASF, IA, CAB, and RB) designed the study protocol. ASF conducted the interviews along with RB. ASF transcribed the interviews. All the authors contributed to drafting the manuscript and critically revised it for intellectual content. All the authors read and approved the final manuscript.

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Availability of data and materials

The study data and material cannot be made publicly available due to the participants' consent agreement and the confidentiality policy. Parts of the dataset (in Norwegian language) can be made available upon request to the corresponding author if the local Institutional Data Protection Office of the respective hospital permits.

Declarations

Ethics approval and consent to participate

The study protocols were reviewed by The Committee for Medical and Health
Research Ethics of South-East Norway (2016/642) and approved by the local Institutional Data Protection Officer (DPO), Oslo University Hospital, Norway (18/17582), and accepted by the department head in the participating hospital. The study was found outside the mandate of the Regional Ethics

Committee. An invitation and information about the study were given to all participants in written and verbal form and included the confidentiality policy. The participants could withdraw at any time and with no explanation until collected data were included in analysis or used in scientific publications. All the participants provided their written informed consent. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication Not
Applicable.

Competing interests
CAB is employed by the Regional Competence Centre for Acute Medicine in Western Norway (RAKOS), with financial support from the Norwegian Directorate of Health. He has participated in Global Resuscitation Alliance meetings sponsored by the Laerdal Foundation for Acute Medicine, TrygFonden, and EMS2018. The other authors declare that they have no competing interests.

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Publisher's Note

Paper III

Assessment of anaesthesia team's non-technical skills in clinical practice before and after simulation-based team training - A quasi-experimental study

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