

Doctoral thesis

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Tore Karlsen

LEARNING TEAMWORK IS NOT AN EVENT; IT'S A JOURNEY

IMPLEMENTING THE TEAMSTEPS® TEAM TRAINING PROGRAM IN BACHELOR OF NURSING EDUCATION TO ENHANCE PATIENT SAFETY

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
Faculty of Medicine and Health Sciences (MH)
Department of Health Sciences in Gjøvik



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Science and Technology

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Gjøvik, November 2022

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Avhandlingens tittel på norsk:

Å lære teamarbeid er en reise.

Implementering av TeamSTEPS® team trenings programmet i en bachelor i sykepleie utdanning for å fremme pasient sikkerhet.

Kort og beskrivende populærvitenskapelig tittel (på norsk):

Lære teamarbeid i sykepleieutdanningen for å fremme pasientsikkerhet

Sammendraget:

Tema for avhandlingen

Avhandlingen handler om at helsetjenesten blir stadig mer spesialisert og kompleks. Helsepersonell tilbyr sine tjenester ved å jobbe i team. Bedre teamarbeid og kommunikasjon kan virke positivt inn på å redusere forekomst av uønskede hendelser og øke pasientsikkerheten. Å jobbe i team må også læres, men team trening er i liten grad en del av utdanningen.

Metode

I avhandlingen som bygger på tre studier er det blitt benyttet både kvantitativ og kvalitativ metode.

I studie 1 ble et spørreskjema om holdninger til teamarbeid (T-TAQ) testet ut om det ga gyldige og holdbare svar når det ble brukt ovenfor sykepleiestudenter (n = 509).

I studie 2 og 3 ble et kunnskapsbasert teamtrenings program integrert i alle relevante emner for et kull av sykepleiestudenter i en periode på 26 måneder. Holdninger til teamarbeid ble målt tre ganger hos to grupper sykepleiestudenter. Studentene startet samtidig på to ulike studiesteder og holdninger til teamarbeid ble målt ved oppstart, etter 10 måneder og 24 måneder. En gruppe fikk team trening og en gruppe fikk ikke TeamSTEPS team trening integrert i utdanningen. Totalt 295 studenter svarte på spørreskjemaet en eller flere ganger (studie 2).

I studie 3 deltok et utvalg studenter (n= 22) i seks fokusgruppeintervjuer og beskrev hvordan de opplevde team treningen og det å bruke teamarbeids ferdigheter i praksis.

Resultater

Den norske versjonen av spørreskjemaet T-TAQ har potensialet til å gi gyldige og holdbare svar når det brukes til å måle sykepleiestudenters holdninger til teamarbeid. Studenter som fikk team trening viste tydelige positive endringer i holdninger til teamarbeid. Studenter erfarte teamtreningen som kompleks og teoretisk i starten. Etter hvert ga team treningen økt bevissthet om at når lærte teamarbeids-ferdigheter ble brukt i praksis fremmet det opplevelsen av å være et medlem av teamet, læring i praksis og pasientsikkerhet.

Navn kandidat: Tore Karlsen

Institutt for Helsevitenskap i Gjøvik

Veiledere: Marie-Louise Hall-Lord, Sigrid Wangensteen og Randi Ballangrud.

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Abstract

Aim: The overall aim of the thesis was to implement a longitudinal team training intervention in bachelor of nursing education and describe students' reactions to team training, explore changes in their attitudes toward teamwork, and describe how they experienced teamwork skills in practice.

Methods: This thesis is based on three studies, using quantitative and qualitative methods. Study I investigated the validity and reliability of the Norwegian version of the Teamwork Attitudes Questionnaire (T-TAQ) when used in a sample of nursing students ($n = 509$). Data were analyzed via confirmatory factor analysis (CFA) (I). In study II and III a team training intervention was conducted in a cohort of nursing students over 26 months. In Study II, attitudes to teamwork were measured using the T-TAQ at baseline (T0) and after the passage of 10 months (T1) and 24 months (T2) in the intervention and control groups. A total of 295 students participated. Data were analyzed using inferential and descriptive statistics (II). In Study III, students' team training experiences and their use of teamwork skills in practice were examined via focus group interviews ($n = 22$). Data were analyzed via inductive content analysis (III).

Main results: The Norwegian version of the T-TAQ has some potential to display reliable and valid answers when used in a sample of nursing students (I). Nursing students who participated in the team training showed significantly positive attitudinal changes with regard to teamwork (II). Students initially experienced team training as complex and theoretical, but team training gradually increased their awareness that the practical application of teamwork skills facilitates the sense of being a team member, while also enhancing learning and patient safety in clinical practice (III).

Conclusion: It is recommended that the Norwegian version of the T-TAQ be considered unidimensional when used in a sample of nursing students. Team training positively affects students' attitudes toward teamwork. However, grasping the principles of teamwork and the relevance of team training requires repeated training. The use of teamwork skills enhances students' experiences of belonging to a team, enhance learning and patient safety in clinical placements. Team training should be an integrated part of the bachelor of nursing program to enhance patient safety.

Norsk sammendrag

Hensikt: Avhandlingens overordnede hensikt var å implementere et team trenings program i en bachelor i sykepleie utdanning og beskrive studentenes reaksjoner på å delta i team treningen, utforske i hvilken grad team trening førte til endring i studentenes holdninger til teamarbeid, samt beskrive deres erfaringer med bruk av teamarbeids ferdigheter i praksis.

Metode: Avhandlingen bygger på tre studier hvor kvalitativ og kvantitativ metode ble benyttet. Studie I undersøkte i hvilken grad den norske versjonen av Teamwork Attitudes Questionnaire (T-TAQ) hadde en gyldig struktur og ga pålitelige svar når det ble brukt i et utvalg av sykepleiestudenter (n = 509). Data ble analysert ved hjelp av bekreftende faktor analyse (CFA) (I). I studie II og III ble en teamtrenings intervensjon gjennomført for et kull av sykepleiestudenter i en periode på 26 måneder. I studie II ble holdninger til teamarbeid målt ved hjelp av T-TAQ før oppstart (T0), etter ti måneder (T1) og 24 måneder (T2) i en intervensjonsgruppe og i en kontrollgruppe. Totalt 295 studenter deltok. Data ble analysert med bruk av beskrivende og hypotesetestende statistikk (II). I studie III ble sykepleiestudenters erfaringer med team treningen og bruk av teamarbeids ferdigheter i praksis undersøkt ved hjelp av seks fokusgruppe intervjuer (n = 22), og analysert ved hjelp av induktive innholdsanalyse (III).

Resultat: Den norske versjonen av T-TAQ har noe potensiale til å vise pålitelige og gyldige svar når det brukes ovenfor sykepleiestudenter (I). Studenter som fikk team trening viste tydelige positive endringer i holdninger til teamarbeid. Studenter erfarte teamtreningen som kompleks og teoretisk i starten. Etter hvert ga team treningen økt bevissthet om at bruk av teamarbeids ferdigheter i praksis fremmet opplevelsen av å være et team medlem, fremmet læring og pasientsikkerhet i praksis (III).

Konklusjon: Den norske versjonen av T-TAQ anbefales å anse som et en-dimensjonalt spørreskjema når den brukes ovenfor sykepleiestudenter. Team trening bidrar til positive endringer i holdninger til teamarbeid hos sykepleiestudenter. Det å lære teamarbeid er ikke en enkeltstående hendelse, det krever læring over tid. Bruk av teamarbeidsferdigheter øker studentenes opplevelse av å høre til et team, forbedrer

læring og pasientsikkerheten i klinisk praksis. Team trening bør være en integrert del av en bachelor i sykepleie utdanning for å fremme pasientsikkerhet.

Navn kandidat: Tore Karlsen

Institutt: Helsevitenskap, Gjøvik

Veiledere: Marie-Louise Hall-Lord, Sigrid Wangensteen og Randi Ballangrud.

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I would also like to express my gratitude to the faculty members who have integrated the TeamSTEPPS® skills into their courses, skills training, simulation scenarios, and reflection sessions during clinical placements, as these educators are on the frontline in direct contact with the students, and it is they who significantly impact students' experience of teamwork as a legitimate aspect of safe and qualitative nursing care. I am also grateful to all the colleagues and students who contributed to making the TeamSTEPPS® demonstration videos. A special thank you is due to Jon Victor Haugom for his contribution as a TeamSTEPPS® video actor and his talent at facilitating simulated scenarios and students' online reflection hours in the fifth semester.

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Abbreviations

AHRQ	Agency for Health Research and Quality
ECTS	European Credit Transfer and Accumulation System (approx. 25–28 study hours per credit)
ISBAR	Identification–Situation–Background–Analyze–Recommendations
IPASS	Illness–Patient summary–Action list–Situation awareness–Synthesis by the receiver
TeamSTEPPS®	Team Strategies and Tools to Enhance Performance and Patient Safety
T-TAQ	TeamSTEPPS® Teamwork Attitudes Questionnaire
TPOT	TeamSTEPPS® Team Performance Observation Tool
WHO	World Health Organization

Original papers

This thesis is based on three papers (I–III), which will be referred to by their Roman numerals

Paper I

Karlsen, T., Hall-Lord, M. L., Wangensteen, S., & Ballangrud, R. (2020). Reliability and structural validity of the Norwegian version of the TeamSTEPPS Teamwork Attitudes Questionnaire: A cross-sectional study among Bachelor of Nursing students. *Nursing Open*, *n/a*(*n/a*). <https://doi.org/https://doi.org/10.1002/nop2.671>

Paper II

Karlsen, T., Hall Lord, M. K. M.-L., Wangensteen, S., & Ballangrud, R. (2021). Bachelor of nursing students' attitudes toward teamwork in healthcare: The impact of implementing a TeamSTEPPS® team training program — A longitudinal, quasi-experimental study. *Nurse Education Today*.
<https://doi.org/http://dx.doi.org10.1016/j.nedt.2021.105180>

Paper III

Karlsen, T., Hall Lord, M. K. M.-L., Wangensteen, S., & Ballangrud, R. Bachelor of Nursing students' experiences of a longitudinal TeamSTEPPS® team training program and the use of teamwork skills in clinical practice. A qualitative explorative study (submitted).

1.0 Introduction

This thesis concerns implementing a team training program in bachelor of nursing education to enhance patient safety, in line with the WHO patient safety curriculum guide, which is recommended for integration into all education programs for health care professionals (WHO, 2011). Core competencies of patient safety include eight topics, among which the fourth topic is being an effective team player (WHO, 2011).

Teamwork and communication are also among six competencies to ensure quality care and patient safety in the education of health professionals in the United States (Knebel & Greiner, 2003). Bachelor of nursing education in Norway follows regulations set by the European Union (EU) under Directive 2005/36/EC (2005) and requires 3 years of full-time study (180 ECTS credits). EU regulations require nursing students in all affiliated countries “to not only learn how to work in a team, but also how to lead a team and organize overall nursing care” (2005, p. 41). When this research project started in 2017, the patient safety issue was not a construct in the national nursing education guidelines. However, the guidelines required educational institutions to arrange for six ECTS credits across communication, cooperation, and conflict management (Norwegian Ministry of Education and Research, 2008).

According to the WHO (2021), patient safety issues should be emphasized in the education of health care professionals. However, despite the policy published in the multi-professional patient safety curriculum guide, the representation of patient safety issues in existing curricula has been limited, as “the challenge is not in creating policies; it is in their implementation” (WHO, 2021, p. 49). The Norwegian national plan for patient safety and quality improvement emphasizes that educational institutions must contribute by implementing patient safety knowledge at all levels of health care education (Norwegian Directorate of Health, 2018). Moreover, the national nursing education guidelines, implemented in 2020, include learning outcomes for leadership, quality, and patient safety (Norwegian Ministry of Education and Research, 2019).

This thesis focuses on how team training may improve teamwork skills to enhance patient safety. Team training contributes to effective teamwork that enhances patient safety and saves patients’ lives (Hughes et al., 2016). Teamwork skills do not emerge automatically; they must be learned and trained and should therefore be a part of health

care professionals' education (White paper nr. 7, 2019-2020; White paper Nr. 13, 2012). Team training has been implemented to a limited extent in bachelor of nursing programs in Norway (Aase et al., 2013).

This thesis was motivated by the fact that health care is provided by teams within a complex system, coupled with the understanding that although teamwork is essential to mitigate patient safety issues (Rosen et al., 2018), bachelor of nursing education include team training to a limited extent.

My interest in team training and teamwork is grounded in a long career as an intensive care nurse and a postgraduate intensive care nursing education lecturer. I have experienced how good leadership, clear communication, and clear role assignment improve the care of patients with complex needs, as well as how poor teamwork hampers care. My personal experience working in health care teams inspired me to pursue this Ph.D. scholarship.

2.0 Background

This chapter will introduce the background and rationale for the thesis. Central constructs will be introduced, such as patient safety, teamwork, and team training. Moreover, previous research on the integration of a team training program in bachelor of nursing education.

2.1 Patient safety

Patient safety is recently defined by WHO as “*a framework of organized activities that creates cultures, processes, procedures, behaviors, 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*” (WHO, 2021, p. 1).

The above definition is much broader than the WHO definition from 2009, which was “*the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum*” (2009, p. 22). This change suggests recognition of the complexity of health care system to reducing unnecessary harm and adverse events involving patients during the provision of health care.

According to Vincent and Amalberti (2016), patient safety initially focused on relatively rare and often tragic events. The significant reports *To err is human: Building a Safer Health System* (Kohn et al., 1999) and *Crossing the Quality Chasm* (Institute of Medicine, 2001) published by the Institute of Medicine in the United States of America promoted patient safety as an issue to be addressed in all aspects of patient care. These reports are considered the most considerable driving forces for patient safety work and research the last 20 years (Aase, 2022). Most patients are vulnerable to some degree to adverse drug events, hospital acquired infections, falls, and surgical complications (Vincent & Amalberti, 2016). Moreover, patient safety concerns scenarios where older, frail patients may experience over-treatment, polypharmacy, delirium, dehydration, or malnutrition and may suffer poor outcomes due to health care professionals’ failure to recognize deterioration and failure to institute treatment (Vincent & Amalberti, 2016). Nurses comprise one of the largest professional health care workforces and are involved

in scenarios like those mentioned above at all levels of health care; therefore, bachelor of nursing education must make students aware of and prepared to encounter such scenarios. The education and training of health care professionals are vital tools to address the challenges involved in improving patient safety (WHO, 2021).

Hollnagel et al. (2015) pointed out that patient safety initially focused on identifying failures and malfunctions and pinpointing their causes to either eliminate them or ameliorate them by improving barriers. This approach to patient safety is called Safety I and is a reactive approach based on responding to something that has gone wrong or that has been identified as a risk (Hollnagel et al., 2015). However, most health care activities and settings are complex, unpredictable, unstable, and hard to manage via the simplistic means Safety I strategies offer (Braithwaite et al., 2015). Recognition of this fact led to a new, proactive approach to safety, in which nurses and other health care professionals on the frontline of care adjust their practices to suit local contexts, demands, and cultural characteristics. This new safety mindset was introduced as resilient health care or Safety II (Mannion & Braithwaite, 2017). A resilient system gives health care providers the ability to succeed despite conditions that could easily lead to failure and allows the system to recover quickly and safely after failure. A system is resilient if it can *“adjust its functioning before, during, or following events (changes, disturbances, or opportunities) and thereby sustain required operations under both expected and unexpected conditions”* (Hollnagel et al., 2015, p. 38). A team's resilience may be described as its collective capacity to addressing problems quickly and effectively, to meet changing demands and stressful situations and the team's ability to recover to previous levels (Chapman et al., 2020). This new approach assumes that systems work because people can adjust their actions to match the work conditions (Hollnagel et al., 2015). Conversely, those who demonstrate a fixed mindset can threaten patient safety (Kvalnes, 2017). The resilient health care approach to safety focuses more on conditions where people succeed rather than fail, in addition to—rather than instead of—looking at why things go wrong (Mannion & Braithwaite, 2017). Braithwaite et al. (2015) noted that all actions have the same starting point, regardless of whether they have a positive or negative outcome, and safety should be measured by how often everyday work goes well rather than how often it fails. This shift toward

measuring patient safety proactively and productively rather than reactively and protectively starts with changing team members' mindset (Braithwaite et al., 2015). Hence, this knowledge must be included in nurses' and other health care professionals' education to raise their awareness of what mitigates versus enhances patient safety risks in patient care.

Norway's national program I trygge hender 24-7 has put patient safety on the agenda in municipal health services and hospital settings (Norwegian Directorate of Health, 2022). It began as a campaign that measured adverse events in hospitals and supported leaders and frontline staff with tools to measure the quality of selected topics where patient safety was at risk. Additionally, the program has, from the outset, promoted the Safety II mindset by focusing on establishing a patient safety culture and psychological safety and encouraging a learning system where leaders and teams discuss improvement (Norwegian Directorate of Health, 2022). This work was inspired by a framework for safe, reliable, and effective care, published by the Institute of Healthcare Improvement (Frankel A et al., 2017).

The complexity of health care, backdropped by the aging population, the increasing number of people living with complex chronic disorders, and the rapid development of technology, treatment methods, and drugs, requires that health care professionals work as a team to ensure quality care and patient safety (Rosen et al., 2018; White paper nr. 11, 2018-2019). The new national nursing education regulations state that nursing education aims to prepare candidates to achieve both competence in the provision of quality care and improvement to reduce adverse events and ensure patient participation. Therefore, professional leadership, quality, and patient safety are among the six core competencies to be learned through bachelor of nursing education (Norwegian Ministry of Education and Research, 2019 Chapter 5). Additionally, health care's complexity and dynamism require that nursing students be trained to work in teams. Human fallibility persists despite good intentions and may threaten patient safety (Kvalnes, 2017). Improved teamwork may offer a degree of protection against human fallibility that leads to adverse events and patient injuries. Section 2.2 explains the construct of teamwork.

2.2 Teamwork

Teamwork can be described 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). It refers to contextual, cultural, and dynamic interpersonal interaction between people (Weaver et al., 2017). Teamwork is an integrated component of health care today (Frush & Salas, 2012). Teamwork’s connection to patient safety and quality of care is acknowledged globally across health care policy (WHO, 2018), including national health care policy (Norwegian Directorate of Health, 2018; White paper nr. 7, 2019-2020) and health care education policy (White paper Nr. 13, 2012; WHO, 2011). In their future jobs, bachelor of nursing students will need to work in teams to care for patients at all levels of health care, from specialized hospital units to municipal and private health care institutions and home-based care (White paper nr. 7, 2019-2020; White paper Nr. 13, 2012).

Teamwork impacts patient safety issues (Rosen et al., 2018), for instance through poor communication regarding medication names, dosage, expected delivery, timing, and other issues related to medication administration (Syyrilä et al., 2021). Hierarchical work structures can inhibit team members from speaking up when patient safety is at risk (Peadon et al., 2020). In particular, the team leader’s role impacts patient outcomes (Husebø & Akerjordet, 2016) and the knowledge derived from patient safety events (Künzle et al., 2010). Incomplete, delayed, or neglected nursing care may be related to poor teamwork and communication (Chaboyer et al., 2021). Rapid response teams in hospitals reduce the risk of cardiac arrest and mortality, while the use of surgical safety checklists reduces the risk of surgical site infections and mortality (Zegers et al., 2016). A surgical safety checklist aims to raise situational awareness and create a mutual mental model for the team.

A *team* consists of two or more individuals with different tasks who work together, are adaptable, and share a common goal (Brannick & Prince, 2009, p. 4). Team members include anyone involved in patient care who takes action, has a clearly defined role and clear responsibilities, and is accountable to the team for their actions (AHRQ, 2019a). An effective team is one where team members, including the patient, communicate with one another, combining their observations, expertise, and decision-making

responsibilities to optimize care (Knebel & Greiner, 2003). One key objective of health professionals' teamwork is the increased ability to achieve a common goal by working together rather than individually. Individuals may be members of multiple teams throughout a shift or workday; in fact, health care professionals rarely work as part of only one team, and teams often work in collaboration with other teams to provide health care (Markiewicz & West, 2011). Nurses work on teams of varying sizes, with other health care professionals, and within their own profession (Kalisch et al., 2009). Team *performance* is the sum of dynamic teamwork and taskwork behavior (Salas et al., 2007), where taskwork is associated with an individual's clinical competence to perform a task (Rosen et al., 2012). Institutions offering bachelor of nursing education are obliged to teach students nursing care and procedures based on evidence-based practice (White paper nr. 7, 2019-2020). Frush and Salas (2012) have asserted that the same rigor should be applied to team training and teamwork.

2.2.1 Core teamwork competencies in health care

Salas et al. (2005) presented a model of five core teamwork competencies required for effective and safe collaborative work; these researchers described the competencies as "the big five of teamwork." This framework will be examined in more detail, as it is the evidentiary foundation for the team training program presented in this thesis.

Salas et al. (2005) identified five competencies and three coordination mechanisms as necessary for effective teamwork. The five competencies are *team leadership* (1), *mutual performance monitoring* (2), *backup behavior* (3), *adaptability* (4), and *team orientation* (5). Team leadership is the ability to define a goal and coordinate, monitor, and delegate roles and tasks based on team members' experience and competence. The team leader should also encourage information sharing among all team members to create a shared mental model. Mutual performance monitoring is awareness of other team members' work to ensure procedural adherence. This competence initiates shared information, feedback, and backup behavior, entailing task assistance, supervision, feedback, and resource allocation to facilitate optimal team performance. Adaptability moves the team more effectively toward achieving its objectives and entails recognizing deviations from expected actions and readjusting accordingly. Team orientation is an attitudinal competence that facilitates task involvement, information sharing, strategies,

and goal setting within the team. Team orientation facilitates the other four competencies (Salas et al., 2005).

The three coordinating mechanisms are a *shared mental model*, *mutual trust*, and *closed-loop communication* (Salas et al., 2005). A shared mental model refers to sufficient shared understanding of situations that guides the team toward achieving its objectives. Mutual trust refers to the team members' common faith in themselves and their colleagues to perform tasks to the best of their ability, share information, admit insufficiency, and accept backup behavior and team leadership for the good of the team. Finally, closed-loop communication involves the sender initiating a message, the receiver receiving the message, interpreting it, and acknowledging receipt, and the sender following up to ensure the intended message was received (Salas et al., 2005).

Since Salas et al. introduced their theoretical framework, more frameworks have been developed to present competencies and principles that influence health care teams' ability to work effectively and ensure patient safety. For instance, Gregory et al. (2021) developed a framework for the perfect team and emphasized many of the same competencies as Salas et al. (2005). However, Gregory et al. (2021) differed in that they also emphasized the importance of psychological safety and conflict management. The essential outcome is team adaptation to increase patient safety.

2.3 Training teamwork in health care teams

As quality of teamwork influences patient safety and quality of care, team training impacts teamwork (Hughes et al., 2016; Weaver et al., 2014). *Team training* is a learning activity focusing on “*developing, refining, and reinforcing knowledge, skills, or attitudes that underlie effective teamwork behaviors*” (Weaver et al., 2014, p. 360). Traditionally, professionals were assumed to work in teams intuitively, but communication and collaboration failures have shown that teamwork skills must be learned and trained and that they require institutional support (Reeves et al., 2010). Team training was adopted in health care settings from high reliability organizations (HROs) outside health care, such as the military, the air force, nuclear power, and the oil industry (Baker et al., 2005; Reeves et al., 2010; Salas et al., 2005). The nature of health care tasks differs from tasks in other industries. Even when patients have the same diagnoses, every case is unique, requiring that health care professionals grapple

with a unique set of problems, as well as each patient's unique personal and social situation (Reeves et al., 2010).

Additionally, the patient's illness may be complex and may demand variability in the kind of teamwork needed (Reeves et al., 2010). Hence, teamwork skills and team training must be adjusted to suit the complexity of health care settings. This knowledge is essential for nursing students. Some students may have teamwork experiences from other professions or volunteer organizations. However, teamwork in health care may be more complex than students have experienced in other settings.

Team training may be offered to health care professionals and health care students separately or jointly or with a mix of the two groups. Teams may comprise a single profession or interprofessional members (Hughes et al., 2016). This thesis focuses on team training within the nursing profession, although clinical placements provide students with interprofessional teamwork experiences. Hughes et al. (2016) found that the effect of team training was unaltered by whether the team was interprofessional or within a single profession; it was also immaterial whether the trainees were students or health care professionals. Further, training may be carried out in different contexts and learning environments and may use multiple pedagogic approaches, and the outcome of team training can be measured at different levels (Hughes et al., 2016). It is vital to incorporate team training into health care professionals' education (Dow et al., 2013; Sherwood, 2017; White paper nr. 7, 2019-2020), and in the context of this research, bachelor of nursing students' education. Nursing education institutions in Europe (Kirwan et al., 2019) and the United States (Smith et al., 2007) have reported integrating the "being an effective team player" topic from the WHO (2011) patient safety curriculum guide. However, team training has only been implemented in the Norwegian bachelor of nursing curriculum to a limited extent (Aase et al., 2013). Section 2.3.1 reflects upon various pedagogic approaches chosen for team training in nursing education.

2.3.1 Pedagogic approaches to team training in nursing education

A pedagogic approach refers to how teachers facilitate students' learning. *Learning* may be described as "*a process that leads to change, which occurs due to experience and*

increases the potential for improved performance and future learning” (Ambrose et al., 2010, p. 3). Ambrose et al. (2010) emphasized that learning is a process, not a product. Learning involves a change in knowledge, behaviors, and/or attitudes and exerts a lasting impact on how students think and act; additionally, learning is not something done *to* students but rather a result of how students interpret and respond to their experiences. According to Dow et al. (2013), teamwork skills are taught most effectively through a sequence of learning activities, including classroom instruction, simulation training, feedback, and reflection in clinical settings. This is further emphasized in the team training program with which this thesis is concerned, as the use of various student-centered approaches is recommended, such as interactive lectures, workshops, demonstration videos, simulation training, and reflection groups (AHRQ, 2017a, 2019b).

The Institute of Medicine recommends using simulation in team training to improve teamwork skills and ultimately enhance patient safety, since “*To err is human*” (Kohn et al., 1999) was published. Simulation has become a widely used pedagogic technique in undergraduate nursing education to help students acquire cognitive, psychomotor, and teamwork skills (Cant & Cooper, 2017; Cantrell et al., 2017; Foster et al., 2019; Granheim et al., 2018). Simulation is a learning strategy that facilitates experimental learning and fosters critical thinking and clinical reasoning in a safe environment (Jeffries, 2021). Barton et al. (2018) pointed out that “*educators who use these constructivist methods create a perfect marriage between social learning about teamwork and potentially developing collective awareness and competence with it*” (Barton et al., 2018, p. 138).

Sociocultural learning approaches emphasize learning through social interaction involving people and artifacts (Husebø & Rysted, 2018). However, when team training is a simulation session learning outcome, multiple learning theories may be applied to the session’s planning and execution. A *behavioristic approach* to learning emphasizes a behavioral change where students’ correct behavior or communication is observed to determine whether the expected outcome has been achieved (Husebø & Rysted, 2018). A *cognitive approach* to learning through simulation focuses on activating prior knowledge in discussions during debriefing and workshops to solve new problems and

build upon existing knowledge and skills (Dieckmann & Ringsted, 2013). Team members must respond to environmental conditions, patients, and other team members' actions and input. Team cognition is vital to developing a shared mental model and affects how problems are solved, tasks are managed, and whether team members support each other (Weller, 2013). Finally, the cognitive theoretical approach emphasizes the thinking and common sense that constitute the source of learning and new knowledge (Dieckmann & Ringsted, 2013).

The learning theory that is applied may vary based on whether the student is a novice first-year student or near graduation and whether the learning outcome is basic or complex or cognitive, psychomotor, or teamwork-oriented (Dieckmann & Ringsted, 2013). Students learn from observing (O'Regan et al., 2016), cooperating with others, and engaging in cognitive processes stimulated by sharing observations, perceptions, and knowledge in guided discussions and reflections (Weller, 2013). However, the complexity of scenarios and team training challenges should not lead to cognitive overload (Van Merriënboer & Sweller, 2010). To mitigate cognitive overload, students must be prepared for simulation scenarios; this entails making learning material and learning outcomes available to students well in advance of the simulation and is called a pre-brief. Additionally, the complexity of the scenario and whether the student is a first-year or senior nursing student are factors that guide the learning outcome and the design of the scenario. Before the simulation starts, students should be briefed on the learning environment and the equipment available, as well as how it functions. Students may train in pairs of two or groups of three to cope with the skills to be learned, assist each other, give feedback, and observe each other. The commonalities of the simulation pedagogic when training teamwork are organizing a pre-brief, briefing, the scenario, and debriefing, with timely feedback to enhance learning (Diaz & Anderson, 2021; Dreifuerst et al., 2021; Kelly et al., 2019).

The safety I and II mindsets are well suited for implementation in patient simulation scenarios and clinical supervision in bachelor of nursing education. Debriefing is a forum for focusing on what the student/team should have done differently to improve care or what they overlooked that put the patient's safety at risk (safety I). Under the safety II mindset, students are encouraged to reflect on their actions as well as

individuals or teams that delivered safe, successful nursing care. The team training program implemented in this research project is described in the next section.

2.3.1 The TeamSTEPPS® team training program

The AHRQ approved the translation of the TeamSTEPPS® curriculum and learning material into Norwegian for use in education and research in 2014.

The TeamSTEPPS® team training program was chosen for its evidentiary foundation and unique learning material, implementation strategy, and measurement instruments (AHRQ, 2017a; King et al., 2008). The “big five of teamwork” framework served as the theoretical foundation when the AHRQ and the American Department of Defense (DoD) developed the TeamSTEPPS® team training program, which is specially designed to accommodate team training in health care settings (AHRQ, 2019a; King et al., 2008). TeamSTEPPS® focuses on specific skills supporting team performance, behavioral methods, human factors, and cultural change and is designed to improve quality of care and patient safety. The TeamSTEPPS® team training program emphasizes team structure and four teachable and learnable skills: *Communication*, *Leadership*, *Situation Monitoring*, and *Mutual Support*. These four skills are mutually supportive and equally crucial to effective and safe patient care (AHRQ, 2019a). There is an interrelationship between the four skills and the team’s knowledge, skills and attitudes (KSA’s). Using the four skills impacts knowledge by creating a shared awareness of the team’s activities and progress toward its goals. Team members will also become familiar with their teammates’ roles and responsibilities. Moreover, using the four skills is likely to promote positive attitudes to teamwork.

Team members are likely to have positive experiences, enjoy working in teams, and trust their team members’ intentions. Improved team performance is an outcome of using the four skills. The team will be able to adapt to changes in the care plan and work more effectively and safely due to their ability to readily identify and correct any errors that may occur (AHRQ, 2019a). Table 1 provides an overview of the key TeamSTEPPS® principles. In the following presentation of TeamSTEPPS®, strategies and skills are referred to when describing the team training program content.

Table 1. TeamSTEPPS® key principles

Team structure	Identification of the components of a multi-team system in which teams must work together effectively to ensure patient safety
Communication	The structured process by which information is clearly and accurately exchanged among team members
Leadership	The ability to maximize team members' activities by ensuring that team actions are understood, updated information is shared, and team members have the necessary resources
Situation Monitoring	Process of actively scanning and assessing situational elements to gain information or understanding or to maintain awareness in order to support team functioning
Mutual Support	The ability to anticipate and support team members' needs through accurate knowledge about their responsibilities and workload

(AHRQ, 2019a)

The *Team structure* is the fundament of teamwork. It refers to the composite of the individual team or the teams comprising a multi-team system, as well as to who and how many people are members of the team and the member competencies needed to accomplish the team task. The patient and next of kin are essential team members and must be included whenever possible (AHRQ, 2019a).

Communication skills emphasize the importance of structured, clear, timely, complete, and accurate communication among team members and how effective information exchange strategies can improve patient safety. Communication skills are the lifeline of teamwork and serve as a coordinating mechanism for teamwork. Additionally, most other teamwork skills are executed through communication (AHRQ, 2019a).

Leadership is the glue that holds the team system together. Leadership may be formal or situated, and any team member may take on a leadership role depending on the situation and the roster of current team members. Leadership skills refer to identifying a goal and defining a plan, assigning tasks and responsibilities, sharing and monitoring the plan

and progress toward the goal, modifying the plan, communicating changes, and reviewing team members' performance (AHRQ, 2019a).

Situation Monitoring refers to a continual process whereby team members monitor the environment to remain aware of their surroundings. A shared mental model is desirable for the team to work toward a common goal by communicating their individual situational awareness. Situation Monitoring facilitates teamwork by providing the skills necessary to ensure that new or updated information about the environment or the patient is identified and communicated to the team and the leader to inform decision making. Situation Monitoring helps team members stay “on the same page,” as it creates a shared understanding among team members regarding who is responsible for which tasks and allows team members to anticipate each other's needs so they can provide synchronized patient care and adequately support one another (AHRQ, 2019a).

The *Mutual Support* skill refers to anticipating and supporting team members' needs through accurate knowledge about their responsibilities and workload. Mutual Support is derived from Situation Monitoring and moderated by communication skills. Methods of providing mutual support include task assistance and information sharing to improve team performance through feedback. Other Mutual Support strategies are advocacy and assertion, which are invoked when team members' viewpoints do not coincide with that of a decision maker (AHRQ, 2019a; King et al., 2008).

Education for health professionals has incorporated elements of the TeamSTEPPS® team training program in interprofessional health care education settings (Chen et al., 2019; Welsch et al., 2018) and nursing education settings (Barton et al., 2018; Ross et al., 2020). Section 2.3.2 presents the recommended implementation strategy for the TeamSTEPPS® team training program.

The TeamSTEPPS® key principles involve using tools and strategies to assist in practicing teamwork in the context of clinical work. These tools and strategies are presented in Table 2.

Table 2 TeamSTEPPS® teamwork tools and strategies

Communication	ISBAR*	Communication acronym: <i>Identity, Situation, Background, Assessment, Recommendation</i> and <i>Request</i> .
	Call-Out*	Strategy to ensure all team members are aware of changes in the situation by verbalizing updates.
	Closed loop communication*	The sender verifies receipt of information to ensure understanding between the sender and recipient.
	Handoff*	Communication of information during a time of change in patient responsibility, such as a patient transfer.
Leadership	Brief*	A short session in which team roles are discussed before the initiation of care.
	Huddle*	A short session to ensure situational awareness and reinforce or adjust patient care plans.
	Debrief*	Exchange of information following a patient care situation designed to improve team performance.
Situation Monitoring	STEP*	A tool for monitoring the situation of the health care environment, including the <i>Status</i> of the patient, <i>Team members, Environment, and Progress</i> toward the goal.
	Cross monitoring*	An error reduction strategy that involves monitoring other team members to ensure mistakes or oversights are caught quickly.
	I'M SAFE*	A tool for self-monitoring that encourages team members to consider things that may interfere with performance, including <i>Illness, Medication, Stress, Alcohol/drugs, Fatigue, and Eating/Elimination</i> .
Mutual Support	Task Assistance*	A strategy that encourages team members to ask for and help when appropriate.
	Feedback*	Exchange of information between team members to improve performance.
	Two-Challenge Rule*	A patient advocacy strategy encouraging repeating concerns a second time if an initial request is ignored.
	CUS	Strategy for the development of assertive statements that include I am <i>Concerned</i> , I am <i>Uncomfortable</i> , this is a <i>Safety</i> issue.
	DESC Script	A conflict management approach that includes <i>Description</i> of the event, <i>Expression</i> of how the situation made you feel, <i>Suggestion</i> of alternatives for future interactions, and <i>consequences</i> in terms of the established goals.

*Used in this intervention

2.3.2 The implementation strategy

The AHRQ (2017a) has designed a 3-phase implementation guide that builds on John Kotter's (2012) 8-step model for successful change management, which is shown in Figure 1. Steps 1–3 constitute Phase 1, which helps change the status quo. In Phase 2, Steps 4–6 introduce new practices, while Phase 3, comprising Steps 7 and 8, improves the sustainability of the changes and grounds them in the new culture (AHRQ, 2017a). Seven of the eight steps are used in this thesis, as Step 8, creating a new culture (Kotter, 2012), is beyond the scope of this research.

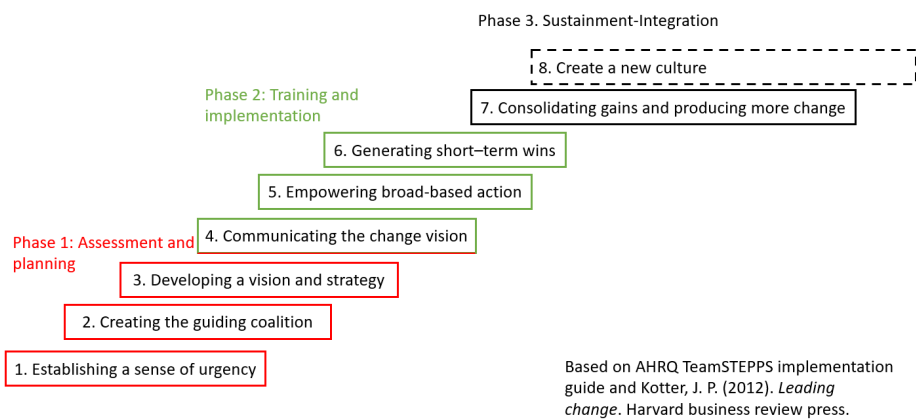


Figure 1. Kotter's eight steps for leading change

The team implementing change is responsible for guiding the process and may need to toggle back and forth between the steps to ensure that the changes are sustainable.

Phase 1 (Steps 1–3) entails determining whether the organization is ready to undertake the TeamSTEPPS® initiative and impressing a sense of urgency upon the leaders and other stakeholders so that they understand that change is important and should be executed as quickly as possible (Kotter, 2012). Step 1, creating a sense of urgency, is vital to disseminate the need for change among leaders and stakeholders. Step 2, creating a guiding coalition or a change-team to implement change, entails assembling a group that is sufficiently powerful to instigate the change. The team should have strong credibility as well as good leadership and management skills to develop trust, guide the

instructors responsible for implementing the change and provide supervision strategies. Step 3, developing a vision and strategy for effecting change, is essential to clarify how the future will differ from the past (AHRQ, 2017a) and how the change can be integrated into the existing practice. The vision and learning outcomes must be simple and easy to communicate. A strategy must also be devised to decide what, how, when, and how many tools and strategies drawn from the TeamSTEPPS® team training program should be implemented. Step 4, communicating the vision for change, starts in Phase 1 and continues throughout implementation of the change. Leaders and other stakeholders must be included and informed about the vision to anchor the implementation strategy (AHRQ, 2017a; Kotter, 2012).

Phase 2 involves implementing the selected TeamSTEPPS® tools and strategies. In this phase, Step 4 continues to communicate the vision and strategy. Step 5 is where the training happens. The organization must be empowered to communicate and guide participants during team training, and they must be provided with training opportunities during learning activities. Step 6 aims to generate short-term wins. At Step 6, it is vital to show participants that they have succeeded at team training. When teamwork skills and strategies are applied, instructors must be rewarded for integrating them, and participants must be appreciated for using them; in the case of the latter, it is important to emphasize why teamwork skills utilization may positively impact patient safety and quality of care.

Phase 3 focuses on sustainment, monitoring, coaching, and integrating teamwork skills into learning and daily work. Kotter's Step 7 is the first step in Phase 3 of the TeamSTEPPS implementation guide (AHRQ, 2017a). The change-team must encourage the organization to motivate participants to keep using the skills they acquired through earlier training. Additionally, strategies are taught for application to new situations and more challenging scenarios. To achieve sustainability, training should not be a one-time occurrence (AHRQ, 2017a). Kotter's (2012) Step 8 anchors changes in the culture. Notably, anchoring comes last, not first, as new approaches usually sink into the culture only after their effectiveness and superiority to the old methods have been demonstrated (Kotter, 2012). Anchoring changes is beyond the scope of this thesis.

2.4. Previous research on the integration of TeamSTEPPS® team training in bachelor of nursing educations

The TeamSTEPPS® curriculum has been used in bachelor of nursing educations in the United States and Canada, with various implementation strategies, durations, and outcomes measurements (Ross et al., 2020); however, no studies have reported implementing TeamSTEPPS® in a bachelor of nursing education in Europe or Scandinavia. The duration of interventions has spanned 6 hours (Goliat et al., 2013) to integration throughout an entire education program (Maguire et al., 2015; Maneval et al., 2020; Ross et al., 2021). Team training content comprises TeamSTEPPS® fundamental courses (Goliat et al., 2013; Maguire et al., 2015), lectures, case studies, video vignettes, and interviews with health care professionals (Maguire et al., 2015; Maneval et al., 2020; Ross et al., 2021). Additionally, discussion groups and patient simulation are widely used (Goliat et al., 2013; Greene & Doss, 2021; Maguire et al., 2015; Maneval et al., 2020; Ross et al., 2021). Roleplay is also a common pedagogic approach (Goliat et al., 2013; Greene & Doss, 2021; Huehn et al., 2020; Maguire et al., 2015; Maneval et al., 2020). Two studies reported using peer teaching (Huehn et al., 2020; Thomas, 2016) and taking inspiration from athletic coaching (Johnson et al., 2011).

Students have reported appreciating team training, particularly the opportunity to develop comfortability communicating with other team members in a nonthreatening environment. They felt prepared to communicate with other health care team members more professionally and effectively and said that team training helped them transition into the role of graduated nurse (Huehn et al., 2020; Ross et al., 2021). Additionally, TeamSTEPPS® team training was perceived to have taught students effective techniques to address conflicts (Huehn et al., 2020). Students reported these reactions by answering open-ended questions after completing the training. Previous studies that used the T-TAQ to measure changes in students' attitudes toward teamwork showed significant positive changes in trainees' T-TAQ total scores and in the Team structure, Leadership, Situation Monitoring, Mutual Support (Goliat et al., 2013; Greene & Doss, 2021), and Communication dimensions (Goliat et al., 2013). Higher post-training scores were reported in the Team structure (Maguire et al., 2015; Maneval et al., 2020), Leadership (Huehn et al., 2020; Maneval et al., 2020), and Situation Monitoring

dimensions (Huehn et al., 2020; Maguire et al., 2015; Maneval et al., 2020), while lower scores representing attitudes toward teamwork between pre- and post-training were reported in the total T-TAQ score (Huehn et al., 2020) as well as in the Mutual Support (Maguire et al., 2015) and Communication dimensions (Huehn et al., 2020). Ross et al. (2021) found no significant attitudinal changes between pre- and post-training. As previous studies have shown, TeamSTEPPS® team training interventions have produced positive and negative changes in attitudes toward teamwork and, in some cases, no significant changes.

Three previous studies reported results from longitudinal TeamSTEPPS® team training interventions integrated into the bachelor of nursing education (Maguire et al., 2015; Maneval et al., 2020; Ross et al., 2021). Two studies reported that team training intervention improved students' teamwork knowledge (Greene & Doss, 2021; Ross et al., 2021). However, there have been no reports concerning behavioral change, the transfer of learning to practice, and whether bachelor of nursing students' participation in TeamSTEPPS® team training influenced patient outcomes.

Most previous studies used the T-TAQ as an outcome measurement instrument, in addition to knowledge tests and open-ended questions prompting participants to describe their reactions to team training. The T-TAQ was designed to measure the core components of teamwork captured within TeamSTEPPS® (Baker et al., 2008) and can be used among health care professionals (AHRQ, 2017b; Baker et al., 2010) in addition to undergraduate health care students. An individual's *attitude* refers to their predisposition to respond favorably or unfavorably to something or someone (Ajzen, 2005); in this context, it is whether a nursing student responds favorably or unfavorably to teamwork in a health care setting. The questionnaire was cross-culturally translated to Norwegian and psychometrically tested for use among health care professionals (Ballangrud et al., 2019). Students differ from health care professionals in that the former have less knowledge and less teamwork and health care experience. According to Wooding et al. (2019), questionnaires should not be reused without considering the population being studied. The reliability and structural validity of the English and Norwegian versions of the T-TAQ have not been tested with respect to a bachelor of nursing student population.

3.0 Rationale

Teamwork skills must be learned, and it is recommended that their teaching and acquisition begin in health care professionals' education, as team training has been shown to improve teamwork and patient safety. Norwegian bachelor of nursing education needs to focus more on teamwork skills and thereby implementing team training will be an important contribution. TeamSTEPPS® is an evidence-based team training program that is implemented in nursing education in the United States but has not yet been implemented in bachelor of nursing educations in Europe or Scandinavia. Nursing students' experiences of participating in a longitudinal team training program and applying teamwork skills in clinical practice have been addressed to a limited extent in previous studies. It would therefore be interesting to explore whether a longitudinal team training intervention would change bachelor of nursing students' attitudes toward teamwork. Additionally, the T-TAQ needs to be psychometrically tested in the population of interest to confirm that it can produce valid and reliable results when applied to a sample of bachelor of nursing students. Finally, since few studies have reported on longitudinal team training interventions, it would be interesting to describe students' team training experiences and their application of teamwork skills to clinical practice.

4.0 Overall and specific aims

The overall aims of the thesis were to implement a longitudinal team training intervention in bachelor of nursing education, describe students' reactions to team training, explore changes in students' attitudes toward teamwork, and describe how students experienced using teamwork skills in practice.

To achieve these overall objectives, we planned an intervention and three studies.

Study I aimed to test the reliability and structural validity of the Norwegian version of the T-TAQ among bachelor of nursing students.

Study II aimed to explore the impact of implementing a longitudinal TeamSTEPPS® team training program on bachelor of nursing students' attitudes toward teamwork.

Therefore, the following research questions were formulated:

Is there any change in attitudes toward teamwork within the intervention group from baseline to 10 months and from baseline to 24 months?

Is there any change in attitudes toward teamwork within the control group from baseline to 10 months and from baseline to 24 months?

Are there any differences in the change in attitudes toward teamwork between the intervention and control groups from baseline to 10 months and from baseline to 24 months?

Study III aimed to describe bachelor of nursing students' experiences of the TeamSTEPPS® intervention and their use of teamwork skills in clinical practice.

5.0. Theoretical perspectives

This chapter describes the theoretical perspectives that guided the planning and design of this thesis' foundational studies.

5.1. Kirkpatrick's four levels of measuring the outcome of training

Kirkpatrick had already launched a multilevel model for measuring the impact of training by the end of the 1950s (Kirkpatrick & Kirkpatrick, 2006). These levels are widely used to evaluate the efficiency of team training in health care and create a plan for assessing educational outcomes (Hughes et al., 2016; Praslova, 2010; Welsch et al., 2018). Use of Kirkpatrick's levels is recommended to measure the outcome of a TeamSTEPPS® team training intervention (AHRQ, 2019a). The TeamSTEPPS® curriculum offers questionnaires that may be customized to measure Kirkpatrick's levels in different settings and groups (AHRQ, 2019a). Some measurement tools have been translated into Norwegian and validated, while others have not. The four levels are 1) reactions, 2) learning, 3) behavior, and 4) training results.

1) Training reactions. *Reactions to training* are participants' perceptions of training and how they react. This level measures whether students "liked" the training (affective reactions) and whether they found it "useful" (utility judgment). This information may be helpful for improving future training programs. If participants do not react positively, they probably will not be motivated to learn (Kirkpatrick & Kirkpatrick, 2006). A course evaluation form is commonly used to gather students' reactions after a team training event; forms are available on the TeamSTEPPS® curriculum website (AHRQ, 2019a). In the present research, focus group interviews were used to explore students' reactions to team training.

2) Learning from training. *Learning from training* can be defined as improvements in students' KSA due to team training (Kirkpatrick & Kirkpatrick, 2006). The KSA's to be measured should align with the training content.

The TeamSTEPPS® team training program has developed knowledge tests, observation tools, and attitudes questionnaires (AHRQ, 2017b) to measure the level of learning from team training. The T-TAQ was chosen for this research project and is presented in

further detail in Section 6. According to Kirkpatrick and Kirkpatrick (2006), a change in KSA must occur if a behavioral change is to occur.

3) Behavioral change. Level three measures the extent to which learned skills are transferred to practice. Kirkpatrick and Kirkpatrick (2006) emphasized four necessary conditions that influence the extent to which learned skills result in behavioral change in practice: The student must have a desire to change, know what to do and how to do it, and the climate must encourage or require a change in teamwork behavior. The fourth condition that encourages individuals to practically apply the skills they have learned is rewarded. The reward may be intrinsic, that is, feeling satisfied or the achievement of positive results, or extrinsic, for example, in the form of supervisors' or peers' recognition (Kirkpatrick & Kirkpatrick, 2006). Behavioral change in practice may be measured using questionnaires for measuring changes in perceptions of teamwork (AHRQ, 2017c) and in patient safety culture. Behavioral change may be observed and aided with the use of observation tools (AHRQ, 2019a). Additionally, interviews may be used to gather team training experiences and considerations of how training influenced behavior in practice (Ballangrud et al., 2020). In this thesis, this level was measured through focus group interviews in which students described how they used teamwork skills in clinical practice.

4) Results. Level four measures training results, that is, the extent to which team training influences the organization through enhanced care quality or patient safety culture (Kirkpatrick & Kirkpatrick, 2006). Based on the aim of the intervention, results concerning infection rates, patients' perceptions of care quality, the number of structured handoffs, and staff perceptions of safety may be measured (AHRQ, 2019a). This level was not measured in this thesis, as the focus was on students' learning.

6.0 Methods

This chapter presents the methodological foundation of the thesis as well as its design, methodological choices, the sampling process, intervention, data collection and analysis, and ethical considerations.

Both quantitative and qualitative methods were chosen to achieve the overall aim of this thesis. Team training and teamwork are complex phenomena where students interact in a social context to provide patient care. Teamwork and team training occur within a cultural, social, and physical context, and the quality of the teamwork is interpreted and constructed within the student's mind. In a constructive paradigm, reality exists in a context, and many constructions of reality are possible. When multiple interpretations or realities exist, there is no process to determine the ultimate truth or falsity of the constructions. Inquiry in a constructivist approach primarily involves qualitative data collection and analysis (Polit & Beck, 2021).

What is assessed as excellent and effective teamwork as a team training outcome has some objective characteristics that evolved through research, experiences, and consensus (Hughes et al., 2016; Salas et al., 2018). This measurable view of teamwork is connected to a positivist paradigm and indicates that teamwork in health care may be objective and real and therefore observable and measurable (Polit & Beck, 2021).

Kirkpatrick's multilevel model requires the use of different research methods to determine the outcome of team training. Research questions and aims are the best way to guide a study toward either a quantitative or qualitative design (Creswell & Plano, 2017). In the case of this research, both quantitative and qualitative approaches were considered appropriate for enriching exploration of team training and teamwork in bachelor of nursing education (Paoletti et al., 2021; Polit & Beck, 2021).

6.1 Study design

This thesis is based on three studies. A quantitative cross-sectional study was designed to test the reliability and structural validity of the T-TAQ when used in a sample of bachelor of nursing students (I). Further, a quasi-experimental design with a pre-post test was conducted to explore the impact of implementing a longitudinal TeamSTEPPS® team training program on bachelor of nursing students' attitudes toward teamwork. The

intervention group was exposed to the intervention, including the TeamSTEPPS® team training program. The TeamSTEPPS® team training program was not integrated into the control group's learning activities. Attitudes toward teamwork were measured at baseline (T0), after 10 months (T1), and after 24 months (II). A qualitative descriptive design was used to gain a deeper understanding of bachelor of nursing students' experiences of the team training program and their use of teamwork skills in clinical practice (III). See Table 3 for an overview of the three studies.

Table 3. Studies I–III: Aim, design, sample, and data collection and analysis

Study	Aim	Design	Sample	Data collection	Data analysis
I	To test the reliability and structural validity of the Norwegian version of the T-TAQ among bachelor of nursing students	Cross-sectional design	<i>n</i> = 509 First-, second-, and third-year students from three campuses	Via paper and digital (emailed) surveys	Confirmatory factor analysis
II	To explore the impact of implementing a longitudinal TeamSTEPPS® team training program on bachelor of nursing students' attitudes toward teamwork	Quasi-experimental pre- and post- design	<i>n</i> = 295 Students from two campuses	Via paper and digital (emailed) surveys	Descriptive and inferential statistics
III	To describe bachelor of nursing students' experiences of the TeamSTEPPS® intervention and the use of teamwork skills in clinical practice	Qualitative descriptive design	<i>n</i> = 22 A convenience sample of students from the intervention group	Focus group interviews	Inductive content analysis

6.2 Sample and settings

This research was conducted at a 3-campus Norwegian university offering a bachelor of nursing program in keeping with the relevant national regulations (Norwegian Ministry of Education and Research, 2008).

In Study I, the inclusion criterion was being registered as an active first- ($N = 408$), second- ($N = 532$), or third-year student ($N = 684$) enrolled in the bachelor of nursing program in fall 2018 at one of the university's three campuses ($N = 1,624$). Figure 2 shows the sampling process.

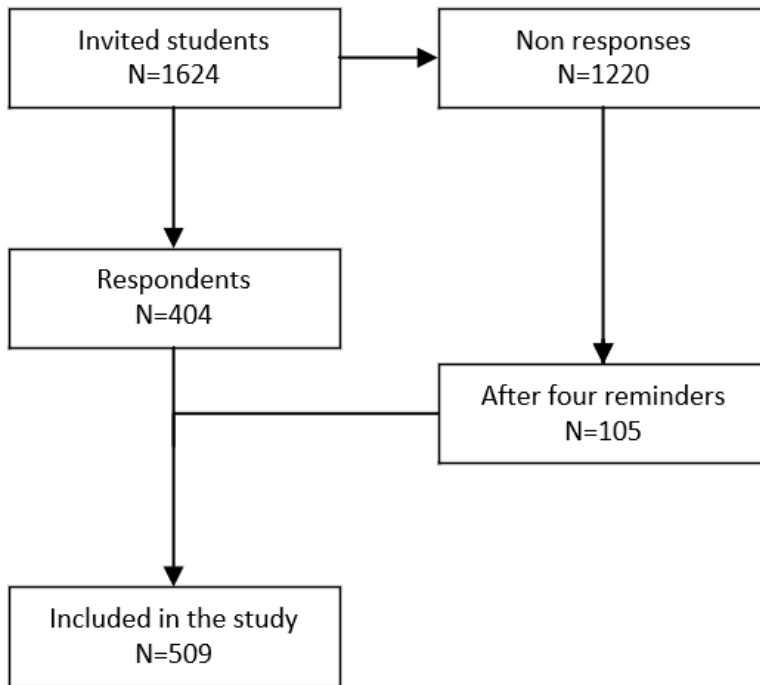


Figure 2. Study I sampling process

A total of 31.2% ($n = 509$) of the invited students completed the questionnaire. The response rate was 61.1% among first-year students ($n = 311$) who completed a paper survey and 16.3% among second- and third-year students ($n = 198$) who completed a

digital survey they received via email. Table 4 shows the sample's demographic characteristics.

In Study II, the inclusion criterion was students attending classes in the bachelor of nursing program in August 2018 at the intervention ($N = 164$) (campus 1) or control campus ($N = 259$) (campus 2). A total of 295 students (69.4%) participated. However, 147 students (34.8%) only completed one survey. Figure 3 depicts the sampling process for Study II, and Table 4 provides the sample's demographic characteristics.

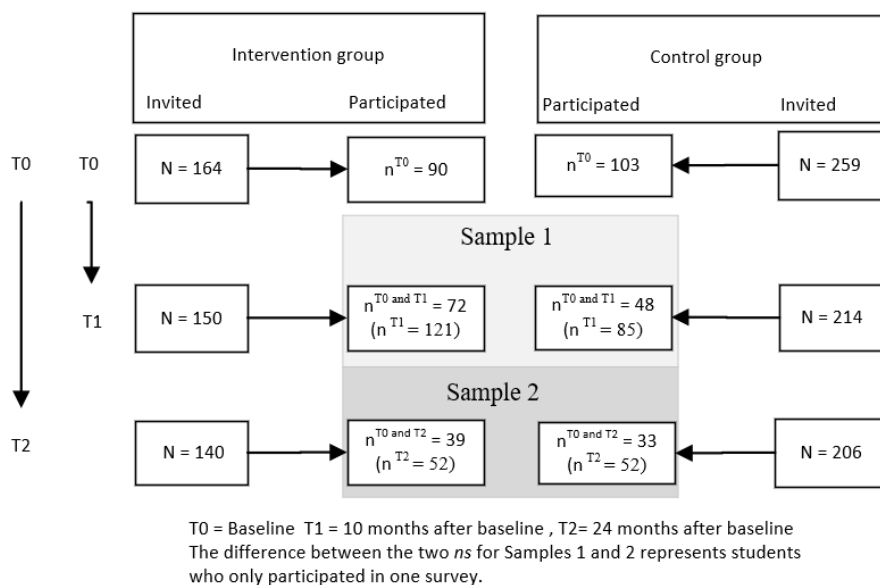


Figure 3. Study II sampling process

By inviting all students, the principle of voluntariness coupled with the study's longitudinal design resulted in significant attrition of students from T0 to T1 and from T0 to T2. The research questions guiding Study II required that students complete two or more surveys. This resulted in a decision to split the students into two samples: Those who participated at T0 and T1 comprised Sample 1, and those who participated at T0 and T2 comprised Sample 2.

Table 4 presents the demographic characteristics of the intervention and control groups. Compared to Sample 1 in the intervention group, Sample 1 in the control group contained significantly more students aged 25 or older ($p = 0.043$). No other significant between-group demographic differences were found. (See Table 4)

In Study III, the inclusion criterion was students who participated in team training from the beginning of their bachelor's program ($n = 140$) at campus 1. The research team intended to conduct five to six focus group interviews, with four to six students in each group. If more students consented to be interviewed, interviewees would have been selected by drawing lots, but this was not necessary. A total of 22 students participated in six online focus group interviews, 17 and 5 of whom were females and males, respectively. The students' median age was 23, and their age range was 20–33. Participants were in their fifth semester on a 10-week clinical placement when the focus group interviews were conducted. See Table 4 for the sample's demographic characteristics.

Table 4: Participants' demographic characteristics for Studies I–III

Demographic variables		Study I		Study II				Study III					
Sample		Students from campus 1, 2 and 3		Intervention group Campus 1		Control group Campus 2		Intervention group, Campus 1					
				Sample 1	Sample 2	Sample 1	Sample 2						
Variable	Category	n	%	n	%	n	%	n	%				
N		509		72	39	48	33	22					
Year of study	1 st -year students	311	61.1										
	2 nd -year students	94	18.5										
	3 rd -year students	104	20.4										
Age groups	≤20 year	129	25.3	32	44.4	14	35.9	16	33.3	13	39.4	1	4.6
	21-24 year	221	43.4	28	38.9	14	35.9	17	35.4	14	42.4	11	50.0
	≥ 25 years	141	27.7	6	8.3	6	15.4	12	25.0	5	15.2	10	45.5
	Missing	18	3.5	6	8.3	5	12.8	3	6.3	1	3.0		
Sex	Female	428	84.1	57	79.2	31	79.5	42	87.5	31	93.9	17	77.3
	Male	75	14.7	14	19.4	8	20.5	6	12.5	2	6.1	5	22.7
	Missing	6	1.2	1	1.4	0							
Work experience in health care	None	110	21.6	25	34.7	12	30.8	15	31.3	15	45.5	9	40.9
	< 1 year	74	14.5	10	13.9	5	12.8	10	20.8	5	15.2	4	18.2
	1-3 years	131	25.7	14	19.4	7	18.0	10	20.8	5	15.2	8	36.4
	> 3 years	174	34.2	19	26.9	14	35.9	13	27.1	8	24.2	1	4.6
	Missing	20	3.9	1	5.6	1	2.6	0		0		0	
Former higher education	Yes	127	25.0	15	20.8	9	23.1	15	31.3	12	36.4		
	No	356	69.9	55	76.4	30	76.9	32	66.7	21	63.6		
	Missing	26	5.1	2	2.8	0		1	2.1				
Working as a nurse assistant	Yes											21	95.5
	No											1	4.5

6.3. The intervention

The following chapter describes the content of the intervention. Kotter's steps (2012) are referenced in parentheses.

Phase 1 Assessment and planning

The head of the department at the intervention campus was informed about the project and approved it. The intervention was presented to faculty at a workshop in March 2018. This workshop (Step 1) was arranged to impress a sense of urgency on faculty. During the workshop, it became evident that some teamwork tools had already been

implemented to a certain extent through the learning objectives of clinical placements. The workshop contributed to greater awareness of the complexity of teamwork. Specifically, it highlighted teamwork skills in the context of patient safety, for example, the importance of using closed-loop communication to avoid misunderstanding patient information and the importance of speaking up regarding safety issues to avoid adverse events. A change-team comprising four faculty members was established (Step 2). Three team members attended a TeamSTEPPS® master trainer course at Northwell Hospital, Long Island, New York, in May 2018. The fourth member was already a TeamSTEPPS® master trainer (Step 2). The master trainer course provided a foundation for developing a change vision and an implementation strategy (Step 3). The vision was as follows: *Nurses graduated from NTNU in Gjøvik are competent, innovative, and critical thinking employees who are role models in team performance* [(Norwegian) *Sykepleiere utdannet ved NTNU i Gjøvik er kompetente, innovative og kritisk tenkende arbeidstakere som er forbilder i måten de utøver teamarbeid på.*] Learning outcomes were set to guide the implementation. Phase 2 was scheduled for the first four semesters, and Phase 3 would span the fifth semester. The sixth semester was not included in the research project for practical reasons. While planning the intervention, experiences from previous health care and nursing education interventions were reviewed, supplemented with mail correspondence with several of the authors, to facilitate learning from their successes and pitfalls (Goliat et al., 2013; Maguire et al., 2015; Robinson et al., 2018; Sharpnack et al., 2015; Thomas, 2016). An implementation plan was developed; it served as the foundation for the vision, learning outcomes, and a 3-hour TeamSTEPPS® course for faculty. Faculty were coached to implement teamwork skills through meetings and written guidelines. Team training was tailored to fit into the students' regular learning activities (Step 4).

Phase 2: Team training (Step 5)

Year 1:

The first semester (fall 2018) started with informing the students about the TeamSTEPPS® program and its implications. Teamwork skills were introduced as a component of practical skills training to raise students' awareness of the relationship between teamwork and patient safety. Regarding Team structure, the importance of

including the patient as a team member was emphasized in all skills training sessions. Most of the tools recommended under each teamwork skill were introduced in the following semesters to avoid cognitive overload. Teamwork skills were introduced through briefing, supervision, and debriefing during basic nursing skills training. The aim of including teamwork skills in basic nursing skills training was to raise students' awareness of how teamwork and taskwork should be integrated to provide patients with efficient and safe care. This thesis provides an overview of the TeamSTEPPS® strategies and tools used to support each teamwork skill, as shown in Table 2, section 2.3.1.

Examples of various teamwork topics were given during debriefing on personal hygiene/bed bathing skills training at the simulation center. During the simulation, one student played the role of a patient, while two other students performed a bed bath.

Teamwork topics raised during personal hygiene/bed bathing skills training

<u>Patient role</u>	<u>Nursing role</u>
How did you experience being a patient?	How did you experience being a nurse?
What made the experience good or bad?	How did you experience Communication, Leadership and Mutual Support on the team?
How did the team communicate with you?	What was being a team leader like?
Did you feel that you were a part of the team?	What made the experience of being a leader good or bad?
	How did the team members contribute to the team through Mutual Support?
	Did you give feedback on tasks that needed improvement?
	Did the leader ask for support?
	Did you notice whether the leader needed support, and if so, did you offer it?
	How did you experience being a leadership assistant?

In the second semester (spring 2018), the students were offered a 6-hour TeamSTEPPS® essential course, during which the Norwegian version of the TeamSTEPPS® pocket guide was distributed. Additional TeamSTEPPS® learning

material was made available to the students through a learning platform (Blackboard). The second semester entailed extended use of the TeamSTEPPS® skills. Leadership tools, briefing, and debriefing were consistently applied as strategies before and after each nursing skills training session at the simulation center.

Communication skills were trained using structured communication in a simulated scenario. Mutual Support skills were trained during a 2-hour workshop involving feedback exercises before the students' first clinical placement at nursing homes. Two hours of structured reflection were arranged twice during the clinical placement. The TeamSTEPPS® skills were used to guide reflections on how teamwork skills can affect students' learning environment. The challenges of being a nursing student on a nursing team during the clinical placement were also discussed.

Year 2:

In the third semester (fall 2019), TeamSTEPPS® skills were implemented on a first aid day, with senior nursing students playing the role of injured patients. Students participated in seven scenarios as first responder teams. All facilitators received a guide containing instructions on how to debrief the teams regarding using teamwork skills to cope with first aid challenges. A 30-minute TeamSTEPPS® lecture was delivered as part of students' briefing. The scenarios were as follows: a traffic accident, a bicycle accident, obstruction of airways in a 1-year-old, drug intoxication, a chainsaw injury, injury due to a pub fight, and cardiac arrest. The students were encouraged to hold a briefing before each scenario, after the case had been announced. Further, the students were encouraged to use closed-loop communication within their team. Leadership skills were trained as follows: One student assumed the role of the leader and assigned tasks to the other students to approach the first aid challenges effectively, with patient safety in mind. Situation Monitoring was a part of the debriefing; students were guided to reflect upon how they had achieved a shared mental model using the STEP-mnemonic tool (status of the patient [S], team monitoring [T], environment [E], and progression toward the desired outcome [P]). The students were encouraged to hold a debriefing on their first aid team's performance including how well they monitored the patients' need for assistance and provided task assistance, supervision, and feedback. A short-term win

(Step 6) was established after the first aid training day, as all the teams were required to use ISBAR communication when reporting to emergency central (faculty member). The students were rewarded with an ice cream bar (Ice-cream bar = IS-BAR in Norwegian). for completing the activity successfully. ISBAR communication was set as a learning outcome in a simulated scenario session and throughout the students' second clinical placement. Situation Monitoring and use of the cross-monitoring tool were emphasized when students were trained to apply complex nursing care skills. These training sessions consisted of changing the dressing on a central venous catheter and bronchial suctioning. Students were trained to create a shared mental model in a psychiatric care scenario using communication skills, situation awareness, and feedback.

In the fourth semester (spring 2020), the interventions from the prior semesters were continued. Communication skills were expanded to focus on patient handover tools. Two demonstration videos were published depicting handovers using IPASS (Shahian, 2021) in two different settings. A 1-hour lecture emphasizing the importance and challenges of providing mutual support was offered before students' third clinical placement. Students had access to several demonstration videos in Norwegian in which the TeamSTEPPS® teamwork skills were explained and demonstrated. Due to the novel coronavirus (Covid-19) pandemic, some adjustments were made to the third clinical placement to facilitate students' achievement of the placement's learning outcomes amidst the pandemic. The students were given an assignment in which they had to reflect upon their use of teamwork skills in clinical practice.

Phase 3 Sustainment integration (Step 7)

Year 3:

In the fifth semester (fall 2020), the intervention consisted of repeating previously trained teamwork skills in new contexts and training teamwork skills that are considered to be more challenging, such as team leadership and conflict management. Reflection sessions focusing on conflict management and how to approach disagreement as a part of the Mutual Support skill were arranged. Students were asked to rate teamwork skills depicted in a video of a simulated scenario in which a nursing team provided care for a septic patient whose condition was deteriorating. Students rated the actors' teamwork using the TPOT (AHRQ, 2014). Their TPOT scores were fundamental for a further

structured reflection session concerning analysis of the content of the video simulation regarding teamwork skills or lack thereof and how the nursing team managed disagreements.

A total of 15.5 hours were added during the intervention period to accommodate workshops, TeamSTEPPS® essential courses and lectures, and integrate team training into existing learning activities. Table 5 provides an overview of the intervention.

Table 5. Overview of the TeamSTEPPS® intervention Phase 2 and 3

Year	Month	Description of the intervention
	January–August 2018	Phase 1: Assessment and planning
		Phase 2: Team training
1	August–December 2018	Introducing teamwork skills as a part of training basic nursing skills Inclusion of the patient in the Team structure
	January 2019	Delivery of a 6-hour (voluntary participation) TeamSTEPPS® course Incorporation of teamwork skills as a part of basic nursing skills Distribution of the TeamSTEPPS® pocket guide Establishment of a TeamSTEPPS® module on Blackboard Posting of video examples of teamwork skills
	February–March 2019	Use of Leadership skills, briefing, and debriefing in each skills training session Use of the ISBAR communication tool in a simulated scenario
	April 2019	Mutual Support skills taught in a (voluntary participation) 2-hour workshop, with a focus on feedback
	May–June 2019	Reflection session in which students reflected on teamwork skills to improve their clinical placement learning outcomes
2	August 2019	Delivery of a 30-minute TeamSTEPPS® summary lecture A 7-hour first aid training day during which the teamwork skills were included in the briefing and debriefing sessions for the seven scenarios Display of teamwork best practice posters at the simulation center facilities (see Appendix 1)
	August–October 2019	Inclusion of Situation Monitoring and Mutual Support training while training complex nursing skills Use of Situation Monitoring and Communication training to create a shared mental model within a simulated psychiatric care scenario
	October–December 2019	Continued use of ISBAR communication in a simulated scenario Posting of videos depicting IPASS handovers Reflection session to discuss students' experiences of applying teamwork skills during their clinical placement
	January–February 2020	Delivery of a 1-hour (voluntary participation) Mutual Support tools lecture
	March–June 2020	Written reflection task on students' perceptions of the use of Leadership skills in their clinical placement
		Phase 3: Sustainment
3	August–October 2020	Continued focus on teamwork skills in skills training and clinical placements Online reflection session during which students rated the use of teamwork skills using the TPOT in a simulation video depicting a nursing team caring for a septic patient Online reflection session on Mutual Support including solving disagreements and conflicts in teams

6.4 Data collection

Data for the three studies were collected from August 2018 to October 2020. A questionnaire was used for the quantitative surveys (I, II), and an interview guide was used for the qualitative study (III).

The questionnaire

The T-TAQ (Baker et al., 2010) was used for data collection in Studies I and II. The questionnaire is designed to measure individuals' attitudes toward the key principles of teamwork captured within the TeamSTEPPS[®] team training program. It can be used to determine whether the intervention produced the desired attitudinal change. The items were developed through a thorough process to ensure content validity and coverage of the core components taught within the TeamSTEPPS[®] team training program (Baker et al., 2010; Baker et al., 2008). The T-TAQ consists of 30 items measuring five dimensions of teamwork, with six items in each dimension; the dimensions are Team structure, Leadership, Situation Monitoring, Mutual Support, and Communication. The items are scored on a 5-point Likert scale, where the students rate their level of agreement with items from 1 (*strongly disagree*) to 5 (*strongly agree*). Four items are negatively worded, and the preferred attitude is designated by 1 in items MS20, MS21, MS24, and C30. The T-TAQ has been cross-culturally translated and psychometrically tested among Norwegian health care professionals (Ballangrud et al., 2019). See Appendix 2 for the Norwegian version of T-TAQ.

The interview guide

A semi-structured interview guide was used to achieve the aim of Study III. The interview guide was tested with a group of faculty members to elicit feedback on the initial questions as well as perceptions of the digital video interview setting. The pilot interviews did not result in any change to the interview guide. The interview guide consisted of three themes aimed at prompting students to describe their experiences regarding:

- The TeamSTEPPS[®] teamwork skills
- The on-campus teamwork learning activities
- The use of teamwork skills in clinical practice

Open-ended follow-up questions were posed to encourage interviewees to explore issues of interest in their own words (Kitzinger, 1995).

The data collection procedure

In Study I, data collection took place in August/September 2018 for second- and third-year students and in May/June 2019 for first-year students. Data were collected from second- and third-year students electronically as these students were spread over a vast geographic area due to their clinical placements. Second- and third-year students' email addresses were provided to a university employee who assisted with inviting the students to participate in the study. Students received an email invitation followed by four reminders to complete the electronic version of the T-TAQ (Questback, 2018). Collection of first-year students' data took place after their first clinical placement to ensure that they had some clinical teamwork experience. The university administration provided lists of first-year students' names across the university's three campuses to facilitate the distribution of a paper version of the T-TAQ. Each student received a sealed envelope containing the questionnaire and related information. Participating students completed and returned the survey as they left the classroom.

In Study II, the first two surveys (at T0 and T1) were administered simultaneously, as in Study I, in August/September 2018 and May/June 2019. The third survey (at T2) was administered in September 2020. The first two surveys were administered on paper, while the third was administered via email due to the Covid-19 pandemic. To facilitate administration of the third survey, an electronic version of the questionnaire was created (<https://nettskjema.no/>), and a link was attached to an email invitation sent to students.

In Study III, data collection was done in September 2020 via virtual focus group interviews. Faculty responsible for arranging clinical placements sent email invitations to students, and students who wished to participate emailed the researcher. The focus group interviews were scheduled for a convenient time when students could attend. Since Covid-19 restrictions impeded physical meetings, the interviews were conducted online via Zoom, with one moderator (male) and one assistant moderator (female). All interviews were audiotaped and transcribed verbatim. Interview duration ranged from 45 minutes to 64 minutes.

6.5 Data analysis

In Study I, statistical analysis was performed using IBM SPSS Statistics version 26 (IBM, 2020) and IBM AMOS version 25 (I). CFA was conducted based on the solid theoretical foundation (Baker et al., 2010). Cronbach's alpha and descriptive statistics were also utilized.

In Study II, IBM SPSS Statistics version 27 was used to perform statistical analyses. Both parametric and non-parametric analyses were used (Pallant, 2016). Based on a previous study, power analysis was performed to estimate the desired sample size (Polit & Beck, 2021). It was determined that a sample of 129 students in each group would be needed to detect a mean difference of 0.2, with a standard deviation of 0.54 between groups from T0 to T2 for the Situation Monitoring dimension, $\alpha = 0.05$, and a power of 0.80. Dropout analyses were conducted in the intervention and control groups to explore whether students who only completed one survey differed from those who participated at T0 and T1 or at T0 and T2. Pearson chi-square testing was used to analyze demographic differences, and independent t-testing and analysis of variance (ANOVA) were used to analyze subgroup mean score differences. A p -value of < 0.05 (two-tailed) was set as the statistical significance level for all tests.

See Table 6 for an overview of the statistical analyses performed in Studies I and II.

Table 6. Statistical analyses in Studies I and II

Statistics	Application of statistical analyses results
Frequency, percentage, mean, median, standard deviation	To derive descriptive results (I and II)
Cronbach's alpha	To test for internal consistency (I)
Confirmatory Factor Analysis (CFA)	To test how well each questionnaire item measures the latent dimensions it is supposed to measure and whether the items explain the variance in the latent dimensions (I)
Comparative fit index (CFI)	To compare the fit of a hypothesized model with a model where all the variables are uncorrelated (I)
Tucker-Lewis fit index (TLI)	Non-normed fit index (I) Analyzes the discrepancy between the chi-squared value of the hypothesized model and the chi-squared value of the null model
Root mean square error of approximate (RMSEA)	To measure the distance between the hypothesized model and a perfect model (I)
Normed chi-square	Chi-square index divided by the degree of freedom (I)
Pearson's chi-square	To test the difference between demographic variables (I and II)
ANOVA	To test differences between mean score when there are three or more groups.
One-way ANOVA	To test mean group differences for a single independent variable (II).
Two-way NOVA	To test mean group differences for two independent variables (II).
Paired t-test	To test the difference in two mean scores and mean change score within the same individual (II)
Independent t-test	To test the difference in two mean score and mean change score between two independent groups (II)
Eta squared	To measure the effect size of the difference between the two means (II)

(Polit & Beck, 2021; Polit & Yang, 2016)

In Study III, qualitative data were analyzed via inductive content analyses based on Elo and Kyngäs (2008) in three phases: preparation, organizing, and reporting. NVivo (QSR International, 2020) was used to facilitate the analyses.

The content of the phases is shown in Table 7.

Table 7. Phases of inductive content analyses (III)

<p>Phase 1: Preparation</p>	<p>The interviews were transcribed verbatim. Interviewees' names were replaced by alphanumeric codes. Individual interviews were the unit of analysis, and the interviews were read several times to familiarize with the data. An inductive approach was chosen for further analyses.</p>
<p>Phase 2: Organizing</p>	<p>Based on the aim of the study, codes were extracted from each interview, initially grouped under headings, and then further grouped in temporary categories. The categories were then grouped under higher-order categories based on similarities and dissimilarities. This process was repeated to group the data into broader generic categories. The research group continued to perform the analysis until consensus was reached and the main category emerged as an abstraction of how the phenomena were understood.</p>
<p>Phase 3: Reporting</p>	<p>The sampling and data collection and analysis processes as well as the analysis results were compiled in a research paper to attest to the trustworthiness of the results.</p>

(Elo & Kyngäs, 2008)

6.6 Ethical issues

The Norwegian Centre for Research Data (NSD) approved the studies (reference number 59994 and 758392) (See Appendix 3), and the studies were also approved by the heads of the involved university departments (see Appendix 4). Furthermore, following the Helsinki Declaration (World Medical Association, 2018), ethical considerations and guidelines were applied concerning autonomy, beneficence, nonmaleficence, and justice.

The principle of autonomy

The principle of autonomy was addressed in all three studies through voluntariness, informed consent, and the provision of information about the participants' right to withdraw from the research project. All students who were invited to participate were provided with written information about the aim of the studies and their rights according to the General Data Protection Regulations (GDPR; (EU, 2018)). (See Appendix 5). The students' names and email addresses were made available to the researcher after thorough consideration of the GDPR and consultation with the university's legal advisors, department heads, and the NSD. Contact information for the researcher and the university's legal advisors formed part of the information letter participants received (I, II, and III). Second- and third-year students' email addresses were made available to a university employee who assisted with sending invitations and reminders on the researcher's behalf. For the paper version of the questionnaire (I and II), students received oral and written information, and returning the completed questionnaire was considered consent to participate. Students who completed the email surveys (I) received written information and completing the survey by following the link to the questionnaire was considered consent to participate (I). Students accessed the second email survey (at T2) (II) via a link to nettskjema.no (UiO, 2021); prior to completing the questionnaire, they were required to read the relevant information and mark that they approved to participate to get access to the questionnaire. In Study III, students who agreed to participate received a link to nettskjema.no via email, where they accessed the relevant information, acknowledged having understood the information, and consented to participate and share their demographic data (III).

Study I participants were included in a lottery to win one of ten gift cards valued at 400 NKR. Study II participants each received one lottery ticket (10 NKR) and focus group interviewees received ten lottery tickets each (III). The NSD approved the use of small rewards, as it was regarded as non-violation of the students' autonomy and voluntariness. Students at the intervention campus were informed that participating in the surveys (I and II) and interviews (III) as well as the extra team training courses was voluntary; however, team training integrated into simulation activities, skills training, and reflection sessions during clinical placements formed part of the mandatory learning

activities. In bachelor of nursing education, mandatory learning activities constitute a prerequisite for achieving the course's expected learning outcome. During transcription of the interviews (III), students' clinical placements were anonymized, and students' names were replaced by alphanumeric codes (e.g., B2, C3, A4).

The *confidentiality* and *integrity* requirements were satisfied through the use of coded questionnaires (I, II) and a coding schema linking the students' names and email addresses stored in a secured and encrypted file on the researcher's computer, which belongs to the university. Integrity was also maintained in the focus group interviews (III), as students were instructed to only share the experiences they were comfortable telling the group. The moderator also took care to respect the students' integrity in the manner in which the follow-up questions were posed.

The principle of beneficence and nonmaleficence

The research group carefully considered the risks versus benefits of the studies and assessed the benefits as exceeding the disadvantages. Survey participation (I, II) was estimated as requiring 10–20 minutes, which was not considered a significant time burden on students. Interviewees were informed that participation would not affect their clinical placement progress or evaluation. All participants were assured that their identity and personal information would be anonymized before publication of the results (III). Team trainees' beneficence was deemed to be the team training's contribution to the enhancement of students' teamwork KSA toward their achievement of their learning outcome and patient safety. Publication of the results will contribute to improving bachelor of nursing education and improving nurses' teamwork (II, III).

The principle of justice

All students who met the inclusion criteria had an equal opportunity to participate (I, II, III). In Study III, a convenience sample was used, and if more students had registered to participate, a random draw would have been conducted to select participants; however, that was not necessary.

The researcher's role

The researcher is a lecturer at the intervention campus who participated, along with other lecturers, in some of the intervention activities (TeamSTEPPS® courses, workshops, and reflection sessions). The researcher's involvement may have compromised the qualitative study's credibility, as the researcher was the main interview moderator. However, the researcher did not have any influence or formal role in evaluating the students' performance during the intervention period, and the issue of the researcher's role was covered in the prelude to the interviews.

7.0 Main results

This chapter provides an overview of the main results of the three studies in this thesis. First, the results of the psychometric testing of the questionnaire are presented (I). Next, the main results of Study II, baseline scores, differences in attitudinal changes with regard to teamwork *between* the intervention and control groups and change score *within* the control and intervention groups are presented (II). Finally, students' experiences of team training and their use of teamwork skills in clinical practice are presented (III).

7.1 Psychometric testing of the T-TAQ (I)

The total T-TAQ score showed an acceptable Cronbach's alpha of 0.79. Alpha values for the dimensions were 0.70 (Situation Monitoring), 0.62 (Leadership), 0.56 (Communication), 0.46 (Team structure), and 0.44 (Mutual Support).

CFA showed acceptable values of the absolute fit indexes and below threshold values in the comparative fit indexes. Three models were tested. Model 1 was the default model. For Model 2, the data were analyzed with the sample randomly split in half, supporting the stability of the Model 1 results. Model 3 was a post-hoc modification based on low factor loading; it presumed an intercorrelation effect between the error variances of the four negatively worded items. Model 3 showed an acceptable normed chi-square of 1.862 (< 2.0) and an acceptable RMSEA of 0.043 (≤ 0.06). The comparative fit indexes showed values below threshold values (> 0.95), with CFI showed a value of 0.743, and TLI of 0.767. Factor loading was > 0.30 for 25 of the 30 items in Model 3. The four negatively worded items were considered troublesome for the model's goodness of fit, especially the Mutual Support dimension, which has three negatively worded items with low factor loadings in the range of 0.09–0.16 (I).

7.2 Bachelor of nursing students' attitudes toward teamwork (II)

Survey respondents at T0 and T1 comprised Sample 1, while respondents at T0 and T2 comprised Sample 2. In the following sections, T0, T1, and T2 are baseline, 10 months, and 24 months, respectively. *Total T-TAQ score* refers to the sum of scores across the five dimensions (II). *Mean change score* refers to difference in score between T1 and T0, respectively T2 and T0, and was calculated as a variable to measure difference between two measurement times *between* groups shown in Table 8b.

7.2.1 Differences *between* the intervention and control groups

Differences at baseline: In Sample 1, compared to students in the intervention group, students in the control group, had significantly higher total T-TAQ score and Mutual Support and Communication dimension scores, with a small to medium effect size (eta squared = 0.04-0.07).

In Sample 2, students in the control group had significantly higher total T-TAQ score, with a medium effect size (eta squared = 0.09), as well as significantly higher leadership dimension scores, with a large effect size (eta-squared = 0.17), compared to students in the intervention group. See Table 8a.

Table 8a Significant differences in mean T-TAQ scores *between* the intervention (I) and control groups (C) at baseline (T0)

Groups	Sample 1(T0 and T1)			Sample 2 (T0 and T2)		
	I (n = 72)	C (n = 48)		I (n = 39)	C (n = 33)	
	Mean (SD)	Mean (SD)	<i>p</i>	Mean (SD)	Mean (SD)	<i>p</i>
Total T-TAQ score	20.42 (1.22)	21.16 (1.60)	0.008	20.37 (1.30)	21.25 (1.58)	0.012
Leadership				4.18 (0.38)	4.51 (0.38)	< 0.001
Mutual Support	4.11 (0.44)	4.33 (0.36)	0.003			
Communication	4.15 (0.36)	4.31 (0.43)	0.033			

Significant difference (two tailed) = $p < 0.05$.

Differences in T-TAQ mean change score: T-TAQ change score differed significantly between the intervention and control groups from baseline to 10 and 24 months, respectively. The intervention group showed a significantly greater change in the total T-TAQ and Mutual Support score from baseline to 10 months than students in the control group. From baseline to 24 months, the change differences were significantly higher in the intervention group than in the control group in terms of the total T-TAQ and Leadership score, with a medium to large effect size (II). See Table 8b.

Table 8b Significant differences in mean T-TAQ change score *between* the intervention group (I) and the control group (C) from baseline to 10 months (T0 to T1) and from baseline to 24 months (T0 to T2)

		Mean score (SD)	Mean change score ² (CI)	Mean score (SD)	Mean change score ² (CI)	<i>p</i>
T0 to T1 (Sample 1)		I (n = 72)		C (n = 48)		
	Total T-TAQ score T1	21.10 (1.30)	0.76 (0.45, 1.06)	21.32 (1.34)	0.21 (-0.23, 0.55)	0.035
	Mutual Support T1	4.22 (0.44)	0.11 (-0.00, 0.22)	4.18 (0.39)	-0.13 (-0.26, -0.02)	0.002
T0 to T2 (Sample 2)		I (n = 39)		C (n = 33)		
	Total T-TAQ score T2	21.07 (1.37)	0.70 (0.24, 1.16)	21.21 (1.44)	-0.05 (-0.55, 0.45)	0.028
	Leadership T2	4.37 (0.38)	0.19 (0.06, 0.32)	4.41 (0.44)	-0.10 (-0.24, 0.04)	0.003

Significant difference (two tailed) = $p < 0.05$. ² = Positive change = T1/T2 score > T0 score, Negative change = T1/T2 score < T0 score

7.2.2 Differences *within* the intervention and control groups

In the intervention group, students showed a positive change in total T-TAQ score as well as in four dimensions from baseline to 10 months. From baseline to 24 months, the students showed significant changes in terms of the total T-TAQ score and their attitudes toward Leadership and Situation Monitoring, with a large positive effect size (eta squared = 0.18–0.20). No significant differences in change score influenced by demographic characteristics were found. See Table 8c.

Table 8c Significant change in mean T-TAQ scores *within* the intervention group from baseline to 10 months (T0 to T1) and from baseline to 24 months (T0 to T2)

	T0 to T1 (n = 72)			T0 to T2 (n = 39)		
	Mean score T0 (SD)	Mean score T1 (SD)	<i>p</i>	Mean score T0 (SD)	Mean score T2 (SD)	<i>p</i>
Total T-TAQ score	20.42 (1.22)	21.1 (1.30)	< 0.001	20.37 (1.30)	21.07 (1.37)	0.004
Team structure	4.00 (0.40)	4.19 (0.34)	0.001			
Leadership	4.27 (0.40)	4.41 (0.37)	0.009	4.18 (0.38)	4.37 (0.38)	0.005
Situation Monitoring	3.90 (0.40)	4.09 (0.63)	0.012	3.88 (0.40)	4.11 (0.42)	0.004
Communication	4.15 (0.36)	4.26 (0.39)	0.033			

Significant difference (two tailed) = $p < 0.05$.

Within the control group, the students showed a significantly positive change score in the leadership dimension and a significantly lower change score in the Mutual Support dimension from baseline to 10 months, with a medium effect size (eta squared = 0.10). See Table 8d. Students in the control group did not show any significant change score from baseline to 24 months.

Table 8d Significant change in mean T-TAQ scores *within* the control group from baseline to 10 months (T0 to T1)

	T0 to T1 (n = 48)		
	Mean score T0 (SD)	Mean score T1 (SD)	<i>p</i>
Leadership	4.38 (0.44)	4.54 (0.36)	0.022
Mutual Support	4.33 (0.36)	4.18 (0.39)	0.028

Significant difference (two tailed) = $p < 0.05$.

7.3 Students' experiences (III)

In Study III, the main category, *Learning teamwork is not an event; it's a journey*, emerged from three generic categories and 12 subcategories. In students' experience, grasping the relevance of team training and learning to apply teamwork skills take time. Moreover, students noted that the use of teamwork skills facilitated awareness of being a team member and promoted learning.

See Table 9 for an overview of the categories.

Table 9. Categories emerged through the inductive content analyses (III)

Subcategories	Generic categories	Main category
Complex and theoretical...in the beginning	Grasping the relevance of team training and the principle of teamwork takes time	Learning teamwork is not an event; it's a journey
Repeated input over time increased the understanding of the impact of teamwork		
Practicing structured communication increased the understanding of the team training's objectives		
Being informed, noticed, and listened to evokes the feeling of being included	Facilitates awareness of being a team member	
Providing feedback to supervisors may be challenging		
Hierarchy and severity of care affect behavior and role		
To achieve a task, make you become a team member		
Need to be mentally and practically prepared	Facilitates learning	
A good relationship with the supervisors was essential		
Concrete feedback using professional arguments improves learning		
Training team leadership and delegating tasks are often outside one's comfort zone		
Awareness of how various teamwork skills are used in different units		

According to the students' experiences, **grasping the relevance of the team training and the principle of teamwork takes time**. *The students experienced the TeamSTEPPS® program as complex and theoretical in the beginning*. It was difficult for students to imagine how and when to use the teamwork skills. However, *repeated input over time increased the understanding of teamwork's impact*. After repeated teamwork skills training integrated into various learning activities and clinical placements, an understanding of the relevance and importance of teamwork seeped into

students' consciousness. The students' experienced that *practicing structured communication increased their understanding of team training's objectives*, and they experienced being viewed as more professional and being in control of the situation. Closed-loop communication was used extensively in medical administration and was experienced as contributing to patient safety.

Students experienced using teamwork skills to **facilitate awareness of being a team member**. *Being informed, noticed, and listened to evokes the feeling of being included*. Some students experienced providing *feedback to supervisors as challenging*. As students, they were aware that they should ask questions to learn, but while the inquisitive questions were easy to ask, questions that could be perceived as negative criticism of the supervisor's knowledge or choice of care were harder to formulate. *Hierarchy and severity of care affect behavior*, and *role* pertains to students' experiences within a hierarchical system, where authoritative behavior made the students reluctant to speak up or share their view on the quality of care. In cases where patients require emergency care, the students may not have sufficient self-efficacy regarding their knowledge and skills to assume a leadership role. Moreover, students' experiential confirmation that one should *work in a team to achieve tasks* contributed to their positive attitude toward teamwork. The students felt that as team members, they had a special obligation to ask questions and that this role contributed to patient safety.

The students noted that using teamwork skills **facilitated learning** in clinical practice in multiple ways. Specifically, the use of leadership tools, such as briefing, reinforced the *need to be mentally and practically prepared*. Briefing facilitated learning and practically prepared students for their taskwork and their role on the team. Additionally, students experienced briefing and huddling as teamwork tools that improved patient safety, as they allowed students to be prepared, share knowledge and information, and change plans throughout the workday based on updated information gathered from monitoring patients. Without briefing in advance of the learning situation, even simple tasks could be experienced as difficult. Students also experienced that *a good relationship with supervisors was essential*. Specifically, students realized that the quality of their relationship with their supervisors impacted the frequency at which they asked questions and spoke up, as well as their role on the patient care team. Having

multiple supervisors was experienced as a possible threat to the psychological safety needed to use the learned teamwork skills, such as speaking up when a threat to patient safety was perceived. Students also noted that *concrete feedback with professional arguments improves learning*. To enhance learning, the feedback should be specific and timely, preferably with suggestions for improvement. In students' experiences, the initiative and the quality of supervisors' feedback varied. Students also found that *training team leadership and delegating tasks was often outside one's comfort zone*. The students expressed ambivalence to training team leadership. They felt more comfortable as team leaders when they received explicit support, indicating their preference for being trainees. The responsibility of leading and delegating was sometimes overwhelming if there were too many leadership tasks. On the other hand, students felt safe when they had a supervisor as a backup. It was noted that delegating tasks to a person occupying a superior position in the hierarchy could be unpleasant. Students doubted whether they had sufficient knowledge to assume a leadership role but were never entirely on their own with the responsibility. From students' perspective, team training raised their *awareness of how various teamwork skills are used in different units*. This category comprises students' experiences of teamwork variances from unit to unit during their clinical placements. The students reflected on how they applied their TeamSTEPPS® teamwork skills during previous clinical placements and while working as a nurse assistant or visiting specialized units as a student. Students reported that team training provided them with a best practices toolbox that they used to assess the teamwork they observed.

7.4 Summary of results

Study I found that the T-TAQ showed some potential to ascertain bachelor of nursing students' attitudes toward teamwork (I). However, the questionnaire should be considered unidimensional when used for bachelor of nursing students, as it showed an acceptable internal consistency regarding the total T-TAQ score but below threshold values in four of five dimensions (I). The sample size was considered representative of the population of interest and was sufficiently large to produce valid results (I).

Study II revealed that compared to the intervention group, the control group had significantly higher T-TAQ total score at baseline. Team training participants showed a significant positive change in total T-TAQ score and their scores in the Team structure, Leadership, Situation Monitoring, and Communication dimensions from baseline to 10 months as well as in their total T-TAQ score and their scores in the Situation Monitoring and Leadership dimensions from baseline to 24 months (II). Additionally, the total T-TAQ and Situation Monitoring score showed acceptable reliability (I) and strengthened the validity of the measured changes (II). The students in the control group showed a significant change in score in the Leadership dimension and a significant negative change in score toward Mutual Support from baseline to 10 months. However, the change difference in the Mutual Support score must be considered to have low validity based on the low reliability shown in Study I. Students in the control group who completed surveys at both baseline and 24 months showed no significant changes in T-TAQ scores.

Study III can be summed as *learning teamwork is not an event; it's a journey*. Students found that grasping the relevance of team training and using teamwork skills take time (III). Students also experienced that the use of teamwork skills in clinical practice facilitated awareness of being a team member and facilitated learning in a variety of ways.

8.0 Methodological considerations

This chapter presents some methodological considerations that informed the choices made throughout work on the thesis in the interest of producing valid and reliable results in the quantitative studies and ensuring trustworthiness in the qualitative study.

Measurement validity and reliability (I)

Validity may be split into a questionnaire's measurement validity (I) and the validity of inferences (II) (Polit & Beck, 2021; Polit & Yang, 2016). A questionnaire's reliability refers to its internal consistency and whether the items reflect a heterogeneous latent construct (I) (Polit & Yang, 2016).

Validity in a measurement context refers to the degree to which a questionnaire measures the construct it is supposed to measure. Validity can be divided into *content validity(not measured)*, *face validity*, *criterion validity (not measured)*, and *construct validity* (Polit & Yang, 2016).

Content validity is whether a questionnaire has the appropriate number of items to fully cover the content of the construct being measured (Polit & Yang, 2016). Measuring content validity was beyond the scope of this thesis; however, the questionnaire is thought to have appropriate content validity due to the thorough process and extensive research used to develop the items (Baker et al., 2010).

Face validity refers to whether a questionnaire appears to measure the target construct (Polit & Yang, 2016). *Face validity* was tested with a group of third-year students who indicated the extent to which the items were comprehensible and the degree of ease they experienced with scoring on the 5-point scale. This pilot test resulted in additional explanations for some constructs in Items 13 and 15 in the Norwegian version of the T-TAQ (I).

Construct validity refers to what is actually being measured and encompasses three aspects: hypothesis-testing construct validity, structural validity, and cross-cultural validity (Polit & Beck, 2021). Hypothesis-testing construct validity aims to test if the questionnaire really measures the construct of interest (Polit & Beck, 2021), and was not measured in this study. Cross-cultural validity was tested in a previous study

(Ballangrud et al., 2019), and *structural validity* was the aim of testing in Study I. CFA is well-suited to measuring structural validity when the researcher has a predefined hypothesis concerning a questionnaire's structure and dimensions (Brown & Moore, 2012). The predefined hypothesis in this research was that the questionnaire used among nursing students would have the same structure as the original T-TAQ questionnaire designed for health care professionals. One of CFA's strengths is its ability to show variance, that is, both reliable variance reflected as each dimension's factor loading on each item, and random error variance, which is also called the measurement error (Brown & Moore, 2012). Hence, CFA can test a questionnaire's structural validity and reliability. Given this study's validity, the most recommended goodness of fit indexes were used for statistical analyses (Polit & Yang, 2016).

Study I's *external validity* hinges on the extent to which the study's results can be generalized to bachelor of nursing students in different settings and times. The sample should represent the population of interest and be sufficiently large to show external validity (Polit & Beck, 2021). Study I aimed for homogeneity by inviting the participation of all first- to third-year students across the university's three campuses. The age and gender of the sample were similar to nursing students in a bachelor's program in Norway; the sample can therefore be considered representative of the population of interest (Statistics Norway, 2018). The sample size ($n = 503$) was considered appropriate for CFA of a 30-item questionnaire, as the recommended sample size is $n \geq 10$ per item (Polit & Yang, 2016). The response rate was low among second- and third-year students (15.3%), which may affect the external validity of the results, that is, whether they are generalizable to bachelor of nursing students as a homogenous group. The results did not differ significantly from the results of psychometric analyses of the T-TAQ for health care professionals in Norway (Ballangrud et al., 2019), Sweden (Hall-Lord et al., 2021), and France (Diep et al., 2021). The analyses could have been performed by splitting the sample into first-, second-, and third-year students to determine whether the goodness of fit differed between the groups. This was not done, as the samples would not have been sufficiently large to obtain valid CFA analysis results for the 30-item T-TAQ (Polit & Beck, 2021).

Reliability was tested using Cronbach's alpha, the most used coefficient for testing internal consistency (Raykov & Marcoulides, 2019). Cronbach's alpha values were comparable with those in a previous study conducted in a Norwegian context (Ballangrud et al., 2019). Further, reliability was tested by splitting the sample into two random halves in Model 2 to test for internal consistency. Results confirmed the stability of the CFA (Polit & Yang, 2016). Response stability can be tested using a test–retest design, with the same sample at two different times and analyzed with an interclass correlation coefficient (ICC) (Polit & Beck, 2021). This study did not prioritize test–retest of the T-TAQ due to student recruitment challenges, although its inclusion could have strengthened the questionnaire reliability test.

Inference validity and reliability (II)

Inference validity may be divided into different aspects of validity, such as *statistical conclusive validity*, *internal validity*, *construct validity*, and *external validity* (Polit & Beck, 2021). Validity refers to the extent to which the inferences drawn from the study's evidence are well-founded, correct, unbiased, and well-grounded (Polit & Beck, 2021).

Statistical conclusion validity refers to the validity of inferences claiming that there is a truly empirical correlation between cause and effect (Polit & Beck, 2021). Statistical conclusion validity was ensured in this research by meeting the assumptions of the statistical tests. Parametric and nonparametric statistics were used. Nonparametric statistics are ideal when data are measured on nominal and ordinal scales and with small samples (Polit & Beck, 2021). In this study, nonparametric statistics were only used to analyze nominal variables. Parametric statistics make assumptions about the sample size, presume a normal distribution of scores within the population, and the variable's measurement level is one an interval-based or continues scale (Pallant, 2016). However, data from social science studies are rarely normally distributed, and when analyses of aggregated scale data are used, an ordinal scale may be treated as continuous if there are five or more response options, indicating that parametric statistics may be appropriate (Harpe, 2015; Tabachnick & Fidell, 2014). The data were considered suitable for the use of parametric statistics to show differences between and within groups at the

dimension level and regarding the total T-TAQ score (II). Parametric tests are considered to be more powerful than nonparametric tests (Polit & Beck, 2021), additionally the use of parametric test was convenient as it facilitated comparison with previous studies, and were therefore used to analyze the data in Study II.

Sample 2 in the control group ($n = 33$) was the smallest, albeit above 30, which should be sufficient to avoid violating the assumptions necessary for the use of parametric statistics and to circumvent any significant problems (Pallant, 2016). The data were checked for homogeneity of variance within the demographic characteristics and for outliers and missing values (II). There were few outliers, and the missing data were random and should not have had any systematic effect on the results. Using a paired t-test to analyze the score differences between the two measurements in the intervention and control groups strengthened statistical conclusive validity. Thus, the students were their own control, and possible confounders were avoided by comparing the two independent groups' scores (Polit & Beck, 2021). Before conducting the study, power analysis was performed to calculate the desired sample size. The sample size did not reach the expected number in any of the surveys, which weakened the statistical validity.

Additionally, substantial participant attrition occurred from baseline to 10 and 24 months, respectively, which shrunk the sample size for the purposes of the equation to calculate T-TAQ score differences between the two measurement times. A larger sample would have strengthened statistical conclusive validity (Polit & Beck, 2021). Dropout analysis was performed to determine whether the data used in the inferential statistics varied substantially from the data collected from students who only participated in one survey (Polit & Beck, 2021). Dropout analyses of demographic characteristics, T-TAQ scores, and variance were performed to ascertain whether the students who only participated in one survey differed from their peers who completed two or more surveys. The only difference was seen in the control group, where most students who participated in only one survey T2 ($n = 15$) had 1–2 years of working experience ($p = 0.048$).

A two-tailed significance level < 0.05 was set for all tests (Polit & Beck, 2021). To minimize the incidence of Type I errors (false positive) leading to rejection of the null hypothesis, a significance level of 0.01 could have been chosen. However, this was not done because it would increase the risk of Type II errors, that is, rejecting a difference even if one were present (Polit & Beck, 2021).

Internal validity refers to the extent to which one can infer that the independent variable, rather than another factor, affected the outcome (Polit & Beck, 2021). Longitudinal studies are exposed to multiple threats to internal validity (Polit & Beck, 2021; Polit & Yang, 2016). In this research, attitude is an abstract construct, and the students might not have understood the meaning of the items, or they may have responded according to social desirability. Substantial respondent attrition occurred from baseline to 10 and 24 months, respectively, which may have led to the inclusion of only devoted students who were fond of team training. Moreover, over the 24-month period, other reasons than team training could have caused attitudinal changes, such as the education in itself. The fact that we had a control group that did not undergo TeamSTEPPS[®] team training contributes to internal validity. Hence, the control group likely used some of the tools that form part of the TeamSTEPPS[®] team training program, as some of the program tools are generic ones commonly used in nursing practice in Norway (e.g., ISBAR communication and briefing and debriefing). However, the TeamSTEPPS[®] program team training structure is unique in the context of patient safety in that it highlights the complexity of teamwork, the dynamic interplay between the four core skills, and the team-related outcomes of enhanced knowledge, positive attitudes, and exceptional performance (AHRQ, 2019a). The use of individual tools that are part of the TeamSTEPPS[®] team training program does not necessarily create the same depth of understanding as to how teamwork skills enhance patient safety. Additionally, to the best of the research team's knowledge, no extant publications indicated that TeamSTEPPS[®] team training had been systematically applied to bachelor of nursing education previously in Norway. Nevertheless, the study's longitudinal quasi-experimental design made it difficult to establish a causal effect between attitudinal changes and team training.

The study's *construct validity* was safeguarded through the use of an evidence-based team training program in the intervention, which was considered a good representation of the underlying teamwork construct (Polit & Beck, 2021). Further, the change-team attended a master trainer course in the United States to prepare to implement the intervention to the best of their ability. Additionally, Kotter's steps guided the TeamSTEPPS® intervention process (AHRQ, 2017a). Construct validity was ensured using a validated questionnaire (I), although the questionnaire was not a perfect fit for nursing students. A threat to construct validity is that the researcher may have influenced participants' responses. Additionally, the students and the faculty responsible for team training may have displayed enthusiasm or skepticism about new methods (Polit & Beck, 2021). To minimize the potential effects of these construct validity threats, responsibility for team training was shared among several faculty members. The researcher was a change-team member and participated in a few team training activities but was not directly involved in simulation scenarios or team training as a component of skills training. Team training offered students a novel experience in the first semester, but because training continued over 26 months, the novelty effect is expected to have diminished as the intervention proceeded.

External validity concerns the generalizability of inferences, that is, the extent to which the study results will hold across variance in subjects, setting, and time (Polit & Beck, 2021). The use of a self-reported questionnaire may raise concerns regarding respondents' degree of honesty. Attrition and the response rate may affect the external validity of the study's results (Polit & Beck, 2021). The attrition rate was high in the longitudinal study (II). The study's results should be generalized to a larger population with caution.

Reliability

Reliability of results in inferential quantitative studies refers to the accuracy and consistency of the information obtained in a study (II) (Polit & Beck, 2021). When using a change score to measure the difference between two measurements, a major issue is amplification of measurement error, which affects the change score's reliability (Polit & Beck, 2021). Study I had low Cronbach's alpha values and factor loadings in

the Mutual Support dimension, suggesting that change score in that dimension would have low reliability. The total T-TAQ and Situation Monitoring score had a Cronbach's alpha of 0.70, indicating acceptable reliability (I).

Trustworthiness (III)

Trustworthiness parallels reliability and validity in quantitative research and concerns whether readers can trust that the researcher has accurately and insightfully presented the inquiry (Polit & Beck, 2021). The criteria for trustworthiness are linked to the concepts of *credibility*, *dependability*, *confirmability*, and *transferability* (Lincoln & Guba, 1985), all of which were duly considered throughout the entire research process. Finally, *reflexivity* is the researcher's guide on how to avoid personal bias in qualitative research (Polit & Beck, 2021); this is described in detail at the end of this section.

Credibility can be compared to internal validity as it concerns confidence in both the veracity and accurate interpretation of the data. Credibility hinges on whether the sample had relevant experiences of the phenomena to be explored. In the present research, all students experienced team training starting in their first semester. The sample was a convenience sample, but the students' demographic profiles showed suitable diversity in terms of age, gender, clinical placements, and previous health care work experience, which, in turn, allowed for a broad description of the phenomenon of interest. Credibility was further established by the pilot interviews, which confirmed the relevance of the open-ended questions.

The interview guide was also used to prompt reflection in all the interviews. If the moderator doubted a student's meaning, he rephrased the student's statement to check whether he understood it correctly. As another layer of clarification, the assistant moderator reread what she heard during the interviews. One possible weakness that may affect credibility is that the moderator's extensive knowledge of the team training program may have influenced the follow-up questions. According to Lincoln and Guba (1985), involving other researchers as critical reviewers increases credibility. Therefore, the manuscript was presented to colleagues during "manus seminars" for critical review to help improve the analyses and presentation of the research. Credibility was further

strengthened through critical review within the research group during a thorough process involving iterations of comparing the interview transcriptions and the categories until consensus was reached. Detailed description of data collection and analysis following the three phases Elo and Kyngäs (2008) recommended also contributed to strengthening credibility, as did reporting the study according to Consolidated criteria for reporting qualitative research (COREQ) criteria (Tong et al., 2007).

Dependability concerns the methodology used to appropriately answer the research questions to show data stability over time and across a range of conditions (Lincoln & Guba, 1985; Peardon et al., 2020). The same two experienced moderators ensured the interviews' dependability by their solid knowledge of the focus group interview methodology coupled with the fact that they began the interviews with the same opening questions (III).

Confirmability is related to the objectivity of the data, whether the data represent participants' viewpoints, and the veracity of the interpretation of the data (Lincoln & Guba, 1985; Polit & Beck, 2021). The research team ensured confirmability by systematically reading the interviews and codes and engaging in iterative comparison to gain insights into the content and carefully generate categories reflecting the students' voices. Quotations were used to enhance and illuminate the content of the categories. Disagreement within the research team concerning whether the data represented the information provided by the students was resolved.

Transferability refers to the applicability of the results and whether they are generalizable to other settings or groups (Lincoln & Guba, 1985; Polit & Beck, 2021). Transferability was ensured by presenting a thorough description of the sample and setting as well as of data collection and analyses. These descriptions allow the reader to infer the extent to which the results are trustworthy and can be extrapolated to other settings (Polit & Beck, 2021).

The researcher's role

Reflexivity refers to how the researcher's background and preconceptions may affect qualitative or quantitative research, although the term is more commonly used in reference to qualitative research (Polit & Beck, 2021). As interviewers, researchers are a

part of the process, given that they conduct interviews and decide how questions are posed and how responses are interpreted during analyses. It is impossible for researchers not to exert some kind of influence on interviewees during focus group interviews given their role as moderators, which entails selecting follow-up questions and rephrasing students' statements. Moderators' age, gender, and profession may also influence the interview process, as interviewees may view the moderator as powerful. From the perspective of the students who participated in this research, the experiences they choose to share may have been influenced by the moderators' identities. For instance, some interviewees may have answered in a way they thought the moderators would appreciate, given the moderators' power by virtue of being researchers and lecturers (Alvesson, 2011). This subject was raised in the preamble to the interviews.

As a lecturer and a researcher, I had a double status, which may have had advantages and disadvantages (Mercer, 2007). Advantages included ease of access to and a higher degree of familiarity with the simulation center and information systems, which allowed me to arrange meetings to provide faculty with formal and informal information. On the other hand, faculty members may have refrained from sharing critical feedback on the intervention on the premise of courtesy and "loyalty" to me as a colleague.

I have made efforts to remain aware of my professional background as an intensive care nurse, lecturer, and nursing student supervisor in this research. I have also considered the potential impact of my preconceptions on this research during data collection and analysis.

9.0 Discussion of main results

The overall aims of this thesis were to implement a longitudinal team training intervention in bachelor of nursing education and explore students' reactions to the team training (III), their attitudinal changes with regard to teamwork (II), and how they experienced the use of teamwork skills in practice (III).

In this chapter, the results from the three studies I, II, and III are discussed and organized according to three levels of measurement (Kirkpatrick & Kirkpatrick, 2006): reaction to team training, learning from team training, and transfer of learned teamwork skills to clinical practice.

9.1 Reactions to team training

The focus group interviews explored students' reactions to team training (III). The students described experiencing team training as hard to grasp initially. They also noted that it was theoretical and that they did not know how to use the TeamSTEPPS® skills (III). These team training reactions contain both the *affective* and *usefulness* aspects (Kirkpatrick & Kirkpatrick, 2006). The students who participated in this study did not explicitly describe team training in affective terms, such as joyful, funny, or scary; rather, they used rational terms, as they appreciated the utility of words to describe teamwork skills, which, in turn, increased their awareness, and they continued to use the tools as they became aware of how important teamwork is a part of learning to be a professional nurse (III).

The pedagogic approach of simulation was used extensively in the intervention to train teamwork skills. Previous studies describe students reaction from participating in simulated scenarios as stressful, as it drew them out of their comfort zone (Roh & Jang, 2017; Tosterud et al., 2014). Other studies have reported using simulation training to boost students' self-confidence (Haddeland et al., 2018; Hustad et al., 2019). For example, Ross et al. (2021) reported that students enjoyed the TeamSTEPPS® program and found it to be very productive; therefore, these students recommended that simulation be introduced earlier in the program and used more frequently. Thus, Ross et al.'s (2021) nursing students showed positive affective and usefulness reactions to team training. Affective reactions may motivate learning if students enjoy training

(Kirkpatrick & Kirkpatrick, 2006), whereas the utilitarian reaction is linked to the level of learning during training (Hughes et al., 2016).

The first step in the implementation strategy was to establish a sense of urgency (Kotter, 2012). The change-team guided faculty as they implemented teamwork skills into their courses with the goal of improving patient safety. Students experienced the integration of teamwork skills as an overload of new information (III). Indeed, first-year students have a lot of new knowledge and many new skills to learn, which may result in cognitive overload (Josephsen, 2015). This may, in turn, impede the development of a sense of urgency for team training in the first semester of nursing education because students are focused on learning psychomotor skills and acquiring anatomy and physiology knowledge (III). The team training described in this thesis approached skills training with the philosophy of integrating teamwork skills, focusing on the impact of teamwork on task performance and patient safety. This approach is supported by Handeland et al. (2022), who have suggested that teachers facilitate simulated skills training with mannequins to expand psychomotor skills training through the integration of the interpersonal aspects of clinical nursing, such as communication, caring, and teamwork. However, given the students' minimal experience in health care, TeamSTEPPS® team training was experienced as complex and theoretical (III). One alternative may be to introduce the TeamSTEPPS® skills to facilitate learning in classroom settings in the first semester, as Johnson et al. (2011) suggested. Introducing teamwork skills and constructs linked to learning anatomy and physiology, for example, where students must pass an exam in the first semester, will allow students to become familiar with teamwork skills in connection to a short-term target, that is, passing the exam. The teamwork skills could then be connected to nursing care and patient safety as the students approach their first clinical placement in the second semester. Johnson et al. (2011) reported that 90% of students agreed that team concepts made class more fun, and 75% said they would be pleased to work with their peers on another team in the future.

9.2 Learning from team training

The T-TAQ was used to measure attitudinal changes. In Study II, a significant positive change in the total T-TAQ score for attitudes toward teamwork was found in the

intervention group from baseline to 10 months and 24 months, respectively, with the most significant changes seen from baseline to 10 months (II). This result is unsurprising, as the students were assumed to be unfamiliar with teamwork skills in the context of health care at the beginning of their nursing education.

Although 60% of the intervention group and 68% of the control group (II) had previous experience in health care prior to enrolling in the bachelor of nursing program, the words used to describe teamwork were new to the students and served to increase their awareness (III). Students in the control group had significantly higher total T-TAQ score at baseline. The only measured demographic difference between the two groups was that the control group had significantly more students aged 25 or older. This difference at baseline can be interpreted as follows: Students starting the bachelor of nursing program at an older age have a more positive attitude toward teamwork by virtue of being older than their peers, as attitudes develop through accumulated experiences, personal values, social relationships, cultural influence, and persuasive messages throughout a person's lifespan (Albarracin & Shavitt, 2018). Carson et al. (2018) found a possible correlation between a positive perception of teamwork and higher age and part-time jobs among nursing students. Additionally, a meta-analysis revealed a moderate correlation between overall positive work attitudes and age (Ng & Feldman, 2010). However, Study II participants aged 25 and older did not differ from their younger peers in terms of attitudinal *change* in either the control group or the intervention group (II).

Additionally, Hughes et al. (2016) found that team training was equally effective across health care professionals and students. Health care professionals are likely older and have more work experience than students. Therefore, even if the control group comprising more older students exhibited more positive attitudes toward teamwork when starting nursing education, they would probably benefit from attending team training. The homogenous changes in the intervention group indicate similar benefits from the team training across all age groups (II)

Among three previous longitudinal studies, one did not show significant total T-TAQ score changes from pre- to post-training, but found that teamwork knowledge increased significantly from pre- to post-training (Ross et al., 2021).

Significant attitudinal changes with respect to Team structure were found from baseline to 10 months in the intervention group but there was no significant change from baseline to 24 months (II). The Team structure dimension showed low internal consistency, with an alpha value of 0.46; it is therefore tenuous whether a team structure score change reflects a change in attitudes toward Team structure (I). The low internal consistency may be influenced by item TS4, which reads “*A team’s mission is of greater value than the goals of individual team members,*” This item had the lowest factor loading of the dimensions' items (0.28) and a high error variance (0.74) (I). A plausible explanation may be nursing students did not understand this item’s meaning properly (I).

Team structure was an essential part of the intervention in the first two semesters; the importance of including the patient on the team was emphasized, which may have led to a significant change from baseline to 10 months (II). Two previous studies found significant attitudinal changes with respect to Team structure (Maguire et al., 2015; Maneval et al., 2020). Empowering the patient as a team member who is involved in their own care, providing relevant information, and giving health care providers feedback may be vital to ensuring patient safety (White paper nr. 11, 2018-2019).

Communication is a lifeline on well-functioning teams, and it serves as a coordinating mechanism of teamwork (AHRQ, 2019a). The Communication dimension of the T-TAQ showed significant change after 10 months but no significant change from baseline to 24 months (II), in line with previous longitudinal studies (Maguire et al., 2015; Maneval et al., 2020). Huehn et al. (2020) found a negative change in the Communication dimension. On the T-TAQ, this dimension showed limited reliability, with a Cronbach’s alpha of 0.56 in Study I and an alpha of 0.57 when used in a sample of health care professionals (Ballangrud et al., 2019), indicating limited internal consistency of the dimension’s constituent items. However, five out of six items showed high factor loadings when used in a sample of nursing students (I) and could be considered to reflect the construct of Communication, although Item C30, which is negatively worded, showed a low factor loading (0.22) and compromised the dimension’s internal consistency. The psychometric test of the questionnaire showed an intercorrelation (0.78) between the Communication and Mutual Support dimensions (I),

indicating that nursing students' responses to these two dimensions are strongly positively correlated. The use of structured communication is a teamwork skill that was trained throughout all the semesters of the team training intervention. Students reported positive experiences of using structured communication to exchange information, perform handovers, and interact with medical administration (III). These positive experiences did manifest as a positive change score with respect to Communication from baseline to 10 months, but was not shown as an positive attitudinal change among students who took part in the baseline and 24 months survey (II). These results may demonstrate the importance of using a highly reliable questionnaire, and quantitative and qualitative methods could provide useful supplementary information. A study to observe students in simulated scenarios pre- and post-team training could reveal measurable changes in communication skills learning. An observation study of a TeamSTEPPS® team training intervention in nursing education has not yet been conducted and is recommended for future research.

The control group showed significant changes from baseline to 10 months in the Leadership dimension, although they did not receive the TeamSTEPPS® team training. The Leadership dimension contains items that emphasize the importance of sharing information (L7, L8), being a role model for team behavior (L10) and encouraging team leaders to ensure that team members help and support each other (L12), as these are the qualities novice nursing students most likely appreciate in a team leader when they need help coping with nursing care. The items in the Leadership dimension had high factor loadings (I), indicating that nursing students link the Leadership items with the leadership construct. The Leadership dimension was one of two dimensions that showed a significant change in the intervention group from baseline to 24 months, with a medium to large effect size. The qualitative results showed that students appreciated being prepared, both practically and mentally (III), and that achieving preparedness involves using Leadership tools to share information, assume a role, and establish a shared mental model through a briefing session prior to a team task. Across all the dimensions, students in the control group had the highest score in the Leadership dimension (II), and the lack of positive change from baseline to 24 months may be due to the ceiling effect (Polit & Yang, 2016).

In the intervention group, the most significant score changes from baseline to 24 months were found in Situation Monitoring and Leadership (II). Previous studies reported similar findings (Greene & Doss, 2021; Huehn et al., 2020; Maneval et al., 2020). For example, Ross et al. (2021) found positive changes in knowledge but no change in attitudes at any measurement times. Situation Monitoring is the foundation for the other teamwork skills; it entails monitoring events such as patients' vital signs, the environment, team members, self-monitoring, and the team's progress toward the teamwork goal (AHRQ, 2019a). Situation Monitoring is the first step to achieving situation awareness, and sharing the findings of monitoring with the team through specific and structured communication may create a shared mental model (Floren et al., 2018). This teamwork skill is a part of sharing situational cognition, taskwork, and teamwork challenges and is an essential component of how effective teams should work to enhance patient safety (Gregory et al., 2021). Students experienced this sharing of knowledge within the team as the core of teamwork (III). According to Mohammed et al. (2010), establishing a shared mental model within a team includes the properties of *similarity* and *accuracy*. *Similarity* refers to the degree to which the team members have a common understanding of teamwork and taskwork, and increased sharing is positively correlated with team performance and efficiency. The *accuracy* of a shared mental model refers to the quality of the similarity, which may refer to the timing of the taskwork; even if the team has a shared understanding of what to do and who should do it, timing may seriously jeopardize the final outcome (Mohammed et al., 2010). Situation awareness is vital to clinical decision making and is therefore integrated into nursing practice, as it influences patient outcomes (Stubbings et al., 2012). Debriefings on the simulation scenarios and reflection sessions in the team training emphasized the idea of a shared mental model, which may have contributed to positive changes in the attitudes toward Situation Monitoring score.

Sharing information through feedback is vital for the Mutual Support skill (AHRQ, 2019a). The Mutual Support dimension did not show any significant score changes from baseline to 10 months or from baseline to 24 months within the intervention group (II). Previous studies found a positive change (Greene & Doss, 2021), a negative change (Maguire et al., 2015), or no significant change from pre- to post-test (Huehn et al.,

2020; Maneval et al., 2020). The Mutual Support dimension in the T-TAQ showed low internal consistency (I), and the validity of score changes may be considered low. The intervention focused extensively on feedback delivered through workshops and on-campus training, and students noted that feedback was essential to enhancing patient safety and learning (III). These results show that various information sources may be needed to measure changes in attitudes toward Mutual Support in teamwork. Changes in the Mutual Support dimension struggle with reliability when used in samples of health care professionals, as this dimension had a low Cronbach's alpha value in such populations (Ballangrud et al., 2019; Diep et al., 2021). Mutual Support in the form of task assistance, feedback, or addressing conflicts within the team is vital to patient safety and effective teamwork (AHRQ, 2019a). This thesis shows that exploring attitudes toward Mutual Support in the context of teamwork behavior might be complicated when using quantitative methods, since the questionnaire has low reliability in the Mutual Support dimension (I).

Students experienced receiving feedback as essential to learning (III). In both simulation training and clinical practice, constructive feedback is essential to facilitate learning (Altmiller et al., 2018; Lefroy et al., 2015). The effectiveness of feedback is found proportional to the volume of information the feedback contains (Wisniewski et al., 2020). Peer-to-peer feedback among students has been shown to exert a significant effect (Wisniewski et al., 2020) and should be encouraged to improve teamwork and taskwork in nursing education. Two studies reported using student instructors in TeamSTEPPS® team training (Huehn et al., 2020; Thomas, 2016). Huehn et al. (2020) reported positive team training narratives but no significant change in attitudes toward teamwork. In the other study, the students were receptive to peer learning (Thomas, 2016).

Given that TeamSTEPPS® is designed to support KSA outcomes, students' teamwork skills should be assessed as a TeamSTEPPS® training outcome measure (Ross et al., 2020). Further research may measure nursing students' teamwork skills using a validated observation tool for measuring teamwork behavior. The TPOT is an observation tool designed to measure teamwork skills (Baker et al., 2015), although it has not been validated in a population of undergraduate health care providers.

9.3 Transfer of skills acquired through team training to practice

The Study III results show that repeated input over time and regularly practicing teamwork skills increased students' understanding of the content of team training and the impact of teamwork (III), which, in turn, supports learning as a process (Ambrose et al., 2010). Kotter's (2012) Step 5 emphasizes the need to practice new skills if change is to occur and supports the extensive use of simulation as a pedagogic approach in team training, a recommendation that this research and most previous studies concerning team training in nursing education settings have adopted (Barton et al., 2018; Ross et al., 2020) as a supplement to clinical practice. Students in the intervention group showed significant attitudinal changes (II), and the interviews (III) suggested that the students acquired knowledge about teamwork best practices through the team training program. Kirkpatrick and Kirkpatrick (2006) identified four necessary conditions to transfer learned KSA to behavior in practice: The person must be *rewarded for changing, working in the right climate that encourage the behavior, know what to do and how to do it, and have a desire to change*. These conditions are likely interconnected, as students' desire to change would be influenced by how their behavior is rewarded, and an appropriate work environment should influence their understanding of behavioral expectations. Previous studies on TeamSTEPPS® team training in bachelor of nursing education have not explored students' experiences of using teamwork skills in clinical practice. Hence, this research used studies that probed nursing students' clinical placement experiences in general for comparison with students' experiences of transferring their learned teamwork skills into practice.

Through their experiences, Students found that repeated input over time increased their understanding of the impact of using teamwork skills, and their supervisors rewarded their use of structured communication. The students thought that they were considered more professional when they used teamwork skills (III). These elements of psychological reward may have motivated the students to keep using teamwork skills. The use of rewards to encourage the continuity of desirable behavior is congruent with Kotter's (2012) Step 6, which concerns attaining a short-term win, and according to Kirkpatrick and Kirkpatrick (2006) it is a necessary condition to change behavior.

Moreover, rewarding behavior that enhances patient safety is congruent with the philosophy of Safety II, that is, rewarding teamwork behavior that enhances the effectiveness of patient care or things that “go right,” which traditionally get less attention than things that “go wrong” (Hollnagel et al., 2015).

Another condition for behavioral change is to be in the right climate (Kirkpatrick & Kirkpatrick, 2006). In students’ experience, the right climate for the application of teamwork skills during clinical placements involved feeling included in the team and having good relationships with supervisors (III). These characteristics are in alignment with Cant et al. (2021) and Panda et al. (2021), who found that belongingness gave students excellent access to learning opportunities. Furthermore, team belonging changed students’ status and made them feel valued and accepted as a nursing colleague. Hence, team belongingness may mitigate the effects of working within a hierarchical system (Cant et al., 2021). Students reported that hierarchical factors influenced their selection of roles and tasks during clinical placements (III). The challenge with hierarchical systems is that health care professionals who occupy a lower status, such as students and junior - nurses, and -physicians, are reluctant to speak up when they witness a medical error (Peadon et al., 2020). This reluctance may be related to students’ experience of psychological safety, which is a dynamic phenomenon that concerns team members’ perception of whether it is safe to take interpersonal risks at work (Edmondson, 1999). Psychological safety has shown to significantly influences patient safety (O’Donovan & McAuliffe, 2020). Individuals that report high levels of psychological safety are more likely to report adverse events, and high levels of psychological safety create conditions that enable learning and reduce mistakes (Salas et al., 2018). The interviews revealed variance in how students experienced the climate at their clinical placement regarding psychological safety (III). Team training included learning activities in which feedback skills were trained. However, the roleplay context and setting populated by students’ peers likely yield a different experience than students’ clinical placements regarding the risk students must weigh and the extent to which they transfer their learned behavior to practice. Study II showed significant positive attitudinal changes with respect to teamwork among students who participated in team training. However, learning transfer requires a right climate to manifest in

behavior in practice, as Kirkpatrick and Kirkpatrick (2006) and Baldwin and Ford (1988) noted.

Additionally, students need to have the moral courage and the inner strength to speak up when facing an ethical conflict that may threaten patient safety, even if their actions may have negative personal consequences including feeling as though they are standing alone (Bickhoff et al., 2017). In simulated settings, barriers to speaking up are predominantly students' subordinate status, the patient's presence, and fear of consequences (Hémon et al., 2020); students who participated in the present research experienced similar barriers (III). Moral courage may be stimulated in a variety of ways to empower students to practice Mutual Support skills in the face of patient safety threats. One method is to create a safe climate where students can voice their concerns. In the present research, students found that having a good relationship with their supervisors impacted the frequency at which they asked questions (III). Acting as patient advocacy empowered students to speak up, even if that entailed putting themselves at personal risk (Bickhoff et al., 2017). Empowering students' moral courage can be accomplished by creating a sense of team belongingness to lower the hierarchical barriers that discourage students from speaking up when they detect a patient safety risk (Cant et al., 2021). The TeamSTEPPS® program delivers the tools to ensure patient safety; however, for nursing students to practice these skills, a supportive environment that creates a climate characterized by psychological safety is necessary to foster students' moral courage to act. Additionally, rehearsed application of the tools the TeamSTEPPS® program provides to navigate professional disagreements regarding patient safety issues shifts communication advocacy from an emotional to a cognitive experience, imbuing students with more power to raise their concerns with authority figures (Horsley et al., 2016).

Attitudes toward Leadership showed a significant positive change from baseline to 10 and 24 months, respectively, among the students who participated in team training (II). However, students often had to venture outside their comfort zone to assume the role of team leader in clinical practice, especially regarding delegating. Assuming the role of team leader during clinical placements could be overwhelming (III). Vincent (2010) confirmed that team leadership is critical, especially in high-risk activities. Even for

students in their fifth semester of the bachelor of nursing program, being a nursing student may well be understood as a responsible role in the team context, especially when they trained to fill the role of a team leader. The team training intervention emphasized briefing, huddling, debriefing, and assigning team members clear roles as leadership tools. The students showed high appreciation for these tools in their roles as team members during clinical placements (III). Training team leadership and delegating tasks received less attention in the team training at campus and should be considered for content expansion in future bachelor of nursing education team training interventions. Some students had good team leadership training experiences during their clinical placements due to a supportive environment (III), a condition necessary to transfer learning to practice (Kirkpatrick & Kirkpatrick, 2006). The importance of a supportive environment is supported by the results Cant et al. (2021) and Panda et al. (2021) have presented, as these researchers found that close supervision and supportive instructors were vital to students' learning as well as to improving their nursing competence. However, in the present research, students doubted whether they had sufficient knowledge and skills to assume a leadership role (III).

Additionally, students' team leader role models may also affect their team leadership training threshold. For example, Künzle et al. (2010) found that students may perceive experienced senior health care professionals with the ability to exert great control over their tasks, delegate tasks, and supervise the team clearly and authoritatively as leaders. On the other hand, students may appreciate non-hierarchical leadership in the context of a fluid, shared process involving all team members, as long as a senior professional can take over whenever necessary to ensure patient safety (Künzle et al., 2010). In nursing education, team leaders should be trained to use the latter approach. Coyle (2018) examined the qualities of highly successful teams in different contexts within and outside health care and found that good team leaders are humble, ask questions, and seek input from their team. This approach to team leadership is how team leaders should endeavor to lead a health care team to ensure the establishment of a shared mental model (AHRQ, 2019a) and create a climate characterized by psychological safety in order to facilitate the timely sharing of all relevant information (Edmondson, 1999).

Students found that information exchange/sharing facilitated learning and prepared them for taskwork and teamwork (III), noting that it is a vital part of creating a shared mental model. On the T-TAQ, the Situation Monitoring and Leadership items reflect whether a team can establish a shared mental model. In these dimensions, a significant change was found among the students who received team training at both measurement times (II). Learning may be seen as rewarding, which positions it as a condition that encourages students' use of teamwork skills during clinical placements, in line with Vincent (2010, p. 344), who has pointed out that effective, safe teams continually verify each other's assumptions through information exchange, briefing, huddling, and debriefing. The aim of knowledge sharing is to create a shared mental model so that the team can clarify who should perform which tasks and the nature of team members' roles (Reeves et al., 2010).

To transfer their learned teamwork skills to clinical practice, students must have the *desire to use* the skills (Kirkpatrick & Kirkpatrick, 2006). Some students experienced the delivery of critical feedback to supervisors as challenging and found delegating in the role of team leader to be out of their comfort zone (III). These teamwork skills may therefore have been the ones students had less desire to use, which would have impeded their practical application in the absence of support in the form of a good relationship with supervisors and a team climate that ensured psychological safety.

9.4 Reflections on the theoretical perspectives

The results in this thesis is discussed in the light of Kirkpatrick's levels of outcome of training. Kirkpatrick's levels are widely used for structuring outcome of training as described in section 5.0. However, the model has been criticized for its hierarchical causal relationship between the levels and its lack of theoretical foundation and for being more focused on behavior learning theory than cognitive learning theory (Reio et al., 2017). Hughes et al. (2016) confirmed a link between the levels but did not find a link between affective reactions and learning of training. The strength of the model is its simplicity (Reio et al., 2017) and has been helpful to structure the work with this thesis.

9.5 Reflections on the intervention

Seven of Kotter's eight steps for leading change guided the implementation strategy. To convey the urgency of implementing team training into the curriculum, we referenced research and policy documents that emphasize the importance of teamwork to ensure patient safety. The *why* of teamwork was a key message to faculty and students throughout the implementation period (Rosen et al., 2012). Strategies that Kotter (2012) recommended, such as the use of multiple forums to communicate teamwork skills, repetition in various relevant training settings, and the initiation of two-way communication through debriefing and reflection sessions, were utilized. The change-team had an important role in communicating *how* teamwork skills can be implemented to produce small and medium changes in the established learning activities.

Empowering faculty to integrate teamwork skills into their courses and further motivating students to practice their learned teamwork skills were vital in Phase 2 of the implementation. In the first semester, we aimed to explain unfamiliar terms from the TeamSTEPPS® curriculum and the teamwork skills content, although students' experiences have indicated that these concepts were still initially hard to grasp (III). Compared to Leadership and Communication skills, which are more popular, Mutual Support and Situation Monitoring skills were unfamiliar to both faculty and students. Teamwork skills were incorporated into basic nursing skills training in the first semester, and the TeamSTEPPS® framework was first introduced in the second semester in the form of a 6-hour fundamental TeamSTEPPS® course.

The students were repeatedly exposed to teamwork skills and related tools and strategies throughout the 26-month implementation phase in different contexts and settings, as described in section 6.3. Students reported that this continuous input in different settings increased their awareness of the importance of teamwork to patient safety (III). However, giving feedback and raising concerns with supervisors regarding potential patient safety issues in clinical practice were two teamwork skills that some students experienced as challenging (III). Retrospectively, the intervention could have allocated more time to practicing use of the DESC (Describe, Express, Suggest, Consequences) and CUS (Concerned, Uncomfortable, Safety issue) tools, as these provide a structured framework in which health care professionals can communicate

clearly and professionally regarding safety issues (AHRQ, 2019a). The change-team considered grasping and applying these tools challenging and planned to introduce them in the last portion of the intervention. However, the Covid-19 pandemic interrupted activity at the simulation center, and the conflict management simulation that was planned had to be replaced by a video simulation featuring faculty members as actors. The video was used to reflect on conflict management. All related previous longitudinal studies used videos as reflection prompts, and the AHRQ has designed and published videos depicting best practices and malpractice in the context of teamwork for use in the TeamSTEPPS® program. However, using a simulated scenario to engage students in conflict management was the preferred pedagogic approach.

The three previous studies that integrated curriculum-wide TeamSTEPPS® team training interventions in nursing education used the same team training skills in combination with high- and low-fidelity simulation, videos, lectures, and student-centered methods (Maguire et al., 2015; Maneval et al., 2020; Ross et al., 2021). In their intervention, Ross et al. (2021) relied heavily on videotaped interviews with health care professionals who discussed their role on their health care team. Previous longitudinal studies describe their interventions in varying degrees of detail, and there is no evidence-based consensus on the best pedagogic practice for integrating TeamSTEPPS® into bachelor of nursing programs (Ross et al., 2020). The AHRQ (2019a) encourages adaptation of the team training to the specific individual contexts where it is implemented to ensure content relevance. However, the principles should be constant, as described in the TeamSTEPPS® program. This flexibility allows users to ensure the relevance of the team training, but it makes it difficult to compare the effect of team training across different settings and education programs (Barton et al., 2018; Chen et al., 2019; Ross et al 2020). However, the approach of integrating teamwork learning outcomes into simulation training and clinical placements and ensuring that the content is situationally and contextually relevant has produced the best competency outcome (Barton et al., 2018). Brown (2014) postulated that spaced practice is more effective at sustaining learning over time than massed practice and that it supports curriculum-wide team training integration.

The intervention in this study did not involve other health care students. There is no consensus on the optimal timing for the introduction of interprofessional team training (Disch, 2017; Ross et al., 2020). Interprofessional education programs are difficult to implement due to variance in terms of the duration of different types of professional education, the availability of resources including teaching faculty and administrative support (Herath et al., 2017), and the need for lengthy teacher training (Chen et al., 2019). These obstacles may be the reason studies that have reported on TeamSTEPPS® team training involving multiple professions conducted shorter interventions involving senior nursing and other health care students who were close to graduation (Chen et al., 2019; Horsley et al., 2016) or a mix of health care students and professionals (Spaulding et al., 2019).

In the present research, during the students' first clinical placement, supervisors were informed about the TeamSTEPPS® team training intervention and how they could support the students' application of teamwork skills to enhance their learning and ultimately patient safety. During subsequent clinical placements, supervisors received less information about team training due to Covid-19 restrictions, which is unfortunate because the involvement of informed supervisors could have contributed to students' transfer of teamwork skills to clinical practice. Up to the present, the TeamSTEPPS® team training program has been implemented in a small number of hospital units but no municipal healthcare facilities in Norway, and most clinical supervisors were unfamiliar with the program prior to the intervention.

Kotter's steps for implementing and leading change are recommended to structure interventions that aim to effect permanent organizational changes (AHRQ, 2019a). However, Kotter's model is one of several change management strategies. The 3-P framework comprising components similar to Kotter's eight steps (AHRQ, 2019a) has also been used to improve students' learning through the TeamSTEPPS® team training program (Liaw et al., 2014). However, given the lack of experience with other change models, the TeamSTEPPS® implementation guide recommends Kotter's model, which was taught in the master trainer course and adopted for this thesis.

10.0 Thesis conclusions

This thesis makes the following contributions to research on team training in nursing education:

- The Norwegian version of the T-TAQ has the potential to reveal reliable and valid changes in attitudes toward teamwork in a Norwegian bachelor of nursing student population when considered as a unidimensional questionnaire.
- Team training contributes to positive changes in nursing students' attitudes toward teamwork.
- The use of teamwork skills enhances students' experiences of team belonging in clinical placements.
- Training teamwork skills facilitates learning
- The use of structured communication makes students feel in control and enhance patient safety.
- Success in training team leadership requires students to experience psychological safety in a supportive environment.

11.0 Implication for practice

This results in this thesis contributes to demonstrate the importance of validating a questionnaire before using it in a different sample and context than the ones for which it was originally designed.

The results in this thesis supports the implementation of team training in Norwegian bachelor of nursing education.

Teamwork skills and associated tools and strategies enhance students' learning during clinical placements; therefore, teachers and supervisors involved in nursing education should familiarize with them.

The results in this thesis contributes to show the importance of students to experience psychological safety to raise their voices to ensure patient safety during clinical placements.

12.0 Recommendations for future research

Several questions remain to be answered.

Further studies should be conducted with the aim of recording higher levels of Kirkpatrick's outcome of team training, such as behavioral change and the transfer of learned teamwork skills to various clinical practices.

Studies involving the observation of teamwork in simulated and clinical contexts should be conducted to obtain more objective knowledge of nursing students' teamwork behavior related to team training. As a potential instrument, the TPOT could be validated in a Norwegian nursing education context.

Studies exploring team training emphasizing training nursing students leadership skills and the provision of critical feedback in an environment characterized by psychological safety should be considered.

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Appendix

Appendix 1 10 A4 Posters displayed in the simulation center facilities

<p>Hvorfor er TeamSTEPS team trening viktig i sykepleieutdanningen?</p> <p>Sykepleiere utdannet ved NTNU i Gjøvik er kompetente, innovative og kritisk tenkende arbeidstakere som er forbilder i måten de utøver teamarbeid på.</p> <p>...til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>	<p>CHALLENGE Ledelse</p> <p>JOBBER DERE SAMMEN? Prat sammen - avklar ansvar, roller og mål</p> <p>Bruk BRIFING</p> <p>....til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>
<p>CHALLENGE Ledelse</p> <p>HAR DET SKJEDD ENDRINGER? Jobber vi fortsatt mot samme mål?</p> <p>Bruk HUDDLING</p> <p>....til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>	<p>CHALLENGE Ledelse</p> <p>HAR DERE GJORT EN AKTIVITET SAMMEN? Fornøyd med prosess og resultat? Hvordan gjøre det neste gang?</p> <p>Gjør en DEBRIFING.</p> <p>....til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>
<p>CHALLENGE Kommunikasjon</p> <p>VÆR STRUKTURERT NÅR DU FORMIDLER PASIENTINFORMASJON</p> <p>Bruk ISBAR ved kritisk beskjed Bruk IPASS når andre overtar ansvaret</p> <p>....til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>	<p>CHALLENGE Situasjonsovervåking</p> <p>HAR DERE KOMMET FRAM TIL FELLES FORSTÅELSE AV SITUASJONEN?</p> <p>Del tanker om hva som er utfordringene, skap felles situasjonsforståelse,</p> <p>....Til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>
<p>CHALLENGE Kommunikasjon</p> <p>OPPFATTET DU INFORMASJONEN KORREKT?</p> <p>Bruk CLOSED LOOP for å bekrefte. Forvent det samme av de andre i teamet.</p> <p>....til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>	<p>CHALLENGE Situasjonsovervåking</p> <p>FØLGER DU MED PÅ HVA DE ANDRE I TEAMET GJØR?</p> <p>Bruk KRYSSOVERVÅKING</p> <p>....Til det beste for pasienten</p> <p>TeamSTEPS</p> <p>Senter for simulering og pasientsikkerhet, NTNU i Gjøvik</p>

CHALLENGE
Teamarbeid

GODE FERDIGHETER HJELPER INGEN

.....så lenge du ikke praktiserer dem

TeamSTEPS[®]



Senter for simulering og pasientsikkerhet, NTNU i Gjøvik

NTNU

CHALLENGE
Teamarbeid

VÆR ET MODIG TEAMMEDLEM

Del oppdatert kunnskap
Bruk gode ferdigheter
Vis dine gode holdninger i møte med
andre

.....til det beste for pasienten

TeamSTEPS[®]



Senter for simulering og pasientsikkerhet, NTNU i Gjøvik

NTNU

Teamarbeid i helsetjenesten

Her er først noen avklaringer av begrep som brukes i spørreundersøkelsen.

Et team kan defineres som en gruppe på to eller flere enkeltpersoner som er avhengig av hverandre i arbeidet mot et felles mål, og hvor det kreves samordning av innsats og ressurser for å oppnå et felles ønsket resultat og hvor alle deltagere har spesifikke roller eller funksjon. Team har ofte en tidsbegrenset deltagelse.

Teamarbeid i helsetjenesten beskrives som samspillet mellom to eller flere helsepersonell (team-medlemmer) som arbeider gjensidig avhengig av hverandre for å gi behandling og pleie til pasienter.

Teamledere er helsepersonell som har et forhåndsbestemt eller situasjonsbetinget ansvar for å lede og koordinere aktivitetene til andre gruppe-medlemmer. (eks. vakthavende lege, visittansvarlig lege eller sykepleiere med gitt ansvar).

Behandlings og pleiepersonalet er helsepersonell som er involvert i den direkte pasientbehandlingen og pleien som en del av et tverrfaglig team (eks. leger, sykepleiere, hjelpepleiere, fysioterapeuter og ergoterapeuter).

Pasientsikkerhet defineres som «Vern mot unøddig skade som følge av helsetjenestens ytelser eller mangel på ytelser»

En uønsket hendelse er en skade som er relatert til behandling og ikke til komplikasjoner ved et sykdomsforløp. Med behandling menes alle aspekter av helsetjenester inkludert diagnose, behandling, pleie, systemer og utstyr som brukes for å levere tjenestene.

Spørreskjema begynner på neste side. Husk å fylle ut bakgrunnsdata på siste side også dersom du ikke deltok i fjor høst.

Takk for at du tar deg tid til å svare på denne undersøkelsen.

Teamarbeid i helsetjenesten

Vennligst svar på utsagnene nedenfor ved å krysse av (x) i boksen som stemmer overens med **din grad av enighet** – fra «Svært uenig» til «Svært enig». Vennligst velg kun ett svar for hvert spørsmål.

Teamstruktur		Svært uenig	Uenig	Nøytral	Enig	Svært enig
TS1	Det er viktig å be om tilbakemelding på behandling og pleie fra pasienter og deres pårørende.					
TS2	Pasienten er en viktig del av behandlings – og pleieteamet.					
TS3	Avdelingens ledelse har innflytelse på hvorvidt de som jobber i direkte pasientkontakt lykkes i arbeidet.					
TS4	Teamets oppdrag er viktigere enn de enkelte team-medlemmers individuelle mål.					
TS5	Dyktige team-medlemmer kan forutse hva de andre i teamet trenger av assistanse og hjelp i gjennomføring av oppgaver.					
TS6	Høyt spesialiserte team i helsetjenesten har mange fellestrekk med høyt spesialiserte team innen andre sektorer.					
Ledelse		Svært uenig	Uenig	Nøytral	Enig	Svært enig
L7	Det er viktig at teamledere deler informasjon med team-medlemmene.					
L8	Teamledere bør legge til rette for at team-medlemmer kan utveksle informasjon på en uformell måte.					
L9	Dyktige teamledere ser på uønskede hendelser som en mulighet for å lære.					
L10	Det er en teamleders ansvar å opptre som en god rollemodell når det gjelder teamadferd.					
L11	Det er viktig at teamledere tar seg tid til å diskutere planen for hver enkelt pasient med de aktuelle team-medlemmene.					
L12	Teamledere bør sørge for at team-medlemmene hjelper hverandre når det er nødvendig.					

Situasjonsovervåking		Svært uenig	Uenig	Nøytral	Enig	Svært enig
S13	Alt personell kan bli opplært til å se etter viktige signaler i omgivelsene som kan ha betydning for pasientens situasjon. (Med <i>Alt personell</i> , menes f.eks. renholdere, portører, bioingeniører og helsesekretærer)					
S14	Overvåking av pasienter er viktig for å sikre et godt teamarbeid.					
S15	Alt personell, også de som ikke er en del av helsepersonellteamet, bør oppfordres til å se etter og melde fra om endringer i pasientens tilstand. (Med <i>Alt personell</i> , menes f.eks. renholdere, portører, bioingeniører og helsesekretærer)					
S16	Det er viktig å være oppmerksom på de andre team-medlemmenes emosjonelle og fysiske tilstand.					
S17	Det er riktig at et team-medlem tilbyr hjelp til en annen kollega som kan være for sliten eller for stresset til å utføre en oppgave.					
S18	Team-medlemmer som er bevisste på sin emosjonelle og fysiske tilstand når de er på jobb, løser oppgavene sine bedre.					
Gjensidig støtte		Svært uenig	Uenig	Nøytral	Enig	Svært enig
MS19	For å gjøre en god jobb bør team-medlemmene ha innsikt i arbeidet til de andre i teamet.					
MS20	Å spørre om hjelp er et uttrykk for at vedkommende ikke vet hvordan han/hun skal gjøre jobben sin på en god måte.					
MS21	Å hjelpe andre team-medlemmer, er et uttrykk for at den som hjelper ikke har nok å gjøre selv.					
MS22	Å tilby og hjelpe et annet team-medlem med hans/hennes arbeidsoppgaver, er en god måte å forbedre teamarbeidet på.					
MS23	Dersom du er bekymret for pasientsikkerheten, er det riktig å si tydelig fra, helt til du er sikker på at du har blitt hørt.					
MS24	Personlige konflikter mellom team-medlemmer påvirker ikke pasientsikkerheten.					

Fortsetter neste side, spørsmål 25-30

Kommunikasjon		Svært uenig	Uenig	Nøytral	Enig	Svært enig
C25	Det er betydelig større risiko for at det kan oppstå uønskede hendelser i team som ikke kommuniserer godt.					
C26	Dårlig kommunikasjon er en av de vanligste årsakene til rapporterte uønskede hendelser.					
C27	Uønskede hendelser kan reduseres gjennom god informasjonsutveksling med pasientene og deres pårørende.					
C28	Jeg foretrekker å jobbe sammen med team-medlemmer som stiller spørsmål om informasjonen som jeg gir.					
C29	Det er viktig å ha en standardisert metode for rapportering ved overlevering av pasient (eks. vaktskiftet, overflytting).					
C30	Det er nesten umulig å lære personer hvordan de skal bli bedre til å kommunisere.					

Her kan du skrive kommentarer til svarene dine og til spørreskjemaet.



Tore Karlsen
Teknologiveien 22
2815 GJØVIK

Vår dato: 06.04.2018

Vår ref: 59994 / 3 / LAR

Deres dato:

Deres ref:

Forenklet vurdering fra NSD Personvernombudet for forskning

Vi viser til melding om behandling av personopplysninger, mottatt 21.03.2018.
Meldingen gjelder prosjektet:

59994	<i>Implementering av et teamtrenings-program i bachelorutdanningen i sykepleie</i>
Behandlingsansvarlig	<i>NTNU, ved institusjonens øverste leder</i>
Daglig ansvarlig	<i>Tore Karlsen</i>

Vurdering

Etter gjennomgang av opplysningene i meldeskjemaet med vedlegg, vurderer vi at prosjektet er omfattet av personopplysningsloven § 31. Personopplysningene som blir samlet inn er ikke sensitive, prosjektet er samtykkebasert og har lav personvernulempe. Prosjektet har derfor fått en forenklet vurdering. Du kan gå i gang med prosjektet. Du har selvstendig ansvar for å følge vilkårene under og sette deg inn i veiledningen i dette brevet.

Vilkår for vår vurdering

Vår anbefaling forutsetter at du gjennomfører prosjektet i tråd med:

- opplysningene gitt i meldeskjemaet
- krav til informert samtykke
- at du ikke innhenter [sensitive opplysninger](#)
- veiledning i dette brevet
- NTNU sine retningslinjer for datasikkerhet

Veiledning

Krav til informert samtykke

Utvalget skal få skriftlig og/eller muntlig informasjon om prosjektet og samtykke til deltakelse.

Informasjon må minst omfatte:

- at NTNU er behandlingsansvarlig institusjon for prosjektet
- daglig ansvarlig (eventuelt student og veileder) sine kontaktopplysninger
- prosjektets formål og hva opplysningene skal brukes til
- hvilke opplysninger som skal innhentes og hvordan opplysningene innhentes

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

- når prosjektet skal avsluttes og når personopplysningene skal anonymiseres/slettes

På nettsidene våre finner du mer informasjon og en veiledende mal for [informasjonsskriv](#).

Forskningsetiske retningslinjer

Sett deg inn i [forskningsetiske retningslinjer](#).

Meld fra hvis du gjør vesentlige endringer i prosjektet

Dersom prosjektet endrer seg, kan det være nødvendig å sende inn endringsmelding. På våre nettsider finner du svar på hvilke [endringer](#) du må melde, samt endringskjema.

Opplysninger om prosjektet blir lagt ut på våre nettsider og i Meldingsarkivet

Vi har lagt ut opplysninger om prosjektet på nettsidene våre. Alle våre institusjoner har også tilgang til egne prosjekter i [Meldingsarkivet](#).

Vi tar kontakt om status for behandling av personopplysninger ved prosjektslutt

Ved prosjektslutt 01.11.2021 vil vi ta kontakt for å avklare status for behandlingen av personopplysninger.

Gjelder dette ditt prosjekt?

Dersom du skal bruke databehandler

Dersom du skal bruke databehandler (ekstern transkriberingsassistent/spørreskjemaleverandør) må du inngå en databehandleravtale med vedkommende. For råd om hva databehandleravtalen bør inneholde, se [Datatilsynets veileder](#).

Hvis utvalget har taushetsplikt

Vi minner om at noen grupper (f.eks. opplærings- og helsepersonell/forvaltningsansatte) har [taushetsplikt](#). De kan derfor ikke gi deg identifiserende opplysninger om andre, med mindre de får samtykke fra den det gjelder.

Dersom du forsker på egen arbeidsplass

Vi minner om at når du [forsker på egen arbeidsplass](#) må du være bevisst din dobbeltrolle som både forsker og ansatt. Ved rekruttering er det spesielt viktig at forespørsel rettes på en slik måte at frivilligheten ved deltakelse ivaretas.

Se våre nettsider eller ta kontakt med oss dersom du har spørsmål. Vi ønsker lykke til med prosjektet!

Vennlig hilsen

Marianne Høgetveit Myhren

Lasse André Raa

NSD sin vurdering

Prosjekttittel

Implementering av TeamSTEPPS®2.0 team-treningsprogram i en bachelorutdanning i sykepleie for å forbedre teamarbeids holdninger og ferdigheter

Referansenummer

758392

Registrert

30.09.2019 av Tore Karlsen - tore.karlsen@ntnu.no

Behandlingsansvarlig institusjon

Norges teknisk-naturvitenskapelige universitet NTNU / Fakultet for medisin og helsevitenskap (MH) / Institutt for helsevitenskap i Gjøvik

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Tore Karlsen, tore.karlsen@ntnu.no, tlf: 41464686

Type prosjekt

Forskerprosjekt

Prosjektperiode

10.06.2018 - 01.11.2021

Status

23.10.2019 - Vurdert

Vurdering (1)

23.10.2019 - Vurdert

BAKGRUNN

Behandlingen av personopplysninger ble opprinnelig meldt inn til NSD 21.03.2018 (NSD sin ref: 59994) og vurdert under personopplysningsloven som var gjeldende på det tidspunktet.

30.09.2019 meldte prosjektleder inn en endring av prosjektet. Endringen gjelder at prosjektet er pågående, og prosjektleder ønsker at nye behandlinger skulle vurderes i tråd med GDPR. Denne vurderingen gjelder behandlingene som starter etter nytt lovverk. Jmf fortalepunkt 171 i forordningen kan behandling hjemlet i samtykke under gammelt lovverk fortsette uten at det innhentes nytt samtykke.

Det er vår vurdering at behandlingen (den nye delen av prosjektet) vil være i samsvar med den gjeldende personvernlovgivningen, så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 23.10.2019 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan fortsette.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:

https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET

Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.11.2021.

LOVLIG GRUNNLAG

Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER

NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER

NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1 f) og sikkerhet (art. 32).

Questback er databehandler i prosjektet. NSD legger til grunn at behandlingen oppfyller kravene til bruk av databehandler, jf. art 28 og 29.

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og/eller rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET

NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Jørgen Wincentzen
Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix 4 Information to the head of departments

Til

Heidi Vifladd, Institutt for helsevitenskap Gjøvik

Svanhild Schønberg, Institutt for helsevitenskap Ålesund

Siri Forsmo, Institutt for samfunnsmedisin og sykepleie, Trondheim

03.09.2018

Rekruttering av studenter til forskningsprosjekt, «Implementering av et teamtrenings program i bachelorutdanningen i sykepleie»

Jeg viser til forespørsel til instituttlederne ved de tre campus som har sykepleieutdanning i mars 2018 om tilgang til studenters mailadresse, for invitasjon til deltakelse ovennevnte forskningsprosjekt. Alle tre instituttene ga samtykke til at mailadresser kunne hentes ut fra FS via administrasjonen her ved campus Gjøvik.

Forskningsprosjektet ble godkjent i NSD 6.4.2018 og fikk prosjektnummer 59994.

I forkant av den første datainnsamlingen henvendte Ralf Kirchoff ved institutt for helsevitenskap i Ålesund seg til NSD med bakgrunn i nye personvernregler, GDPR, som trådte i kraft i mai 2018. Svaret fra Trine Annikken Larsen i NSD var at «Utgangspunktet er at forespørsel om deltakelse i et forskningsprosjekt som skal rekruttere studenter fra en institusjon, helst skal gå gjennom institusjonen. Det vil si at dersom en forsker ønsker å rekruttere studenter fra NTNU, må NTNU sende ut forespørselen om deltakelse til studentene uten at forskeren får oppgitt e-postadressene. Studentene må derfor samtykke til deltakelse før forskeren eventuelt kan be om e-postadresse»

Jeg tok kontakt med saksbehandler for prosjektet i NSD, Lasse Andre Raa, og fikk 23.08 svar:Det enkleste vil være om NTNU sender ut invitasjon til å delta i spørreundersøkelsen på dine vegne. Den som sender ut forespørselen, bør være en som har naturlig tilgang til kontaktopplysningene, slik at det sikres at disse ikke deles ut til uvedkommende. Dette kan for eksempel være administrativt ansatte. Vær oppmerksom på at det er opp til institusjonen hvilke retningslinjer den har for utlevering av forskjellige typer opplysninger. Det er ikke nødvendigvis slik at kontaktopplysninger ikke kan utleveres uten samtykke, men det vil i så tilfelle være opp til institusjonen å finne et annet lovlig grunnlag for utlevering. For å unngå problemstillingen, anbefaler vi altså at institusjonen viderefremidler invitasjonen om deltakelse.

Første datainnsamling er gjennomført, hovedsakelig med papirversjon av spørreskjemaet og oppmøte på hvert studiested. Neste skritt i prosjektet er å sende ut invitasjon til 2. og 3 års studenter på sykepleieutdanningene ved NTNU. Med stor spredning av studenter på tre byer og fordelt på mange praksisavdelinger er det ikke praktisk mulig å møte alle disse studentene for å dele ut spørreskjema i papir.

Med bakgrunn i svar fra NSD 23.08 ber vi hermed om tillatelse til at en administrativt ansatt på NTNU i Gjøvik kan sende ut invitasjon om å delta til aktuelle studenter på e-post på vegne av forskeren. Samtykke til å delta vil føre studentene videre til spørreskjema. Forskerne vil derfor ikke ha tilgang på e-postadresser før studenten har samtykket til å delta.

Vennlig hilsen Tore Karlson (sign)

Stipendiat/PhD student

Institutt for helsevitenskap , NTNU i Gjøvik

Forespørsel om deltakelse i forskningsprosjekt

Til

Deg som er 2. og 3. års student ved Bachelor i sykepleie heltid ved NTNU i Ålesund, Trondheim og Gjøvik samt 1.-4. års student deltid ved NTNU i Gjøvik

Bakgrunn og formål

Dette er en forespørsel om å delta i en spørreundersøkelse. Spørreundersøkelsen har til hensikt å teste et spørreskjemaet som skal kartlegge sykepleiestudenters holdninger til samarbeid i helsetjenesten. Studien er en del av et doktorgradsprosjekt.

Kompetanse som fremmer effektivt og sikkert samarbeid er viktig for deg som framtidig sykepleier. Mange av de feil og uønskede hendelser som rammer pasienter skyldes svikt i samarbeidet mellom helsepersonell. Norske og internasjonale helsemyndigheter fremhever viktigheten av å trene på å jobbe i team for å fremme pasientsikkerhet. Et team-treningsprogram blir testet ut ved bachelorutdanningen ved NTNU i Gjøvik fra høsten 2018. Spørreskjema skal brukes videre i denne sammenhengen.

Hva innebærer deltakelse i studien?

Undersøkelsen gjennomføres ved å svare på et spørreskjema. Det tar ca 10 minutter å svare på. Spørreskjemaet inneholder 30 spørsmål inndelt i fem temaer. Spørreskjema tar ca 10 minutter å svare på og det inneholder 30 spørsmål inndelt i fem temaer. Du bes om å svare på utsagnene ved å krysse av i boksen som stemmer overens med **din grad av enighet** – fra «Svært uenig» til «Svært enig».

Deltagere

Alle sykepleiestudenter ved NTNU høsten 2018 inviteres til å delta i spørreundersøkelsen.

Prosjektet skal etter planen avsluttes og data anonymiseres høsten 2021. NTNU er behandlingsansvarlig institusjon. Data vil bli lagret på sikker server etter retningslinjer for datalagring av forskningsdata ved NTNU. Kun doktorgradsstudent og veiledere vil ha tilgang til data. Data vil bli behandlet konfidensielt. Personopplysninger vil ikke kunne bli koblet til deg som person ved publisering av studien.

Frivillig deltakelse


Det er frivillig å delta i studien. Du kan når som helst trekke deg uten å oppgi noen grunn. Deltagelse i spørreundersøkelsen vil ikke ha noen innvirkning på ditt studieløp eller vurdering av deg. Dersom du har spørsmål til studien, ta kontakt med Tore.Karlsen@ntnu.no, tlf. 41464686.

Mine veiledere er professor Marie-Louise Hall-Lord, førsteamanuensis Randi Ballangrud og førsteamanuensis Sigrid Wangensteen, alle ved IHG.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Svar på spørreundersøkelsene på mail betraktes som samtykke til deltagelse.

Vennlig hilsen


Tore Karlsen
Doktorgradsstudent
Institutt for helsevitenskap i Gjøvik
NTNU
Gjøvik, august 2018

 NTNU

Institutt for helsevitenskap i Gjøvik

Forespørsel om deltakelse i forskningsprosjekt

Til

Deg som er førsteårsstudent ved Bachelor i sykepleie heltid ved NTNU i Ålesund og Trondheim

Bakgrunn og formål

Dette er en forespørsel om å delta i en spørreundersøkelse. Spørreundersøkelsen har til hensikt å teste et spørreskjemaet samt kartlegge sykepleiestudenters holdninger til samarbeid i helsetjenesten. Studien er en del av et doktorgradsprosjekt.

Kompetanse som fremmer effektivt og sikkert samarbeid er viktig for deg som framtidig sykepleier. Mange av de feil og uønskede hendelser som rammer pasienter skyldes svikt i samarbeidet mellom helsepersonell. Norske og internasjonale helsemyndigheter fremhever viktigheten av å trene på å jobbe i team for å fremme pasientsikkerhet. Et team-treningsprogram blir testet ut ved bachelorutdanningen ved NTNU i Gjøvik fra høsten 2018.

Hva innebærer deltakelse i studien?

Undersøkelsen gjennomføres ved å svare på et spørreskjema tre ganger i løpet av studietiden din. Det første får du utlevert i papirversjon, de to neste svarer du på elektronisk og vil bli sendt ut våren 2019 og våren 2020. Spørreskjema tar ca 10 minutter å svare på og det inneholder 30 spørsmål inndelt i fem temaer. Du bes om å svare på utsagnene ved å krysse av i boksen som stemmer overens med **din grad av enighet** – fra «Svært uenig» til «Svært enig».

Deltagere

Alle sykepleiestudenter ved NTNU høsten 2018 inviteres til å delta på den første spørreundersøkelsen. Til å svare på de to neste spørreundersøkelsene inviteres studenter som begynte samtidig med deg og studerer heltid på sykepleieutdanningen i Gjøvik, Ålesund og Trondheim.

Prosjektet skal etter planen avsluttes og data anonymiseres høsten 2021. NTNU er behandlingsansvarlig institusjon. Data vil bli lagret på sikker server etter retningslinjer for datalagring av forskningsdata ved NTNU. Kun doktorgradsstudent og veiledere vil ha tilgang til data. Data vil bli behandlet konfidensielt. Personopplysninger vil ikke kunne bli koblet til deg som person ved publisering av studien.

Frivillig deltakelse

Det er frivillig å delta i studien. Du kan når som helst trekke deg uten å oppgi noen grunn. Deltagelse i spørreundersøkelsen vil ikke ha noen innvirkning på ditt studieløp eller vurdering av deg. Dersom du har spørsmål til studien, ta kontakt med [Tore Karlsen@ntnu.no](mailto:Tore.Karlsen@ntnu.no), tlf. 41464686.

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Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Svar på spørreundersøkelsene i papirversjon eller på mail betraktes som samtykke til deltagelse.

Vennlig hilsen


Tore Karlsen
Doktorgradsstudent
Institutt for helsevitenskap i Gjøvik
NTNU
Gjøvik, august 2018

 NTNU

Institutt for helsevitenskap i Gjøvik

Forespørsel om deltakelse i forskningsprosjekt

Til

Deg som er førsteårsstudent ved Bachelor i sykepleie heltid ved NTNU Institutt for helsevitenskap i Gjøvik

Bakgrunn og formål

Dette er en forespørsel om å delta i en spørreundersøkelse. Spørreundersøkelsen har til hensikt å teste et spørreskjemaet samt kartlegge sykepleiestudenters holdninger til teamarbeid i helsetjenesten. Studien er en del av et doktorgradsprosjekt.

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Hva innebærer deltakelse i studien?

Undersøkelsen gjennomføres ved å svare på et spørreskjema tre ganger i løpet av studietiden din. Det første får du utlevert i papirversjon, de to neste svarer du på elektronisk og vil bli sendt ut våren 2019 og våren 2020. Spørreskjema tar ca 10 minutter å svare på og det inneholder 30 spørsmål inndelt i fem temaer. Du bes om å svar på utsagnene ved å krysse av i boksen som stemmer overens med **din grad av enighet** – fra «Svært uenig» til «Svært enig».

Deltagere

Alle sykepleiestudenter ved NTNU høsten 2018 inviteres til å delta på den første spørreundersøkelsen. Til de to neste spørreundersøkelsene inviteres du og ditt kull og studenter på tilsvarende kull i Ålesund og Trondheim. Ditt kull vil få teamtreningprogrammet som en del av utdanningen og vil være integrert i emner gjennom utdanningen. De to andre kullene vil få ordinær undervisning.

Prosjektet skal etter planen avsluttes og data anonymiseres høsten 2021. NTNU er behandlingsansvarlig institusjon. Data vil bli lagret på sikker server etter retningslinjer for datalagring av forskningsdata ved NTNU. Kun doktorgradsstudent og veiledere vil ha tilgang til data. Data vil bli behandlet konfidensielt. Personopplysninger vil ikke kunne bli koblet til deg som person ved publisering av studien.

Frivillig deltakelse


Det er frivillig å delta i studien. Du kan når som helst trekke deg uten å oppgi noen grunn. Deltagelse i spørreundersøkelsen vil ikke ha noen innvirkning på ditt studieløp eller vurdering av deg. Dersom du har spørsmål til studien, ta kontakt med Tore.Karlsen@ntnu.no, tlf. 41464686.

Mine veiledere er professor Marie-Louise Hall-Lord, førsteamanuensis Randi Ballangrud og førsteamanuensis Sigrud Wangensteen, alle ved IHG.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Svar på spørreundersøkelsene i papirversjon eller på mail betraktes som samtykke til deltagelse.

Vennlig hilsen


Tore Karlsen
Doktorgradsstudent
Institutt for helsevitenskap i Gjøvik
NTNU
Gjøvik, august 2018

 NTNU

Institutt for helsevitenskap i Gjøvik

Vil du delta i et intervju?

Intervjuet er knyttet til doktorgradsprosjektet; Implementering av TeamSTEPPS® i en bachelorutdanning i sykepleie

Bakgrunn og formål

Vil du delta i intervju der hensikten er å få høre om noen av dine erfaringer og opplevelser av teamarbeid som en del av undervisningen og treningen/simuleringen på skolen og i bruken av disse ferdighetene i dine praksisstudier?

Kompetanse som fremmer effektivt og sikkert teamarbeid er viktig for deg som framtidig sykepleier. Mange av de feil og uønskede hendelser som rammer pasienter skyldes svikt i teamarbeidet mellom helsepersonell. Norske og internasjonale helsemyndigheter fremhever viktigheten av å trene på å jobbe i team for å fremme pasientsikkerhet. TeamSTEPPS team-trening er en del av undervisningen til ditt kull.

Hva innebærer deltakelse i studien?

Deltagelse i studien innebærer at du deltar i et gruppeintervju sammen med 4-5 av dine medstudenter. Intervjuet vil gjennomføres etter andre refleksjonsvakt som du har i denne praksisperioden. Du vil få invitasjon til å delta i det digitale gruppeintervju via Zoom. Intervjuet vil vare inntil 1 time. Intervjuene vil bli tatt opp og deretter skrives ut.

Deltagere

Sykepleiestudenter som gjennomfører VPP/MK3002 høsten 2020 vil bli spurt om å delta.

Ditt personvern

Prosjektet skal etter planen avsluttes og data anonymiseres høsten 2022. NTNU er behandlingsansvarlig institusjon. Data vil bli lagret på sikker server etter retningslinjer for datalagring av forskningsdata ved NTNU. Data vil bli behandlet konfidensielt. Bakgrunnsopplysninger som kjønn, alder og tidligere arbeidserfaringer i helsesektoren ønsker vi å få av de som deltar. Deltagelse i studien har ingen påvirkning på ditt studieløp og vurdering av deg som sykepleiestudent. Det vil ikke være mulig å identifisere deg i resultatene når studien publiseres. I samsvar med GDPR vil vi informere deg om at så lenge du kan identifiseres i datamaterialet, har du rett til:

- Innsyn i hvilke personopplysninger som er registrert om deg
- Å få rettet personopplysninger om deg
- Få slettet personopplysninger om deg
- Få utlevert en kopi av dine personopplysninger (dataportabilitet).
- Sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Frivillig deltakelse

Det er frivillig å delta i studien. Du kan når som helst trekke deg uten å oppgi noen grunn. Deltagelse i studien vil ikke ha noen innvirkning på ditt studieløp eller vurdering av deg. Dersom du har spørsmål til studien, ta kontakt med [Tore Karlsen@ntnu.no](mailto:Tore.Karlsen@ntnu.no), tlf. 41464686.

Mine veiledere er professor Marie-Louise Hall-Lord, førsteamanuensis Randi Ballangrud og

førsteamanuensis Sigrid Wangensteen, alle ved IHG.
Vårt personvernombud er Thomas.Helgesen@ntnu.no

På oppdrag fra NTNU har NSD - Norsk senter for forskningsdata AS, postmottak@nsd.no vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket. Prosjektnummer 758932

Vennlig hilsen

Tore Karlsen, Doktorgradsstudent, NTNU Institutt for helsevitenskap i Gjøvik, september 2020



Reliability and structural validity of the Norwegian version of the TeamSTEPPS Teamwork Attitudes Questionnaire: A cross-sectional study among Bachelor of Nursing students

Tore Karlsen¹ | Marie Louise Hall-Lord^{1,2} | Sigrid Wangensteen¹ | Randi Ballangrud¹

¹Department of Health Science Gjøvik, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, Gjøvik, Norway

²Department of Health Sciences, Faculty of Health, Science and Technology, Karlstad University, Karlstad, Sweden

Correspondence

Tore Karlsen, Department of Health Science Gjøvik, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, Gjøvik, Norway.
Email: tore.karlsen@ntnu.no

Funding information

This study was supported by the Norwegian University of Science and Technology in Gjøvik.

Abstract

Aim: To test the reliability and structural validity of the Norwegian version of the TeamSTEPPS[®] Teamwork Attitudes Questionnaire (T-TAQ) among Bachelor of Nursing students.

Design: Cross-sectional study.

Methods: Bachelor of Nursing students ($N = 1,624$) at three campuses in different regions of Norway were invited to complete the survey. The data were analysed with descriptive statistics, Cronbach's alpha and confirmatory factor analysis (CFA). Three models were tested. Model 3 was a post hoc modification with a correlation between four negatively worded items. The data was collected in September 2018 and May–June 2019.

Results: A total of 509 students were included in the study. Cronbach's alpha ranged from 0.44–0.70 for the dimensions and was 0.79 for the total questionnaire. The fit indexes of model 3 were as follows: RMSEA = 0.043, chi-square = 724.3 ($p < .000$), normed chi-square = 1.862, TLI = 0.812 and CFI = 0.832. The questionnaire shows some potential to display attitudes towards teamwork in health care among Bachelor of Nursing students. Low Cronbach's alpha in the dimensions might indicate that the questionnaire should be considered used as a unidimensional questionnaire.

KEYWORDS

Norway, nurses, nursing, nursing students, students, teamwork

1 | INTRODUCTION

There is a consensus that teamwork constitutes one of the critical elements in today's highly complex system of delivering safe and effective patient care (Neuhaus et al., 2019; Rosen et al., 2018; Schmutz & Manser, 2013). According to the Institute of Medicine (IOM) report entitled "Health Professions Education: A Bridge to Quality," teamwork is one of the skills necessary to ensure quality

and safety in health care (Knebel & Greiner, 2003). It is therefore vital to incorporate teamwork into the education of healthcare professionals (Dow et al., 2013; Norwegian Ministry of Health & Care Services, 2019; Sherwood & Barsteiner, 2017). Team training has, to a limited extent, been implemented in the education of Bachelor of Nursing students in Norway (Aase et al., 2013). This study is part of a project that aims to create new knowledge regarding the integration of a team training programme into a Norwegian Bachelor of Nursing

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programme. Changes in attitudes are a frequently used measure of learning outcomes in team training (LaMothe et al., 2016; Reeves et al., 2016; Sweigart et al., 2016; Vertino, 2014); thus, high validity and reliability are essential for questionnaires measuring changes in attitudes (Polit & Yang, 2016).

2 | BACKGROUND

Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) is a team training programme based on more than 20 years of research examining elements that are essential for providing effective and safe care in health care, including the principles of sustainable implementation (King et al., 2008; Salas et al., 2018). The Agency for Healthcare Research and Quality (AHRQ) developed the TeamSTEPPS® team training programme in cooperation with the Department of Defense (DoD) in the United States (AHRQ, 2012). The programme emphasizes the importance of team structure and four team skills: leadership, situation monitoring, mutual support and communication. The training programme consists of lectures, reinforcement in simulation-based scenarios, low-fidelity training and roleplay, feedback and reflection in clinical settings (AHRQ, 2012; Chen et al., 2019). The TeamSTEPPS® team training programme has been used in various healthcare educational settings, such as in nursing education (Gaston, 2018; Goliat et al., 2013; Maguire et al., 2015; Robinson et al., 2018) and in interprofessional educational settings (Chen et al., 2019; Welsch et al., 2018). Previous research has shown positive outcomes of the TeamSTEPPS® team training programme, including reduced patient complications, mortality (Forse et al., 2011) and risk of fall (Spiva et al., 2014). Positive organizational outcomes include an increase in effective patient treatment (Capella et al., 2010) and improved patient safety culture (Aaberg et al., 2019). Learning outcomes show a positive change among students (Maguire et al., 2015; Sweigart et al., 2016) and among healthcare professionals' (Vertino, 2014; Wadsworth, 2019) attitudes towards teamwork after the implementation of TeamSTEPPS®. Participants also seem to enjoy attending the team training programme (Thomas & Galla, 2013; Welsch et al., 2018). These outcomes motivated the research team to design a study to implement TeamSTEPPS® in Bachelor of Nursing education. To our knowledge, no Bachelor of Nursing programme in Europe has implemented the TeamSTEPPS® team training programme.

Methods used to measure attitudes can provide useful information regarding the perception of teamwork behaviour (Frager, 2014; Manser, 2009). According to Ajzen (1991), intentions to perform behaviours can be predicted by attitudes towards the behaviour, subjective norms and perceived behavioural control. Behavioural purposes account for considerable variance in actual practice (Ajzen, 1991). The content of the T-TAQ was developed based on extensive research on essential teamwork attributes (Baker et al., 2008). According to Baker et al. (2010), the TeamSTEPPS® Teamwork Attitudes Questionnaire (T-TAQ) was designed to measure attitudes towards the core components of teamwork aligned

with the TeamSTEPPS® team training programme. Data from the questionnaire can be used to assess changes in participants' attitudes towards teamwork as a result of training, as attitudes are an aspect of learning. The questionnaire may also support quality improvement activities associated with teamwork (Baker et al., 2010). The T-TAQ is the most frequently used instrument to measure changes in attitude following intervention with the TeamSTEPPS programme in interprofessional education settings (Welsch et al., 2018). The Norwegian version of the T-TAQ has been validated in a population of healthcare professionals (Ballangrud et al., 2019).

Previous studies have used the T-TAQ questionnaire to evaluate team training with interprofessional students (Chen et al., 2019; Welsch et al., 2018), nursing students (Gaston, 2018; Godin et al., 2017; LaMothe et al., 2016; Maguire et al., 2015) and healthcare professionals (Grapensteter, 2017; Vertino, 2014). Bachelor students are a different population from experienced healthcare professionals with respect to knowledge, teamwork and healthcare experience. Therefore, it was essential to validate the questionnaire among Bachelor of Nursing students, as they were the population of interest in this project. According to Wooding et al. (2019), questionnaires should not be reused without consideration of the population studied. Structural validity should be reassessed to obtain valid and reliable results in a new target population (Polit & Yang, 2016). Previous T-TAQ studies in nursing education have been conducted with relatively small samples ($N = 7-182$) (Gaston, 2018; Goliat et al., 2013; LaMothe et al., 2016; Maguire et al., 2015), which makes it challenging to conduct powerful studies of the validity and reliability of a questionnaire (Polit & Yang, 2016). At this point, we have not found any studies examining the reliability and validity of the T-TAQ within a population of Bachelor of Nursing students.

2.1 | Aim of the study

This study aimed to test the reliability and structural validity of the Norwegian version of the T-TAQ among Bachelor of Nursing students.

3 | THE STUDY

3.1 | Design

The study used a cross-sectional design (Polit & Beck, 2016).

3.2 | Method

3.2.1 | Setting and sample

The study was conducted at a Norwegian university, which offers a Bachelor of Nursing programme at three campuses in three different regions. All students ($N = 1,624$) were invited to participate;

408 were first-year students, 532 were second-year students and 684 were third-year students. According to Polit and Yang (2016), an estimated minimum sample size of ten individuals per item on the questionnaire is necessary for confirmatory factor analysis (CFA), but a larger sample is desirable.

3.2.2 | The questionnaire

The T-TAQ was designed to evaluate the TeamSTEPPS® team training programme (AHRQ, 2014). The T-TAQ evaluates five dimensions of teamwork: team structure (TS), leadership (L), situation monitoring (S), mutual support (MS) and communication (C). The questionnaire comprises 30 items, with six items in each dimension. Four items are negatively worded (MS20, MS21, MS24 and C30) (Table 2). The questionnaire was cross-culturally translated as recommended (c.f. Brislin, 1970), and some semantic and conceptual changes were made after a pilot test. The analysis showed Cronbach's alpha values from 0.53–0.76, a normed chi-square of 1.896, an RMSEA of 0.061, a TLI of 0.773 and a CFI of 0.794 (Ballangrud et al., 2019). The respondents score each item on a five-point Likert scale to indicate their level of agreement from strongly disagree (1) to strongly agree (5) with the statement. Central teamwork constructs were explained on the first page of the questionnaire. The students were asked to complete background data on sex, age, study progression, campus, former higher education and work experience in health care.

3.2.3 | Face validity

We invited a convenience sample of final-year Bachelor of Nursing students ($N = 40$) who did not participate in the main study to take part in an email pilot survey to evaluate the face validity of the T-TAQ. The students were asked to respond to each item, as well as to answer additional questions about to what extent they perceived the items as clear and understandable, as well as how easy it was to choose an option on the Likert scale. The respondents had the opportunity to comment with suggestions on how to improve the questionnaire. Based on the response ($N = 10$), we added supplementary information to items 13 and 14.

3.2.4 | Data collection

The data collection took place in September 2018 and May–June 2019. A paper version of the T-TAQ (paper survey) was distributed to first-year students ($N = 408$) who were present during a class. The survey took place after their first clinical placement. The students who wanted to participate answered the survey and returned the questionnaire as they left the class.

Because second- and third-year students in clinical placements were spread over a large geographic area, an electronic survey was administered as an email survey to these students ($N = 1,216$). For

the students who accepted the invitation, a hyperlink directed them to the questionnaire. Reminders were sent after 3 and 7 days.

3.2.5 | Analysis

The statistical software IBM SPSS version 26 (2019) and SPSS AMOS version 25 were used to analyse the data. Before the analysis, the scores of the four negatively worded items were reversed. Descriptive statistics were used to analyse the background data, teamwork dimensions and items. Cronbach's alpha was used to calculate internal consistency; a value above 0.70 was considered acceptable (Polit & Yang, 2016; Tavakol & Dennick, 2011).

We examined the data for missing item responses before the CFA analysis. The analysis of missing data resulted in a listwise deletion of 32 respondents before the CFA was conducted with a sample of 477. A rule of thumb is a sample size of at least 10 individuals per item for the analysis (Polit & Yang, 2016).

A CFA makes it possible to test how well each item measures the dimension that it is supposed to measure and whether the items explain the variance in the latent dimensions (Brown & Moore, 2012). The structure of the Norwegian version of the questionnaire is based on the original instrument developed by Baker et al. (2010) and hypothesizes that the variance in the responses to the items reflects the variance in the latent dimensions on which the manifest items are loaded (Brown, 2006; Polit & Yang, 2016). The regression coefficient between the first variable and the latent construct in each dimension was fixed to 1, and the unstandardized regression coefficients from the error terms to the measured variables were also fixed to 1 (Polit & Yang, 2016). The error (e) variance for each item indicates the reliability of the observed variables and is influenced by the random measurement error (Byrne, 2010).

We tested the goodness-of-fit of three models. Model 1 was based on the unmodified T-TAQ questionnaire structure and Model 2 tested the same model with the sample randomly split in half to examine the stability of the results in Model 1 (Schreiber et al., 2006). Model 3 calculated the model fit with a post hoc modification. We wanted to test whether an intercorrelation between error variances among the four negatively worded items (MS20, MS21, MS24 and C30) could result in a better model fit. This was based on poor factor loading and a hypothesis of intercorrelation based on the shared reversion of the items.

The model fit was estimated with equations of four recommended fit indexes in all three models (Polit & Yang, 2016; Schreiber et al., 2006). Absolute fit indexes indicate how well the T-TAQ model fitted the data and were calculated with the chi-square, normed chi-square and root mean square error of approximation (RMSEA). The chi-square statistic should be nonsignificant with a p -value $> .05$. The normed chi-square (χ^2/df) should be < 2 , and the RMSEA has a threshold value of ≤ 0.06 (Hu & Bentler, 1999; Polit & Yang, 2016). Comparative fit indexes compare the model with a null model where all of the variables are uncorrelated (Polit & Yang, 2016). These indexes were calculated with the comparative fit index (CFI) and the

Tucker–Lewis fit index (TLI). The CFI and TLI should have values close to 1.0, and threshold values are ≥ 0.95 (Hu & Bentler, 1999; Polit & Yang, 2016).

As a part of the CFA, correlations between the latent dimensions were analysed. Since all dimensions address aspects of teamwork, a positive correlation between the latent dimensions was hypothesized (Polit & Yang, 2016).

3.2.6 | Ethics

The study was conducted according to the Helsinki Declaration for ethical principles of research (WMA, 2013). The study was approved by the Norwegian Social Science Data Service (NSD ID: 738592) and by the university involved. The invited students obtained written information about the aim of the study and were informed that responding to the questionnaire was voluntary and had no consequences for their educational progression. Returning the questionnaire was considered to indicate consent to participate in the study.

4 | RESULTS

A total of 509 students answered the questionnaire (31.3%). The email survey had a response rate of 15.3% and the paper survey had a response rate of 76.2%. The sample characteristics are displayed in Table 1. In short, 61.1% of the respondents were first-year students, 84.1% were female, the median age was 22 years with a range from 18–55 years and 75.2% had work experience in health care.

Table 2 shows the mean scores and the standard deviations of the T-TAQ total scale, the five dimensions and the individual items. The mean score of the items ranged from 3.69 (TS4) to 4.80 (L7). The standard deviation (SD) varied between 0.44 (L7) and 1.06 (M20†).

Cronbach's alpha coefficient for the total questionnaire was 0.79, and the coefficients for each dimension varied from 0.44–0.70, as shown in Table 3. Table 4 shows the fit indexes for the three models.

Model 1 had a significant chi-square value. The normed chi-square was 2.24. The RMSEA was 0.051, and the TLI and CFI were lower than the threshold values. Model 2 confirmed the stability of the equations in model 1. Model 3 generated the fit indexes after a post hoc modification with the estimation of intercorrelation between error variances (residuals) of the four negatively worded items MS20, MS21, MS24 and C30. Model 3 showed a significant chi-square value. The normed chi-square was < 2 and the RMSEA was 0.043. The TLI and CFI increased because of model modification but were still lower than the threshold values. The factor loadings, error variances and correlations between dimensions and between the selected error variances in model 3 are displayed in Figure 1.

Standardized factor loading ranged from 0.09–0.63. Of the 30 items, 25 had a factor loading > 0.30 to the targeted latent dimension. Situation monitoring shows the highest factor loading for all six items, with a regression coefficient of 0.45–0.63. The mutual support dimension showed the lowest factor loading for two negatively worded items with a value of 0.09 and one item with a value of 0.16. The error variance (e) for all items varied from 0.17–1.05. Model 3 showed positive correlations between the error variances of all the negatively worded items and the highest correlation was between e20–e21. The correlation between dimensions ranged from 0.48–0.78, as shown in Figure 1.

5 | DISCUSSION

This study aimed to test the reliability and structural validity of the Norwegian version of the T-TAQ among Bachelor of Nursing students. Cronbach's alpha indicated that the reliability of the total questionnaire was acceptable, although Cronbach's alpha within dimensions ranged from 0.44–0.70. The analysis of goodness-of-fit indexes showed acceptable values in two absolute fit indexes (RMSEA, normed chi-square) and below-threshold values for the comparative fit indexes (CFI, TLI) and the chi-square index.

Variable	Category	N	%
Study progression	First-year students	311	61.1
	Second-year students	94	18.5
	Third-year students	104	20.4
Age median(range)		22 (18–55)	
Sex	Female	428	84.1
	Male	75	14.7
	Missing	6	1.2
Former working experience in healthcare	0 year	110	21.6
	<1 year	74	14.5
	1–2 years	132	25.9
	3–5 years	132	25.9
	>6 years	42	8.3
	Missing	19	3.7

TABLE 1 Characteristics of the sample (N = 509)

5.1 | Reliability

The total questionnaire showed acceptable internal consistency with Cronbach's alpha value of 0.79. The questionnaire has 30 items, and Cronbach's alpha value tends to increase with higher number of items (Tavakol & Dennick, 2011). The situation monitoring dimension had a Cronbach's alpha value of 0.70 and indicated acceptable internal consistency. This dimension showed the highest value of internal consistency in both the current study and in previous T-TAQ studies, as shown in Table 3 (Baker et al., 2008; Ballangrud et al., 2019; Sweigart et al., 2016). Cronbach's alpha value of 0.44 in the mutual support dimension indicated low internal consistency. The low Cronbach's alpha value is congruent with previous research that shows that the mutual support dimension had the lowest reliability of the five dimensions when used in professional healthcare samples (Baker et al., 2010; Ballangrud et al., 2019) as well as in a sample of interprofessional students (Brock et al., 2013). Cronbach's alpha values indicate inter-item homogeneity (Cronbach, 1951), and a low value may thereby indicate that all the items do not reflect the same latent dimension. Our study showed Cronbach's alpha value of 0.56 in the communication dimension, which is close to the value of 0.57 reported in two previous studies (Ballangrud et al., 2019; Sweigart et al., 2016). A low factor loading of items to the dimensions may partly explain the low values of Cronbach's alpha.

5.2 | Validity

The RMSEA values were acceptable and indicated a good fit, as the values were below the threshold value and had narrow confidence intervals (Byrne, 2010). This index is considered one of the most informative fit indexes and is widely used to measure how well the correlations of the theoretical model match the observed correlations (Byrne, 2010; Meyers et al., 2016). The RMSEA may be vulnerable with a small sample size (Hu & Bentler, 1999), but the sample size in this study ($N = 477$) is considered acceptable to calculate a valid RMSEA. The number of participants needed is not an exact rule, but ten individuals per estimated item seems to be the consensus (Polit & Yang, 2016; Schreiber et al., 2006). The sample size in our study was equivalent to 70% of the typical sample size in structural equation modelling (SEM) studies in nursing research (Sharif et al., 2018).

A perfect fit for a model would be indicated by a nonsignificant chi-square value (Polit & Yang, 2016). However, for most empirical SEM studies, this has been proven to be unrealistic (Byrne, 2010). The chi-square test is highly sensitive to sample size, a high correlation between the dimensions in the questionnaire and error variance in the model (Kline, 2011). Thus, other fit indexes often receive more attention (Mishra, 2016; Polit & Yang, 2016).

We considered the normed chi-square acceptable with a value <3 in all three models. There is no consensus regarding whether the cut-off value should be below 2 or 3 (Polit & Yang, 2016; Schreiber et al., 2006). The normed chi-square in our study was <2 in two out of three models. The goodness-of-fit indexes showed better values

from model 1 to model 3 (Polit & Yang, 2016; Schreiber et al., 2006). The comparative fit indexes (TLI and CFI) are below-threshold values but are, to some degree, considered too strict, especially with complex models (Marsh et al., 2004). The CFI compares the targeted model with a model that has no correlation between the variables, which is unlikely in most models (Rigdon, 1996). Rigdon (1996) claims that the CFI is more suited for explorative factor analyses and small samples and the RMSEA is more suited for more confirmatory, large-sample cases, as in our study. Absolute fit indexes and comparative fit indexes represent the data from different perspectives and a model with inconsistency may be neither "good" nor "bad" but may have limitations and the results must be interpreted with this in mind (Lai & Green, 2016).

The structural validity of a model demonstrates whether the model measures what it is described to measure and is indicated by the factor loading and associated error variances (Byrne, 2010). Twenty-five out of 30 items loaded on the targeted latent dimensions with a factor loading above 0.30, which should be considered acceptable, according to Kääriäinen et al. (2011). Situation monitoring shows a factor loading for all items >0.40 and reveals the highest internal consistency. The mutual support dimension has three items with acceptable factor loading and three with low factor loading and shows a low Cronbach's alpha. Negatively worded items loading on the mutual support and communication dimensions may explain why not all fit indexes are within threshold values in this model (Fan & Sivo, 2005). The items with low factor loadings showed similarly high error variances, which indicates that there is a bias that is not a result of variation in the respondents' attitudes towards the targeted dimension. A model should have an appropriate factor loading of items to the latent dimension to be a valid instrument (Byrne, 2010).

According to Mishra (2016), some plausible explanations of error variances might be that respondents have limited experience with the construct, the respondents might not have understood the meaning of the items, or they respond according to social desirability. Cote and Buckley (1987) claim that abstract constructs may be more challenging to measure than concrete constructs are and measurement error in social science research within the education discipline accounts for 30.5% of the variance. We conducted our study in the context of education and measured an abstract construct; thus, variance as a result of measurement error may be plausible.

Model 3 (after post hoc modification) shows that a correlation between error variances of the reversed items strengthens the fit indexes of the model. This confirms that there is a substantial correlation between the error variances for item MS20 and item MS21. These items pertain to seeking and offering assistance and are some of the core elements of mutual support in teamwork (King et al., 2008); furthermore, these two items have both low factor loading and high error variance and the error variance is correlated.

Negatively worded items have both advantages and disadvantages (Polit & Yang, 2016; Weijters & Baumgartner, 2012). Negatively worded items may correct for agreement bias, mainly if the scale comprises equal numbers of regular and negatively worded items (Baumgartner & Steenkamp, 2001). However, it may affect

TABLE 2 Mean score and standard deviation for T-TAQ items and dimensions (N = 509)

	Items description	Mean	SD
	Team structure (TS)	4.17	0.38
TS1	It is important to ask patients and their families for feedback regarding patients' care	4.49	0.63
TS2	Patients are critical component of the care team	4.76	0.50
TS3	The facility's administration influences the success of direct care teams	4.13	0.73
TS4	A team's mission is of greater value than the goals of individual team members	3.69	0.89
TS5	Effective team members can anticipate the needs of other team members	4.12	0.74
TS6	High performing teams in health care share common characteristics with high performing teams in other industries	3.80	0.79
	Leadership (L)	4.46	0.39
L7	It is important for leaders to share information with team members	4.80	0.44
L8	Leaders should create informal opportunities for team members to share information	4.14	0.83
L9	Effective leaders view honest mistakes as meaningful learning opportunities	4.35	0.68
L10	It is a leader's responsibility to model appropriate team behaviour	4.56	0.58
L11	It is important for leaders to take time to discuss with their team members plans for each patient	4.45	0.68
L12	Team leaders should ensure that team members help each other out when necessary	4.46	0.65
	Situation Monitoring (S)	4.22	0.52
S13	Individuals can be taught how to scan the environment for important situational cues	4.24	0.78
S14	Monitoring patients provides an important contribution to effective team performance	4.13	0.93
S15	Even individuals who are not part of the direct care team should be encouraged to scan for and report changes in patient status	4.02	0.93
S16	It is important to monitor the emotional and physical status of other team members	4.16	0.67
S17	It is appropriate for one team member to offer assistance to another who may be too tired or stressed to perform a task	4.45	0.61
S18	Team members who monitor their emotional and physical status on the job are more effective	4.25	0.74
	Mutual support (MS)	4.21	0.41
MS19	To be effective, team members should understand the work of their fellow team members	4.15	0.68
MS20†	Asking for assistance from a team member is a sign that an individual does not know how to do his/her job effectively	3.94	1.06
MS21†	Providing assistance to team members is a sign that an individual does not have enough work to do	4.25	0.72
MS22	Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance	4.28	0.65
MS23	It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard	4.63	0.52
MS24†	Personal conflicts between team members do not affect patient safety	4.01	0.98
	Communication (C)	4.28	0.38
C25	Team that do not communicate effectively significantly increase their risk of committing errors	4.72	0.54
C26	Poor communication is the most common cause of reported errors	4.02	0.73
C27	Adverse events may be reduced by maintaining an information exchange with patients and their families	4.34	0.58
C28	I prefer to work with team members who ask questions about information I provide	3.95	0.74
C29	It is important to have a standardized method for sharing information when handing off patients (e.g. shift exchange, transfer to other units)	4.48	0.60
C30†	It is nearly impossible to train individuals how to be better communicators	4.14	0.84
	T-TAQ total score	4.27	0.27

Abbreviations: T-TAQ, TeamSTEPPS Teamwork Attitudes Questionnaire. †Reversed items; Scale: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree.

TABLE 3 Cronbach's alpha of T-TAQ, in the current study and previous studies

Dimensions	N of items	Current study (N = 509)	Baker et al. (2010) (N = 449)	Ballangrud et al. (2019) (N = 249)	Brock et al. (2013) (N = 149)	Sweigart et al. (2016) (N = 109)
Total scale	30	0.79	n/a	0.83	0.93	n/a
Team structure	6	0.46	0.70	0.57	†	0.71
Leadership	6	0.62	0.81	0.76	†	0.82
Situation monitoring	6	0.70	0.83	0.75	†	0.89
Mutual support	6	0.44	0.70	0.53	0.62	0.75
Communication	6	0.56	0.74	0.57	†	0.57

Abbreviation: n/a, not available.

†Brock et al. (2013) reported Cronbach's Alpha values of the other dimensions as a range from 0.85–0.94.

TABLE 4 Confirmatory factor analysis (CFA) fit indexes

	CFA index standard	Model 1	Model 2		Model 3
		Total sample without missing (n = 477)	Random split half (n = 238)	Random split half (n = 239)	Correlation between four reversed items (n = 477)
Chi-square		884.2	665.3	629.7	724.3
p-value	>.05	.000	.000	.000	.000
df		395	395	395	389
Normed chi-square	<2	2.239	1.684	1.594	1.862
RMSEA (CI)	≤0.06	0.051 (0.047–0.056)	0.054 (0.047–0.061)	0.050 (0.043–0.057)	0.043 (0.038–0.047)
TLI	>0.95	0.730	0.710	0.743	0.812
CFI	>0.95	0.755	0.737	0.767	0.832

Abbreviations: CFI, Comparative Fit Index; CI, Confidence Interval; df, degree of freedom; RMSEA, Root Mean Square Error of Approximation; TLI, Tucker-Lewis Index.

the reliability, goodness-of-fit and factor loading of questionnaires (Baumgartner & Steenkamp, 2001). A problem in the T-TAQ was that the negatively worded items were not balanced through the questionnaire, as all the negatively worded items were in the last two-thirds of the questionnaire. This location may make the respondents more relaxed and more careless in interpreting and responding to the items (Baumgartner & Steenkamp, 2001).

Baker et al. (2008, p. 7) state in their T-TAQ manual that “items on the T-TAQ should not be modified.” The modification of a model should be theoretically justified (Polit & Yang, 2016) as well, and the T-TAQ is built on a thorough theoretical base (Baker et al., 2010). Our results indicate that the reversed items are troublesome for factor loading and affect the reliability of the dimensions.

Our study shows intercorrelation between dimensions between 0.48–0.78 (Figure 1). The strongest intercorrelation is 0.78 between mutual support and communication and between team structure and leadership. Previous studies of the T-TAQ show weaker intercorrelation between the latent dimensions (Baker et al., 2010; Ballangrud et al., 2019), which may be attributable to different methods of analysis. The mean score is high in all dimensions, and this is congruent with what the developers of the instrument found (Baker et al., 2010) and what Ballangrud et al. (2019) showed in the

Norwegian version. However, several studies show statistical significant changes in pre- and post-test studies used in educational settings (Brock et al., 2013; Goliat et al., 2013; Maguire et al., 2015). This might indicate that the questionnaire is suitable for measuring a change in attitudes among healthcare students.

5.3 | Limitations

A limitation of this study is that more than 60% of the sample comprised first-year students. First-year students are supposed to be both the youngest and the least experienced segment of the sample with respect to teamwork experience and professional knowledge. Another limitation is the use of two different methods of data collection. The email survey invited most of the available students but resulted in a response rate of only 15.3%. It is a known challenge to researchers that email surveys may have lower response rates than other survey methods (Manfreda et al., 2008). Regarding data collection by pen and paper, the number of students responding was limited to the students present in the class. On the other hand, the range and median age and sex of the respondents seem to be representative of the target population in Norway (Statistics, 2018).

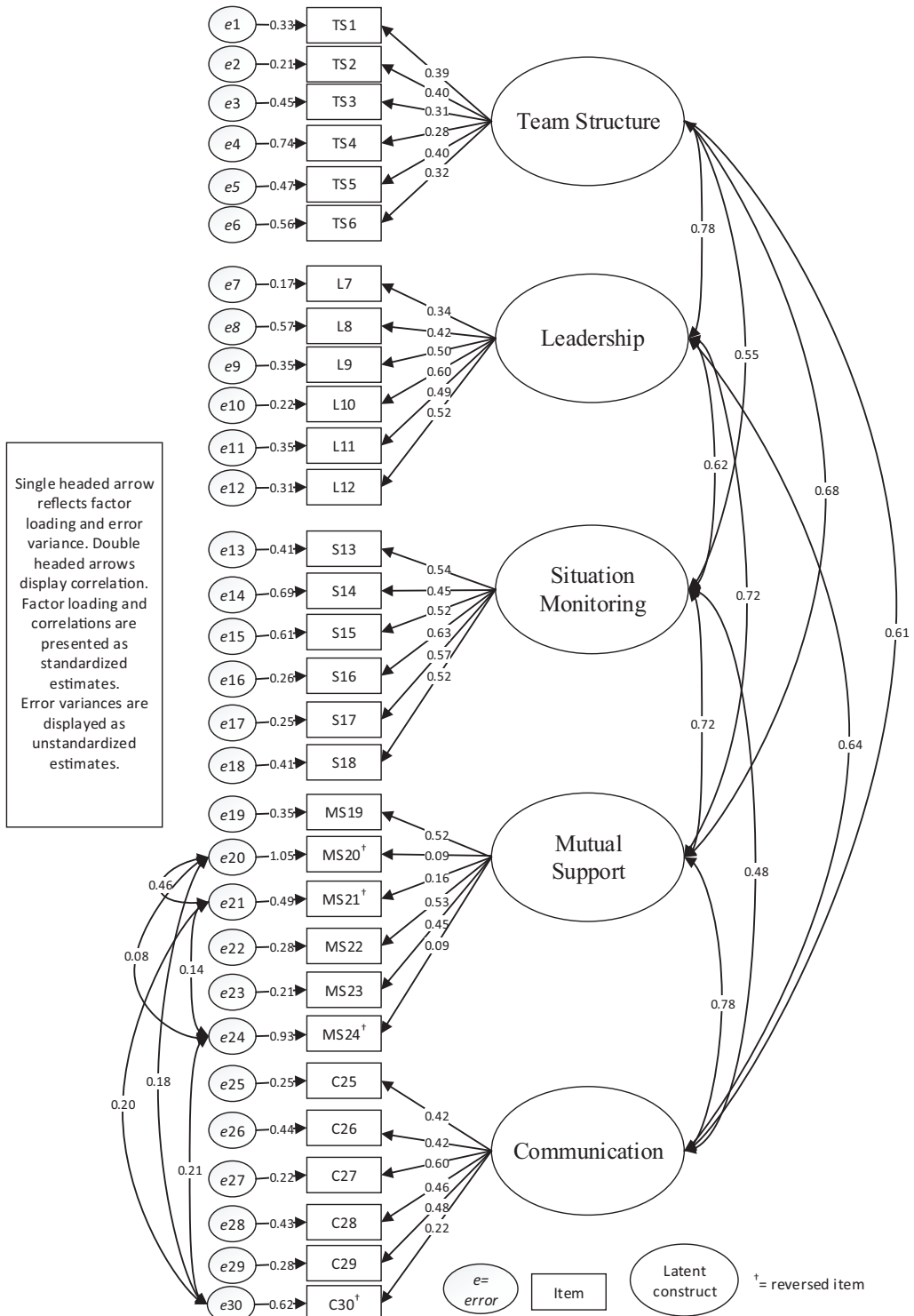


FIGURE 1 Structural model with factor loading, error variance and correlations

6 | CONCLUSION

The questionnaire shows acceptable absolute fit indexes. The CFA analysis shows acceptable values of RMSEA and normed chi-square values. Cronbach's alpha coefficient for the total questionnaire was acceptable. However, the internal consistency of four out of five dimensions was low. This study shows that the negatively worded items are troublesome for factor loading and affect the reliability of the dimensions. These results might indicate that the questionnaire should be considered unidimensional when used with undergraduate healthcare students, even if it comprises different fractions of the concept of teamwork. When the questionnaire is applied in educational settings, awareness of some negatively worded items should be highlighted to avoid measurement errors. Further studies are recommended to test the psychometric properties of the T-TAQ among other Bachelor of Nursing students and among multi-professional students.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHOR CONTRIBUTION

TK, MH, SW, RB: responsible for the conception and study design. TK: performed the data collection. TK, MH, SW, RB: contributed to the analysis of the data. TK, MH, SW, RB: involved in drafting the manuscript and revising it critically for important intellectual content. All authors have read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, [TK], upon reasonable request.

ORCID

Tore Karlsen  <https://orcid.org/0000-0002-1389-3472>

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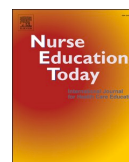
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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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Paper II



Research article



Bachelor of nursing students' attitudes toward teamwork in healthcare: The impact of implementing a teamSTEPPS® team training program — A longitudinal, quasi-experimental study

Tore Karlsen^{a,*}, Marie Louise Hall-Lord^{a,b}, Sigrid Wangensteen^a, Randi Ballangrud^a

^a Norwegian University of Science and Technology (NTNU) Faculty of Medicine and Health Sciences, Department of Health Sciences in Gjøvik, Norway

^b Faculty of Health, Science and Technology, Department of Health Sciences, Karlstad University, Karlstad, Sweden

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ABSTRACT

Background: Teamwork skills are essential to the quality of care and patient safety; nevertheless, team training is limited in Bachelor of Nursing degree programs in Norway.

Objectives: The objective of this study was to explore the impact of implementing a TeamSTEPPS® team training intervention on Bachelor of Nursing students' attitudes toward teamwork in health care.

Design: A longitudinal quasi-experimental design with pre- and posttests was used.

Settings: One intervention group and one control group were recruited from two campuses at a Norwegian university offering a Bachelor of Nursing degree.

Participants: Subjects were recruited from a population of 423 students.

Methods: For 26 months, the intervention group was exposed to the TeamSTEPPS® team training program with various learning activities to enhance teamwork skills. The intervention group and the control group responded to the Norwegian version of the TeamSTEPPS® Teamwork Attitude Questionnaire (T-TAQ) before the intervention (T0), after ten months (T1), and after 24 months (T2). The students participated in survey T0 and T1 was defined as Sample 1 and students participated in survey T0 and T2 was defined as Sample 2. The data were analyzed with parametric and nonparametric statistics.

Results: At T0 there was a significant difference between the intervention and control group. The intervention group showed a significant positive change in the Total T-TAQ score from T0 to T1 and from T0 to T2. The change in mean score differed significantly between the intervention and control group in favor of the intervention group.

Conclusions: This study showed that a team training program improved Bachelor of Nursing students' attitudes toward teamwork. Therefore, we recommend that the TeamSTEPPS® team training program be implemented in Bachelor of Nursing programs to facilitate a culture of teamwork.

1. Introduction

Teamwork skills are essential to the quality of care and patient safety, enabling effective patient care and preventing adverse events (Hughes et al., 2016; Rosen et al., 2018). The Norwegian national hospital and health care plan (2019) highlights the importance of creating a culture of teamwork in health care. Nurses work in both interprofessional and within-nursing-care teams (Kalisch et al., 2009). However, working as a team does not happen automatically; teamwork has to be learned, and team training has to start early in health care education (Norwegian Ministry of Health and Care Services, 2019). This study

reports on the process of implementing a Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) team training program in a Bachelor of Nursing program in Norway and its impact on students' attitudes toward teamwork in health care.

2. Background

Team training is a learning activity focusing on “developing, refining, and reinforcing knowledge, skills, or attitudes that underlie effective teamwork behaviors” (Weaver et al., 2014 p. 360). A team consists of “two or more individuals with different tasks who work

* Corresponding author.

E-mail address: tore.karlsen@ntnu.no (T. Karlsen).

together, are adaptable, and share a common goal” (Brannick and Prince, 1997 p. 4). Teamwork in health care is described as “the interaction or relationship of two or more health care professionals who work interdependently to provide care for patients” (Oandasan et al., 2006 p. 3). A team member in health care is anyone involved in the process of patient care who has a clearly defined role and responsibilities and can take action (AHRQ, 2017a). The TeamSTEPPS® team training program was developed by the US Agency for Healthcare Research and Quality (AHRQ) and the US Department of Defense (DoD) to optimize team performance and patient safety (AHRQ, 2017a). The TeamSTEPPS® framework consists of five fundamental principles, also labeled as dimensions: The Team Structure and four teamwork skills: Leadership, Situation Monitoring, Mutual Support, and Communication (AHRQ, 2012), as shown in Table 1. The TeamSTEPPS® framework was chosen for the team training intervention based on the program's evidence-based development, implementation guide, and instruments for outcome measurement (King et al., 2008). AHRQ (2017b) has developed an implementation guide in three phases based on John Kotter's (2012) eight steps of leading change.

Health care education has carried out elements of the TeamSTEPPS® team training program in interprofessional health care education (Chen et al., 2019; Welsch et al., 2018) and Bachelor of Nursing education (Barton et al., 2018), with a variety of pedagogical approaches. Nursing education in Europe (Kirwan et al., 2019) and the US (Smith et al., 2007) has reported integrating the topic from the WHO patient safety curriculum guide, “Being an effective team player” (WHO, 2011). However, Bachelor of Nursing education in Norway has, to a limited extent, incorporated team training into the curricula (Aase et al., 2013). Teamwork is one of the necessary skills to ensure quality and safety in health care (Knebel and Greiner, 2003). It is, therefore, vital to incorporate teamwork training into the education of health care professionals (Dow et al., 2013; Norwegian Ministry of Health and Care Services, 2019; Sherwood and Barsteiner, 2017).

The evaluation of team training in health care education (Barton et al., 2018) is commonly reported in relation to four levels described by Kirkpatrick (1996). Level 2 is the learning of training, where students' changes in knowledge, skills, and attitudes (KSAs) may be measured (Kirkpatrick and Kirkpatrick, 2006). Students' attitudes toward teamwork are a frequently measured outcome (Barton et al., 2018; Welsch et al., 2018). Team attitude competencies are the internal states that influence a team member's decision to act in a particular way. Changes in attitudes and the link between attitudes and behavior are complex (Ajzen and Fishbein, 2000). Attitudes have an affective and cognitive component related to a behavior intention component, which has various effects on behavior (Frager, 2014). Therefore, measuring attitudes can provide information regarding perceptions of teamwork behavior (Manser, 2009).

Previous studies with a TeamSTEPPS® intervention measuring the

change in attitudes toward teamwork in Bachelor of Nursing student cohorts have revealed a significant increase in Team Structure, Leadership, Situation Monitoring, Mutual Support, and Communication dimensions (Gaston, 2018; Goliat et al., 2013). Studies have shown increased post training scores in the Team Structure dimension (Maguire et al., 2015; Maneval et al., 2020), the Leadership dimension (Huehn et al., 2020; Maneval et al., 2020), and the Situation Monitoring dimension (Huehn et al., 2020; Maguire et al., 2015; Maneval et al., 2020). Decreased attitude scores from pre- to post training have also been reported (Huehn et al., 2020; Maguire et al., 2015). Few studies have a longitudinal design (Maguire et al., 2015; Maneval et al., 2020), and studies on the TeamSTEPPS® intervention in a Bachelor of Nursing program outside the US have not been published.

The objective of this study was to explore the impact of a TeamSTEPPS® team training intervention on Bachelor of Nursing students' attitudes toward teamwork in health care. Therefore, we formulated the following research questions:

- 1 Is there any change in attitudes toward teamwork within the intervention group from baseline to 10 months and from baseline to 24 months?
- 2 Is there any change in attitudes toward teamwork within the control group from baseline to 10 months and from baseline to 24 months?
- 3 Are there any differences in the change in attitudes toward teamwork between the intervention and control groups from baseline to 10 months and from baseline to 24 months?

3. Methods

3.1. Design

This study used a longitudinal quasi-experimental design with pre- and posttests (Polit and Beck, 2020). Two groups participated; one intervention group was exposed to the intervention, and one control group followed the regular study program. Attitudes toward teamwork were measured at baseline (T0), after ten months (T1), and after 24 months (T2).

3.2. Sample and settings

The study took place at a multicampus Norwegian university. The sample comprised students in the Bachelor of Nursing program in August 2018. The intervention group ($N = 164$) and the control group ($N = 259$) were students at different campuses. Both groups followed a study program based on the national regulations for Bachelor of Nursing education. These regulations require educational institutions to arrange for six European Credit Transfer and Accumulation System (ECTS) credits (Study.eu, 2021) in communication, cooperation, and conflict management (Norwegian Ministry of Education and Research, 2008). The control group did not receive any formal TeamSTEPPS® team training. The number of students recruited (N) fell from T0 to T1 and T2, as shown in Fig. 1. The reasons for the dropout in the first year are not known. Later dropout may be because the students do not complete their education, take a break from school, fail to pass exams, or attend an individual course study. The students who participated in both survey T0 and T1 is defined as Sample 1 and students participating in both survey T0 and T2 is defined as Sample 2. The Norwegian Bachelor of Nursing program is a three-year, full-time program (180 ECTS credits) where 50% of credits are obtained through clinical placements (Norwegian Ministry of Education and Research, 2008). The intervention and control groups had four 10-week clinical placements during the intervention period.

3.3. The intervention

The intervention lasted from August 2018 to October 2020. The

Table 1
TeamSTEPPS® key principles (AHRQ, 2017).

Team structure	Identification of the components of a multi-team system that must work together effectively to ensure patient safety
Leadership	The ability to maximize the activities of team members by ensuring that team actions are understood, changes in information are shared, and team members have the necessary resources
Situation Monitoring	The process of actively scanning and assessing situational elements to gain information or understanding or to maintain awareness to support team functioning
Mutual Support	The ability to anticipate and support team members' needs through accurate knowledge about their responsibilities and workload
Communication	The structured process by which information is clearly and accurately exchanged among team members

AHRQ. (2017). *TeamSTEPPS 2.0*. <https://www.ahrq.gov/teamsteps/instructor/index.html>

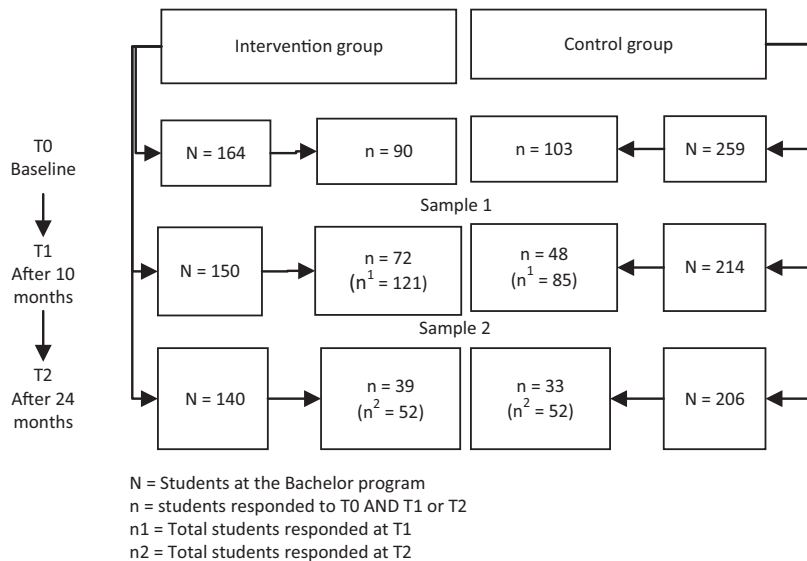


Fig. 1. The sampling process.

framework was the TeamSTEPPS® team training program (AHRQ, 2012; King et al., 2008), which was carried out in three phases according to the TeamSTEPPS® implementation guide (AHRQ, 2017b). Phase I includes determining whether the organization is ready to undertake the TeamSTEPPS® initiative and planning. Phase II provides training and implementation, and Phase III focuses on sustainability and integration and took place in the students' third year.

3.3.1. Phase I: assessment of readiness to undertake the TeamSTEPPS® intervention and planning

The head of the department at the campus was informed about the project and approved it. The intervention idea was presented at a workshop with faculty members and revealed that some elements of teamwork skills were implemented through learning objectives in clinical placements but not in a structured mode. They commented that they found the TeamSTEPPS® framework to help structure the training of teamwork skills. However, some of the constructs were unfamiliar, and they expressed a need for more knowledge to become familiar with the program. We established a change team with four TeamSTEPPS® master-trained members, consisted of two researchers (TK, RB) and two faculty members with the course responsibility of training basic nursing skills and clinical placements. The change team developed the implementation plan, which provided a foundation for the vision, learning outcomes, and a three-hour TeamSTEPPS® course to the faculty. The faculty was coached to implement the teamwork skills through meetings and written hints for implementation. As recommended by previous studies (Barton et al., 2018), we tailored the students' team training to fit into regular learning activities to facilitate implementation. The teamwork skills were implemented in practical nursing skills courses at the university campus (two courses, a total of 15 ECTS). The teamwork skills were also implemented in four clinical placements with 15 ECTS each, a total of 60 ECTS, in nursing homes (municipal) and medical, surgical, and psychiatric care (hospitals). One ECTS requires 26–27 h of study activity (Study.eu, 2021).

3.3.2. Phase II: training and implementation — the students' first and second years

We used multiple methods to stimulate student learning. Table 2

presents an overview of the implementation. The settings were skills training, simulated patient scenarios, structured reflection time during clinical placements, workshops, and classroom lectures. Two simulation scenarios were designed to challenge the students' teamwork skills (Situation Monitoring and Communication in psychiatric care). Seven first-aid scenarios were conducted, and the faculty and students' briefing and debriefing were redesigned to emphasize teamwork skills to accomplish effective and safe first-aid care. In the simulated patient scenarios, 2–3 students were active, and 10–15 students were respondents. Reflection time was conducted with 7–17 students during a 2 × 2-h structured reflection in each clinical placement. Finally, the faculty used video examples and discussions of clinical cases as part of workshops and plenary lectures.

3.3.3. Phase III: sustainment — integration, students' third year

At the beginning of the third year, the corona virus disease pandemic restrictions (COVID-19) (WHO, 2021) made it necessary to replace a simulated scenario with a remote reflection time in the learning platform (Blackboard collaboration). The students attended virtually with video and sound and an opportunity to chat online. Four faculty members made a video in the simulation center of a scenario with a nursing team taking care of deteriorating septic patient. The scenario showed team members' disagreement about further treatment, safety in drug administration, and the urgency of extending the team by adding a physician. The students watched the video two times and rated the teamwork using the TeamSTEPPS® Team Performance Observation Tool (Agency for Healthcare Research and Quality, 2014), which provided a foundation for further reflections on teamwork. A second remote reflection hour used the same video to focus on Mutual Support skills with conflict management and how to resolve disagreements among peers and health professionals with different positions in the hierarchy. The students discussed teamwork and conflict management in small groups of 3–4 students before they summarized the discussions in plenum.

3.4. Data collection

The data were gathered using three surveys: T0 in August/September

Table 2
Overview of the TeamSTEPPS® intervention.

Year	Month	Students (n)	Description of the intervention	Course	Hours
Phase I Assessment and planning					
January–August 2018					
Phase II Training and implementation					
1	End of August–December 2018	164	Introduction to teamwork skills as a part of training basic nursing skills. Inclusion of the patient in the Team Structure . Conducted in groups of 40 with 3–4 students in each team. A six-hour TeamSTEPPS® course was conducted (not mandatory).	Practical Nursing skills course	^a
	January 2019	80	Teamwork skills as a part of basic nursing skills	Practical Nursing skills course	6
		164	The TeamSTEPPS® pocket guide was distributed. A TeamSTEPPS® module was established in the Blackboard learning platform. Videos of examples of teamwork skills were published.		^a
	February–March 2019	164	Leadership skills, with <i>Briefing</i> and <i>Debriefing</i> were used in each skill training session. The <i>ISBAR Communication</i> tool was used in a simulated scenario.	Practical Nursing skills course	^a
	April 2019	164	Mutual Support skills , a two-hour workshop with a focus on <i>feedback</i> .	CP ^f Nursing homes	2
	May–June 2019	150	Reflection time. Teamwork skills included tools and strategies were reflected upon to improve learning outcomes in clinical placement.	CP ^f Nursing homes	2
2	August 2019	150	A 30-minute TeamSTEPPS® summary lecture	Practical Nursing skills course	0.05 ^a
			A seven-hour first-aid training day. All teamwork skills and strategies were a part of the <i>briefing</i> and <i>debriefing</i> sessions of seven scenarios		
			Short-time-wins after the first-aid training day.		
			Teamwork “best practice” posters were displayed in the simulation center facilities.		
	August–October 2019	150	Situation Monitoring and Mutual Support training when training complex nursing procedures.	Practical Nursing skills course	^a
			Five short videos showing a dialog among two faculty members of each teamwork skill was published at the learning platform.		
			Situation monitoring and Communication . The use of <i>shared mental model</i> in a simulated scenario within psychiatric care.		
	October–December 2019	150	Use of <i>ISBAR^b Communication</i> in a simulated scenario continued.	CP ^f Medical or surgical care	^a
			Demonstration videos of <i>IPASS^c handover</i> was published.		
			Reflection time – Students’ experience of application of teamwork skills in clinical placement.		
					2
	January–February 2020	4	One-hour Mutual Support tools lecture. (Not mandatory)	CP ^f Medical, surgical, or psychiatric care	1
	March–June 2020	Not registered	Reflection task; students’ perception of Leadership skills in clinical placement.	CP ^f Medical, surgical, or psychiatric care	^a
Phase III Sustainment - Integration					
3	August–October 2020	100 ^d	Continuing focus on teamwork skills in skill training and clinical placement	CP ^f Medical or surgical care	4
			Reflection time online. Rating teamwork in a video with a nursing team taking care of a septic patient in a simulated scenario. TPOT ^d rating scale		
			Reflection time online. Mutual Support including solving disagreements and conflicts in teams		
Total hours added to the curriculum in addition to the team training integrated into existing learning activities					15.5

n = Approximately number of students participating. Attending the practical skill and clinical placement courses was mandatory with a limit of 10% absence rate to get the course approved.

Bold significance values show p- values < 0.05.

^a The intervention was integrated into the training which made it difficult to separate how much time was used on the team training as a part of skills training, simulation and in clinical placements.

^b ISBAR = Identification, Situation, Background, Assessment, Recommendation.

^c IPASS = Illness, Patient Summary, Action list, Situation awareness, Synthesis by the receiver.

^d TPOT = TeamSTEPPS® Team Performance Observation Tool.

^e Students in clinical placements in psychiatric care did not take part in these reflection times.

^f CP = Clinical Placement.

2018, T1 in May/June 2019, and T2 in September 2020. The rationale for the point of data collection at T1 was that both groups had received basic nursing skill training and were in their first clinical placement and the intervention group had started the TeamSTEPPS® intervention. The rationale for performing the data collection at T2 was that the TeamSTEPPS® intervention had been continued and repeated through various learning activities (see Table 2). The first two surveys (T0 and T1) were administered on paper after a lecture on campus. The first author conducted the data collection (TK) with help from faculty members. The students obtained written information about the aim of the study. Envelopes with the student’s names were organized alphabetically and placed in the auditorium. The students who wanted to participate found their envelopes, filled in the coded questionnaire, and returned them before leaving class. Due to the COVID-19 pandemic restrictions, we used an email invitation for the third survey (T2). The T-TAQ was converted to be answered electronically (nettskjema.no). The

students had to follow a link in the email that led them to sign an information formula before accessing the questionnaire. Three email reminders were sent when it was time for the third survey, and all registered students were invited to participate.

3.5. The questionnaire

The TeamSTEPPS® teamwork attitude questionnaire (T-TAQ) is based on extensive research on essential teamwork attributes (Baker et al., 2010) and designed to measure attitudes toward core teamwork components aligned with the TeamSTEPPS® team training program (Baker et al., 2008). The questionnaire evaluates five dimensions of teamwork: Team Structure (TS), Leadership (L), Situation Monitoring (S), Mutual Support (MS), and Communication (C). The questionnaire comprises 30 items, with six items in each dimension. Four items are negatively worded. The respondent scores each item on a 5-point Likert

scale to indicate agreement, from (1) strongly disagree to (5) strongly agree. The T-TAQ instrument has been cross-culturally translated (Balangrud et al., 2019) and psychometrically tested in a sample of Bachelor of Nursing students (Karlsen et al., 2020). The questionnaire displayed a Cronbach's alpha of 0.79 for the total T-TAQ score, and values for the dimensions varied from 0.44 to 0.70 (Karlsen et al., 2020). Despite low internal consistency in four dimensions, the questionnaire showed acceptable values of goodness-of-fit indices. The questionnaire may be considered unidimensional when used with undergraduate health care students (Karlsen et al., 2020). The strength of the instrument is that it is widely used and designed to measure the constructs of the Team-STEPPS® training program, which provides an opportunity to compare the results with previous studies. Demographic details on the students, such as age, sex, former higher education, and former work experience in health care, were collected. Key teamwork constructs were explained on the first page of the questionnaire in all surveys.

3.6. Statistical analysis

All statistics were calculated using SPSS Statistics 27.0 (IBM, 2020). The scores of four negatively worded items (MS20, MS21, MS24, and C30) were reversed before further analysis. There were between two and three randomly missing responses (T-TAQ) for T0 and T1 survey items and no missing responses in survey T2. Descriptive statistics were used to display the frequency, percent, mean, and standard deviations. We used Pearson's chi-square for statistical analysis of the demographic variables and parametric statistics were used to estimate differences within and between groups. An independent *t*-test was used to compare the mean score (dimensions and total score) differences between the intervention and control groups in Sample 1 and Sample 2 at T0. We calculated the mean change score in Sample 1 (between T1 and T0 score) and Sample 2 (between T2 and T0 score). We used it as a new variable to compare the intervention and control groups (independent *t*-test). Independent *t*-tests (sex, former higher education) and two-way ANOVA (age, former working experience in health care) were used to control for the impact of demographic variables on dimensions and Total T-TAQ score.

Paired *t*-test was used to examine changes within groups for Sample 1 (participating in T0 and T1) and Sample 2 (participating in T0 and T2). Eta squared statistics were used to calculate the effect size, where 0.01 is considered as a small effect size, 0.06 medium, and 0.14 is regarded as a large effect (Cohen, 1988 p 285–288). We chose two-tailed tests for all statistics and $\alpha < 0.05$ was selected for statistical significance in all variables. We performed a power analysis to estimate the desired sample size based on a previous study (Brock et al., 2013). We needed 129 students in each group to detect a mean difference of 0.2 and a standard deviation of 0.54 between groups from T0 and T2 for the Situation Monitoring dimension, with $\alpha = 0.05$ and a power of 0.80 (Polit and Beck, 2020).

Dropout analyses were performed within the intervention and control groups to explore whether students who participated in only one survey ($n = 147$) differed from those who participated in more than one survey simultaneously. Pearson chi-square statistics were used to compare demographic variables between dropout groups and Sample 1 and Sample 2. In addition, an independent *t*-test was used to analyze the difference in mean T-TAQ scores (dimensions and Total T-TAQ) and equality of variance.

Demographic variables differed for Sample 2 in the control group, as students who only took part in the T2 survey ($n = 15$) had more students with working experience of 1–2 years ($p = 0.048$). Students who took part in only one survey did not differ significantly in mean T-TAQ scores or variance from their peers on any of the surveys.

3.7. Ethics

The study was conducted according to the Helsinki Declaration for

Ethical Principles of Research (WMA, 2018). The Norwegian Social Science Data Service (NSD ID: 738592) and the university departments involved approved the study. The students' names and email addresses were made available to the first author (TK) after thorough consideration of the General Data Protection Regulations (GDPR) (EU, 2018), consultations with legal advisors at the university, and department leaders, and the NSD. The invited students obtained written information about the study's aim and their rights according to the GDPR. Responding to the questionnaire was voluntary and had no consequences for their study progression. In the first two surveys, returning the questionnaire was considered consent to participate. In the third survey, students had to follow a link in the email invitation to take part. They had to indicate that the information was understood and agree to participate to access the questionnaire.

4. Results

Of the 423 students who started their bachelor's program in August 2018, 295 students participated in one or more surveys. Sample 1 consisted of students who participated in both T0 and T1 (72 students in the intervention group and 49 in the control group). Sample 2 consisted of students participating in both T0 and T2 (40 students in the intervention group and 33 in the control group), as shown in Fig. 1.

Table 3 shows the demographic variables of samples 1 and 2. In Sample 1, the control group had more students in the age group 25 years and older; otherwise, there were no significant differences in demographic variables between the intervention and control groups.

4.1. Differences in score between the intervention and control group at baseline (T0)

At T0, there was a significant difference in mean scores between the intervention and control groups in both Sample 1 and Sample 2, as shown in Table 4.

In Sample 1, the students in the control group, showed higher Mutual Support, Communication, and Total T-TAQ scores. Eta-squared statistics indicate a small to medium effect size. Post hoc analysis showed homogeneity of variance and no significant difference in the Total T-TAQ and Communication score, influenced by demographic variables. In the Mutual Support dimension, students in the intervention group, 25 years of age or older, displayed a lower T0 score than their younger peers ($f(2, 19) = 5.26, p = 0.015$).

In Sample 2, students in the control group showed higher Leadership scores and Total-TAQ scores at T0 with a medium to large effect. Students in the intervention group with former higher education ($M = 3.90$, $SD = 0.40$) showed a significantly lower score in the Leadership dimension than their peers without former higher education ($M = 4.28$, $SD = 0.33$) ($t(11.4) = -2.53, p = 0.027$).

4.2. Change in attitudes toward teamwork within the intervention group

The change in T-TAQ scores within the intervention group is outlined in Table 5. In Sample 1, the students displayed a positive change in four dimensions and the Total T-TAQ score between T0 and T1. The Team Structure was the dimension showing the most considerable positive change. Eta-squared statistics indicated a medium to large positive effect. Post hoc analyses revealed no violations of homogeneity of variance or significant differences in mean change influenced by demographic variables.

In Sample 2, the students' mean score changed significantly in the Leadership and Situation Monitoring dimensions and the Total T-TAQ score between T0 and T2, with a large positive effect. Post hoc analyses showed homogeneity in variance and no significant differences in change in score influenced by demographic variables.

Table 3
Demographic variables of Sample 1 and Sample 2.

Label	Groups ^b	Sample 1 ^a					Sample 2 ^a				
		I		C		p ^c	I		C		p ^c
		n	(%)	n	(%)		n	(%)	n	(%)	
		72		48			39		33		
Sex	Female	57	79.2	42	87.5	0.302	31	79.5	31	93.9	0.077
	Male	14	19.4	6	12.5		8	20.5	3	6.1	
	Missing	1	1.4								
Former higher education	Yes	15	20.8	15	31.3	0.203	9	23.1	12	36.4	0.217
	No	55	76.4	32	66.7		30	76.9	21	63.6	
	Missing	2	2.8	1	2.1		0	0			
Former working experience in healthcare	None	25	34.7	15	31.3	0.833	12	30.8	15	45.5	0.581
	<1 year	10	13.9	10	20.8		5	12.8	5	15.2	
	1–2 years	14	19.4	10	20.8		7	18.0	5	15.2	
	≥3 years	19	26.4	13	27.1		14	35.9	8	24.2	
	Missing	4	5.6				1	2.6	0		
Age	≥ 20 years	32	44.4	16	33.3	0.043*	14	35.9	13	39.4	0.967
	21–24 years	28	38.9	17	35.4		14	35.9	14	42.4	
	25 + years	6	8.3	12	25.0		6	15.4	5	15.2	
	Missing	6	8.3	3	6.3		5	12.8	1	3.0	

^a Sample 1 = took part in both T0 and T1, Sample 2 = took part in both T0 and T2.

^b I = intervention group, C = control group.

^c Pearson Chi-Square,

* p < 0.05.

Table 4
T-TAQ^a score differences between intervention groups and control groups at T0.

Groups ^b	Sample 1					Sample 2						
	I n = 72		C n = 48		Independent t-test t(df) p	Eta-squared ^c η ²	I n = 39		C n = 33		Independent t-test t(df) p	Eta-squared ^c η ²
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			Mean (SD)	Mean (SD)				
Total T-TAQ ^a score	20.42(1.22)	21.16(1.60)	2.71(81.9)	0.008*	0.06	20.37(1.30)	21.25(1.58)	2.59(61.9)	0.012*	0.09		
Dimensions												
Team structure (TS)	4.00(0.40)	4.13(0.47)	1.71(89.9)	0.091		4.03(0.47)	4.16(0.44)	1.24(69.9)	0.219			
Leadership (L)	4.27(0.40)	4.38(0.44)	1.40(94.8)	0.164		4.18(0.38)	4.51(0.38)	3.76(68.4)	<0.001*	0.17		
Situation monitoring (S)	3.90(0.40)	4.00(0.51)	1.21(82.5)	0.221		3.88(0.40)	3.98(0.55)	0.91(57.5)	0.364			
Mutual support (MS)	4.11(0.44)	4.33(0.36)	2.99(113.2)	0.003*	0.07	4.13(0.40)	4.30(0.37)	1.75(70.0)	0.084			
Communication (C)	4.15(0.36)	4.31(0.43)	2.17(88.7)	0.033*	0.04	4.15(0.36)	4.31(0.42)	1.66(63.0)	0.103			

SD = standard deviation.

df = degree of freedom.

Scale: 1 = Strongly disagree. 2 = Disagree. 3 = Neutral. 4 = Agree. 5 = Strongly agree.

^a T-TAQ = TeamSTEPPS Teamwork Attitude Questionnaire.

* Significant difference (two tailed) = p < 0.05.

^b I = intervention group, C = control group.

^c Eta squared effect size (0.01 = small effect, 0.06 = medium effect, 0.14 = large effect).

4.3. Change in attitudes toward teamwork within the control group

Table 6 shows the change in score within the control group. In Sample 1, the students showed a significantly positive change in score in the Leadership dimension and a significantly negative change in the Mutual Support dimension score between T0 and T1. Eta-squared statistics indicated a medium effect size. Post hoc analysis revealed homogeneity of variance and no significant differences in change in score within demographic subgroups.

In sample 2, the students in the control group, displayed no significant change in score between T0 and T2.

4.4. Differences in the mean change scores between the intervention and control groups

Table 7 shows how the students' mean change T-TAQ scores differed between the intervention and control groups in samples 1 and 2. In Sample 1, students in the intervention groups showed a significantly higher change in the Total T-TAQ and the Mutual Support score with a small to medium effect size.

In Sample 2, the students in the intervention group showed a significantly higher change in the Total T-TAQ score and Leadership score between T2 and T0 than the control group. Eta-squared statistics indicate a medium effect size.

Post hoc analyses displayed no significant differences in the change in score between students by age, sex, former higher education, or former work experience.

Table 5
Change in T-TAQ^a score within the intervention group from T0 to T1 and from T0 to T2.

	Sample 1 (n = 72)				Effect size ^b	Sample 2 (n = 39)				
	Mean score T0 (SD)	Mean score T1 (SD)	Paired t-test T0 to T1			Mean score T0(SD)	Mean score T2 (SD)	Paired t-test T0 to T2		
			t(df)	p				t(df)	p	Effect size ^b
Total T-TAQ ^a score	20.42(1.22)	21.1(1.30)	4.98(71)	<0.001*	0.26	20.37(1.30)	21.07(1.37)	3.10(39)	0.004*	0.20
Dimensions										
Team structure (TS)	4.00(0.40)	4.19(0.34)	3.47(71)	0.001*	0.14	4.03(0.47)	4.12(0.39)	1.09(39)	0.285	
Leadership (L)	4.27(0.40)	4.41(0.37)	2.68(71)	0.009*	0.09	4.18(0.38)	4.37(0.38)	2.95(39)	0.005*	0.18
Situation monitoring (S)	3.90(0.40)	4.09(0.63)	2.59(71)	0.012*	0.09	3.88(0.40)	4.11(0.42)	3.09(39)	0.004*	0.20
Mutual support (MS)	4.11(0.44)	4.22(0.44)	1.97(71)	0.053		4.13(0.40)	4.26(0.44)	1.65(39)	0.108	
Communication	4.15(0.36)	4.26(0.39)	2.17(71)	0.033*	0.06	4.15(0.36)	4.21(0.40)	0.83(39)	0.410	

Scale: 1 = Strongly disagree. 2 = Disagree. 3 = Neutral. 4 = Agree. 5 = Strongly agree.

T0 = baseline, T1 = 10 months after start of the intervention, T2 = After 24 months.

SD = standard deviation.

df = degree of freedom.

^a T-TAQ = TeamSTEPPS Teamwork Attitudes Questionnaire.

* Significant difference (two tailed) = $p < 0.05$.

^b Eta squared effect size, calculated for significant *t*-test results (0.01 = small effect, 0.06 = medium effect, 0.14 = large effect).

Table 6
Changes in T-TAQ^a score within the control group from T0 to T1 and from T0 to T2.

	Sample 1 (n = 48)				Effect size ^b	Sample 2 (n = 33)			
	Mean score T0 (SD)	Mean score T1 (SD)	Paired t-test T0 to T1			Mean score T0 (SD)	Mean score T2 (SD)	Paired t-test T0 to T2	
			t(df)	p				t(df)	p
Total T-TAQ ^a score	21.16(1.60)	21.32(1.34)	1.05(48)	0.299		21.25(1.58)	21.21(1.44)	-0.21(32)	0.839
Dimensions									
Team structure (TS)	4.13(0.47)	4.19(0.40)	0.83(48)	0.411		4.16(0.44)	4.14(0.38)	-0.35(32)	0.728
Leadership (L)	4.38(0.44)	4.54(0.36)	2.37(48)	0.022*	0.10	4.51(0.38)	4.41(0.44)	-1.46(32)	0.154
Situation monitoring (S)	4.00(0.51)	4.14(0.50)	1.96(48)	0.061		3.98(0.55)	4.08(0.44)	-1.23(32)	0.227
Mutual support (MS)	4.33(0.36)	4.18(0.39)	-2.27(48)	0.028*	0.10	4.30(0.37)	4.27(0.45)	-0.27(32)	0.792
Communication	4.31(0.43)	4.29(0.43)	-0.21(48)	0.835		4.31(0.42)	4.31(0.41)	-0.00(32)	1.000

Scale: 1 = Strongly disagree. 2 = Disagree. 3 = Neutral. 4 = Agree. 5 = Strongly agree.

T0 = baseline, T1 = 10 months after start of the intervention, T2 = After 24 months.

SD = standard deviation.

df = degree of freedom.

^a T-TAQ = TeamSTEPPS Teamwork Attitudes Questionnaire.

* Significant difference (two tailed) = $p < 0.05$.

^b Eta squared effect size, calculated for significant *t*-test results (0.01 = small effect, 0.06 = medium effect, 0.14 = large effect).

5. Discussion

This study was the first to implement the TeamSTEPPS® team training intervention in a Bachelor of Nursing program in Norway. We measured attitudes toward teamwork in health care three times during the intervention. The results indicated significant, positive changes in the intervention group between T0 and T1 and T0 and T2 in the Total T-TAQ score. The control group showed a significantly higher score at T0, a nonsignificant positive change between T0 and T1 and a nonsignificant negative change between T0 and T2.

Glasman and Albarracín (2006) found a stronger correlation between attitudes and future behavior when attitudes are easy to recall and stable over time. This correlation suggests that the use of multiple teaching approaches over time, as in the TeamSTEPPS® program, is positive and may be necessary to achieve a sustainable change in attitudes and affect future behavior.

Sample 1 in the intervention group demonstrated a positive change in score for Team Structure from T0 to T1. Including the patient in the team was emphasized in lectures and skills training in the first year of the TeamSTEPPS® intervention and may have influenced the considerable positive change in the Team Structure dimension between T0 and T1. The two previous longitudinal studies (Maguire et al., 2015; Maneval et al., 2020) reported similar changes in the Team Structure.

The positive changes in the Leadership and Situation Monitoring

dimensions in both Sample 1 and Sample 2 may have been influenced by the repeated focus on Situation Monitoring skills, including structured observation of the patient, team members, and the environment. These changes seemed to be sustainable and may affect future behavior (Glasman and Albarracín, 2006). In addition, the positive change in attitudes toward Leadership in the intervention group may have been affected by the intervention, which incentivized the students to use the Leadership tools briefing and debriefing before and after each teamwork task. These results are supported by similar findings among the intervention group in the Maguire et al. (2015) study. In the control group, Sample 1 showed a significant positive change toward Leadership between T0 and T1. However, Sample 2 showed a negative change between T0 and T2. The lack of positive change between T0 and T2 in the control group may be due to a ceiling effect (Polit and Yang, 2016), as Sample 2 showed the highest score of all dimensions in the Leadership dimension at T0.

Sample 1 in the control group had more older students than the intervention group. Previous studies have indicated a positive correlation between higher age and more positive attitudes (Maneval et al., 2020) and perceptions of teamwork (Carson et al., 2018). However, our analysis showed that students 25 years or older in the intervention group, Sample 1, differed significantly from their peers in the Mutual Support dimension at T0. In the other mean score or change in mean scores the older students did not differ from their peers in the control

Table 7
Mean changes in T-TAQ^a scores: Differences between the intervention group and control group in Sample 1 and Sample 2.

Sample 1		Intervention group n = 72		Control group n = 48		Independent t-test of change			
		Mean T1(SD)	Mean change ^b (CI)	Mean T1(SD)	Mean change ^b (CI)	t (CI)	df	p	η ²
Total T-TAQ ^a score		21.10(1.30)	0.76(0.45, 1.06)	21.32(1.34)	0.21(-0.23, 0.55)	-2.14(-1.01, -0.04)	96.5	0.035*	0.04
Dimensions									
Team structure (TS)		4.19(0.34)	0.19(0.08, 0.30)	4.19(0.40)	0.06(-0.09, 0.19)	-1.62(-0.31, 0.03)	100.7	0.108	
Leadership (L)		4.41(0.37)	0.14(0.04, 0.25)	4.54(0.36)	0.15(0.02, 0.29)	0.15(-0.16, 0.18)	98.7	0.879	
Situation monitoring (S)		4.09(0.63)	0.20(0.05, 0.35)	4.14(0.50)	0.14(-0.02, 0.27)	-0.06(-0.18, 0.17)	90.3	0.954	
Mutual support (MS)		4.22(0.44)	0.11(-0.00, 0.22)	4.18(0.39)	-0.13(-0.26, -0.02)	-3.11(-0.41, -0.09)	110.7	0.002*	0.08
Communication (C)		4.26(0.39)	0.11(0.01, 0.22)	4.29(0.43)	-0.01(-0.14, 0.08)	-1.85(-0.29, 0.01)	111.2	0.068	
Sample 2		Intervention group n = 39		Control group n = 33					
		Mean T2(SD)	Mean change ^b (CI)	Mean T2(SD)	Mean change ^b (CI)	t (CI)	df	p	η ²
Total T-TAQ ^a score		21.07(1.37)	0.70(0.24, 1.16)	21.21(1.44)	-0.05(-0.55, 0.45)	-2.25(-1.42, -0.09)	68.7	0.028*	0.07
Dimensions									
Team Structure (TS)		4.12(0.39)	0.09(-0.08, 2.64)	4.14(0.38)	-0.03(-0.17, 0.12)	-1.06(-0.34, 0.01)	70.6	0.294	
Leadership (L)		4.37(0.38)	0.19(0.06, 0.32)	4.41(0.44)	-0.10(-0.24, 0.04)	-3.08(-0.48, -0.10)	69.2	0.003*	0.12
Situation Monitoring (S)		4.11(0.42)	0.23(0.08, 0.39)	4.08(0.44)	0.10(-0.07, 0.27)	-1.19(-0.35, 0.09)	68.7	0.239	
Mutual Support (MS)		4.26(0.44)	0.13(-0.03, 0.28)	4.27(0.45)	-0.03(-0.22, 0.17)	-1.23(-0.39, 0.09)	64.3	0.222	
Communication (C)		4.15(0.36)	0.06(-0.08, 0.20)	4.31(0.41)	0.00(-0.18, 0.18)	-0.52(-0.28, 0.17)	64.4	0.605	

T0 = baseline, T1 = ten months after the intervention, T2 = 24 months after start of the intervention.

SD = Standard deviation.

t = Negative value shows higher change in the intervention group compared to the control group.

CI = 95% confidence interval,

df = Degree of freedom.

η² = eta squared (0.01 = small effect, 0.06 = medium effect, 0.14 = large effect).

^a T-TAQ = TeamSTEPPS Teamwork Attitudes Questionnaire.

^b Positive change = T1/T2 score > T0 score, Negative change = T1/T2 score < T0 score.

* Significant difference (two tailed) = $p < 0.05$.

group or intervention group. These results may be influenced by the low reliability of the score in the Mutual Support dimension shown in Karlsen et al. (2020) study.

The intervention had a significant focus on Mutual Support skills throughout the intervention. However, the Mutual Support dimension changes may have limited validity to illustrate attitudes toward the construct. The Mutual Support dimension consists of three negatively worded items that were shown to be troublesome, and variance within the score may have a large margin of error (Karlsen et al., 2020).

Team communication was essential throughout the total TeamSTEPPS® intervention. This constraint to train Bachelor of Nursing students in Communication skills may have lost some power after the first year of intervention. Sample 1 shows a significantly positive difference in the Communication dimension scores between T1 and T0, which was much smaller in Sample 2. Our results indicate a positive change in the students' attitudes toward communication in teams after ten months of the intervention, which diminishes in the second year of the intervention. Previous longitudinal studies did not report significant changes in attitudes toward communication in teamwork (Maguire et al., 2015; Maneval et al., 2020).

5.1. Strengths and limitations

One strength of this study is its longitudinal design and the use of a control group. Another strength is that the study used an evidence-based team training program in the intervention.

Possible bias in longitudinal studies exists (Polit and Beck, 2020), and this study has several limitations. First, since the sample decreased throughout the study period, caution must be taken in generalizing the results. Second, the research design turned out to be unbalanced due to the dropout from the T0 to T1 and T2 surveys. Attrition of participants in longitudinal studies is often a challenge (Ibrahim and Molenberghs, 2009; Polit and Beck, 2020). However, dropout analyses showed that students who participated in only one survey did not differ in the mean

score or demographic variables compared to their peers. Student maturation may have impacted attitudes toward teamwork, but it is often very subtle and difficult to control (Hammer, 1977). Third, significant differences in mean scores between the intervention and control group samples at T0 limited the study to measuring differences in change in scores between groups. Fourth, the two different data collection methods (paper vs. email surveys) may have affected the response rate (Manfreda et al., 2008). Finally, as in this study, previous research has shown high T-TAQ scores at baseline (Gaston, 2018; Huehn et al., 2020; Maguire et al., 2015), which may cause a ceiling effect (Polit and Yang, 2016).

6. Conclusion

Nursing students showed positive attitudes toward teamwork from the start of their Bachelor degree education. The TeamSTEPPS® team training intervention seems to have positively impacted attitudes toward teamwork among Bachelor of Nursing students. The intervention group exhibited a significant, positive change in attitudes toward teamwork during the intervention period in the total T-TAQ score.

The intervention in which the TeamSTEPPS® team training is integrated into all relevant learning activities and repeated over time seems to have successfully changed the students' attitudes toward teamwork in health care.

Further studies with a longitudinal design of attitudes toward teamwork should be conducted with a larger sample of Bachelor of Nursing students. We further recommend that future studies investigate Kirkpatrick's four levels of evaluation to shed light on the impact of team training on Bachelor of Nursing students' teamwork competence to promote patient safety.

CRediT authorship contribution statement

Tore Karlsen: Conceptualization, Methodology, Formal analysis,

Investigation, Writing-Original Draft.

Marie Louise Hall-Lord: Conceptualization, Methodology, Formal analysis, Writing - Review & Editing.

Sigrd Wangensteen: Conceptualization, Methodology, Formal analysis, Writing - Review & Editing.

Randi Ballangrud: Conceptualization, Methodology, Formal analysis, Writing - Review & Editing.

Declaration of competing interest

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