Transforming Communication and Relationships in Interdisciplinary Teams

a mixed methods study

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DISSERTATION SUBMITTED 2018

AALBORG UNIVERSITY
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CV

Birgitte Tørring graduated as a nurse from the Nursing School in Aalborg in 1988. She was employed as a critical care nurse in different intensive care units in Denmark from 1990 to 1995. Then, from 1995 to 1999, Birgitte became a frontline manager in a critical care unit at Aalborg Hospital, which was followed by a period (1999-2002) spent employed as a critical care nurse assigned development tasks.

Since 2002, Birgitte has been a lecturer, consultant, and coach at act2learn, the postgraduate education department of the University College of Northern Denmark. As part of her work on postgraduate education, courses, and projects at act2learn, Birgitte has taught and collaborated with various health professionals, focusing on topics such as critical care nursing, communication, supervision, ethical issues, interdisciplinary collaboration, patient safety culture, and development of practice.

Additionally, Birgitte has been responsible for, and participated in several projects related to development of practice in the health care field, focusing on training communication and collaboration skills, both at hospital and at the primary care level in the municipality.

Birgitte Tørring completed a Graduate Diploma in Educational Psychology at the Danish University of Education in 2002, and she received a Master´s Degree in Humanities and Health Studies in 2006 from Aarhus University. Further, Birgitte Tørring completed and passed the first qualification year for enrolment as a Ph.D. student at Aalborg University in 2013.

Since January 2014, Birgitte Tørring has been enrolled as a Ph.D. student in the Faculty of Medicine, Aalborg University.

ENGLISH SUMMARY

In interdisciplinary surgical teams, in which the involved health professionals are highly interdependent and work under time pressure, it is vital that the interdisciplinary collaboration is well-functioning to secure high-quality treatment of surgical procedures and patient safety. Greater attention should be paid to the capability to engage in teamwork among the interdisciplinary and multispecialty members of surgical teams if they are to adapt to rapidly advancing diagnostic modalities and the increasingly complex surgical treatment of patients. This necessity is shaped by the increasing fragmentation of health professionals that results from a very strong specialization tendency. Today, most surgical teams are established ad hoc, comprised by different team members from day to day. This fluid team structure is poses challenges for the team's adaptive capacity and the interactive dynamics among team members. This highlights the need to understand the interpersonal interactions that occur between team members in fluid surgical teams more deeply, as well as to understand how shared goals, knowledge of one another, and mutual respect between surgical team members are expressed at the micro level. The theory of relational coordination (RC) captures many of these desired insights. RC is a mutually reinforcing process of communicating and relating across areas of expertise for the purpose of task integration. The application of RC theory and the associated methodology may be a key to understanding teamwork in surgical teams in search of successful collaboration, communication, and relationships. Few studies have explored how RC can be observed and improved at the micro level in this specialized context.

Building on this background, the present study explored surgical teams in selected operating rooms (OR) with the purpose to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in Denmark, guided by the theory of RC, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future.

The study was a mixed methods study with a multiphase design. PHASE I included fieldwork using ethnographic principles in practice, where the data were collected through participant observations, interviews, and focus group interviews, over a ten-month period in 2014 in two orthopedic surgical units in a university hospital in Denmark. In PHASE II, an organizational intervention using RC theory and methodology as a tool for improvement of interdisciplinary collaboration in a surgical unit was monitored and evaluated. In PHASE III, RC and safety culture were assessed before, during, and after the implementation of improvement initiatives using the *Relational Coordination Survey* (RC Survey) and the *Safety Attitudes Questionnaire* (SAQ). In PHASE IV, the qualitative and quantitative data and findings from PHASE I, II, and III were integrated at the interpretative level, using a narrative weaving approach.

PHASE I found that interdisciplinary collaboration in surgical teams was challenged by uncertainties in terms of the daily surgical program, the high degree of interdependency among team members, and the strong focus on time and capacity utilization. Surgical teams practiced different communication and relationship patterns when performing surgical procedures with varying degrees of complexity. These patterns included: *Proactive and intuitive communication, Silent and ordinary communication, Inattentive and ambiguous communication,* and *Contradictory and highly dynamic communication.*

PHASE II found RC theory and methodology to be useful in relation to organizational interventions as a diagnostic tool for the improvement and identification of the challenges associated with interdisciplinary collaboration in surgical teams.

In PHASE III, the RC Survey was found to be useful for measuring interdisciplinary collaboration, as well as for identifying strong and weak collaboration ties between and within workgroups collaborating around a core task. The RC (RC index) was found to be statistically significantly higher eight months after the implementation of an organizational intervention, while it was the same as before implementation of an organizational intervention when measured some 16 months later. Furthermore, collaboration ties between workgroups in surgical teams were non-reciprocal between surgeons and nurses and across clinical specialties in the operating room (OR). In addition, statistically significant positive correlation was found between the construct of RC and safety culture dimensions such as teamwork climate, safety climate, job satisfaction, and working conditions included in the SAQ.

In PHASE IV, the findings from PHASE I, PHASE II, and PHASE III were integrated and interpreted through narrative discussions and joint displays under the identified themes: *Collaboration in need for transformation*, *Experiences during an intervention process*, and *Evaluation of an organizational intervention*.

In conclusion, interdisciplinary collaboration in surgical teams is made necessary challenged by uncertainty, interdependency, and time constraints. Interdisciplinary surgical teams were found to meet this need by using different types of communication and relationship patterns. These patterns included non-reciprocal collaboration ties between surgeons and nurses, and across clinical specialties in the OR. The interdisciplinary collaboration was found to be appropriately in some surgical teams, while collaboration in other surgical teams was found to be inappropriately and in need of transformation. RC theory and methodology were found to be useful as framework for organizational change processes aimed at improving interdisciplinary collaboration and safety culture in surgical teams, leading to significant changes initially. The dissertation concludes by proposing how to improve and sustain the quality of collaboration and safety culture in future interdisciplinary surgical teams.

DANSK RESUME

I tværfaglige operationsteams, hvor sundhedsprofessionelle er stærkt indbyrdes afhængige og ofte arbejder under tidspres, er det afgørende for kvaliteten af den udførte pleje og behandling og for patientsikkerheden, at det tværfaglige samarbejde er velfungerende. Derfor må sundhedsprofessionelles evner og engagement til at indgå i tværfagligt samarbejde have skærpet opmærksomhed, hvis samarbejdet i operationsteams skal tilpasse sig nye avancerede kirurgiske operationsmetoder og behandlinger af patienter. En nødvendighed, der er formet af øget specialisering i sundhedsprofessionerne og i sundhedsvæsenet generelt. I dag er de fleste operationsteams sammensat ad hoc, idet de sammensættes på daglig basis, så de består af sundhedsprofessionelle med netop de specifikke kompetencer, som den konkrete kirurgiske behandling af en given patient fordrer. Denne flydende teamstruktur udfordrer den adaptive kapacitet i tværfaglige operationsteams og den interpersonelle dynamik mellem de involverede sundhedsprofessionelle. Dette tydeliggør et behov for at forstå de interpersonelle interaktioner i tværfaglige operationsteams mere dybtgående, samt forstå hvordan fælles mål, kendskab til hinanden og gensidig respekt udtrykkes og praktiseres blandt kirurger, anæstesiologer og sygeplejersker på operationsstuen. Teorien om relationel koordinering (RK) indfanger nogle af disse perspektiver og behov. RK beskriver gensidigt forstærkende dynamikker, der udtrykker, hvordan medarbejdere på tværs af fagområder kommunikerer og interagerer med hinanden med henblik på at løse en bestemt opgave sammen. Anvendelse af teori om RK og den tilhørende metodik kan være en nøgle til forståelse af teamwork i tværfaglige operationsteams, som også kan anvendes med henblik på at styrke det tværfaglige samarbejde på operationsstuen (OP). Få studier har undersøgt, hvordan RK kan observeres og forbedres på mikroniveau i denne specialiserede kontekst.

På denne baggrund undersøgte dette studie tværfaglige operationsteam på udvalgte operationsstuer i Danmark med formål om, a) at skabe ny viden om hvordan kommunikation og relationer praktiseres i tværfaglige operationsteam i forskellige kontekster, samt b) at tilbyde anbefalinger til hvordan kvaliteten af det tværfaglige samarbejde og sikkerhedskulturen i disse teams kan styrkes i fremtiden. Studiet anvender teori om RK som referenceramme.

Studiet var et mixed methods studie med et flerfaset design. FASE I omfattede et feltarbejde, hvor etnografiske principper blev anvendt i praksis, og data blev indsamlet gennem observationer, interviews og fokusgruppeinterviews i løbet af en 10 måneders periode i 2014 i to ortopædkirurgiske operationsafsnit på et universitet sygehus i Danmark. FASE II fulgte og evaluerede en forandringsproces, hvor RK teori og metode blev anvendt i en organisatorisk udviklingsproces som et redskab til forbedring af samarbejdet i tværfaglige operationsteams. FASE III målte og vurderede RK og patientsikkerhedskultur før, under og efter implementering af forbedringsinitiativer ved

anvendelse af spørgeskemaerne *Relationel Koordinering* (RK Survey) og *Patient Sikkerhedskultur* (SAQ-DK). FASE IV integrerede de kvalitative og kvantitative fund i tre narrative diskussioner og joint displays.

Resultater fra FASE I viste, at det tværfagligt samarbejde i operationsteams er udfordret af en stor foranderlighed, en høj grad af gensidig afhængighed mellem de sundhedsprofessionelle, og et stærkt fokus på tids- og ressourceforbrug. De sundhedsprofessionelle i disse operationsteams viste sig at anvende forskellige kommunikations- og relationsmønstre, når de samarbejdede omkring udførelse af operationelle indgreb af varierende kompleksitet. Mønstre som: *Proaktiv og intuitiv kommunikation*, *Stille og rutinepræget kommunikation*, *Uopmærksom og tvetydig kommunikation* og *Modsætningsfyldt og højdynamisk kommunikation*. Resultater fra FASE II viste, at RK teori og metode er brugbar i organisatoriske forandringsprocesser, som diagnostisk redskab til identifikation af udfordringer i tværfagligt samarbejde i operationsteams og til udvikling af forbedringsinitiativer. Resultater fra FASE III viste, at RK Survey er et nyttigt redskab til at måle det tværfaglige samarbejde, og til at identificere stærke og svage samarbejdsrelationer mellem samarbejdende faggrupper på OP. RK (RK index) var statistisk signifikant højere 8 måneder efter implementeringen af forandringsinitiativer, mens den var tilbage ved udgangspunktet, da målingen blev gentaget efter 16 måneder. Samarbejdsrelationerne mellem kirurger og sygeplejersker viste sig at være karakteriseret som *ikke-gensidige*. Det samme var tilfældet i samarbejdsrelationerne på tværs af kliniske specialer på OP. Endeligt blev der fundet statistisk signifikant korrelation mellem RK og skalaerne teamwork klima, sikkerhedsklima, job tilfredshed og arbejdsbetingelser, alle inkluderet i SAQ-DK. I den afsluttende FASE IV blev fire temaer identificeret: *Et samarbejde med behov for transformation*; *Erfaringer fra en interventionsproces* og *Evaluering af en organisatorisk intervention.*

Et stærkt samarbejde er nødvendigt, da tværfaglige operationsteams er udfordret af stor foranderlighed i forhold til den daglige operationsplanlægning, stærk indbyrdes afhængighed og øget fokus på tidsforbrug og kapacitetsudnyttelse. De tværfaglige operationsteams imødekom dette behov ved at anvende forskellige kommunikations- og relationsmønstre. Disse mønstre omfattede ikke-gensidige samarbejdsrelationer mellem kirurger og sygeplejersker og på tværs af kliniske specialiteter på OP. Samarbejdet viste sig at fungere optimalt i nogle operationsteams, mens det i andre operationsteams viste sig at fungere mindre hensigtsmæssigt og derfor kaldte på forbedringer. Anvendelsen af metoder baseret på teori om RK var nyttige, som redskaber i en organisatoriske forandringsproces, hvori der blev arbejdet målrettet på at forbedre det samarbejdet og sikkerhedskulturen i tværfaglige operationsteams. I første omgang medførte forandringsprocessen væsentlige ændringer, og på længere sigt viste det sig, at den erhvervede styrkelse af det tværfaglige samarbejde på OP var vanskelig at fastholde. Afhandlingen tilbyder anbefalinger til, hvordan man forbedrer og opretholder kvaliteten af samarbejde og sikkerhedskultur i fremtidige tværfaglige operationsteams.

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I would like to offer my gratitude to act2learn, University College of Northern Denmark, my managers Søren Samuelsen and Michell Kannegaard Olesen, and my dear colleagues in Health & Welfare, Management & Organization, Education & Learning, and Technology, who all supported me by providing a base that made it possible to immerse myself in the study and thereby grow. Additionally, I want to express my appreciation for my former managers Pernille Simonsen, Kristina Østergaard Kristoffersen, and Betinna Rønnest.

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Educational Research, University College of Northern Denmark, for sharing reflections, inspiring dialogues, and providing feedback on the various analyses.

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Additionally, I want to acknowledge the funding from the Danish Nursing Council, Danish Association of Critical Care Nurses, Lundbeck Foundation, Augustinus Foundation, and the Doctoral School of Engineering and Science, Aalborg University, which enabled my participation and presentation at international conferences: Congress of the European Operating Room Nurses Association, Rome, 2014; International Conference on Communication in Health Care, New Orleans, 2015; and Annual Roundtable Meeting in Relational Coordination Research Collaborative, Portland, 2016. Their funding also supported my visiting scholarship at the Heller School for Social Policy and Management, Brandeis University, 2017.

Finally, my warmest and sincerest thanks go to my husband, John, my children Thomas, Rebecca, and Niklas, and their wonderful families, and my friends, for all their patience, invaluable support, and understanding. Without their never-ending support, the completion of the study would not have been possible. I wish to thank them so much for everything they have done.

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Abbreviations

SUR	Surgeon
SURASS	Surgeon assistant
ANE	Anesthesiologist
AN nurse	Nurse anesthetist
OR nurse	Operating room nurse
SN	Surgical nurse
CN	Circulating nurse
NURASS	Nurse assistant
COORNU	Coordinating nurse
COORSU	Coordinating surgeon
OR	Operating room
RC	Relational Coordination
RC Survey	Relational Coordination Survey
SAQ	Safety Attitudes Questionnaire
SAQ-DK	The Danish version of the Safety Attitudes Questionnaire

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PART I THEME AND PURPOSE

CHAPTER 1. INTRODUCTION

In this Ph.D. dissertation, interdisciplinary collaboration in surgical teams will be subject to investigation. The purpose of this study is to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in Denmark, guided by the theory of relational coordination, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future.

The study focuses on exploring how interpersonal communication and relationships, organizational structures, work processes, and logistical challenges all affect interdisciplinary teamwork in surgical teams. This may lead to identification of important implications concerning the quality of patient outcomes, patient safety, and the efficiency and cost of health care. Therefore, this study is placed within the framework of health services research (Agency for Healthcare Research an Quality (AHRQ), 2002) and health system research (World Health Organization (WHO), 2012; Sanders and Haines, 2006). The study also focuses on how to improve interdisciplinary teamwork in surgical teams. Based on this consideration, the study is additionally placed within the research domain of implementation science (Remme et al., 2010).

The findings derived from the study will subsequently be applicable in the field of health care at several levels, across sectors, as well as for different professional specialties. The findings will be of relevance to establishing, maintaining, and strengthening interdisciplinary teams required to perform health care tasks that can be characterized by high quality, the optimal utilization of the available resources in a culture of learning, psychological safety, and mutual trust.

1.1 Background

Interdisciplinary collaboration in surgical teams is the subject of investigation in this study. My specific interest in this topic is motivated by my many years of experience as both a nurse and a nurse manager, working in a multi-disciplinary high-tech health professional practice, and paying attention to collaboration, communication, and relationships. I have experienced how strong and trust-based interdisciplinary collaboration is of great importance to the quality of the complex care and treatment offered to patients in units such as critical care, surgery, and anesthesia.

I have also learned through numerous supervision and coaching sessions with health professionals how interpersonal communication and the collaborative culture in certain

situations can be challenging, which will likely impact the quality of care and treatment in a negative way. Over the past ten years, I have been particularly engaged in training health professionals with regard to their communication skills from a patient-centered perspective, inspired by the Calgary-Cambridge Guide to the Medical Interview developed by the medical schools of the University of Cambridge and University of Calgary (Kurtz et al., 1998, 2013). Inspired by the theory of relational coordination and the process of relational coordination network mapping (Gittell, 2009, 2016), I have conducted numerous workshops focused on mapping, analyzing, and strengthening interdisciplinary teamwork in and between units as well as across organizations. In the meantime, the increased task complexity seen in both the primary and secondary health-care systems has resulted in the need to strengthen interdisciplinary collaboration across units, silos, and organizations, with a focus on enhanced collaboration with patients and citizens, and with better consistency in terms of care and treatment. The issues of particular concern to the present study will be presented in the following section.

In order to highlight the communicative and relational challenges inherent in interdisciplinary collaboration between health professionals, the background section is divided into three steps, inspired by the metaphorical movement "zooming in and out of practice," which describes a strategy for understanding and studying practice (Nicolini, 2009).

This study will zoom in on interdisciplinary collaboration within a highly specialized surgery department, using the WHO's leveled model of a health-care system and moving across three levels: the macro, meso, and micro levels (WHO, 2012), as shown in Figure 1. First, I will state some general observations regarding the challenges and contemporary tensions in the field of health care in Denmark (macro level).

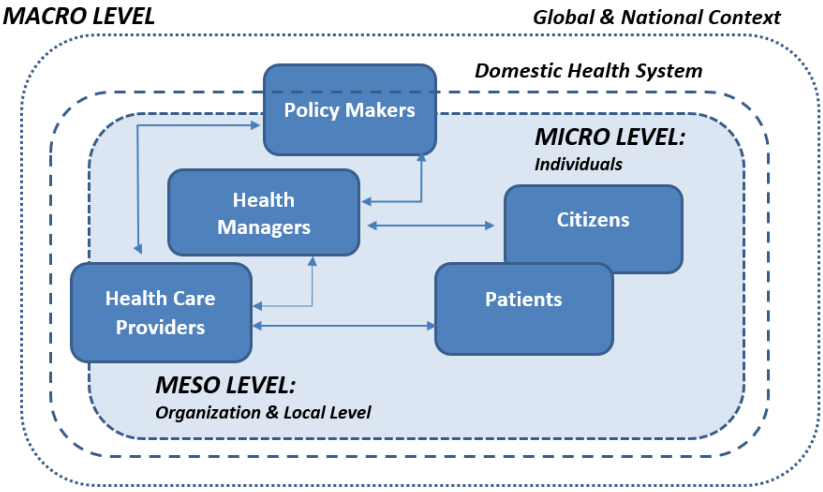


Figure 1 Model of the different levels within the health-care system (WHO, 2012).

Then, I will highlight some organizational (meso level) and interpersonal (micro level) perspectives relevant to interdisciplinary collaboration between health professionals in an operating room, based on a literature review. Finally, I will argue for the study's relevance and legitimacy.

1.1.1 Contemporary Tensions in Health Care

Starting at the macro level, over the past 10 -15 years, we have seen profound changes in hospitals. The development of new medical and technological treatments, changes in economic priorities and models, as well as the growing number of people with chronic diseases and multiple illnesses, have proved challenging for the health care services – both nationally and globally (WHO, 2010; Organization for Economic Co-operation and Development (OECD), 2011; Statens Institut for Folkesundhed, 2007; Sundhedsstyrelsen, 2013). In Denmark, these challenges have led to organizational and structural changes within the hospitals. These changes have included the establishment of acute hospitals and the enhancement of the pre-hospital effort implemented through a structural reform in 2007, as well as new principles for specialty planning implementation following the adoption of a new health law in 2004 and Plan for Specialization in 2010, which was compiled by the National Board of Health (Pedersen, 2014; Sundhedsstyrelsen, 2010). These reforms represent political intentions to promote a strong public health-care system in Denmark, which is intended to offer patients free access to prevention, testing, treatment, and care at a high professional level (Indenrigs- og Sundhedsministeriet, 2004; Sundhedsstyrelsen, 2010, 2015, 2017). The complexity of patients' diseases evokes the need for both long-term outpatient treatments across professional specialties and treatment in highly specialized hospital departments. This complexity also has implications regarding individualization, coherence, and accessibility in relation to the hospitals of the future (Wandel and Freil, 2014; Freil, 2012). According to Morten Freil (2012), the director of the Danish patient association, Danish Patients, health professionals are performing their tasks in a field of tension between patients' expectations of health care and existing development trends within health care. First, as Freil points out, the attachment to availability is counterbalanced by a strong tendency toward centralization. Second, the requirement for consistency of treatment is facing a significant specialization trend. Thirdly, patients demand to receive care and treatment services that are attuned to the individual's everyday life, which stands in opposition to the increased standardization seen within health care, as illustrated in Figure 2.

The need to navigate through such instances of cross-pressure between patients' expectations and the health system's organization, capabilities, and requirements poses significant challenges for health professionals during their face-to-face meetings with patients. Furthermore, the cross-pressure places high demands on the interdisciplinary collaboration required when providing specialized, high-quality health care services.

Ensuring the quality of health care and preventing adverse events have been subject to particular attention since 2000, both nationally and internationally. Nationally, laws concerning patient safety, reports of adverse events, and root cause analytics are all sources of learning that are intended to prevent errors and quality gaps (Ministeriet for Sundhed og Forebyggelse, 2004, 2007, 2011; Sundheds- og Ældreministeriet, 2016; Institute of Medicine/ Kohn, 2000; Vincent 2010). Globally, the World Health Organization's stance on patient safety (WHO Patient Safety) has supported national legislation and the implementation of patient safety initiatives through strategic plans and specific guidelines.

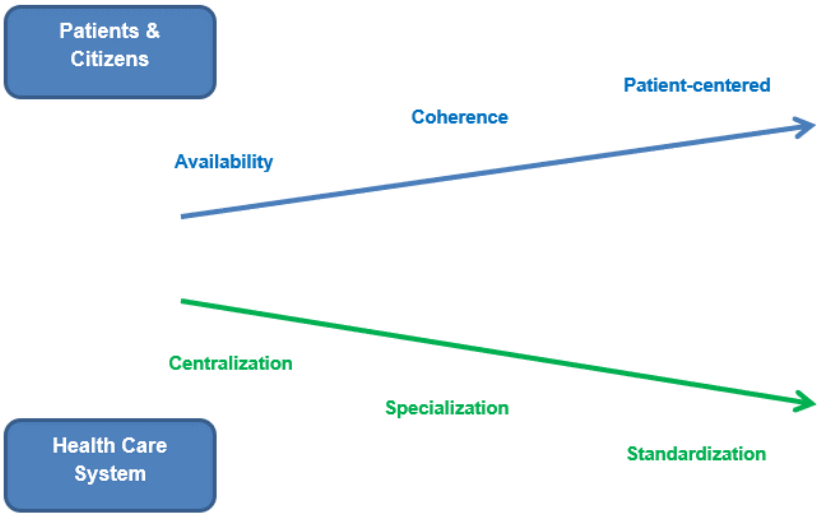


Figure 2 Tensions between patients 'expectations and tendencies within health care.

Initiatives such as Guidelines on Safe Surgery and the Surgical Safe Checklist (WHO, 2009a, 2009b) and other training materials and tools are intended to help organizations and health professionals improve their understanding and knowledge of patient safety. Several studies have described and evaluated the implementation of these specific guidelines (Lingard et al., 2008; Haynes et al., 2009; Woodman, 2016; Singer et al., 2016). The work of other public and private organizations has focused and coordinated with the research and development concerning health care practice in order to ensure the provision of high-quality healthcare services. An example of this can be seen in the American Institute for Healthcare Improvement (IHI), which focuses on patient safety and quality improvement, with the aim of improving health and healthcare worldwide (IHI, 2016). Another example is the National Patient Safety Agency (NPSA) in the United Kingdom (UK), which has the declared mission of leading and contributing to improved, safe patient care by informing, supporting, and influencing the health sector

(NPSA, 2016). Finally, a national example can be seen in the Danish Society for Patient Safety (Danish Society for Patient Safety, 2016), an independent organization that aims to promote patient safety in the Danish health care sector. In other words, a political and strategic focus on the prioritization of quality and improvement in health care is presently needed – both nationally and internationally.

1.1.2 Interdisciplinary Collaboration in Surgical Teams

The desired quality and outcomes require interdisciplinary teamwork to be carried out at the meso and micro levels. In order to explore the challenges and character of interdisciplinary teamwork in surgical teams, repeated literature searches of databases such as PubMed, CINAHL, Psych INFO, and Google Scholar have been conducted. The searches were limited by including the heading terms *Health Care Providers, Hospital Medical Staff, Multidisciplinary Care Team, Health Personnel, Operating Room Personnel, Interdisciplinary Communication, Health Personnel Attitudes, Teamwork, Interprofessional Relations, and Operating Room,* as well as related keywords, such as Operating Room Teamwork, Relational Coordination, Operating Theater, Operating Wards, and Surgical Wards. Studies published in Danish, English, Norwegian, and Swedish were considered for inclusion. No delimitation was made in relation to research methods. Relevant articles were identified by reading the text words contained in the title and abstract, as well as the index terms used to describe the articles. Additional studies of interest were found by screening the references of the identified articles, as well as by a citation search. During the study, I searched using the same keywords and new keywords, such as mental models, adaptive capacity, psychological safety, and safety culture, which emerged through the research process, in order to update my knowledge of the topic.

The identified studies represent different perspectives surrounding interdisciplinary teamwork in surgical teams. Some studies highlight the issues by focusing on collaboration in the operating room from an organizational viewpoint – the meso level. Other studies are based on more specific perspectives, which explore the collaboration and teamwork between health professionals in the operating room from an interpersonal viewpoint – the micro level. At the meso level, the challenges and opportunities are explored under headings such as increased specialization in the operating room (Nawaz et al., 2014), leadership role in the surgical team (Yule et al., 2006a, 2006b; Mitchell and Flin, 2008), safe surgery (Clapper and Kong, 2012), implementing surgical checklist (Haynes et al., 2009; Singer et al., 2016), patient-centered care in the operating room (Sørensen, 2011; Sørensen et al., 2014), team training (Awad et al., 2005; Forse et al., 2011; Courtright et al., 2012), teaming (Edmondson, 2012; Nawaz et al., 2014; Valentine and Edmondson, 2015), and relational coordination (Gittell et al., 2000). At the micro-level, the challenges, concerns, and opportunities are explored under themes such as communication and misunderstandings (Lingard et al., 2004; Gillespie et al., 2012; Kirschbaum et al., 2015; Bezemer et al., 2016), hierarchy and status differences (Nembhard and Edmondson, 2006), interdependency and interdisciplinary respect (Leape et al., 2012a, 2012b;

Cochran and Elder, 2015; Sandelin and Gustafsson, 2015; Kaldheim and Slettebø, 2016), psychological safety (Edmondson, 2003; Carmeli and Gittell, 2009), trust and mistrust (Leape et al., 2012a, 2012b; Rydenfält et al., 2012), shared mental models (Leach et al., 2009; Burtscher and Manser, 2012; Kurmann et al., 2014), and adaptive capacity (Bogdanovic et al., 2015).

As illustrated in the previous paragraph, health care practice in today's hospitals is characterized by complexity. However, from a practice theoretical perspective (Nicolini, 2009, 2012), iterative movements between the organizational level (meso level) and the practice level (micro level) seem to be conducive. An understanding of the micro level at which task-performing, meaning-making, and identity-creation activities take place among individuals working in surgical teams will promote an understanding of the complex conditions surrounding health professionals' responsibility and task performance in a surgical ward – and vice versa. By reading the identified articles, I captured some of the issues on which the articles are based, and I arranged my presentation of these challenges. Therefore, the literature will be presented under the following subheadings: a) increased specialization in the operating room, b) structural changes in team composition from fixed to fluid, c) hierarchy and status differences in interdisciplinary surgical teams, d) securing patient safety and high-quality health care, and e) relational coordination and improving interdisciplinary teamwork.

1.1.2.1 Increased Specialization in the Operating Room

Rising costs, the comorbidities of patients, and new, advanced diagnostic modalities and medical treatments all pose challenges to interdisciplinary collaboration and the quality of care in highly technological surgical units seen in today's university hospitals. These challenges are highlighted in *Critical Issues*, which was published by a group of doctors specializing in internal medicine and surgery and a professor of management in an American journal for orthopedic surgeons (Nawaz et al., 2014). To meet contemporary demands, greater collaboration and teamwork among various specialties, as well as between interdisciplinary workgroups, is needed (Nawaz et al., 2014; Edmondson, 2012; Gittell, 2009). This necessity is shaped by the increased fragmentation of health professionals' work due to a very strong specialization tendency. The specialization, sub-specialization, and ultra-specialization seen in the nursing and medical professions result in increased numbers of caregivers being involved in the treatment of the patient from admission to discharge from hospital, as described in a theory development article by Nembhard and Edmondson (2006). Along with this increased specialization, the changeable everyday life seen in the highly technological units of the hospital has enhanced the interdependence among health professionals. When the increased exchange of information between caregivers, the specialization trends, and the derived interdependency are considered together, it suggests the need for collaborative learning in workgroups consisting of different disciplines (Nembhard and Edmondson, 2006). To secure high quality health care and patient safety, greater attention must be paid to the capability and skills needed to engage in teamwork among interdisciplinary and multispecialty members who are

required to adapt to the quickly advancing diagnostic modalities and medical treatments associated with the increasingly complex surgical treatment of patients (Nawaz et al., 2014). Surgical team members require more than just clinical knowledge and technical skills. They also need the skills necessary to engage in teamwork, to understand the complexity of the clinical situation, to make appropriate decisions, and to act efficiently, as presented in various literature review studies (Fletcher et al., 2002; Vincent et al., 2004; Mitchell and Flin, 2008; Yule et al., 2006b; Hull et al. 2012) and interview studies (Yule et al., 2006a: Mitchell et al., 2011). These so-called non-technical skills may be assessed and potentially strengthened through the use of various behavioral measurement systems. Over time behavioral measurement systems have been developed for the specific workgroups involved in surgical teams by a multidisciplinary team of surgeons, psychologists, and anesthesiologists in UK, for example non-technical skills for surgeons – or NOTSS (Yule at al., 2006a,b), anesthetists´ non-technical skills - or ANTS (Fletcher at al., 2002, 2003, 2004; Flin and Maran, 2015), and non-technical skills of the operating theatre scrub nurse – or SPLINTS (Michell and Flin, 2008). Now validated and implemented in other countries (Spanager et al., 2015a, 2015b; Lyk-Jensen et al., 2016), these rating systems contain behavioral markers for assessing the presence of non-technical skills displayed through the individual health professional's behavior. With small variations, the system markers measure aspects such as situation awareness, decision making, communication and teamwork, task management and leadership (Yule et al., 2008; Fletcher et al., 2004; Mitchell et al., 2011; Flin and Patey, 2011; Lyk-Jensen et al., 2014). However, these measuring systems may not stand alone, since it may also be important to explore the impact on adverse events in the operating room. A recent observation study using these different behavioral marker measurements showed that poor communication and teamwork between team members in surgical teams had a large impact on intra-operative incidents[1] (Siu et al., 2016). The study also demonstrated the particular importance of surgeons' leadership skills being present during surgical procedures. Hence, more team training and a better understanding of how these incidents occur are needed to secure high treatment quality and guarantee patient safety. Clearly, ensuring the quality of surgical teamwork is not merely a matter of teaching surgical team members non-technical skills and instituting new leadership practices. In addition, surgical team members need to discuss the plan and establish a shared mental model (Cannon-Bowers et al., 1993; Burtscher and Manser, 2012) of what needs to be done during the surgery in order to coordinate their work and develop adaptive coordination strategies, especially during challenging moments or unexpected situations (Bogdanovic et al., 2015). Gaps in communication and a lack of coordination are often recognized as barriers to effective teamwork (Nawaz et al., 2014). In the same way differences in styles of conflict negotiation, communication patterns, and teamwork engagement among physicians with different specializations seem to affect teamwork, as described in a quantitative evaluation study by

[1] Siu et al. (2016) defined intra-operative incidents, as adverse events occurring in the time period from surgical incision to the "check-out" stage. They are divided into Level 1 (minor incidents) and Level 2 (operating problems).

Kirschbaum et al. (2015). When focusing on the concept of teaming, the dimension of a learning culture also seems to be particularly important in a specialized surgical setting (Edmondson, 2012). A learning culture can be established with the purpose of facilitating shared and collaborative learning. It can guide the interdisciplinary surgical team through a learning cycle of diagnosis (assess the situation), design (develop specific plan for action), action (execute and record the process), and reflection (evaluate the process and outcome), so as to provide greater adaptability in terms of overcoming challenges in dynamic and complex situations during surgical procedures (Edmondson, 2012; Nawaz et al., 2014).

Although a great amount of research has been conducted regarding the challenges associated with the increased specialization of the involved workgroups further knowledge about communication and relationship dynamics among team members performing surgical procedures in the context of different levels of complexity is needed, especially due to the current transformation of team composition described below.

1.1.2.2 Structural Changes in Team Composition from Fixed to Fluid

The specialization of the workgroups involved in surgical procedures in the operating room, centralization, and the standardization of surgical procedures have all led to structural changes in the team composition from fixed to fluid. A transformation where surgical teamwork in teams with membership doing well-defined tasks, which enable effective routines and familiarity changes to dynamic interdisciplinary collaboration in fluid and shifting composition of the teams. This transformation causes surgical teams to perform tasks with a greater adaptability to the dynamic aspect of the current complexity of surgical treatment (Nawaz et al., 2014). Today, most surgical teams are established on an ad hoc basis, being comprised of different team members from day to day. In a sense, teams are put together by integrating role-based work, since the roles of each individual member of the different workgroups involved in surgical teams are so well defined that anyone (with the required expertise and skills) could easily occupy the role and perform the work. Further, surgical teams are also team-based, since the effective performance of high-quality surgical treatment requires the expertise and skills of different workgroups of surgeons, assistant surgeons, anesthesiologists, operating room nurses (scrub nurse and circulating nurse[2]), and nurse anesthetists. Interdisciplinary action teams is another name for such teams, in which members with specialized skills improvise and respond to unexpected events in a coordinated way (Edmondson, 2003). It is well known that teams in which team members know each other's skills – their weaknesses as well as their strengths -

[2] The term "scrub nurse", is commonly used to describe the operating room nurse who is responsible for handing the surgeons the appropriate sterile instruments required during the surgical procedure. The term "circulating nurse" is often used to describe the operating room nurse who ensures that the scrub nurse and the surgeons have the necessary instruments and equipment during surgical procedures. Before and after the surgical procedures, the scrub nurse and circulating nurse together take care of the patient and prepare the procedures.

perform better than teams in which members are unfamiliar with each other (Hackman, 2002; Kurmann et al., 2014, Valentine and Edmondson, 2015). Importantly, familiarity among surgical team members also reduces morbidity in patients undergoing surgery (Kurmann et al., 2014). In a recent multi-methods study, Valentine and Edmondson (2015) showed that when team members do not know each other well, the unstructured ad hoc composition of teams in a clinical setting can be ineffective and overwhelming when performing task with a high level of complexity as well as in emergencies. In contrast, familiarity in surgical teams appears to foster open and respectful communication between team members, which results in a shared understanding of the planned treatment (Sandelin and Gustafsson, 2015). Structural changes as team scaffolds at the meso level, which highlight shared responsibility and a sense of belonging in the team, might support team members in fluid teams in engaging in appropriate and effective coordination processes in the team, in such a way that allows everybody to remain up to date and helpful to each other (Valentine and Edmondson, 2015). The fluid nature of team composition also seems to challenge the team's adaptive capacity (Sørensen, 2011), as well as the interactive dynamics among team members (Leach et al., 2009). A lack of knowledge about one another increases the likelihood of miscommunication and interruption (Gillespie et al., 2012; Bezemer et al., 2016), and it may result in delays due to a lack of experience and predictability during surgical procedures (Bezemer et al., 2016). To avoid such disruptions, both team coordination and leadership are needed, especially given that team members must continually switch their focus of attention between the execution of their individual assignments and coordination with the team (Kurmann et al., 2012). However, enhancing the management and leadership of a fluid and shifting mix of team members is crucial in order to improve teamwork and deliver high-quality surgical treatment. The surgeons, who are responsible and accountable for the patients undergoing surgery, should, according to Nawaz (2014), lead the necessary team transformation. This team transformation calls for a new leadership role in surgical teams, with a greater focus on the overall goal and shared vision of the quality of surgical treatment. It also calls for team management and a team culture that promotes learning from experience and establishing appropriate conflict management strategies (Nawaz et al., 2014; Edmondson, 2003). The latter is particularly important, since conflicts among team members have been shown to result in negative effects on the team's efforts as well as inappropriate impacts on patient outcomes (Edmondson, 2012). To create the best conditions and environment for an optimal team effort, the team leader must be a role model, both behaviorally and emotionally. Indeed, Nawaz et al. (2014) note that the attitude, behavior, and state of mind of the team leader will impact the culture, behavior, and effectiveness of the whole surgical team in the operating room.

Whether the transformation of surgical teams from fixed, familiar, and well defined to fluid, unfamiliar (to a certain extent), and dynamic is a permanent and everlasting construction is hard to predict. Certainly, the present nature of surgical team composition demands that the involved health professionals sharpen their focus on communication and their relationships in order to carry out their work in accordance

with a common goal and mutual respect. This indicates the need to understand the interpersonal interactions between team members in fluid surgical teams more deeply, as well as to understand how shared goals, knowledge of one another, and mutual respect between surgical team members are expressed at the micro level during the inter-operative period, the intra-operative period, and the extra-operative period[3].

1.1.2.3 Hierarchy and Status Differences in Interdisciplinary Surgical Teams

High-quality treatment, teamwork, and collaborative learning can be made difficult by the fact that the involved health professionals seem to be focused on different aspects of the treatment of patients. Surgeons and anesthesiologists possess specialized medical knowledge concerning both technical surgical procedures and the patients' underlying conditions. Operating room nurses and nurse anesthetists have greater knowledge of the work processes undertaken in the operating room and the surgical ward, and they have greater experience and knowledge of the patient-interaction processes inherent the inter-operative, intra-operative, and extra-operative periods. Taken together, their knowledge would provide a more complete picture of complex situations, although valuable knowledge and information often go unshared (Tucker and Edmondson, 2003). The power differences seen among surgical team members seem to intensify the sense of risk experienced by individuals who want to speak up, raise concerns, questions, or ideas (Edmondson, 1996, 2003). Thus, nurses do not always communicate their creative solutions for emergent situations to other members of the surgical team, due to differences in status and hierarchical roles (Tucker and Edmondson, 2003; Nembhard, 2006). It has also been found that nurses more frequently seem to remain silent during dialogues with physicians, unless they are asked a question directly (Graham, 2009). This silence, which might protect the nurse in a particular situation, could be viewed as a protective reaction that might harm both the team and the patient. The culture in the operating room also results in status differences, conflicting communication, and differing views as to who must fulfil the leadership role when a patient's treatment calls for rapid changes and decision making (Kirschbaum et al., 2015). Previous research concerning the hierarchical culture in which health care teams are embedded has shown correlation between patient outcomes and the degree of hierarchy seen in team interactions (Feiger and Schmitt, 1979). The hierarchy also seems to reduce team members' engagement in problem solving and discourage them from sharing authority and learn appropriate ways of communication (Institute of Medicine/Kohn, 2000). Additionally, more recent studies reinforce these challenges (Edmondson, 2003; Nembhard and Edmondson, 2006). The diversity in status between team members in the operating room has recently been explored by focusing on the impact of surgeons exhibiting disruptive behavior. The findings showed that surgeons' inappropriate outbursts during surgical procedures affected the operating room nurses' focus on the patient undergoing surgery, disrupted

[3] The inter-operative period is the period of time from the patient arrives in the OR to the patient being anesthetized. The intra-operative period concerns the time from when the patient is anesthetized to the "check out" stage, while the extra-operative period is the time from "check-out" to when the patient leaves the OR (Sørensen, 2011).

collaborative learning, and resulted in feelings of powerlessness among team members (Cochran and Elder, 2015). This could have negative consequences for patient care. The dark side of the medical culture or more specifically, the disrespectful behavior exhibited by physicians has been highlighted in two discussion papers written in 2012 by a group of professors, directors, and lecturers from Harvard Medical School and the Harvard School of Public Health. These papers were written in order to motivate and stimulate the creation of a culture of respect in hospitals and other health care institutions. Different types of disrespect have been identified, including disruptive behavior, the humiliating treatment of nurses, residents, and students, passive-aggressive behavior, passive disrespect, dismissive treatment of patients, and systemic disrespect (Leape et al., 2012a, 2012b). All these types of disrespectful behaviors could threaten the quality of treatment, patient safety, and health-care workers' well-being, and they may poison the climate of collegiality and collaboration in surgical teams (Leape et al., 2012a, 2012b). Although the hierarchy and status diversity in surgical teams might be differently reflected across cultures and countries, they appear to affect team members' psychological safety as well as the quality of interdisciplinary teamwork in the operating room (Kaldheim and Slettebø, 2016). However, it remains unclear whether the team members' attitudes regarding psychological safety impacts their engagement and attitudes toward teamwork in surgical teams. Further knowledge regarding how to create equality, eliminate status differences, and improve mutual respect across team members in surgical teams is hence needed.

1.1.2.4 Securing Patient Safety and High-Quality Health Care

Interdisciplinary collaboration in surgical teams has been extensively studied for a number of years due to concerns about how human factors impact patient safety in the surgical context. Of particular research interest has been the question of how the quality and efficiency of surgical procedures are affected by communication failures (Lingard et al., 2004; Manser, 2009), as well as how attitudes toward medical errors and teamwork influence the quality and efficiency of surgical procedures (Lingard et al., 2004; Sexton et al., 2000; Mitchell et al., 2011). The quality and efficiency of surgical procedures and patient safety are contingent on high-quality communication and shared knowledge, which are necessary to achieve due to the interdependence, time constraints, and uncertainty that characterize the surgical working context (Gittell, 2000a, 2009; Gittell et al., 2000).

Evidence-based team-training concepts are used in many hospitals to train health professionals and improve surgical teamwork. The implementation of these programs improves communication and interdisciplinary collaboration in the operating room (Awad et al., 2005), and it increases awareness of the importance of human factors on patient safety (Østergaard et al., 2011). Communication training also seems to affect team members' approach to being part of surgical teams. The findings of a recent quantitative study that implemented and evaluated communication training in the operating room for a group of anesthesiologists, surgeons, and gyn-obstetricians

showed a significantly higher score on interdependence and a significantly lower score on independence after communication training had been conducted (Kirschbaum et al., 2015). The results indicated that the communication training supported participatory teamwork and communication among the physicians in surgical teams. Moreover, systematic and continuous team training has been found to have a positive effect due to reducing mortality and morbidity (Forse et al., 2011). Questions have been raised regarding how simulation-based team training can be used effectively and optimally in clinical settings, while a study focusing on goal setting, problem solving, and debriefing has shown that the success of simulation-based learning primarily depends on the interaction between the participants involved and the organizational framework in which the training takes place (Dieckmann et al., 2012). Yet, the implementation of these programs often encounters multiple barriers, which indicates the need for a better understanding of the dynamics of communication and miscommunication among health professionals in the operating room (Kirschbaum et al., 2015), as well as a need for further knowledge about how best to successfully implement evidence-based practices such as these team-training programs (Courtright et al., 2012). In order to ensure a high degree of clinical performance and patient safety during surgery, surgical checklists are used in many surgical operating rooms (WHO Guidelines for Safe Surgery, 2009a, 2009b; Haynes et al., 2009; Patient Sikkert Sygehus, 2010; Singer et al., 2016). In a multicenter study evaluating the implementation of the WHO's Safe Surgery Saves Lives program, Haynes et al. (2009) associated improvements in patients' postoperative outcomes with improved perceptions of teamwork and the safety climate among surgeons in the operating room following the implementation of the use of surgical checklists. Although the WHO's Guidelines for Surgery are well known and well implemented across countries and surgical settings, numerous studies have demonstrated the barriers to the successful use of the guidelines. Dismissive attitudes among surgical team members, the time-consuming nature of such guidelines in a surgical setting facing time constraints, a lack of engagement due to a lack of understanding, and, finally, the hierarchy in the operating room all seem to discourage open communication (Woodman, 2016; Carney et al., 2010). The creation of a culture of respect is suggested to be the first movement toward the creation of a culture of safety, and thereby the improved quality of patients' treatment (Leape et al., 2012b). In the absence of mutual respect and shared goals, surgical team members are discouraged from working together effectively (Leape et al., 2012b; Kaldheim and Slettebø, 2016).

Another perspective when focusing on patient safety and the prevention of adverse events is the current desire to create patient-oriented relationship between patients and caregivers. The competencies needed to establish equal relationships and communicate precisely, structurally, and situationally seem to be essential skills for engaging with patients, patients' relatives, colleagues, and other interdisciplinary collaborators in clinical practice (Kurtz et al., 1996, 1998, 2013). The need to develop a more person-oriented approach toward patients who require surgical treatment has been highlighted. In an ethnographic study focusing on operating room nursing,

Sørensen et al. (2014) underlined the significance of the operating room nurses' skills in striking the right balance between nursing care skills and technical skills. This necessitates the dual presence of technical flair and seeing patients as human beings. In a qualitative interview study, Sandelin and Gustafsson (2015) showed that establishing a partnership between nurses in the surgical team and the patient during the inter-, intra-, and extra-operative periods seems to create a relationship that generates a mutual understanding of the situation as well as clear goal-orientation. Furthermore, person-centered nursing care, together with interdependent collaboration and familiarity in surgical teams, has been found to contribute to safe surgery (Sandelin and Gustafsson, 2015).

Recently, the attention paid to the concept of the patient safety culture has increased. Indeed, several studies have defined and described the concept (Sammer et al., 2010; Etchegaray and Thomas, 2012; Kristensen et al., 2013, Kristensen, 2015a, 2015b), as well as its possible diversion from tendencies and demands to provide patient safety and high-quality person-centered care. In terms of improving the safety culture of an organization, leadership has been shown to be an unambiguous focal point (Kristensen, 2016a). Clinical leaders should be aware of their own role in the improvement process, take the initiative to explore the safety culture, and be curious about the "how" and "why" of the matter. Even though numerous studies over the past decade have demonstrated the positive results of implementing team-training concepts (Forse et al., 2011, Kirschbaum et al., 2015) and surgical-safety guidelines and check lists (Haynes et al., 2009; Patient Sikkert Sygehus, 2010; Singer et al., 2016), it still appears very important to explore and develop effective strategies for improving the safety culture.

1.1.2.5 Relational Coordination and Improving Interdisciplinary Teamwork

High-performance teams are characterized by a high degree of relational coordination and appropriate communication (Gittell et al., 2000; Gittell, 2009, 2012b). The concept of relational coordination is used as a measure of the quality of collaboration and teamwork, and it is based on seven dimensions namely shared goals, shared knowledge, mutual respect, and accurate, timely, frequent, and problem-solving communication. These qualities of coordination and communication are crucial for workflow success in terms of quality, efficiency, and job satisfaction (Gittell, 2009; Deneckere et al., 2011). They also have significance for psychological safety in multidisciplinary teams (Carmeli and Gittell, 2009). The degree of relational coordination is related to fewer hospital-related infections, postoperative pain, functionality, and length of stay (Gittell et al., 2000; Havens et al., 2010). The quality of the surgical team's collaboration is hence rooted in team members' knowledge and skills in relation to procedures, as well as their knowledge of their own and other team members' roles. Furthermore, it is rooted in communication processes that support the appropriate modalities of collaboration, particularly so in the face of unexpected surgical challenges. The theory of relational coordination captures many of these insights. Relational coordination is a mutually reinforcing process of communicating

and relating across areas of expertise for the purpose of task integration (Gittell, 2002b, 2016). It is a high-bandwidth form of coordination that is expected to impact performance the most under conditions of task interdependence, uncertainty, and time constraints. Relational coordination has been found to predict higher levels of quality, efficiency, and job satisfaction (Havens et al., 2010; Gittell, 2009), as well as a higher degree of psychological safety and the ability to learn from errors (Gittell, 2009; Carmeli and Gittell, 2009). Furthermore, relational coordination predicts a lower occurrence of hospital-related infections, patients' complaints, and medication errors (Havens et al., 2010).

There is also increasing knowledge regarding the organizational structures that best support high levels of relational coordination (Gittell, 2002b; Gittell et al., 2010; Gittell and Douglass, 2012; Gittell and Logan, 2015; McDermott et al., 2017). These high-performance working practices include supportive organizational structures such as cross-functional selection, cross-functional conflict resolution, cross-functional performance measurement, cross-functional rewards, cross-functional team meetings, and cross-functional boundary spanners. These practices were found to be positively associated with relational coordination in hospital units (Gittell et al., 2010). The findings emphasized how the implementation of structural initiatives that support role-based relationships between health professionals tend to strengthen relational coordination and thereby improve the quality of the performance outcome.

While many cross-sectional studies have shown positive correlation between relational coordination and outcomes in healthcare and other industries, while other studies have identified organizational structures that support relational coordination, less is known about how best to improve relational coordination in organizations over time (Gittell, 2012b). However, emerging and ongoing studies across multiple countries and industries using the recently developed Relational Model of Organizational Change might add further knowledge to this field in this regard (Suchman et al., 2011; Beswick et al., 2014; Hornstrup, 2015; Gittell et al., 2015; Gittell, 2016).

1.1.3 Summary

In order to highlight the challenges inherent in the interdisciplinary collaboration between health professionals in surgical teams, I have moved between three levels: the macro, meso, and micro levels: These "zooming in and out of practice" movements describe a valuable strategy for exploring practice. The political and organizational attention paid to patient safety and high-quality person-centered treatment and care represent just some of the tendencies identified at the macro and meso levels. Other challenges are reflected in the tensions and cross-pressures described between citizens' expectations regarding health care availability, coherence, and patient-centeredness, on the one hand, and developing tendencies in the health-care system, such as specialization, centralization, and standardization, on the other hand. The identified challenges and complexity in the contexts surrounding interdisciplinary teamwork in surgical teams have been explored from an organizational viewpoint (the

meso level), while the challenges faced in surgical teams have been explored from an interpersonal viewpoint (the micro level). Studies exploring the challenges observed in the interdisciplinary collaboration in the operation room at the meso level have highlighted the importance of team training, strengthening the leadership role, improving health professionals' non-technical skills, and implementing safe surgical procedures in order to meet the demands that arise from increased specialization, the transformation of team composition, and the complexity of patient treatments. Studies focusing on interdisciplinary teamwork from a micro-level perspective have added valuable knowledge about misunderstandings and disruptive communication in the operating room, power differences due to an existing hierarchical culture, and the awareness of trust and psychological safety. Together, these studies have provided important insights into interdisciplinary teamwork in surgical teams in the operating room.

1.2 Relevance and Legitimization

The above literature review reveals the need for further knowledge in order to understand the context in which interdisciplinary surgical teams are embedded, as well as the challenges that they face. First, relational coordination seems relevant to the functioning of surgical teams in operating rooms. Although extensive research has been carried out regarding relational coordination in many contexts, including surgery, no prior study exists that explores relational coordination at the micro level. Hence, deeper insight is needed into the patterns of communication and relationships that can be found at the micro level. Knowledge of the patterns that exist between health professionals working in surgical teams would be valuable in terms of improving relational coordination. Therefore, an exploration of how communication and relationships (relational coordination) work in interdisciplinary surgical teams at the micro level, especially in contexts of variable complexity, is needed. Second, high relational coordination in organizations is associated with high performance, but knowledge about how relational coordination can be strengthened over time in interdisciplinary surgical teams is limited. Experiences drawn from longitudinal studies are thus needed. Therefore, exploring and examining how the theory of relational coordination can be used in organizational intervention processes as a tool for improvement in interdisciplinary surgical teams in a surgical unit will add new insights to the existing knowledge regarding the application of the theory of relational coordination for organizational development. Finally, prior evidence has shown that the presence of psychological safety is crucial for surgical teams to be able to carry out their tasks in a qualified manner. Thus far, however, little attention has been paid to the correlation between relational coordination and the safety culture in high-tech hospital units. Therefore, an examination of the correlation between relational coordination and the safety culture during an organizational intervention in a surgical ward is desirable.

1.3 Purpose and Research Questions

Based on the background detailed above, the purpose of this study is to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in Denmark, guided by the theory of relational coordination, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future. The purpose will be addressed from different angles guided by four objectives:

1. To explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark.
2. To explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units.
3. To assess whether relational coordination and safety culture in a surgical unit are improved during an organizational intervention process.
4. To provide recommendations for improving collaboration and safety culture in interdisciplinary surgical teams.

These four objectives will be accomplished by answering the associated research questions (1 – 4), with a focus on collaboration in interdisciplinary surgical teams, which were derived from the literature review and the identified knowledge gap.

Research Question 1 (RQ1): *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?*

RQ1 is based on the assumption that relational coordination in surgical teams will be observed in the team activities performed during surgical procedures in the operating room in the form of communication and relationships between health professionals.

Research Question 2 (RQ2): *How is the theory of relational coordination used as a tool for improvement in organizational intervention processes in surgical units?*

RQ2 is based on the assumption that the interventions that are identified and developed from the challenges experienced by health professionals, as well as from measures of relational coordination, will provide the best starting point for the implementation of organizational interventions.

Research Question 3 (RQ3): *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention process using the theory of relational coordination as a tool for improvement?*

RQ3 is based on the hypothesis that the implementation of interventions identified from the health professionals' measures of relational coordination within and between workgroups will reinforce the interdisciplinary collaboration over time.

Research Question 4 (RQ 4)*: How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?*

RQ4 is based on the assumption that performing the metaphorical movement of "zooming in" on practice from different angles will enable us to understand the here and now of the situated practice in interdisciplinary teamwork.

In the following, a definition of a surgical team inspired by the *Encyclopedia of Surgery* (2017) is used:

> *A surgical team is a unit providing the continuum of care, beginning with preoperative care and extending through perioperative (during surgery) procedures and postoperative recovery. Each specialist on the team, whether surgeon, anesthesiologist, nurse anesthetist, or operating room nurse, has completed advanced training for his or her role before, during, and after surgery.*

The following abbreviations will be used in the dissertation: surgeon (SUR), surgeon assistant (SURASS), anesthesiologist (ANE), nurse anesthetist (AN nurse), operating room nurse (OR nurse), surgical nurse (SN), circulating nurse (CN), nurse assistant (NURASS), and operating room (OR).

1.4 Structure of the Dissertation

The dissertation is written as a monograph, in which empirical analyses derived from different studies and different angles are presented. The dissertation is divided into three parts presenting various stages of the research process.

Part I, *Theme and Purpose,* starts with *Chapter 1. Introduction*, wherein the background, purpose, and research questions are presented.

Part II, concerning the *Research Strategy*, is divided into four chapters. In *Chapter 2. Paradigm Worldview*, the ontological and epistemological assumptions are presented, which is followed by a short introduction to the theoretical framework that appears from three different angles on interdisciplinary teamwork in *Chapter 3. Theoretical Lenses.* First, there is a presentation of the understanding of interdisciplinary teamwork as a relational way of coordinating task performance based on essential dimensions of

communication and relationships. These are inspired by the work of Jody Hoffer Gittell, an American professor of management, and the theory of relational coordination. Second, psychological perspectives are introduced, highlighting the presence of interpersonal psychological safety to be of major importance for high performance in surgical teamwork, as inspired by the work of Amy Edmondson, an American professor of leadership and management. Third, an understanding of organizational culture inspired by the work of Edgar Schein, an American professor of organizational psychology. This will be followed by a presentation of the concept of safety culture inspired by the work of Charles Vincent, a British professor of clinical safety research and John Bryan Sexton, an American professor of behavioral science. In *Chapter 4. Methodological Approach*, the utilized approaches and considerations are described, and the multiphase design of the mixed methods study is illustrated. This is followed by a detailed specification of the methods used for data collection in *Chapter 5. Methods and Procedures*, including a presentation of the context in which the data have been collected and the study has been accomplished, as well as descriptions of the methods used for data collection and the associated ethical considerations.

Part III, concerning the *Analyses and Findings,* is divided into five chapters. In *Chapter 6. Communication and Relationships*, collaboration in surgical teams is described and the different types of communication and relationship patterns seen in surgical teams are presented based on qualitative analyses, followed by a discussion and a partial conclusion. In *Chapter 7. Organizational Intervention Process*, an organizational intervention process in a surgical unit is described and analyzed from initiation, screening, action-planning, and implementation through to evaluation, followed by a discussion and a partial conclusion. In *Chapter 8. Assessing Relational Coordination and Safety Culture,* the findings derived from the measurements of relational coordination and safety culture during an organizational intervention process are presented based on quantitative analyses, followed by a discussion and partial conclusion. In *Chapter 9. Integrated Mixed Methods Findings and Interpretation*, the threads from *Chapter 6*, *Chapter 7,* and *Chapter 8* are drawn together in order to extract new and integrated findings so as to provide recommendations for improvement of collaboration in interdisciplinary surgical teams. Finally, in *Chapter 10. Conclusions and Implications*, the contributions of the dissertation and the implications of the study are presented.

PART II RESEARCH STRATEGY

Part II places the study within the appropriate research paradigm and argues for the choice of methodology, theoretical framework, research design, data collection methods, preparation procedures, and applied analysis. Before diving into the research, I have acknowledged some considerations about the philosophical foundation of the study (ontology) and I have reflected on my assumptions regarding how best to gain knowledge during the research (epistemology), with the purpose of shaping the research process and the conduction of the investigation.

Inspired by Crotty (1998) and Creswell and Plano Clark (2011), I have built my research strategy on four hierarchical levels for the development of a research study, as shown in Figure 3. According to Creswell and Plano Clark (2011), assumptions held at the upper philosophical level will inform the use of theoretical perspectives. The theoretical lens will then guide the methodological approaches, which will finally incorporate the last procedural and technical level – the methods used for data collection and preparation.

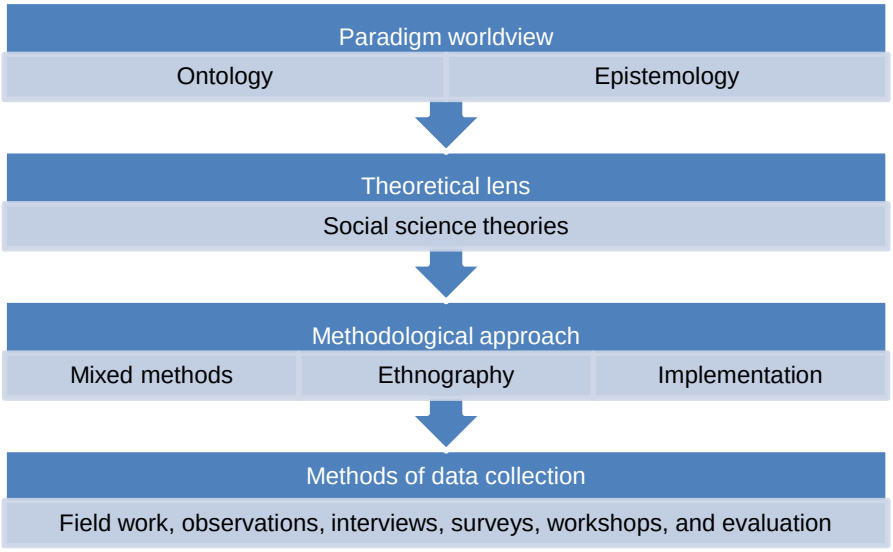


Figure 3 Four levels for developing a research study, adapted from Crotty (1998), Creswell and Plano Clark (2011).

Part II is divided into four chapters inspired by the four levels for developing a research study. In *Chapter 2. Paradigm Worldview,* the ontological and epistemological assumptions are presented. The assumptions are inspired by perspectives derived from pragmatism. In *Chapter 3. Theoretical Lenses,* the theoretical frameworks derived from social science are introduced. This is followed by *Chapter 4.* on *Methodological*

Approach, in which the methodology and design for the mixed methods study are described. This chapter will clarify how the qualitative and quantitative data will together provide rich and complementary information for the final integration phase of the study. The methods used for data collection are described phase by phase in *Chapter 5. Methods and Procedures*, including descriptions of how the reliability, validity, and legitimization issues are addressed. The ways in which the data are used, as well as how the qualitative and quantitative analyses have been undertaken, in each phase of the study and in the final integration are presented in the last final part of the dissertation, that is, *Part III Analyses and Findings, in the interests* of readability and understanding.

CHAPTER 2. PARADIGM WORLDVIEW

As a researcher, one should be aware of one's own interpretation of the nature of the thing being studied as well as the associated implications, since this awareness is crucial for achieving a reflective and responsible research investigation (Van de Ven, 2007). The philosophical assumptions underlying the chosen worldview will provide the researcher with both a framework and conceptual tools for the research process.

2.1 The Ontological Approach

This study is grounded in a worldview inspired by thoughts from John Dewey (1859-1952), the American philosopher, psychologist, and educator known as one of the founders of the philosophical tradition of pragmatism (Brinkmann, 2006). This choice has been made based on some key aspects of this approach.

Dewey's view of reality as being ever changing (Dewey, 1925; Brinkmann, 2006) is one of the key points that seems to match with the very complex context surrounding surgical teams performing everyday tasks in a reality characterized by uncertainty, time constraints, and interdependency. From a Deweyan perspective, reality turns out as a result of the activities and interactions that take place between human beings and their environments. Dewey referred to the interactions between living human organisms and their environments as transactions (Dewey and Bentley, 1949; Brinkmann, 2006). According to this concept, reality consists of events in interaction, which only can exist in context, exchange, or transaction. In complex and changeable ways, any organism is related to any other, and no single part can be comprehended in isolation. This view may be valuable to have in mind when exploring a challenging, changeable, and specialized clinical practice in order to provide recommendations for improvement. However, it is essential to remember that understanding and observing reality itself becomes a transaction that influences dynamics between events (Brinkmann, 2006).

Another key argument for adopting a pragmatic approach in this study is Dewey's view of reality as being mediated through the human experience as understood as functions of interactions between the living human organism and its environments (Dewey, 1920; Biesta and Burbules, 2003). Taking this insight into the operating room makes it possible to explore, experience, and achieve knowledge about this specific part of reality by being present in the room. Being present includes listening to health professionals' exchange of knowledge and problem-solving communication, observing activities between health professionals, and observing how occurring situations are handled during surgical procedures.

Finally, I want to lean on the practice- and improvement-oriented approach underlying Dewey's view, which hold that human beings through transactions with their

environments continuously attempt to maintain a balance of stability and thereby collect experiences regarding activities and consequences (Dewey, 1920; Biesta and Burbules 2003; Brinkmann, 2006). This practice-oriented approach might be useful in terms of providing recommendations for improving teamwork in surgical teams.

Prior to offering a more detailed and thoroughly argued presentation of the epistemological assumptions, I will highlight some simple statements concerning the present study's ontological stance:

- *Reality exists through being experienced as a function of interaction between organism and environment.*
- *Reality reveals itself as a result of the activities and interactions between human beings and our environments.*
- *Reality is interactionally constructed. Experience and meaning are created in interactions between human beings and our environments as well as between individuals.*

A pragmatic approach recognizes the existence of a social and psychological world including participants' language and subjective experience, the surrounding culture and institutions, as well as the existence of a physical world (Johnson and Onwuegbuzie 2004). In the following, I will focus on a more thoroughly argued presentation of my considerations regarding the research field and how I consider knowledge to be generated during the research process.

2.2 Pragmatism as an Epistemological Approach

Given that the dual purpose of this study is to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future, it would be relevant to lean on a philosophical framework that will allow me, as a researcher, to capture knowledge from different perspectives. It would also be appropriate to select a research design that combines methods and procedures that promote the best answer to the overall research question. Based on these considerations, a pragmatic approach seems to be the obvious choice, especially in terms of the value that this epistemological approach attaches to practice-based activities and human interactions in order to generate knowledge (Dewey, 1925; Johnson and Onwuegbuzie, 2004; Brinkmann 2006).

2.2.1 Knowledge Closely Related to Action

From a pragmatic approach knowledge is viewed as being both constructed and based on the reality of the world in which we live. Therefore, qualitative explorations and quantitative examinations attempt to produce knowledge that best matches or represents reality (Rorty, 1999; Feilzer, 2010). From a pragmatic worldview knowledge

is derived from human transactions, and it is seen as contextual and closely related to action (Greene, 2007; Brinkmann, 2006). The pragmatic approach also endorses a practice-oriented exploration of the research design in terms of evaluating what works (Johnson and Onwuegbuzie, 2004). From a pragmatic approach, the research design should be mixed in such a way that gives the researcher the best opportunity to directly address the research questions (Johnson and Onwuegbuzie, 2004). Various aspects indicate that a pragmatic approach might provide the best opportunity for this study to both explore communication and relationship patterns in interdisciplinary surgical teams and understand the complex and constructed culture surrounding interdisciplinary collaboration in surgical teams – in order to develop recommendations for improvement.

First, a pragmatic standpoint highlights and recognizes the potential for acquiring experiences and knowledge through human activities and interactions. In this way, action is constitutive of both meaning and knowledge (Biesta and Burbules, 2003; Greene, 2007). Practicing explorative research in a complex and challenging health-care environment such as the operating room will provide opportunities for observing the interactions between health professionals and the activities performed, thereby providing insights into the specific nature of collaboration in surgical teams. Data that originate from exploratory fieldwork will add fruitful and rich experiences, such as participants' quotes, concerning the understanding and meaning of interdisciplinary teamwork as a phenomenon, as formed by the participants and their subjective attitudes and views (Creswell and Plano Clark, 2011). When the health professionals working in surgical teams express a particular understanding of interdisciplinary teamwork, communication, and relationships, they do so from a point of view shaped by their social interactions with other team members as well as from their own life story. According to Creswell and Plano Clark (2011), these perspectives provide research that is shaped "from the bottom up" in the sense of creating a movement from individual perspectives to broad understandings.

Second, by using a pragmatic approach, the researcher will have the opportunity to be both close to the participants and distanced from the object of study (Creswell and Plano Clark, 2011). Adopting a pragmatic stance will allow me to be close to the participants in the surgical teams and collect qualitative data in the form of participants' experiences, attitudes, and daily activities. It will also allow me to be distanced from the objects of study (health professionals in surgical teams) and collect data through survey instruments over time.

Finally, the pragmatic view concerning explaining the phenomenon under study by using theoretical perspectives as well as understanding and interpreting different individual perspectives on the nature of the phenomenon (Creswell and Plano Clark, 2011) provides desirable opportunities to understand a complex health-care practice (such as the one in the operating room) from different angles. Using individual perspectives, activities observed between health professionals, and theoretical

perspectives in the interpretation process enriches the quality of the analysis. Turning these perspectives into an argument for the use of inductive, deductive, or abductive reasoning, a pragmatic approach will make use of abductive inference (Peirce, 1932, Van de Ven, 2007). According to Rorty (1999), the aim of conducting research today is to seek and provide useful knowledge rather than to represent reality in the most accurate way (Feilzer, 2010). Applying a pragmatic abductive approach in this study may well enrich the development process in which the recommendations for collaborative improvement in interdisciplinary surgical teams are described.

Before the theoretical lenses used in this study are described in *Chapter 3. Theoretical Lenses*, I will highlight some simple statements concerning the study's epistemological approach:

- *Knowing a complex reality requires the use of multiple perspectives.*
- *When exploring individuals and the social activities that takes place between them, there are no absolute universal truths.*
- *Knowing and doing are inseparable parts of the same process.*
- *Knowledge is trustworthy when it succeeds in guiding action and prediction.*

CHAPTER 3. THEORETICAL LENSES

Chapter 3 presents an understanding of the theoretical frameworks that are involved to varying degrees in each phase of the present study. The study is focused on communication and relationships in interdisciplinary collaboration in surgical teams, as well as on the presumed spillover effect on safety culture. Therefore, an understanding of the relevant concepts, namely relational coordination, teaming, psychological safety, organizational culture, and safety culture, is presented.

I begin with an introduction to the theory of relational coordination developed by Jody Hoffer Gittell (2000a). This theory has been used in different ways in the present study. First, it has been used as a theoretical framework for understanding and exploring the communication and relationship dynamics that underlie surgical teams' task performance in the operating room. Second, it has been used as an organizational change model for improving relational coordination and, thereby, the interdisciplinary collaboration in surgical teams in the operating room. The specific change model, namely the Relational Model of Organizational Change, is based on the theory of relational coordination, and developed by Gittell together with Edmondson and Schein (Gittell, Edmondson, and Schein, 2011; Gittell, 2016). Finally, the Relational Coordination Survey has been used as a measurement tool for identifying strong and weak collaboration ties between workgroups, as well as for prioritizing and developing interventions intended to achieve improvement.

The theory of relational coordination will be supplemented by theoretical perspectives derived from the field of organizational psychology, particularly the theoretical concepts of teaming and psychological safety devised by Amy C. Edmondson (2012). These concepts add psychological perspectives on the interpersonal dynamics in teams, and they will be used in the interpretation and discussion involved in different phases of the study.

At the end of *Chapter 3*, an understanding of the cultural context that embrace interdisciplinary collaboration in the operating room is presented, which is based on the concept of organizational culture provided by Edgar Schein (1990, 2010) as well as the concept of safety culture developed by Charles Vincent (2010). The concept of safety culture has been used in several phases of the study. First, it has been used as a theoretical framework for understanding and exploring the social activities and clinical practice seen in the operating room. Second, the Safety Attitudes Questionnaire has been used to assess health professionals' attitudes toward safety culture. Finally, the concept has been used as a lens for the interpretation in the final integration part of the study, where the recommendations for improvement are discussed.

3.1 Relational Coordination

The presence of professional, collaborative, and resilient multidisciplinary surgical teams is needed in the operating room when demands for efficiency and high-quality care must be met in a clinical practice that typically faces time pressure, especially because surgical tasks are highly complex and uncertain, and therefore difficult to plan in advance. As described in the introduction, the health professionals working in such high-tech clinical settings must be prepared to participate in surgical teams. Specialized knowledge and technical skills are not enough. Non-technical skills are also needed, while the interpersonal dynamics of communication and relationships are crucial for task performance. Relational coordination is defined as "*a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration*" (Gittell, 2002b, p. 301), and it is expected to drive performance when the work is highly interdependent, uncertain, and constrained in terms of time (Gittell, 2002b).

According to the theory of relational coordination, effective task coordination is not just a technical process managing coordination between tasks; it is a relational process that takes place through the relational network among the professionals who are part of the same work process (Gittell, 2009).

The theory of relational coordination describes the nature of the communication and relationships through which coordination occurs. According to the theory, the relationships that exist between workers, as well as between workgroups, include shared goals, which, incorporate participants' specific and functional goals (treatment-specific objectives), shared knowledge, which enables participants to understand how exactly their individual tasks interact with the whole work process and with the team's performance of the core task, and mutual respect, which provides the participants with the ability to overcome potential barriers in their work life, such as a diversity in status, education, profession, gender, ethnicity, and age, that might otherwise hinder them taking into account each other´s work.

Taken together, these relationship dimensions both strengthen and are in turn reinforced by communication that is frequent, accurate, timely, and problem-solving rather than blaming (Gittell, 2012a, 2012b).

3.1.1 Different Communication and Relationship Dynamics

There may be appropriate as well as inappropriate dynamics of communication and relationships seen across different workgroups in the team, as shown in Figure 4.

Shared goals, shared knowledge, and mutual respect lead to more frequent, accurate, timely, and problem-solving communication, which in turn helps to further strengthen the shared goals, shared knowledge, and mutual respect. Conversely, functional goals, specialized knowledge, and a lack of respect contribute to infrequent, inaccurate,

delayed, and blaming communication, which in turn reinforces the functional goals, specialized knowledge, and lack of respect (Gittell, 2009).

There may be strong as well as weak communication and relationships across the different workgroups in the same team although this possibility has not received sufficient attention.

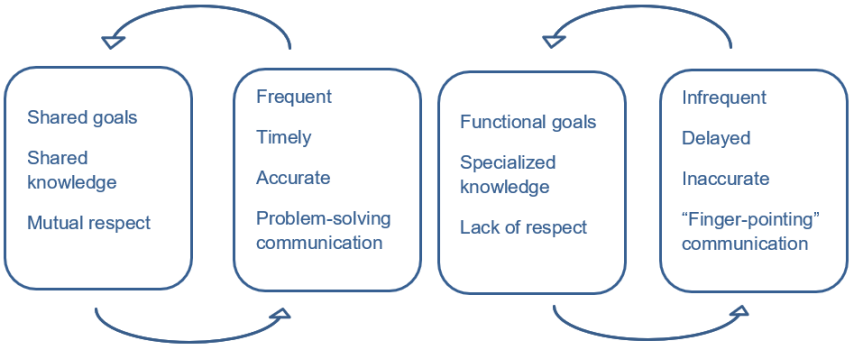


Figure 4 Different communication and relationship dynamics (Gittell, 2009).

3.1.2 Improving Relational Coordination

Gittell and other organizational researchers have for several years studied the impact of relational coordination on practical outcomes. As described in the introduction, these studies have typically demonstrated positive correlation between relational coordination and outcomes. Therefore, it seems both relevant and very interesting to ask the following questions: "how do we improve the relational coordination among frontline team members?" and "how do we get from here to there?"

The Relational Model of Organizational Change can be used to implement organizational changes intended to improve relational coordination among employees and add value to an organization (Gittell et al., 2011; Gittell, 2016), as shown in Figure 5. Gittell (2016) recommends using the model stepwise: a) strengthening the collaboration ties through relational interventions, b) focusing on work process improvement interventions, and c) exploring structural interventions that may be needed to support higher levels of relational coordination. In recent years, this model has been widely used in different countries, as well as in different industries, including social and health services. In Denmark, the Relational Model of Organizational Change has been used in organizational change processes in a variety of public institutions, with the aim of fostering increased consistency, higher quality, higher patient satisfaction, and greater job satisfaction (Hornstrup and Madsen, 2015).

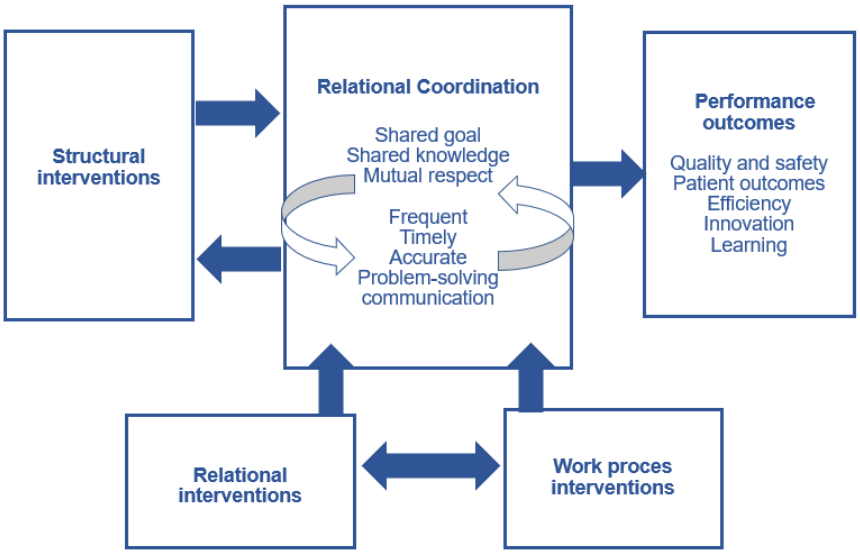


Figure 5 The Relational Model of Organizational Change, adapted from Gittell, Edmondson, and Schein (2011).

A process, through which the Relational Model of Organizational Change is used may be conveniently constructed in steps (Gittell, 2016), as shown in the text box below (Box 1)

.

Principles of Relational Coordination as Tools for Change

- Creating a safe space.
- Organizing and setting goals and frames for the organizational change process
- Introducing relational coordination and the seven associated dimensions.
- Dialogue-based exploration of the current state of relational coordination through relational mapping.
- Relational assessment using the Relational Coordination Survey.
- Reflecting on survey results and feedback dialogue, defining strengths and weaknesses.
- Prioritizing and determining the next steps.
- Defining and developing relational, work process, and structural interventions.
- Monitoring the change process during the interventions.
- Evaluating the change process and assessing the outcomes.

Box 1 Step-by-step process using the principles of relational coordination as tools for organizational change, inspired by Gittell (2016).

3.1.3 Assessing Relational Coordination

During the research work she conducted in the airline industry in the late 1990's, Gittell created the Relational Coordination Survey (RC Survey) in order to assess relational coordination in different airline companies, as well as to correlate the measure of relational coordination with the companies' performance outcomes (Gittell, 2000a).

Subsequently, the RC Survey was adapted for use in relation to the health service, when Gittell focused her research on relational coordination within health care organizations (Gittell, 2002a, 2002b). Relational coordination is assessed by surveying the participants in a particular work process about their communication and relationships with other participants involved in that work process.

The RC Survey includes seven questions addressing the seven dimensions of relational coordination. Four questions concern communication (frequency, timeliness, accuracy, and degree of problem-solving), while three questions concern relationships (shared goals, shared knowledge, and mutual respect) (RCRC, 2016). The seven dimensions and questions are detailed in Table 1.

RC Dimension	Survey Question
Frequent communication	*How frequently do people in each of these groups communicate with you about [work process]?*
Timely communication	*How timely is their communication with you about [work process]?*
Accurate communication	*How accurate is their communication with you about [work process]?*
Problem-solving communication	*When there is a problem in [work process], do people in these groups blame others or try to solve the problem?*
Shared goals	*Do people in these groups share your goals for [work process]?*
Shared knowledge	*Do people in these groups know about the work you do with [work process]?*
Mutual respect	*Do people in these groups respect the work you do with [work process]?*

Table 1 Communication and relationship dimensions and the questions used in the Relational Coordination Survey (Gittell, 2016).

Today, the RC Survey is used for research purposes and as a tool for organizational change, in different industries, and the survey has been translated and validated in

several languages (Gittell et al., 2010; Cramm and Nieboer, 2012; Valentine et al., 2015; Lundstrøm et al., 2014; Naruse et al., 2014; RCRC, 2016).

The measurements allow the participants in an organization the possibility to assess the current state of relational coordination within and between workgroups in a particular work process, as well as to assess their progress over time, especially during organizational changes (Gittell, 2016). When used together with the Relational Model of Organizational Change, the RC Survey provides a platform for dialogue and reflection, which might be a useful starting point for managers and change team prior to organizing, defining, and prioritizing interventions intended to foster organizational change. Before using the RC Survey in an organizational change process, a dialogue-based exploration is needed in order to customize the survey. The work process that is going to be explored in the organization must be defined, and so must each workgroup involved.

3.2 Teaming and Psychological Safety

Perspectives adopted from the field of organizational psychology and the concepts of teaming and psychological safety seem to be useful lenses with which to understand the interpersonal relations between participants working together in conditions characterized by uncertainty, time constraints, and interdependency. In the following, a short presentation of these concepts will be offered.

3.2.1 Teaming

The concept of teaming is based on the specific conditions that, according to Edmondson (2012), apply to teamwork in today's organizations, not least in the health-care system. Here, interdisciplinary teamwork is rarely performed in fixed groups, but rather in teams established for the purpose of performing specific tasks in the here and now, for example emergency teams who provide life-saving treatment to traumatized patients in the emergency department. The concept of teaming is understood as a verb, and as a dynamic activity performed between team participants. Teaming involves practicing teamwork in a given situation in such way that communication and coordination are based on the team members' ability to recognize interdependence, establish trust, and share crucial knowledge quickly – without the benefits of stable team composition, prior shared experiences, and familiarity between team members. As stated in the introduction, the terms and conditions surrounding today's operating rooms are characterized by uncertainly, time constraints, and a high degree of interdependence between the involved health professionals. Edmondson (2012) has described these conditions as complex adaptive systems. Within complex adaptive systems, it might be crucial for the team members to ask questions clearly and frequently, while it might also be crucial for the team's performance that the team members have the capacity to adjust so that the available skills and knowledge are interwoven and can be used in the most efficient and appropriate way. Therefore, it

might be necessary for the organization to have employees who know how to team, and who have the skills and flexibility required to act in a potential collaboration. In complex adaptive systems teaming is essential for improvement, problem solving, and learning. Finally, Edmondson (2012) has emphasized that teaming is extremely important when: a) the task requires team members to navigate between multiple goals, b) the task calls for engagement and combination of perspectives from different disciplines, and c) team members must be able to maintain accurate and appropriate communicate as well as tight coordination when shifting from one situation to another. Teaming is thus an important prerequisite for successful collaboration in complex adaptive systems.

3.2.2 Psychological Safety

In addition, Edmondson (2012) has underlined the importance of psychological safety if a complex health-care organization is to succeed. Edmondson (2012) has defined psychological safety as a climate in which team members feel free to communicate their reflections, thoughts, and feelings without fear of being punished or convicted. This implies that psychological safety is an expression of the extent to which team members feel comfortable asking questions, seeking help, and daring to admit mistakes. Edmondson (2012) has expressed the vital connection between teaming and psychological safety by emphasizing that teaming will flourish within an organization with psychological safety, while it will shrink without it.

3.3 Organizational Culture and Safety Culture

As mentioned in the introduction, high-quality surgery requires the presence of health professionals with the necessary specialized competencies, the availability of technical and medical remedies, and an effective and appropriate structure within the organization. Further, as stated in the previous paragraph, health professionals having the ability to team and experience psychological safety in the performance of their daily work also has great importance for complex adaptive systems' ability to success. As Edmondson (2012) has defined psychological safety as a climate in which team members feel free to speak up, the term psychological safety seems to be linked to the concept of organizational culture and the concept of safety culture. These concepts will be presented in the following paragraphs.

3.3.1 Organizational Culture

During studies conducted in the 1980s, Edgar Schein sought to understand the complex aspects of life within organizations, and he was particularly keen to obtain deeper insight into the different dynamics of the cultures of organizations (1990). Based on these studies, Schein defined culture (Schein, 2010, p. 18):

> *"The culture of a group can now be defined as a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems."*

To analyze the culture of a given organization, Schein (2010) developed a model in which the organizational culture is described from different angles: observable artifacts, values, and basic underlying assumptions. The observable artifacts in an organization such as a hospital, and more specifically an operating room, include everything observable, such as the physical environment built with smooth tiles, steel surfaces, and strong spotlights; the use of uniforms, gloves, and face masks; and the significant occurrence of surgical instruments and clinical materials. This category also includes clinical recommendations and guidelines, prescriptions for work processes and procedures, and the way health professionals talk to each other. Another, non-visible, way of describing the culture of an organization is to describe the shared values and norms behind the activity being conducted within an organization by asking people to share their experiences and reflections about why things happen as observed. Finally, the culture of an organization can be identified by unfolding the underlying assumptions – or the assumptions that are taken for granted. The underlying assumptions are invisible and hence less conscious than the values. Engaging people in reflective dialogue and further intensive observation are needed to decipher the underlying assumptions that determine the behavior, thoughts, and feelings seen in an organization. Hence, when Schein talks about the organizational culture, he talks about assumptions derived from experiences or lessons learned, about values derived from the underlying assumptions telling people within the organization how to act, and about the visible artifacts and activities embodying the adopted values (Weick and Sutcliffe, 2007).

Schein's (1990, 2010) model for analyzing the culture within an organization might be useful in this study when exploring the communication and relationships seen in surgical teams. Schein (1990, 2010) has disclosed the difficulties involved in exploring and describing the culture within an organization, since culture is ubiquitous, and because different levels of concurrence and opposing values and assumptions are woven into each other. To obtain an insight in to the culture, Schein (1990, 2010) has developed a level-based exploration process. At the first level, the researcher can start by observing and noticing the observable artifacts in the culture. During this phase, looking for differences, difficulties, and challenges can be fruitful. In the second level, the researcher can establish a platform for reflection and dialogue by interviewing the members of the organization and thereby gaining knowledge about the adopted values within that organization. At the final level, an exploration of the underlying assumptions can be undertaken if the researcher has developed trustworthy and respectful relationships with members of the organization (Schein, 1990, 2010). For the process of inquiry to be successful and the underlying assumptions to appear, a combination

of insider knowledge and outsider questions is needed. In addition, the process of inquiry must be interactive in the sense of the outsider (the researcher) asking questions from a humble and exploratory position, and the insider (the member of the organization) responding to the questions and considerations from a reflective and curious position (Schein, 2010). In this way, it should be possible to develop a greater understanding of the underlying assumptions embedded within the organizational culture, as well as to capture a better understanding of what can be done to make changes to the culture if needed. Schein (2010) has described how conflicts can occur between different workgroups within an organization, followed by differences in the underlying assumptions founded on earlier experiences and on the organization's history. Schein's (2010) perspectives of organizational culture and his model of organizational analysis might be useful in the interpretation and discussion undertaken in the different phases of this study, especially since this understanding of organizational culture is consistent with the understanding of culture underlying the theory of relational coordination, as well as with the understanding of culture underlying safety culture perspectives presented in the following section.

3.3.2 Safety Culture

Some aspects of the culture of an organization focus on behavior, values, and assumptions regarding securing quality, preventing errors, and learning from mistakes. Different terms such as safety culture, patient safety culture, culture of safety, and patient safety are used for those aspects, and they are very often used synonymously. In this study, these terms will be used synonymously. There are various definitions of safety culture (Sammer et al., 2010; Kristensen, 2015a), with the following definition having been used by several researchers in the field (Nieva and Sorra, 2003; Pronovost et al., 2009; Vincent 2010):

> *"The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures."* (ACSNI, 1993, p. 23)

Based on this definition, Vincent (2010) has emphasized that safety culture includes the degree to which the individual and the group show responsibility and skills in relation to the provision of patient safety. In addition, Vincent (2010) has pointed out that safety must be taken seriously at all levels of the organization; therefore, strong organizational and management commitment is needed. A simpler way to describe the culture of safety is to use the common phrase: "*Culture is the way we do things around here!"* used by the American professors and safety culture researchers Peter Pronovost and John B. Sexton (2005, p. 231). In this phase "here" refers to the particular work unit. The Safe Surgery Guidelines and Safe Surgery Checklist are excellent examples of current recommendations (artifacts) focused on creating and

maintaining a safety culture in the operating room. These artifacts, which are used worldwide in surgical units, were developed within international health-care organizations such as the WHO by medical experts (macro level) and then implemented by the management of the particular surgical unit (meso level). Yet, if these guidelines and checklists are to work properly and promote safety for patients undergoing surgical procedures, health professionals must understand the intentions behind them and act accordingly (micro level). Creating and maintaining a safe culture is a systematic and continuous process (Vincent, 2010). It is a process that depends on the extent to which health professionals act on these initiatives and adapt them into their values and underlying assumptions. Systematic processes for interdisciplinary reflection such as briefings and debriefings, are other concrete examples of a safety culture that could be implemented within the operating room. Such safety initiatives are also important elements of a culture of learning. However, structural and organizational initiatives do not create and maintain a safety culture on their own. A safety culture based on learning should be based on an open and fair culture characterized by health professionals' responsibility and accountability combined with supportive responses to adverse events, errors, and harm if they occur (Vincent, 2010).

3.3.3 Assessing Safety Culture

The international research focusing on quality, patient safety, and safety culture has for years been concerned with how patient safety can be improved and how the safety culture can be measured. International organizations such as the Institute for Health Care Improvement (IHI), the Joint Commission for the Accreditation of Healthcare Organizations (USA), the Agency for Healthcare Research and Quality (USA), The Health Foundation (UK), and the National Health Service (UK) encourage health-care organizations to provide measurements of safety culture. Research concerning the measurement of the safety culture within health-care organizations has adopted different approaches. One research direction has focused on assessing the safety culture by measuring the behavior of health-care providers (Vogus and Sutcliff, 2007). A self-reported survey, namely the Safety Organizing Scale (SOS), has been developed with the purpose of improving patient safety by capturing the behaviors supposed to underlie the safety culture within a work unit. Another research direction has designed the assessment of safety culture based on health-care providers' attitudes toward patient safety (Sexton et al., 2006). A survey, the Safety Attitudes Questionnaire (SAQ), including six factors relevant to patient safety, has been developed by a group of American patient safety researchers, among them Sexton. The SAQ includes 35 items (statements) addressing the six factors: teamwork climate, safety climate, perceptions of management, job satisfaction, working conditions, and stress recognition (Sexton et al., 2006). The dimensions and items (statements) of the SAQ are presented in Appendix 4.

To capture a more comprehensive picture of the safety culture a stepwise analysis of the organizational culture could be completed, as suggested by Schein (2010). Another

approach could be to capture quantitative measures from surveys such as the SAQ or the SOS and combine them with qualitative impressions (statements, attitudes, observations) derived from health professionals' attitudes toward patient safety and their behavior as reflected in the daily task execution, as suggested in recent mixed methods studies focusing on improving safety culture within health care (Listyowardojo, 2012; Kristensen 2016a).

3.4 Summary

The theoretical lenses used in the present study are presented in order to clarify how they will guide the next level, that is, the methodological approaches, according to the four levels for developing a research study suggested by Creswell and Plano Clark (2011) (Figure 3).

The theory of relational coordination is useful for understanding phenomena within organizations, as well as for understanding the communication and relationship dynamics between workgroups and between health professionals working together on a given task. The Relational Model for Organizational Change, a newly developed model intended to guide organizational change processes, is useful here as a model for understanding the complexity, composition, and interaction between different types of interventions in organizational change processes. The RC Survey, a measurement tool for assessing relational coordination and the collaboration ties between workers and workgroups, is useful for identifying strong or weak collaboration ties and prioritizing and developing improvement interventions.

The concept of teaming, a dynamic activity performed between team members based on the skills needed to establish trust and share knowledge, is useful for understanding the interpersonal dynamic in complex adaptive systems. Teaming is essential when challenging situations that call for quick problem solving and reflected action occur. In interdisciplinary surgical teams, trust, knowledge sharing, and the courage to speak up are all of great importance to the health professionals' psychological safety as well as the quality of care.

The concepts of organizational culture and safety culture are useful for understanding and analyzing the interpersonal dynamics seen within a surgical unit by exploring the observable artefacts, values, and underlying assumptions. The SAQ, a measurement tool for assessing safety culture that exists between health professionals, is useful for assessing and identifying weaknesses and strengths within the safety culture, as well as for prioritizing and developing improvement interventions.

A detailed description of how the introduced theories, models, and surveys are used in the dissertation is presented in *Chapter 5. Methods and Procedures* and *PART III Analyses and Findings.*

CHAPTER 4. METHODOLOGICAL APPROACH

This chapter presents the methodological assumptions that have been made and the considerations that justify the choice of study design. A pragmatic stance has made it possible to apply different approaches during the study in order to achieve the purpose to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in Denmark, guided by the theory of relational coordination, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future. A mixed methods study with a multiphase design has been chosen because it appeared to be most appropriate for meeting the stated purpose through a study that developed over time and because it allowed each phase of the study to build on the other phases (Creswell and Plano Clark, 2011). Referring to Creswell and Clark's (2011) typology of mixed methods design, the term "multiphase" design is used in this dissertation. In this chapter, I will elaborate on the methodological considerations related to the use of a multiphase design, the application of ethnographic principles in practice, and the use of a framework for evaluation of organizational interventions.

4.1 A Mixed Methods Study with a Multiphase Design

Using a mixed methods design for a study provides both a methodology involving different philosophical assumptions and methods that focus on collecting, analyzing, and integrating quantitative and qualitative data, as Creswell and Plano Clark (2011, p.5) describe in their definition of mixed methods research:

> *"Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis and the mixture of qualitative and quantitative approaches in many phases of the research process. As a method, if focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approaches alone".*

Greene (2007, p. 20) refers to this mixed methods way of thinking as multiple ways of seeing and hearing. Understanding the communication and relationships that occur between health professionals in complex adaptive systems in order to formulate improvements demands multiple approaches and multiple ways of knowing; hence, a mixed methods study with a multiphase design was used in this dissertation. The use of a combination of qualitative and quantitative approaches should provide better conditions for achieving the purpose of the study than any one the approaches by itself.

There were several additional reasons for using a multiphase design for this study. One such reason was the longitudinal nature of the study. There was clear temporal progress throughout the research process due to the terms contained within the objectives intended to address: to explore, to assess, and to provide recommendations. The collection of data and the analyses from one research phase should be used to build the next phase. Another reason for the design choice was founded on the pragmatic considerations that multiple perspectives are needed and appropriate in order to experience and understand a complex reality, while knowledge is trustworthy when it succeeds in guiding actions. The final reason was the possibility to combine both sequential and concurrent components in order to produce knowledge that best matches reality, which could result in recommendations for improvement.

In **PHASE I**, a qualitative explorative inquiry of communication and relationships in interdisciplinary surgical teams in ORs was provided. This was followed by **PHASE II**, in which an organizational intervention was developed, implemented, and evaluated. During this phase, the findings from the qualitative explorative inquiry and the assessments of relational coordination were incorporated into an organizational intervention with the aim of strengthening the interdisciplinary collaboration in a surgical unit. The intervention was followed over a period of one and a half years, and it was qualitatively evaluated along the way. This was supplemented by an impact evaluation conducted in **PHASE III**, in which changes in health professionals' attitudes toward relational coordination and safety culture were measured quantitatively. Finally, in **PHASE IV**, the experiences and findings derived from each phase of the study were integrated, which provided the basis for improvement recommendations concerning how best to improve interdisciplinary collaboration in surgical units in general.

The phases were connected in different ways over time, as illustrated in the diagram of the research process (Figure 6, p. 40). In this figure, guidelines for drawing visual models for mixed methods designs (Ivankova et al., 2006) as well as terms from the terminology of mixed methods design and integration have been used (Creswell and Plano Clark, 2011; Fetters et al., 2013).

The data collection process applied during each phase of the study will be described in detail in *Chapter 5. Methods and Procedures*, although an overview of the content and the methodological approaches used in each phase will be presented shortly. Each research phase is guided by an objective, which will provide new perspectives to be integrated during the final interpretation.

The objective during **PHASE I** was to explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark, in order to address the first research question:

Research Question 1 (RQ1): *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?*

The use of ethnographic principles in practice during **PHASE I** seemed to be highly appropriate given the exploratory nature of this research question. Therefore, the methodological considerations focusing on ethnography will be further described in section *4.2 Ethnographic Fieldwork.*

The objective during **PHASE II** was to explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units, in order to build **PHASE III** and address the second research question:

Research Question 2 (RQ 2): *How is the theory of relational coordination used as a tool for improvement in organizational intervention process in surgical units?*

A process that uses the principles of relational coordination as tools for organizational change including the Relational Coordination Survey, and a framework for evaluation of organizational change seemed to be applicable during **PHASE II**. Therefore, the methodological considerations focusing on a framework for evaluation of organizational interventions will be presented in section *4.3 Framework for Evaluation of Organizational Interventions*.

Using validated tools for the assessment of both relational coordination (RC Survey) and safety culture (SAQ), as well as descriptive and statistical analyses, seemed to be useful during **PHASE III** in order to determine whether relational coordination and safety culture have been improved during the implementation of organizational interventions, and thereby address the third research question:

Research Question 3 (RQ 3): *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention process using the theory of relational coordination as a tool for improvement?*

The objective during **PHASE IV** was to provide recommendations for improving collaboration and safety culture in interdisciplinary surgical teams, in order to address the last research question:

Research Question 4 (RQ 4): *How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?*

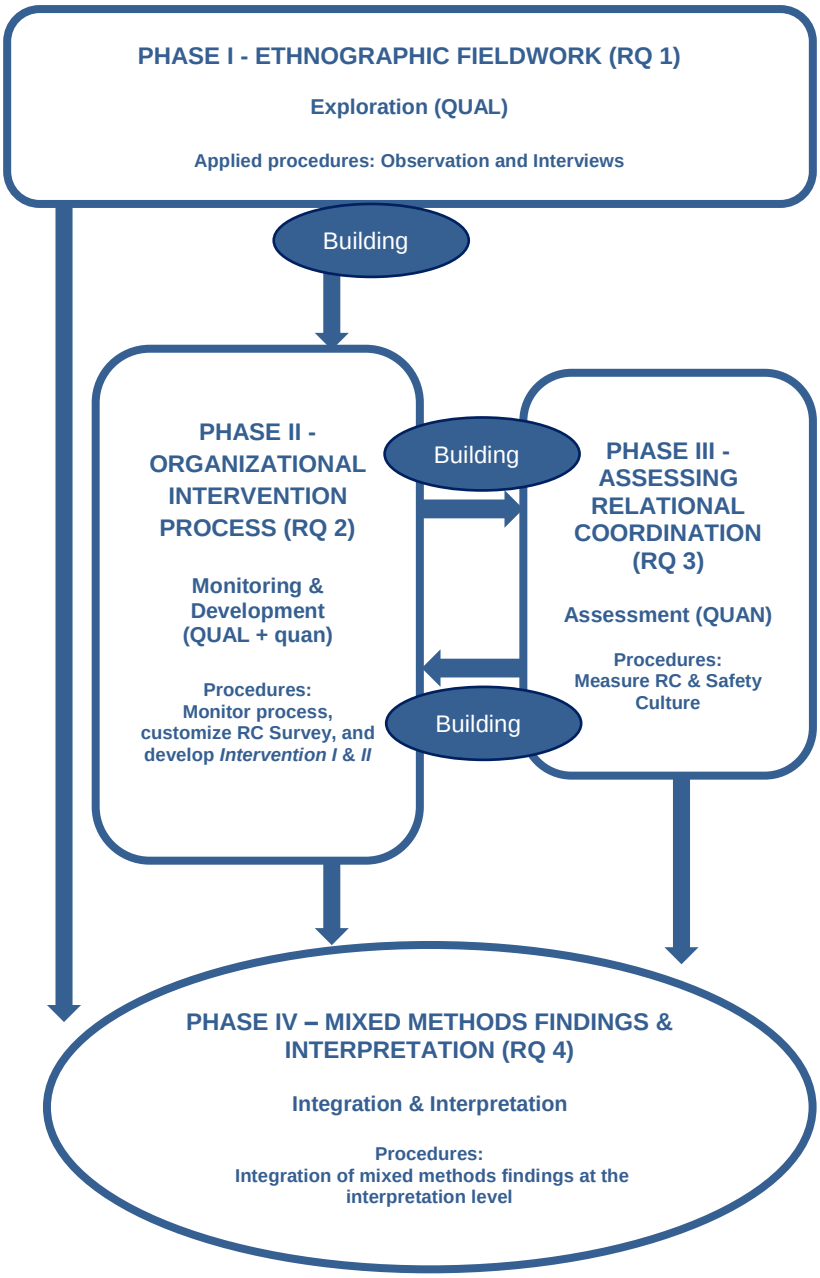


Figure 6 Overview of the mixed methods study with a multiphase design.

In *Chapter 9. Mixed Methods Integrated Findings and Interpretation,* I will describe the process used to integrate the findings, and I will emphasize the limitations and the assessment of quality of a mixed methods inquiry. Prior to that, the methodological considerations concerning the use of ethnographic principles during **PHASE I**, as well as the use of perspectives from evaluation science in **PHASE II** and **PHASE III**, will be presented in the following sections.

4.2 Ethnographic Fieldwork

The objective during **PHASE I** was to explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark. The use of ethnographic principles in practice seemed to be an obvious choice that would be faithful to an exploratory approach. To explore, to obtain insight, and to understand the particular culture that exists in a surgical unit might contribute to the development of new knowledge regarding the communication and relationship patterns in surgical teams.

Conducting ethnographic fieldwork provides unique opportunities for the researcher to step into and share the everyday life of people (Atkinson, 2015). The essential aspect of conducting ethnographic fieldwork is to seek the meaning of actions to the people involved, which we as field researchers try to understand (Spradley, 1980; Creswell, 1998). In order to satisfy the intention of seeking insight and understanding the culture and essence of everyday life among a group of people, it is essential to listen carefully to what people say (and thereby to seek knowledge of what people know), to look at what people do, and to study and be aware of people's use of instruments, structural systems, and procedures. In other words, it is through the participants' language, behavior, and use of artifacts that we have the opportunity to gain insight and understanding concerning the culture we as field researchers are exploring (Spradley, 1980). Fieldwork, including observations of participants in a particular social context over a long period of time, provides opportunities to obtain valuable knowledge of, and a commitment to, other people's everyday life, as well as to the organizational culture and social life surrounding them (Atkinson, 2015). Spending many hours observing and talking to participants in both informal and formal conversations, listening to dialogues between participants, seeing participants acting together during the daily task performance, and listening to participants spontaneously telling stories and anecdotes about their work life all provide valuable insight for the researcher. Such insight and knowledge, when combined with a cyclical analysis and interpretation process, could provide some qualified answers to the research questions and hence help to achieve the purpose of the study. It also seems important to highlight that the ethnographic fieldwork is a scientific method characterized by being practical, distinctly time consuming, and often unpredictable (Atkinson, 2015), which implies that the researcher must work reflectively, analytically, and interpretively throughout the entire research process. Therefore, ethnographic field research processes focus on a few

groups of people in order to facilitate in-depth study (Hammersley and Atkinson, 2007), and they might be cyclic, iterative, and changeable so as to be consistent with the methodological approach (Atkinson, 2015). This is demonstrated when the researcher, during the observation period, reads through the fieldnotes, reflects, and asks new questions intended to further the investigation. New issues are brought to the research field and examined together with the participants in a search for meaning and understanding, which, according to Atkinson (2015), represents a way of interacting with the data. To be able to interact with the data and bring new ideas to the data, the researcher requires a framework for understanding the social world in the particular culture being explored, as Atkinson (2015, p. 11) notes:

> *"We interact with the data. In doing so, we need to bring ideas to the data as well at trying to derive from them. But since these ideas are part of cyclical process of field research it follows that we need to bring ideas to the field. We need as a minimum, a framework for understanding social worlds, cultural systems and social processes. This might, ultimately, mean that we need a waste amount of education in the social sciences before we embark on any particular ethnographic enterprise. In the ideal world, perhaps, that might be so. But in the real world, practitioners need at least a framework of ideas and perspectives. We all need exemplars to point us in profitable and fruitful directions."*

Although ethnographic fieldwork is rarely based on a strictly formulated hypothesis or predetermined design, a framework for understanding the social world is needed in order for the field researcher to reflect on the question: "What might this be a case of?" (Atkinson, 2015, p. 35). This emphasizes the need for the researcher to strike a balance and make circular movements between using his/her senses and reflecting upon a framework for understanding the social world, the organizational culture within the surgical unit, and the interpersonal dynamics among the participants. The ways in which these aspects are addressed in this study are described in section *5.2.3 Data Collection and Applied Procedures*. The education, experience, and training undertaken during many years spent working in health-care might add an appropriate framework for understanding the social world in a particular surgical unit, although a reflective attitude is still required if the researcher is to be humble and curious in order to understand and seek knowledge about the culture being explored (Schein, 2013).

The ethnographical fieldwork conducted in this study during **PHASE I** included participant observation of health professionals performing surgical procedures in the OR, individual and group interviews, and an exploration of context, structures, work processes, and documents. The ethnographic fieldwork was conducted in two surgical units. The practical implications of using ethnographic principles in practice in this study will be described in section *5.2 PHASE I - Ethnographic Fieldwork*. Here, the methodological considerations to assessing the field, the participation/engagement of the researcher, and the iterative analytical movements during the long-term period of observation are detailed.

4.3 Framework for Evaluation of Organizational Interventions

A framework for evaluation of organizational interventions was needed to move toward the objective of **PHASE II**, that is *to explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units,* and the objective of **PHASE III***,* namely *to assess whether relational coordination and safety culture in a surgical unit are improved during an organizational intervention process.*

A research- and theory-based framework presenting an evaluation model that includes both process evaluation and outcome evaluation was chosen as the primary inspiration of evaluation in this study. Three dimensions highlighted the importance of applying a differentiated evaluation model as a reference framework in order to achieve a detailed understanding of the changes seen in this project. First, the framework captured different elements that reflected a change process, even in an ever-changing context such as the one the surgical unit was embedded in. Second, it incorporated the participants' involvement and engagement in the intervention process during **PHASE II**, as well as the changes in participants' attitudes as measured during **PHASE III**. Finally, it facilitated an awareness of the contextual conditions surrounding organizational intervention processes.

The framework is based on a process-oriented organization theory describing how best to evaluate organizational interventions (Tsoukas and Chia, 2002; Nielsen and Abildgaard, 2013). What made the chosen framework particularly interesting was the fact that it is based on a system-oriented and dynamic understanding of the processes of change within organizations, rather than on a linear and causal explanatory approach.

Instead of looking at the evaluation of organizational change as changes causing movements from one stage to another, the model proposes the need to also focus on the contextual conditions and evaluate both processes and outcomes, as shown in Figure 7, p. 44)

According to the framework, the evaluation of an organizational intervention process is divided into phases (Nielsen and Abildgaard, 2013). Initiation is the phase at the beginning of an organizational intervention process, in which the intervention and communication plan is developed, and the participants who are going to be involved in the change process are designated. Screening is the phase in which the problem areas are identified and the baseline measurements for evaluating the intervention's effect are conducted. In the following action-planning phase, the intervention activities are developed, and a description of both the content and the development process is documented.

Finally, there is the implementation phase, in which the intervention initiatives are implemented, and the implementation activities are documented. By evaluating the initiation, screening, action-planning, and implementation phases during an organizational intervention process, valuable knowledge regarding any changes in the organization during the intervention will be gained, resulting in a more differentiated evaluation.

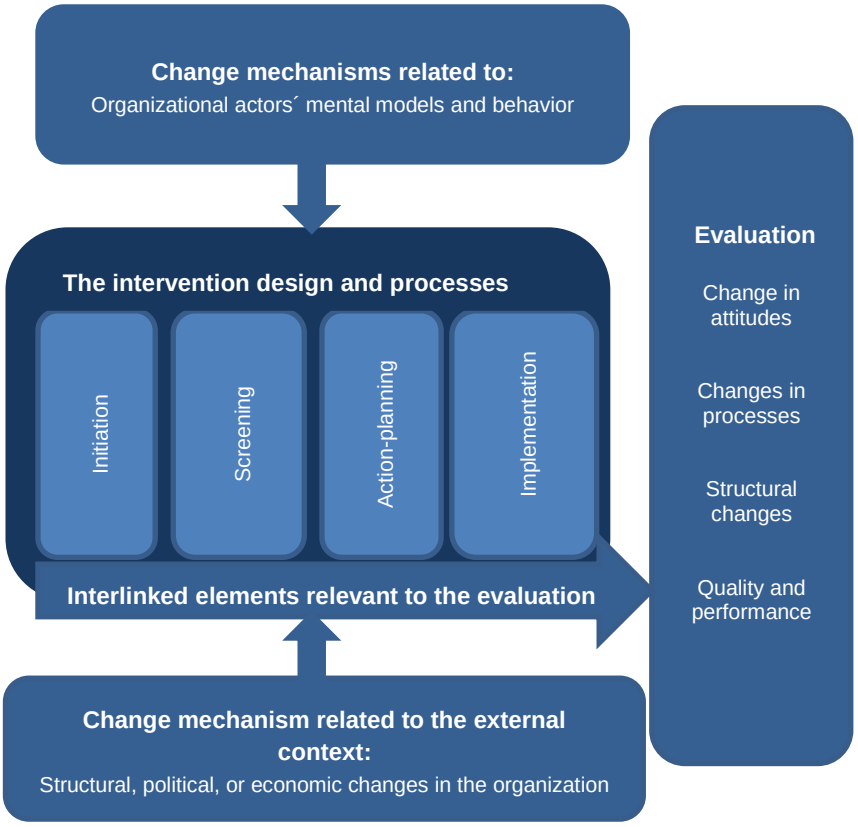


Figure 7 Framework for Evaluation of Organizational Interventions, inspired by Nielsen and Abildgaard (2013).

These elements are during the intervention process influenced by, what the framework names, the organizational actors' mental models through the influence the mental models have on participants´ behavior. Nielsen and Abildgaard (2013) use definitions adopted from the science of psychology when they emphasize that actors' use mental models to make sense of the world. Mental models are individually developed, and they guide the actors' understanding of the surroundings and how best to react to changes that occur (Johnson-Laird, 1983). Transferring this definition of mental models

to organizational intervention processes, mental models govern how organizational actors react to the change initiatives, and they may explain the actors' behaviors. Insight into the actors' mental models may be gained by exploring the actors' attitudes toward issues related to the organizational culture and the everyday performance of tasks (Nielsen and Abildgaard, 2013).

The evaluation model emphasizes that the effect of organizational interventions must be evaluated based on different parameters, including changes in actors' attitudes, knowledge, and values, changes in organizational procedures and structures, changes in working conditions, and changes in quality and performance outcomes (Nielsen and Abildgaard, 2013). Furthermore, changes that occur concurrently must be anticipated (Nielsen and Abildgaard, 2013). Changes derived from economic challenges and realized in staff and/or production reductions are often unforeseen and, when carried out with immediate effect, are likely to affect the participants' attitudes toward engaging in organizational changes. Interventions at the meso and micro levels within an organization are influenced by organizational and structural changes at the macro level due to policy decisions and strategic modifications issued by the senior management.

As described in the introduction, surgical units are situated in a context characterized by uncertainty, time pressure, and complexity at the micro and meso levels, and they are embedded within constantly changing hospital organizations. Therefore, it would be unrealistic to evaluate the intervention initiatives that originate from the organizational intervention process in this study as being isolated from the changes, terms, and events surrounding the project. Hence, it seemed essential to choose an evaluation model that embraced both processes and outcomes by tracking and assessing the interlinked elements relevant to the evaluation. These elements, such as the change mechanisms related to the health professionals' attitudes (relational coordination and safety culture), the intervention processes (initiation, screening, action planning, and implementation), and the external context, were measured and documented during the intervention process in the surgical unit. The framework used for the evaluation of the organizational interventions in the surgical unit in this study is shown in Figure 7, which was inspired by Nielsen and Abildgaard (2013).

However, the practical implications of using a model that include both process and outcome evaluations in this study will be described in *Chapter 5. Methods and Procedures,* when the data collection methods and procedures applied in **PHASE II**, **PHASE III**, and **PHASE IV** are presented.

4.4 Summary

This mixed methods study was designed with the purpose to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in DK, guided by the theory of relational

coordination, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future.

A multiphase design was used, in which four phases were conducted sequentially and concurrent over time. These phases are: **PHASE I** (Exploration), **PHASE II** (Monitoring & Development), **PHASE III** (Assessment), and **PHASE IV** (Integration & Interpretation).

In **PHASE I**, qualitative data were collected from observations, interviews, and focus group interviews, inspired by the ethnographic principles in practice suggested by Atkinson (2015), Spradley (1979, 1980), and Hammersley and Atkinson (2007), in order to form the basis for the planning interventions applied in **PHASE II**.

In **PHASE II**, qualitative data were drawn from an organizational intervention process inspired by the Relational Model of Organizational Change (Gittell, 2000b, 2016; Gittell et al., 2010; Gittell et al., 2011), while the Framework for evaluation of organizational interventions (Nielsen and Abildgaard, 2013) provided the basis for the development, implementation, and evaluation of the interventions. Further, in **PHASE II**, the quantitative data collected from measurements of relational coordination in **PHASE III** were used as a prioritizing tool during the intervention process (Gittell et al., 2011, Gittell, 2016).

In **PHASE III**, the quantitative data collected from measurements of relational coordination and safety culture were analyzed separately and then compared (Gittell, 2012a, 2016; Sexton et al., 2002; Kristensen, 2016a, 2016b).

Finally, the qualitative data and findings derived from **PHASE I** and **PHASE II**, as well as the quantitative data from **PHASE II** and **PHASE III**, were integrated and interpreted during **PHASE IV,** as inspired by Creswell and Plano Clark (2011), Greene (2007), Fetters, Curry, and Guetterman (Fetters et al., 2013; Guetterman et al., 2015).

CHAPTER 5. METHODS AND PROCEDURES

This chapter focuses on the technical and concrete elements embedded within the lowest level of the model illustrating the four levels for developing a research study (Figure 3, p. 19) (Creswell and Plano Clark, 2011). First, a description of the clinical context in which access and agreement to the fieldwork and the implementation of interventions will be offered in section *5.1 Context*. Next, the methods used for data collection during each phase of the mixed methods study will be presented in *5.2 PHASE I – Ethnographic Fieldwork*, *5.3 PHASE II – Organizational Intervention Process*, *5.4 PHASE III – Assessing Relational Coordination and Safety Culture*, and *5.5 PHASE IV – Integration at the Interpretative Level*. Finally, the relevant ethical issues and considerations will be addressed in section *5.6 Ethical Considerations*.

In order to systematically structure the presentation of the data collection procedures applied during each phase of the study the same order and headings are used: Setting, Participants/Respondents[4], Data Collection and Applied Procedures, Reflexivity and Validity Procedures, and Steps from One Phase to the Next Phase. An overview of the objectives, applied procedures, and expected outcomes for each phase is given in Appendix 1.

5.1 Context

The study has been carried out in an orthopedic surgery clinic in a university hospital in Denmark. The clinic was part of a large ethnographic study conducted in 2010 exploring the functions of surgical assistants and perioperative nursing (Sørensen, 2011). That study recommended further studies of the adaptive capacity in interdisciplinary surgical teams in order to improve teamwork in the operating room and thereby improve the quality of patients' outcomes. Contact was established, and agreements were made between senior management and the researcher(s) in 2013, as well as between the specific frontline managements and researcher in 2014. The vice director of human resources at the orthopedic surgery clinic acted gatekeeper, while the nurse managers were the closest daily cooperation partners. The orthopedic surgery clinic is divided into four surgical units, which are located in different geographical areas of the region. These units conduct orthopedic surgical procedures of different levels of complexity, which are divided into different sub-specialties: arthroplasty (replacement), trauma and fracture management, foot and ankle, shoulder and elbow, spine, children and reconstructive surgery, and hand surgery. Contextual

[4] The term "participants" is used when describing the ethnographic fieldwork and the organizational intervention. The term "respondents" is used when describing the measurement of relational coordination and safety culture using surveys.

variation was ensured by recruiting teams from two geographically different locations that work at different levels of complexity within the same organizational setting.

PHASE I was conducted in Surgery Unit I and Surgery Unit II. They were mainly selected based on differences in the level of complexity, as presented in the following. Subsequently, they differed from each other in terms of the level of uncertainty, that is, they differed according to the proportion of surgical procedures carried out as scheduled or emergency surgical procedures. PHASE II and PHASE III were only conducted in Surgery Unit II. This decision was made partly to match the time and resource framework established for the research process and partly to accommodate a managerial need for change within the organization.

In order to describe the diversity between the two units, data reported from all orthopedic surgical units in Denmark to a national clinical surgery database has been consulted (The Danish Hip Arthroplasty Registry, 2015).

The four surgical units in the region all differ from each other (Table 2). Almost all the hip arthroplasties performed in Surgery Unit I are categorized as primary hip surgical procedures *(*364 primary hip surgical procedures and only 13 revision hip surgical procedures in 2015*)*, while almost all the hip arthroplasty surgeries in the region that are categorized as revision hip surgical procedures are performed in Surgery Unit II (78.5% of all revision hip surgical procedures performed in the region in 2015).

Reported Primary and Revision Hip Arthroplasty						
	1995-2013		2014		2015	
	Primary *n*, (% R)	Revision *n*, (% R)	Primary *n*, (% R)	Revision *n*, (% R)	Primary *n*, (% R)	Revision *n*, (% R)
Denmark	130.065	20.737	9415	1372	9674	1321
Region (R)	11.765	1278	871	97	861	130
Surgery Unit I	5427 (46,1)	152 (11.9)	358 (41.1)	7 (7.2)	364 (42.3)	13 (10)
Surgery Unit II	790 (6.7)	990 (77.5)	77 (8.8)	85 (87.6)	62 (7.2)	102 (78.5)
Surgery Unit III	1639 (13.9)	26 (2)	152 (17.5)	0	120 (13.9)	0
Surgery Unit IV	3012 (25.6)	47 (3.7)	284 (32.6)	5 (5.2)	315 (36.6)	12 (9.2)

Table 2 Reported primary and revision hip arthroplasty operations, as adapted from the Danish Hip Arthroplasty Registry (2015).

The diversity between the units is also supported by Table 3, which demonstrates the case mix for surgical procedures in the units in terms of for hip arthroplasties during the same period. The case mix is a term used in clinical databases that serve, as an information tool for understanding the complexity of health care delivery.

Case Mix for Surgical Procedures (Hip Arthroplasty) 2010 – 2015					
	Woman (%)	> 70 years (%)	Primary arthroplasty (%)	One hip affected (%)	With comorbidity (%)
Denmark	57	49.9	79.8	61.1	26.7
Region	54.4	51.5	79.7	62.5	26.1
Surgery Unit I	50.4	46.2	85.7	65.2	21.8
Surgery Unit II	57.8	55.3	28.4	81.5	47.9
Surgery Unit III	55.2	56	77.7	75.4	28.4
Surgery Unit IV	58	55	85.4	49.6	25

Table 3 Reported case mix for surgical procedures (hip arthroplasty), as adapted from the Danish Hip Arthroplasty Register (2015).

In this table, which presents the case mix for patients undergoing hip arthroplasty, the patients' relevant demographic factors, such as gender, age, primary arthroplasty, severity of arthrosis, and comorbidity[5], are included. Primary arthroplasty is included as a factor describing the case mix, since primary arthroplasty is a less complicated surgical procedure than revision arthroplasty. Whether one or both of a given patient's hips are affected by arthrosis is a factor that provides, an indication of the severity of the arthrosis. The age and comorbidity are both dimensions that are considered when a patient's ASA score[6] is assessed by anesthesiologists prior to surgery. The frequency of patients undergoing surgical procedures with a comorbidity is highest in Surgery Unit II (47.9%) and lowest in Surgery Unit I (21.8%), while the patients are elderly in Surgery Unit II (55.3% of the patients are older than 70 years) than in Surgery Unit I (46.2% of the patients are older than 70 years).

[5] "Comorbidity" is the medical term used to indicate the presence of one or more additional diseases. In this case mix table (Table 2), it covers other diseases in addition to arthrosis.
[6] The ASA score is a physical status classification system stated by the American Society of Anesthesiologists (ASA), which is commonly used and known worldwide to assess the fitness of patients prior to surgery.

Given that the level of complexity involved in the revision hip surgical procedures is higher than the level of complexity involved in primary hip surgical procedures, it can be stated that:

Surgery Unit I is the regional unit in which the level of complexity is estimated to be lowest. It also has the lowest percentage of comorbidity (21.8%), the highest percentage of primary arthroplasty (65.2%), and the lowest average age (46.2% of patients were older than 70 years).

Surgery Unit II is the regional unit in which the level of complexity is estimated to be highest. It also has the highest percentage of comorbidity (47.9%), the lowest percentage of primary arthroplasty (28.4%), and a high average age (55.3% of patients were older than 70 years).

Each of the surgical units had a management group (frontline management), including a nurse manager and a surgeon manager, and each of the units had several employed operating room nurses and nurse assistants, as illustrated in Figure 8.

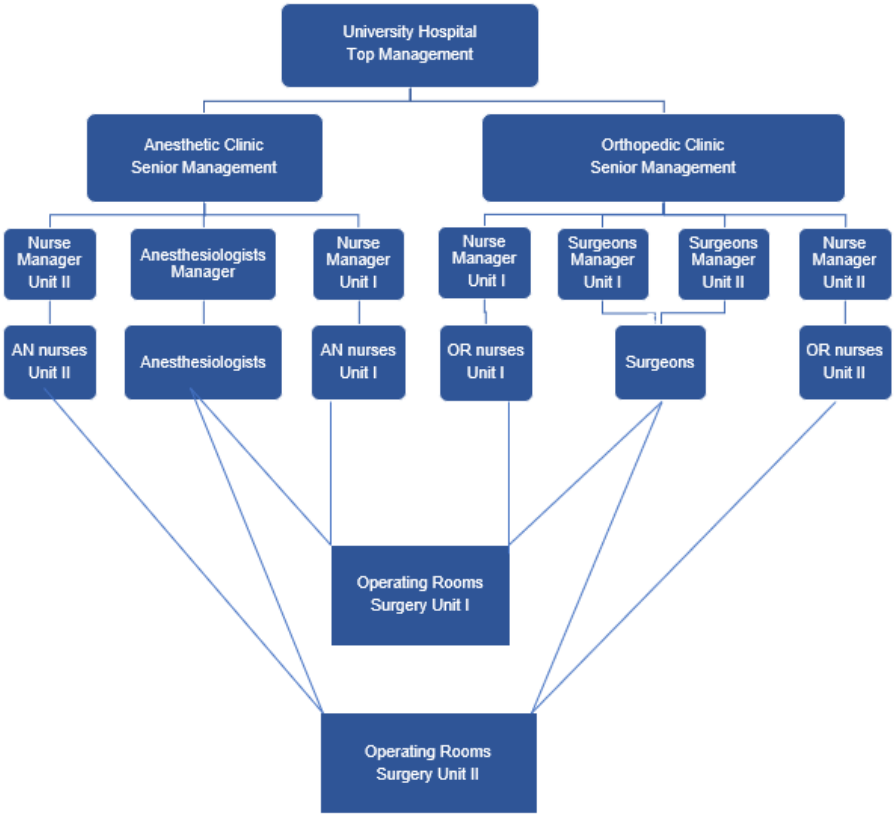


Figure 8 Organization diagram showing the management and organization of the surgical units.

The surgeons were employed by the senior management, which meant that the surgeons performed surgical procedures in all four units, and they thereby collaborated with a large group of collaborators in various clinical settings. The anesthesiologists and nurse anesthetists, who were also part of the surgical teams, were employed in another unit, namely the anesthesia clinic, which was organized in a similar way. The main consequence of this organizational structure was that the health professionals (surgeons, OR nurses, AN nurses, anesthesiologists, nurse assistants, and surgeon assistants) worked together in the same operating room but referred to different senior managers and different frontline managers.

5.2 PHASE I – Ethnographic Fieldwork

The objective during PHASE I was to explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark. The following procedures, which were inspired by ethnographic principles in practice presented in *Chapter 4* (Hammersley and Atkinson, 2007; Spradley 1980) were completed in PHASE I:

- Selection of clinical settings and participants.
- Participant observations.
- Semi-structured interviews.
- Semi-structured focus-group interviews.
- Analyses of qualitative data.

As a result of these procedures, the following outcomes or products were generated: observation guides, fieldnotes, interview guides, transcriptions of interviews, descriptions of communication and relationships in interdisciplinary surgical teams, and descriptions of health professionals' attitudes toward collaboration in surgical teams and toward safety culture.

The analyses and findings derived from PHASE I are presented in *Chapter 6. Communication and Relationships.*

5.2.1 Setting

The ethnographic fieldwork was conducted in Surgery Unit I and Surgery Unit II from January 2014 to December 2014. These surgical units were both divisions of the orthopedic surgery unit. These units were chosen for a number of reasons. First, because of the similarity that arose due to them being part of the same hospital and the same department, as well as by being managed under the same organizational structure by the same senior managements. Second, because they mostly differ in proportion to the level of complexity when performing the knee and hip arthroplasty. Finally, because they differ in proportion to the level of uncertainty. As shown in the table below (Table 4), a significantly larger group of staff is employed in Surgery Unit

II, which reflects the fact that this unit performs several other orthopedic surgeries in addition to hip and knee arthroplasty, as mentioned in the description of the context.

Staffing Composition of Surgery Unit I & Surgery Unit II					
	OR Nurses	AN Nurses	NURASS	SUR[7]	ANE
Surgery Unit I	16	14	0	10	2
Surgery Unit II	38	38	4	63	7

Table 4 The staffing composition of the observed surgical units.

The ethnographic fieldwork focused on interdisciplinary collaboration in surgical teams performing hip and knee replacement operations, since a delimitation was needed. The need for such a delimitation resulted from the huge variations in orthopedic surgery - in terms of the time involved and the staff and instruments needed. In addition to these variations, other differences and similarities were found between Surgery Unit I and Surgery Unit II, as shown in Table 5.

Differences and Similarities Between Surgery Unit I & Surgery Unit II	
Differences	• Level of complexity • Degree of uncertainty • Categories of surgical procedures • Capacity – number of operating rooms, number of employees, and number of surgical procedures/ year • Educational obligations for medical staff • Working time appointments (nurses)[8]
Similarities	• Senior managements and organizational structure • Economic structure and conditions • Staff of performing surgeons • Supply and purchasing of replacement materials and surgical instruments • Working time appointments[9] • National and regional health policy and legislation

Table 5 Differences and similarities between Surgery Unit I and Surgery Unit II.

[7] In Surgery Unit I and Surgery Unit II, the surgeons are assisted by surgeon assistants, who are not included in this number.

[8] The working time appointments in the two units were similar, except the OR nurses. In Surgery Unit I, surgical procedures were only performed during the daytime (8 AM to 5 PM) therefore, nurses only worked during the daytime. In Surgery Unit II, surgical procedures were performed 24 hours a day, that is, scheduled surgical procedures during the daytime (8 AM to 5 PM), and emergency surgical procedures 24 hours a day. The nurses in Surgery Unit II worked in both day, evening, and night shifts.

[9] The health professionals in each of the professional groups worked according to similar employment contracts and the similar labor agreements in terms of working hours and payments.

5.2.2 Participants

The members of the interdisciplinary surgical teams were observed and interviewed in the performance of their daily tasks, namely performing hip and knee surgery in the operating room. The selection of hip and knee surgery was made in order to create opportunities for identifying patterns, habits, and consistency across events and situations.

An interdisciplinary surgical team included a surgeon (SUR), a surgeon assistant (SURASS), two operating room nurses (OR nurse) (one surgical nurse[10] [SN] and one circulating nurse [CN]), two anesthetist nurses (AN nurse), an anesthesiologist (ANE), and sometimes a nurse assistant (NURASS). The surgical teams were constituted at the beginning of the day by the surgeon manager, anesthesiologist manager, and nurse managers. In that way, each manager individually assigned a health professional to the individual patient undergoing a surgical procedure. The observed participants comprised a total of 39 surgical teams including 84 health professionals. The distribution of the observations in the two surgical units is presented in Table 6.

Participants and Teams Observed in the Surgical Units						
	OR nurses	AN nurses	NURASS	SUR	ANE	Team
Surgery Unit I	12	12	0	8	3	26
Surgery Unit II	18	19	4	15	4	13
Total	30	31	4	19	4	39

Table 6 Numbers of participants and teams observed in the surgical units.

The selections of the individual participants and particularly the surgical procedure, was made with the intention of investigating both uniformity and diversity. Therefore, I have observed some surgeons collaborating with several groups of OR nurses, and I have observed OR nurses collaborating with several surgeons. Regarding the selection of AN nurses and anesthesiologists, there were no particular considerations.

In Figure 9 and Figure 10, I have illustrated the diversity in the composition of the 39 surgical teams that performed the 39 observed surgical procedures. The numbers in the figures indicate the numbers assigned to the individual health professionals observed in order to anonymize the individuals. For example, a surgeon (SUR1) working in collaboration with a group of OR nurses – a surgical nurse (ORN27) and a

[10] In the surgical team, there was a need for operating room nurses, who fulfilled two different functions during the surgical procedures. The surgical nurse performed the sterile assistant function, while the circulating nurse performed the non-sterile assistant function (Sørensen 2011). The OR nurses agreed among themselves who should be the surgical nurse and who should be the circulating nurse.

circulating nurse (ORN33) - is specified as: SUR1 + ORN27/ORN33[11]. The number in parentheses indicates the number of surgical procedures observed. For each of the surgical procedures, I have observed a surgical team, which was subsequently assigned a team identification number. For example, SUR2 and ORN27/ORN28/ORN29 were observed performing surgical procedures on four patients, and they were therefore members in four teams.

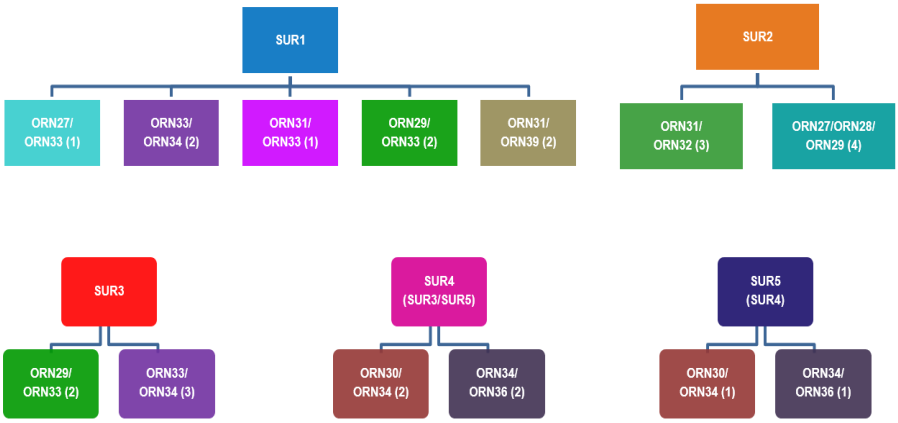


Figure 9 Composition of the surgical teams observed in Surgery Unit I. The number in parentheses indicates the number of surgical procedures, and hence the number of teams.

In Surgery Unit I, five surgeons (SUR1, SUR2, SUR3, SUR4, and SUR5) were observed in collaboration with nine different groups of OR nurses, as shown in Figure 9.

Figure 9 also illustrates that one surgeon (SUR1) collaborated with five different groups of OR nurses in Surgery Unit I, and that surgeon participated in eight observed surgical procedures.

One OR nurse (ORN34) has been observed collaborating with four surgeons (SUR1, SUR3, SUR4, and SUR5), and that nurse has participated in 11 surgical procedures in Surgery Unit I.

Figure 9 illustrates through the use of color code that groups of OR nurses were observed in collaboration with different surgeons. For example, one group of OR nurses (ORN33/ORN34, colored purple) was observed in collaboration with two surgeons (SUR1 and SUR3).

In Surgery Unit II, six surgeons (SUR1, SUR3, SUR4, SUR6, SUR7, and SUR8) were observed in collaboration with one to three groups of OR nurses, as shown in Figure 10.

[11] Figure 9 and Figure 10 do not indicate which OR nurse served as a surgical nurse (SN) and which OR nurse carried out the function of a circulating nurse (CN). Typically, they switched roles if they were to perform more surgical procedures together during the same day.

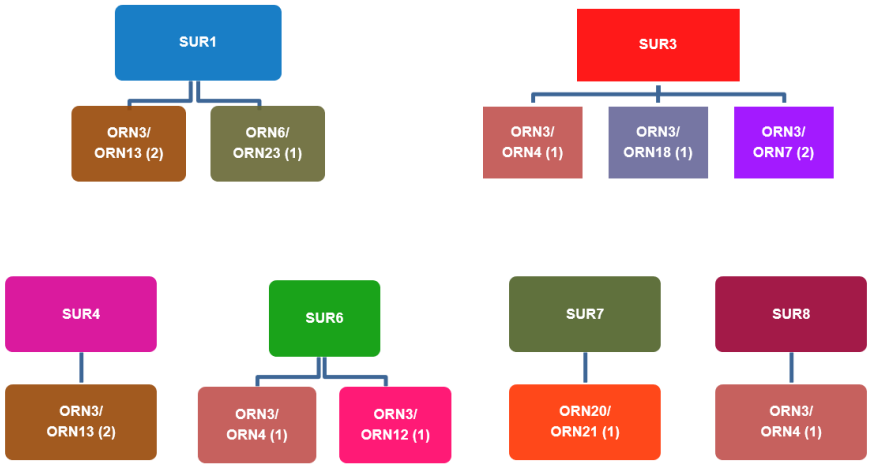


Figure 10 Composition of the surgical teams observed in Surgery Unit II. The number in parentheses indicates the number of surgical procedures.

In Surgery Unit II, one OR nurse (OR3) was observed collaborating with five surgeons (SUR1, SUR3, SUR4, SUR6, and SUR8), and that nurse participated in 11 surgical procedures. One group of OR nurses (OR3/OR4) was observed collaborating with three surgeons (SUR3, SUR5, and SUR8). Three surgeons were observed in both units (SUR1, SUR3, and SUR4).

The selection of the individual surgical procedures observed was made in consultation with the nurse managers in the surgical units, and the observation of surgical teams who performed knee and hip arthroplasty was prioritized. As illustrated in the above figures, the selection of both the individual participants and the surgical teams observed was based on realistic opportunities, which were referred to as opportunistic considerations in the qualitative research of Maunsbach and Lunde (1996).

5.2.3 Data Collection and Applied Procedures

The data collection and procedures applied during **PHASE I** were based on fieldwork, that is, observing participants' activities, listening and participating in conversations, and interviewing based on practical ethnographic principles (Atkinson, 2015). In the following, I will present the data collection methods and procedures applied.

5.2.3.1 Participant Observation

Although ethnographic fieldwork is characterized by being unpredictable, as noted in *Chapter 4* and, according to Atkinson (2015), guided by an exploratory spirit, which implies that the researcher must work reflectively, analytically, and interpretively throughout the whole research process, a broad structure for the observation period was followed in the units, as shown in Table 7.

Structure for the Observation Periods in the Ethnographic Fieldwork		
Time	Procedures	Focus
Week 0	Establishing contact	Presentation of the research project, researcher, and implications for observed participants
Week 1-3	Grand tour observations	Descriptive observations: What is going on? When is it going on? Who is collaborating? *Being present without taking fieldnotes*
Week 3-14	Mini tour observations	Observations focused on communication and relationships during the surgical procedures *Being present and taking fieldnotes*
Week 12-16	Interviews	Semi-structured interviews with individuals and with a focus group

Table 7 Structure for the observation periods and procedures applied in the ethnographic fieldwork.

The chosen structure was inspired by Spradley's (1980) illustration of change in the scope of observation from descriptive observations to focused observations.

First, the observations were conducted using an unstructured explorative approach, with the aim of informing about what was going on. Questions were asked about the space (operating room, logistical issues), actors (roles, competencies, responsibility), activities (preparation, sterilization, documentation), instruments (surgical instruments, materials), events (surgical procedures), and goals. Then, the observations become more focused, with an increased awareness of the communication and relationships in the interdisciplinary collaboration. I have particularly focused on what people do, what they say, and what dynamics can be observed among the participants. Finally, I have been more elective in terms of my observations, as well as more interested in how the participants clarify their communication and what considerations form the background to their actions. During the focused observations, the questions encouraged the participants to express their feelings, experiences, and thoughts.

Throughout the whole process of the fieldwork, that is, observing, conversing, interviewing, analyzing, and interpreting, I have as a researcher asked myself the following question, taken from Atkinson (2015, p. 57), "What might this be a case of?" This iterative movement between engagement and reflections has been practiced in order to explore the phenomenon of communication and relationships in interdisciplinary collaboration in the operating room.

PHASE I took place over a period of ten months in 2014. During this period, 60 surgical procedures were observed, corresponding to 240 hours of observation (Table 8). All the observations took place during day time.

The Extent of the Observations, Interviews, and Focus-Group Interviews				
	Hour of observation	Surgical procedures (*n*)	Interviews (*n*)	Focus group interviews (*n*)
Surgery Unit I	110	36	5	1
Surgery Unit II	130	24	8	1

Table 8 The extent of the observations, interviews, and focus-group interviews.

There was a four-month observation period in Surgery Unit I in which the surgical procedures were elective and characterized by being organized as an accelerated care pathway performed by firmly established surgical teams. Similarly, there was a four-month observation period in Surgery Unit II in which the knee and hip arthroplasties/replacements carried out on particularly vulnerable patients (category of surgical procedures, age, comorbidity, and ASA score) were performed by ad hoc surgical teams.

The differences in the categories of surgical procedures observed during the focused observation period are shown in Table 9. As described above, the observation of surgical teams performing hip and knee arthroplasties was prioritized. In some situations, the surgical teams were observed while performing other types of surgical procedures, such as knee arthroscopies. These situations occurred if a different category of surgery was planned in between scheduled hip and knee arthroplasties in the operating room. A total of 25 routine surgical procedure categories were observed, mostly in Surgery Unit I, while a total of 14 complex surgical procedure categories were observed, mostly in Surgery Unit I. In total, the surgical teams were observed performing 25 hip arthroplasties and six knee arthroplasties during the focused observation.

Categories of Surgical Procedures					
	Hip Primary/ Rev.	Knee Primary/ Rev.	Arthroscopy Routine/ Complex	Other Routine/ Complex	Total Routine/ Complex
Surgery Unit I	14/1	2/2	2/0	3/1	21/4
Surgery Unit II	1/9	1/1	0/0	0/2	2/12

Table 9 Categories of surgical procedures observed during the focused observation period.

5.2.3.2 The Role of the Researcher

On the one hand, as a researcher, I was engaged in passive participation, in the sense of being present at the scene of action in the operating room without participating in the surgical procedures (Spradley, 1980). On the other hand, I was engaged in active

participation, in the sense of being present, engaging, and interacting with the surgical teams during their everyday lives spent performing surgical procedures in the operating room. I was guided by the intention to explore or as expressed by Atkinson (2015), occupy a shared social world and engage in mutual attention. A typical day of participant observation began by participating in the morning staff meeting, in which information was shared about the patients undergoing surgery on that day, and the staff were allocated to the different operating rooms. Afterwards, I followed the nurses who were allocated to the operating room where the hip and knee arthroplasty surgery was to be performed, and I observed the activity in the surgical team in the operating room for the rest of the dayshift. We had conversations before, during, and after each surgical procedure to the extent that it was possible and occurred naturally. As Atkinson (2007) noted, one should, as a researcher conducting ethnographic fieldwork, be aware of the field relations and the extent to which the people being observed know about the role of the researcher. I introduced myself when meeting any health professionals in the operating room for the first time, and I informed them about the scope of the research, as well as my background as a former critical care nurse. The members of the surgical team were familiar with having persons observing them in the operating room. This familiarity was based on former observation studies that included the researchers being present, or experiences from training and education programs, including students and new employees observing for the purpose learning and becoming familiar with the surgical procedures.

According to Atkinson (2007) and Kristiansen and Krogstrup (2015), analysis and interpretation will always occur during the collection of empirical data through observations in a field study. The observations and fieldnotes will be affected by the researcher's preunderstandings, as well as by related relevance criteria. It was impossible for me as a researcher to avoid sorting and prioritizing during the observation, so conscious and unconscious interpretations of what was seen and what was heard were present in the moment and afterward. Therefore, it was important for the data collection and the analysis that I was aware of, and reflected upon, my preunderstandings throughout the whole research process. I have concretely reflected on how my theoretical background in the shape of my master's education in humanistic health science, and my practical experiences derived from training concerning communication and relationship skills for health professionals, have impacted my observation of communication and relationships in interdisciplinary surgical teams. Being present and engaged in the observations, I reminded myself that I have to exclude theories and experiences. I sought release from interpretations in the light of theories. I reminded myself that I just had to be receptive – listening, looking, and asking myself the question "what is going on?" I made reflection notes in the fieldnotes if I became aware of any preunderstanding emerging.

According to Atkinson (2007, 2015) and Brinkmann and Kvale (2015) the researchers' preunderstanding will always be an active part of the dialogue between the participant/informant/interviewed and the observer/researcher/interviewer.

Additionally, the preunderstanding is an essential part of the researcher's involvement in the reflective research process underlying social research. This is a part of the essential reflexivity that, according to Atkinson (2015), is the condition whereby any social research helps to constitute the phenomenon under investigation.

5.2.3.3 Fieldnotes

As a researcher applying ethnographic principles, I have endeavored to use the three principles for making an ethnographic record highlighted by Spradley (1980). The language identification principle is used to identify the language used in the fieldnotes. The verbatim principle is used to make a verbatim record by what people say, while the concrete principle is used to make concrete descriptions of the activity being observed. During the first exploration and unstructured part of the participant observation, fieldnotes were made when I was alone. These notes, in the form of keywords or minor quotes expressed by the observed participants, were written up afterwards or the following day into a more comprehensive text, which also contained reflections, further questions to explore, and thoughts that I was curious about. The fieldnotes from these observations also described the specialized technical language used by the participants regarding the surgical procedures, surgical instruments, and materials – production names as well as nicknames. Afterwards, more and more focused observation fieldnotes were written openly while observing the surgical teams performing surgical procedures. The fieldnotes were written as a verbatim text of what people said to each other (what was heard?) and concrete descriptions of what people did (what was seen?) in order to apply a systematic and methodical approach to the exploration, as recommended by Atkinson (2015). As it is humanly impossible to write down everything that is said and occurred, fieldnotes have been made to the greatest extent possible, and to the extent that seemed relevant in light of the focus on communication and relationships, as based on my knowledge and understanding of the practice. I made it clear to myself that I should always strive to be as "naked" and currently sentient as possible, which meant that repeated communication and coordination activities were described every time they occurred. For example, the repeated check-in and check-out safety procedure. This strategy allowed for the repetition of procedures and conversations between teams, actors, and contexts about technical procedures over time, and it set aside the "tip-of-the-iceberg" assumption (Spradley 1980). Following the approach of Spradley (1980), these extensive notes can represent a condensed picture of what actually occurred in the operating room, that is, a sort of condensed account. These fieldnotes, which also contained the participants' reports and essential verbal exchanges between the participants, were written into coherent text immediately after each field observation. In this part of the research process, the situations and events observed was recalled by reading the condensed version, as well as the keywords and phrases, and the details were filled in. An expanded version of what occurred was then written, which Spradley (1980) termed the expanded account. When engaged in writing the expanded version, I allowed space to be made for upcoming reflections and wonderings in order to foster new questions to ask the participants and keep reflections in mind for the following

analysis process. These reflections were written in the margin beside the expanded text, and they were read and used in the following individual interviews if it was considered appropriate.

5.2.3.4 Field Conversations

As an essential part of the fieldwork, I engaged in different forms of conversations. I participated in conversations that naturally occurred between participants in the surgical teams, as well as in conversations about values and attitudes toward quality of treatment, quality of teamwork, and quality of safety culture. These conversations, which were referred to as field conversations by Cato Wadel (2014), represented an aspect of being present in the operating room, and they were the source of inspiration for the development of the individualized interview guides.

5.2.3.5 Semi-Structured Interviews

In order to gain insight into the intentions and attitudes that motivated the participants' behavior, individual semi-structured interviews (n=13) were conducted with the OR nurses, AN nurses, surgeons, and anesthesiologists based on previous observations (Spradley, 1979). The selection of participants for the interview process was derived from the participant observations. The semi-structured interviews were conducted based on an individualized interview guide. First, questions were asked about the participants' reflections, attitudes, and experiences according to the interdisciplinary teamwork and safety culture in the unit, while, second, questions were asked about the participants'' attitudes and experiences according to the quality of care and recommendations for improvement. Typically, the questions were expressed as open-ended, they were answered, and then detailed questions related to specific observations marked for further exploration were asked. The interviews took place in a quiet place in the surgical unit (a free office), and they had a duration of ½ – 1 hour. Finally, two semi-structured interdisciplinary group interviews (4–5 participants) were conducted in order to comprehend the participants' culture, attitudes, and ways of speaking about interdisciplinary collaboration (Bryman, 2012) (Interview Guide, Appendix 2.). The individual interviews and the focus group interviews were taped. The audio recordings of the interviews were fully transcribed by the researcher.

5.2.4 Reflexivity and Validity Procedures

In an effort to address the legitimation of the qualitative components in PHASE I (data collection, data analysis, and interpretation of findings), I have throughout the iterative process sought the verification of the data, analysis, and interpretation by checking, confirming, ensuring, and being responsive. When applying these processes, I have been inspired by methodological perspectives concerning the strategies for verifying and determining validity and reliability in qualitative research, as suggested by Morse and Mitcham (2002), Morse (2015), and Brinkmann and Kvale (2015). According to Morse et al. (2002), verification strategies should be woven into every phase of the

entire research process, since the process is iterative - going back and forth during the processes of data collection, analysis, and interpretation.

During PHASE I, my attention was focused on ensuring methodological coherence, being persistent, sampling those participants who best represented the research topic, collecting and analyzing concurrently, thinking theoretically, and checking my reflections and interpretations.

In concrete terms, the verification strategies applied to ensure validation and reliability in this phase were conducted by a) having prolonged engagement, b) being present and attentive throughout my time in the surgical units, c) sampling participants who had knowledge about the core task and different degrees of experience, d) systematically recording what was observed in fieldnotes, e) writing detailed, verbatim fieldnotes during the observations in the operating room, and then writing extended fieldnotes afterwards, f) using the fieldnotes and written reflections in conversations and interviews with participants in order to obtain clarification and confirmation from the participants during the fieldwork, g) performing the analysis coding processes several times on a paper version of the verbatim texts and a digital version in NVivo (version 10), and h) debriefing with peers during all the processes of PHASE I.

Finally, I made certain considerations in light of my role and my capacity as researcher - namely, the researcher's responsiveness. Such an approach is essential in a longitudinal research study that takes place in a rapidly changing and complex organization. I intended to be as responsive as possible when schedules were changed, unforeseen situations occurred, and new opportunities were visible. Inspired by Schein (2013) and the concept of humble inquiry, I intended to foster relationships with the participants by listening, asking questions, and paying attention – an inquiring approach derived from an attitude of interest and curiosity. Due to my decision to use the theory of relational coordination as a framework for the study, I was aware of the need to be responsive and open-minded in order to accommodate and minimize what Morse and Mitcham (2002) termed the "pink elephant" bias (Morse, 2015). This metaphor is used to describe the tendency for the researcher to see what is expected.

5.2.5 Step from PHASE I to PHASE II

The data, analyses, and findings from **PHASE I** informed the following research phases. In **PHASE II**, the recommendations for interventions and the development of the customized survey are built upon the data and analysis found in **PHASE I**. Thus, integration occurs by ways of linking the methods of data collection and analysis, which Fetters, Curry, and Creswell (2013) termed building. The data, analyses, and findings from **PHASE I** are further integrated with the data, analyses, and findings from **PHASE II** and **PHASE III** in the final integrating and interpretative phase, **PHASE IV**.

5.3 PHASE II – Organizational Intervention Process

The objective of PHASE II was to explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units. The following procedures were completed in PHASE II, as inspired by the theory of relational coordination (Gittell et al., 2011; Gittell, 2016), and inspired by the framework for evaluation of organizational intervention presented (Nielsen and Abildgaard, 2013):

- Monitoring an organizational intervention process during the initiation, screening, action-planning, implementation, and evaluation phases.
- Planning *Intervention I* based on the findings from PHASE I.
- Customizing the RC Survey.
- Facilitating results feedback.
- Prioritizing *Intervention II* based on results of PHASE III.
- Evaluating the organizational intervention.

As a result of the procedures applied during PHASE II, the following outcomes were generated: a description of an organizational intervention process, a customized RC Survey, and a qualitative description of an evaluation process. In the following, the designation “RC Survey” will be used for the customized survey distributed in this study. The analyses and findings of PHASE II are presented in *Chapter 7 Organizational Intervention Process*.

5.3.1 Setting

PHASE II was conducted in Surgery Unit II from August 2014 to May 2016. This unit was chosen because the senior management and frontline managers had experienced the need for organizational interventions in order to improve the interdisciplinary collaboration. This need had emerged because the task performance was challenged by delays, inefficiency, improper utilization of capacity, and dissatisfaction among the involved health professionals. The intervention process was initiated in collaboration between two clinics in a university hospital, namely the orthopedic clinic and the anesthetic clinic.

5.3.2 Participants

Three groups of participants were involved in PHASE II, although some participants were members of more than one group.

The change team, was composed of frontline managers (six persons), representatives from senior managements (four persons), and participant representative from the workgroup of nurses (four persons) who were chosen by their frontline managers. No employee representatives from the workgroup of surgeons or the workgroup of

anesthesiologists were included in the change team. The change team included a total of 14 participants.

Health professionals in the surgical unit, including operating room nurses, nurse anesthetists, nurse assistants, surgeons, anesthesiologists, and frontline managers. This group included between 137 and 150 participants.

The management group, included the senior managers and frontline managers. The management group included a total of ten participants.

5.3.3 Data Collection and Applied Procedures

The data collection and procedures applied during PHASE II draw on methods and models derived from the field of organizational science (Gittell, 2002b, 2009, 2016; Gittell et al., 2011) and evaluation science (Nielsen and Abildgaard, 2013).

Qualitative data were obtained by monitoring an organizational intervention process during the phases commonly observed in an organizational intervention, as illustrated in the framework for evaluation of organizational interventions (Figure 7, p. 44). The principles of relational coordination were used as tools for organizational change during the organizational intervention process (Box 1, p. 28). The data collection was achieved through participating in and writing notes about:

- Meetings with the management group (4 meetings).
- Change team meetings (11 meetings).
- Introduction meeting, kick-off meeting, and status meeting for all health professionals (3 meetings).
- Final evaluation workshop with the change team.

The notes captured the challenges expressed, the participants' attitudes and behavior, and the changes described as being derived from the external context - to the greatest extent possible. In addition, internal documents describing the intervention process and initiatives were read.

Quantitative data deriving from the baseline measurement of relational coordination conducted in PHASE III were integrated trough building by informing the approach of data collection in PHASE II. The data collection and the procedures applied for the quantitative data are described later in section *5.4 PHASE III - Assessing Relational Coordination and Safety Culture.*

Finally, quantitative data concerning the performance outcomes were obtained from the national registers of quality in orthopedic surgery.

5.3.4 Reflexivity and Validity Procedures

In PHASE II, I was inspired by several different perspectives in my quest to ensure both validity and reliability.

First, I was inspired by the methodological perspectives concerning the strategies for determining validity and reliability in qualitative research, as suggested by Morse (Morse et al., 2002; Morse, 2015) and Brinkmann and Kvale (2015). My attention was focused on ensuring methodological coherence, being persistent, and checking my reflections and interpretations with members of the change team. Throughout the intervention process, I attempted to perform the verification of the data, analyses, and interpretation by checking, confirming, and being responsive. As in PHASE I, I was led by the assumption that the research process is iterative and hence validity procedures should be woven into every phase of the entire research process (Morse et al., 2002; Morse, 2015; Brinkmann and Kvale, 2015). In concrete terms, the verification strategies used in relation to validation and reliability in this phase were performed by a) being present and attentive during my participation in the change team meetings, b) systematically recording my observations and experiences in notes, c) writing detailed meeting reports and sharing those reports with the change team afterwards, d) documenting the activities during the development period and the implementation period, (agendas, meeting reports, participants, decisions made), e) presenting the findings derived from the fieldwork to the change team and senior management and questioning their recognizability, f) testing the customized survey on the frontline managers before distributing it to all respondents, g) presenting the results of the RC Survey Time 1 to the change team and senior management and questioning their recognizability, and h) discussing the findings derived from the fieldwork and the results of the RC Survey Time 1 with other researchers, with a focus on interdisciplinary teamwork, psychological safety, and safety culture and inviting shared reflections.

Second, a framework for the evaluation of both the process and the outcomes was used in order to increase the internal and external validity of the evaluation of the organizational intervention (Nielsen and Abildgaard, 2013). Due to using such framework, data from different sources with different characteristics paved the way for mixed methods integration. In this organizational change process, the involved health professionals played an important role in developing and implementing the activities included in the interventions. Therefore, the fact that the health professionals were also involved in the change team seemed to have a significant influence on the success of the interventions. According to Nielsen and Abildgaard (2013), health professionals' participation in a change team makes it possible to use the health professionals' specific knowledge, ensure ownership of the interventions, and ensure the integrating of new activities in the existing structure, work processes, and relationships. Throughout this phase, I remained attentive to the role of frontline managers and senior managers in initiating, planning, implementing, and supporting the interventions, due to the great importance that these actors are considered to have in relation to a successful change process.

Third, to ensure the validity of the quantitative components in PHASE II, the data were collected using questionnaires validated in the Danish language and context. The tests for the reliability and validity of the RC Survey are discussed when describing the validity and reliability analyses applied in PHASE III in section *8.2 Test for Reliability and Validity.*

Finally, considerations were made concerning the dual role of being a researcher and a participant in the organizational change process. I intended to balance proximity and distance by listening to the participants experiences and challenges, asking questions in order to obtain knowledge about the progression of the organizational change process, being available throughout the process, and facilitating the final work shop.

5.3.5 Step from PHASE II to PHASE III

The data and analyses from **PHASE II** have informed the subsequent research phases by influencing the assessment tool designed to measure relational coordination in surgical teams that was used in **PHASE III**. Again, integration occurs by ways of linking the methods used for data collection and analysis, which is known as building (Fetters et al., 2013). The data and analysis from **PHASE II** were also integrated with the data, analyses, and findings/results from **PHASE I** and **PHASE III** in the final integration process at the interpretation level, which occurred in **PHASE IV**.

5.4 PHASE III – Assessing Relational Coordination and Safety Culture

The objective during PHASE III was to assess whether relational coordination and safety culture in a surgical unit are improved during an organizational intervention process. The following procedures were completed in PHASE III, as inspired by the theory of relational coordination (Gittell et al., 2011; Gittell, 2016), and theoretical perspectives on safety culture (Sexton et al., 2006):

- Assessing relational coordination via the distribution of the RC Survey before, during, and after an organizational intervention.
- Assessing health professionals' attitudes toward safety culture via the distribution of the SAQ-DK Survey during and after an organizational intervention.
- Analyzing the quantitative data obtained from the RC Survey.
- Analyzing the quantitative data obtained from the SAQ-DK Survey.
- Comparing the quantitative data obtained from the surveys

As a result of the procedures applied during PHASE III, the following outcomes were generated: descriptive and statistical analyses of the data, graphical illustrations of the collaboration ties, and a comparative analysis of relational coordination and safety

culture. The analyses and findings from PHASE III are presented in *Chapter 8. Assessing Relational Coordination and Safety Culture*

5.4.1 Setting

PHASE III was conducted in Surgery Unit II and it was carried out from December 2014 to June 2016.

5.4.2 Respondents

The health professionals in Surgery Unit II, who took part in the functional workgroups, including OR nurses, AN nurses, nurse assistants, surgeons (senior surgeons), anesthesiologists, and coordinating nurses were chosen by the change team to be respondents to the surveys.

5.4.3 Data Collection and Applied Procedures

The methods and procedures applied during PHASE III were based on the theory of relational coordination and the Relational Model of Organizational Change (Gittell et al., 2011; Gittell, 2016). In addition, theoretical perspectives regarding safety culture and assessment of safety culture (Sexton et al., 2006) were used. The utilized theoretical lenses are presented in *Chapter 3*.

In order to measure relational coordination during an organizational intervention process quantitative data were collected using the customized RC Survey provided in PHASE II.

Further, to measure the health professionals' attitudes toward safety culture during an organizational intervention process, quantitative data were collected using the validated Danish language version of the Safety Attitudes Questionnaire (SAQ-DK) (Kristensen et al., 2016a, 2016b; Kristensen et al., 2015a) and the guidelines for measurement and analysis using the SAQ (Sexton et al., 2002).

5.4.3.1 Distribution of Surveys

The RC Survey and the SAQ-DK have been used as survey instruments in this study. Ideally, the plan was to distribute both surveys at the same time: before, during, and after the implementation of interventions. However, the validated Danish language version of the SAQ was not available for use before the implementation of *Intervention I.* Hence, the surveys were distributed as shown in the figure below (Figure 11).

Figure 11 Timeline for the distribution of surveys and the implementation of interventions.

5.4.3.2 Relational Coordination Survey

During PHASE III, the RC Survey was used to measure the relational coordination between the workgroups involved in the work process (OR nurses, AN nurses, nurse assistants, surgeons, surgeon assistants, anesthesiologists, coordinating nurses, coordinating surgeons, and ward nurses). The survey posed questions related to the seven dimensions of communications and relationships, and it was distributed to respondents three times, namely at Time 1, Time 2, and Time 3. The questions used in the RC Survey at Time 1, Time 2, and Time 3 were identical, and they are shown in the customized RC Survey (Table 17 p. 138) as well as in the full version found in Appendix 3. Each respondent was invited to answer each of the seven questions with respect to each of the other workgroups, resulting in 63 questions per respondent (nine workgroups were involved). The respondents were asked to answer the questions with responses recorded on a five-point Likert scale, which was supplemented with the possibility of answering "Not Applicable."

Prior to the distribution of the survey, the nurse managers, surgeon manager, and anesthetist manager were asked to submit the names and email addresses of the health professionals who should receive the questionnaire, as described in *5.4.2. Respondents.* A link to the survey was emailed using the web-based survey tools available from Relational Coordination Analytics (version, 2014). The link was sent to the respondents' work email addresses, as provided by the frontline managers.

The RC Survey was distributed before *Intervention I* (Time 1) to 150 respondents, then to 150 respondents some eight months after *Intervention I* (Time 2), and to 138 respondents eight months after *Intervention II* (Time 3). This meant that the survey was distributed three times during the period from December 2014 to June 2016 (Figure 11). The survey was open for competition for 25-35 days (variation caused by holidays). During this period, reminders were sent to non-respondents with a seven-day interval. The distribution procedures for the RC Survey were the same, except that at Time 2 and Time 3 the surveys were distributed together with the survey measuring the health professionals' attitudes toward safety culture (SAQ-DK), which will be described in the next section.

5.4.3.3 Safety Attitudes Questionnaire

The SAQ-DK was used to measure the health professionals' attitudes toward safety culture in the surgical unit by asking questions about the six dimensions: teamwork climate, safety climate, job satisfaction, perceptions of managers, working conditions, and stress recognition. In addition, the questionnaire included 6 items outside scales. All the items in the Danish version (SAQ-DK), are shown in Appendix 4. The SAQ-DK includes 32 items, and the respondents were asked to answer the SAQ-DK on a five-point Likert scale:*1 = Disagree strongly, 2 = Disagree slightly, 3 = Neutral, 4 = Agree slightly, and 5 =Agree strongly* - supplemented with the possibility of answering *Not Applicable*. The items from the two dimensions included in the SAQ-DK, namely teamwork climate and safety climate, which are considered to be the most essential for the focus of this study are shown in Table 10. The SAQ-DK was distributed together with the RC Survey to 150 respondents at Time 2 and then to 138 respondents at Time 3 (Figure 11).

Dimension	Items
Teamwork climate: The health professionals' perceptions of the collaboration within the surgical unit in relation to providing safe care for patients	• *Input is well received in this clinical area* • *In this clinical unit, it is difficult to speak up if I perceive a problem with patient care* • *Disagreements in this clinical area are resolved appropriately* • *I have the support I need from other personnel to care for patients* • *It is easy for personnel here to ask questions when there is something that they do not understand* • *In this clinical area, we work together as a well-coordinated team*
Safety climate: The health professionals' attitudes toward patients' safety and the management of clinical risk	• *I would feel safe being treated here as a patient* • *Medical errors are handled appropriately in this clinical area* • *I know the proper channels to direct questions to regarding patient safety in this clinical area* • *I receive appropriate feedback about my performance* • *In this clinical area, it is difficult to discuss errors* • *I am encouraged by my colleagues to report any patient safety concerns I may have* • *The culture in this clinical area makes it easy to learn from the errors of others*

Table 10 Teamwork climate and safety climate, the included dimensions, definitions and items, as adapted from Sexton et al. (2006) and Kristensen (2016a, 2016b).

The SAQ-DK was chosen because it contains items that focus on both the teamwork climate and safety climate, and it captures elements that are expected to offer insight into the health professionals' level of trust in each other in terms of their “courage to speak up”. Therefore, the answers are expected to aid understanding of the level of safety in the surgical teams, which Edmondson (2012) referred to as psychological safety. The SAQ is a commonly used tool for culture measurement in surgical settings (Sacks el al., 2015). In addition, the SAQ was chosen because it has been tested and validated widely in the United States (Sexton et al., 2006), Europe (Zimmermann et al., 2013), and Scandinavia (Deilkås and Hofoss, 2008; Nordén-Hägg et al., 2010). The Danish version of the SAQ, the SAQ-DK, was validated in 2015 (Kristensen et al., 2015a).

5.4.4 Reflexivity, Reliability and Validity Procedures

In order to ensure the validity of the quantitative components during PHASE III, the data were collected using questionnaires validated in terms of the Danish language and context. The necessary considerations at this stage involved the selection of respondents to the surveys and the form of distribution of the surveys. The change team discussed the selection of respondents and made the choice to include all health professionals working in Surgery Unit II, that is, both part-time and full-time employees. The managers of each workgroup were asked to submit the names and email addresses of the respondents prior to each distribution (Time 1, Time 2, and Time 3). Email was chosen as the distribution form, since it represented the usual channel for information exchange within the unit, as well as because face-to-face extradition of the survey and anonymous submission were considered to be too time consuming and unmanageable due to the health professionals’ changing working hours. To overcome the potential risk of a low response rate, written survey information was sent to the frontline managers, who undertook the task of encouraging their co-workers to respond to the surveys – verbally at daily meetings and in writing in an informational email. Furthermore, the strengths of the RC Survey and the SAQ-DK were tested for reliability and validity, with a focus on internal consistency, structural validity, inter-scale correlation, and content validity, presented in section *8.2 Test for Reliability and Validity.*

5.4.5 Step from PHASE III to PHASE IV

The data and analyses involved in the assessment of relational coordination and safety culture in **PHASE III** informed the organizational intervention process going on in **PHASE II**; hence, **PHASE II** served to build **PHASE III** and to build on **PHASE III** (Figure 6, p. 40). Furthermore, the data, analyses and results from **PHASE III** were merged with the data, analyses, and findings from **PHASE I** and **PHASE II** in the final integration process at the interpretation level during **PHASE IV**.

5.5 PHASE IV – Integration at the Interpretation Level

The objective during PHASE IV was to provide recommendations for improving collaboration and safety culture in interdisciplinary surgical teams. However, PHASE IV differs from the other phases, since no new data were collected. In this phase, mixed methods integration at the interpretative and reporting levels occurred. The integrated analyses and mixed methods findings are presented and discussed in *Chapter 9. Transforming Communication and Relationships in Surgical Teams.*

5.5.1 Legitimation Procedures

In an effort to address the legitimation of the mixed methods integration of qualitative and quantitative findings during PHASE IV, relevant mixed methods legitimation types were assessed. Onwuegbuzie and Johnson's (2006, 2011) approaches to legitimation in mixed methods research were used. Legitimation is the term preferred by Onwuegbuzie and Johnson over the term validity, since the term legitimation is used by both quantitative and qualitative researchers. As highlighted previously when referring to the work of Morse et al. (2002), I intended to weave legitimation strategies into every phase of the entire research process. To address the specific threats of legitimation that are relevant to the mixed methods design and integration, I have been inspired by Onwuegbuzie and Johnson´s (2011) typology of mixed methods legitimation types. The key considerations here are made associated with the legitimation types: sample integration, inside-outside, sequential, conversion, weakness minimization, and multiple validities.

To secure sample integration, expressing the extent to which it provides quality, comparing findings derived from a sample with findings derived from another sample, only data and findings deriving from the same sample are integrated. This has the consequences, that not all data derived from the ethnographic fieldwork in Surgery Unit I has been included when integrating the findings from PHASE I with the findings from PHASE II and PHASE III.

To accommodate the legitimation of the appropriate use of insider' and outsider' views, both insider perspectives (quotations from health professionals collected through the ethnographic fieldwork and the semi-structured interviews, the health professionals' measurements of relational coordination, and my own insider's view as health care professional) and outsider's view (my views as the researcher, including the theoretical framework used and the descriptive and statistical analyses of the health professionals' measurements of relational coordination) have been incorporated into the understanding of the phenomenon (interdisciplinary collaboration and safety culture) in an accurate, balanced, and equally emphasized way. This balanced incorporation of both insider' and outsider' views is in accordance with the pragmatic stance chosen in this mixed methods study, as well as with the purpose and the objectives

(exploration, assessment, and providing), the research questions, and the final integration process for the findings at the interpretation level.

In a multiphase design, sequential as well as concurrent phases are conducted. In this study, PHASE I was followed by PHASE II, III, and IV, which demonstrates the sequential design. I have sought to minimize the potential threats to legitimation that might arise due to the sequential design. In this case, the potential effect of the findings from PHASE I on the screening and planning of the interventions in PHASE II was both intended and appropriated. The results obtained from the baseline measurements of relational coordination during PHASE II were used when analyzing and comparing the data from the RC Survey at Time 1, Time 2, and Time 3 during PHASE III, which was also intended and appropriated. A possible sequential threat to legitimation, might exist if the measurements of relational coordination during the intervention (results from the RC Survey at Time 2) were presented to the change team and the health professionals during the intervention. To minimize this threat, only the baseline measurements of relational coordination were presented to the change team in order to be used during the implementation and planning processes in PHASE II.

Another legitimation type when using a mixed methods design is conversion, which expresses the extent to which the data are transformed. This legitimation type had required some reflections, as the qualitative data derived from the ethnographic fieldwork during PHASE I, were quantified to a small extent.

Weakness minimization is a type of legitimation that Onwuegbuzie and Johnson (2011) described as the intention to design a study and let the weaknesses from one approach within a mixed methods study be compensated for by the strengths of the other approaches. The findings from the ethnographic fieldwork conducted in PHASE I have been used as bottom-up perspectives when planning the interventions in PHASE II, and thereby they have been used to build up an organizational intervention based on the need for change - from both a bottom-up and a top-down perspective. The findings derived from monitoring the intervention process during PHASE II have provided qualitative experiences of the changes that occurred within the organization (changes in structures, work processes, and relationships). This resulted in a more detailed evaluation of the intervention process than would have been possible if the changes during that process were only measured by the changes in the health professionals' assessments of relational coordination.

Finally, to address the legitimation type known as multiple validities and secure the quality of this mixed methods study, pertinent strategies were described and complied during each of the mixed methods phases. Pertinent qualitative legitimation strategies were adhered to in PHASE I and PHASE II, while pertinent quantitative legitimation strategies were compiled in PHASE III, as described previously in this chapter.

5.6 Ethical Considerations

When preparing the design and the ethical protocol for this study, I explored the ethical principles behind performing research in the field of health science. The study plan has been approved by the North Denmark Regional Research Council (Data Protection Agency Journal, no. 2008-58-0028). No sensitive personal data concerning patients has been recorded or stored. The study plan has also been sent to the North Denmark Regional Ethical Review Board, although that was not demanded, since the study did not directly involve patients and patients' treatment. Furthermore, I have been guided by the Ethical Guidelines for Nursing Research in the Nordic Countries (Northern Nurses' Federation, 2003), as well as by the Declaration of Helsinki (WMA, 2013). These guidelines are consistent with ethical guidelines from other research areas involving human subjects, although the medical researcher's responsibility for the protection of vulnerable patients is particularly emphasized in these guidelines. In order to capture the ethical issues surrounding this mixed methods study, I have been inspired by the considerations relevant to ethical issues in qualitative research presented by Hammersley and Atkinson (2007) and Brinkmann and Kvale (2015). More specifically, I have been inspired by their assumptions regarding ethical issues in ethnography and qualitative research interviewing, which can be grouped under the following headings: informed content, confidentiality, consequences for participants, and the role of the researcher.

5.6.1 Informed Consent

To meet the ethical demands of informed consent, the participants were informed about the study and the consequences of their participation during meetings prior to the fieldwork. During the meetings, the study was presented, and questions were answered. In terms of the presentation of the study, the participants were told what to expect from my presence in the operating room. They were also told about the purpose of the study being to explore the interdisciplinary collaboration in surgical teams by observing what is going on, listening to what is talked about, asking questions, and writing fieldnotes. The theoretical framework of the study, that is, the theory of relational coordination, was presented, as was the intention of using the findings from the fieldwork in the latter interventions within the surgical unit. In addition, the participants were informed by a written statement in which the study was described, and they were told about anonymity and their right to withdraw at any time (Appendix 5). Afterwards, the participants were asked to sign a letter of agreement to participate (Appendix 6). Prior to the interviews, the participants were informed about the purpose of the interviews and their right to anonymity.

Despite my intention to provide the participants with the possibility to make decisions regarding their participation based on comprehensive information, I am aware of the fact, highlighted by Hammersley and Atkinson (2007), that not everything about the study has been told to them. First, as a field researcher, I wanted to go into the operating room with an open, curious, and humble mind, and therefore I had little

knowledge of how the observations and the interviews would proceed in advance. Second, I did not want detailed information to affect the behavior of the participants and thereby to invalidate the conclusions derived from the fieldwork. Throughout the period of observations, I attempted to be as well-known as a person as possible, and I endeavored to build a rapport in order to minimize the behavioral changes due to my presence in the operating room. Despite my intention to provide all the participants with all the necessary information, it has not always been possible. For example, one day, when I was following a coordinating nurse, I participated in the daily surgeons' conference in the morning. During these conferences, surgeons from all the different orthopedic specialties where meet, including surgeons from other specialties than the hip and knee specialty. These other surgeons were not informed about the study or the purpose of my presence in the conference. It also happened that on another occasion one of these surgeons was called to supervise during surgical procedures in the operating room when I was observing. In these cases, I contacted the surgeon directly immediately after the surgery was over, explained the reason for my presence in the OR, and invited questions to be asked if needed.

The respondents to the surveys in PHASE III were informed about them prior to receiving an email containing a link to the surveys. This information was given verbally by their managers, as well as by handing out a written description of the survey.

5.6.2 Confidentiality

The participants who were observed and interviewed during the fieldwork were assured about their right to anonymity, and they were told that the interpersonal communication and relationship dynamics between team members in surgical teams were the focus of the study. This assurance was given to help build a rapport, create confidentiality, and address any suggestions that the observation was intended to evaluate the individual's performance. The participants were also assured that any data arising from their participation would be anonymized and precautions would be taken to protect the participants' privacy. The respondents to the surveys were assured that their responses would be treated anonymously. In order to minimize the recognition of the answers given by respondents in the small workgroups, an analysis will only be presented of the surveys obtained from workgroups larger than five people.

In the operating room, contact between patients who were awake and me as a researcher was avoided. This decision was based on a professional assessment of how best to protect patients undergoing surgery. Such patients are considered to be in a particularly vulnerable position in the minutes leading up to the administration of anesthesia and surgery. The professional assessment was derived from my experiences, knowledge, and preunderstandings due to working as a critical care nurse for several years. When the observations were carried out in a preparation room where the patients were prepared for surgery, an introduction was needed, since these rooms were very small, and it was impossible to remain out of sight. I introduced myself very briefly by saying: "Hey, my name is Birgitte Tørring, I am a nurse and a researcher

in the hospital". I intended the contact between the patient and me to be minimized, and the contact between the patient and the AN nurses to be the focus of the patient's attention.

5.6.3 Consequences for the Participants

Generally speaking, throughout the phases of the study, I have sought to minimize the risk of harm to the participants by informing, securing, and being aware of my responsibility as a researcher. It was important to be aware of that open and close relationships with the participants, would also enable them to be placed in vulnerable situations. I also had to be aware that the participants being observed in the operating room could be worried about doing something wrong in difficult situations, as well as that questioning the interviewees could lead them to reveal information they might later regret having shared.

Finally, I had to recognize the exploitative potential of ethnographic research, as mentioned by Hammersley and Atkinson (2007). I have hence been concerned about the possibility of giving something back to the participants and the surgical teams by taking advantage of the findings derived from PHASE I during PHASE II and PHASE III.

5.6.4 Reflections on the Role of Researcher

The role of the researcher during the ethnographic field study in PHASE I has been described previously (p. 57-59). In the following, I will add some ethical reflections concerning my role as a researcher. Traditionally, ethnographic methodological discussions have highlighted the challenges involved in conducting ethnographic fieldwork due to the researcher's prior deep knowledge of the field and the researcher's active involvement in the field (Hammersley and Atkinson, 2007; Borbasi et al., 2005; Uhrenfeldt et al., 2017). A deep knowledge and understanding of the field could lead to researcher presenting the field in an unrealistically positive light (insider myths). Yet, the methodological discussions also emphasize other challenges that derived from the researcher having no prior knowledge about the field, since such a researcher could be incapable of understanding and appreciating the true character of the everyday life of the group being studied (outsider myths). Having these perspectives about the insider and outsider distinctions in mind, I have endeavored to balance my role as a researcher in the surgical units between being an insider and an outsider. To do so, I have had to strike a balance between being an experienced nurse with professional knowledge about anesthesia and critical care nursing, as well as experiences derived from being employed in the hospital for several years (insider), and being a curious, reflective, and analytical observer in the field of orthopedic surgery without knowledge and experience of being a member of a surgical team in the OR (outsider). In order to balance these ways of being a researcher in the field, I have drawn on my experiences as a supervisor. In particular, my knowledge and experiences concerning how to ask

lineal, circular, reflexive, wondering, and strategic questions have been a great benefit to my role as a researcher in the surgical units.

During PHASE II, the role of the researcher was different. Here, a more direct involvement in the planning, monitoring, and evaluating of the interventions was characteristic. Alongside my Ph.D. education, I have continued teaching and undertaking consultancy tasks in primary and secondary health care with a focus on communication, patient safety, interdisciplinary collaboration, and organizational development. I have therefore fulfilled different roles during these years. In the following, I will reflect on how my background as a nurse, teacher, and consultant impacted the researcher's role during PHASE II.

During the initiation phase of the intervention process in PHASE II, my role and engagement were discussed with the management group. The role of the researcher was clarified and described. I was offered the chance to participate in meetings with the change team, and I was asked to present the preliminary results of PHASE I, so they could be used in the planning of the interventions. Finally, I was invited to facilitate workshops intended to customize the RC Survey, as well as to evaluate the intervention process. As a result, my experience as a consultant during previous organizational development projects was not included in the organizational intervention process in Surgery Unit II. This would otherwise have been an obvious choice. I had to accommodate methodical considerations concerning how the dual roles as of researcher and consultant in the intervention process could be balanced. The roles needed to be balanced, so that the consultant's necessary and strong involvement in the intervention process did not color and impact the researcher's necessary curiosity and analytical interpretation of the process. In addition, the management group had previously used consultancy assistance for various improvement initiatives, which did not yield the desired results. These experiences led to certain perceptions regarding the improvement process, which were exchanged during the change team meetings, as: “We are the ones who know what is needed, and those who know best what can be done in this unit. We do not need help from the outside to solve these challenges.” Therefore, it was not difficult to decide that I, as a researcher, should adopt a traditional researcher role, being more distant, observing, and asking questions about the process – instead of being directly involved in the development and implementation of the organizational interventions.

During PHASE III, the role of the researcher was distanced through email contact to with the participants concerning invitations and a link to participate in the survey, as well as follow-up invitations to participate in the survey sent every eight days for a period of three weeks to those participants who had not yet responded. I intended to establish a relationship of trust built on distance in these emails by securing the anonymity of the responses and inviting the respondents to ask questions if needed. Finally, I signed the email with my name, title, and contact address.

PART III ANALYSES AND FINDINGS

The final part of the dissertation addresses the analyses, findings/results, interpretations, discussions, conclusions, and implications derived from the mixed methods study with a multiphase design, as illustrated in Figure 12.

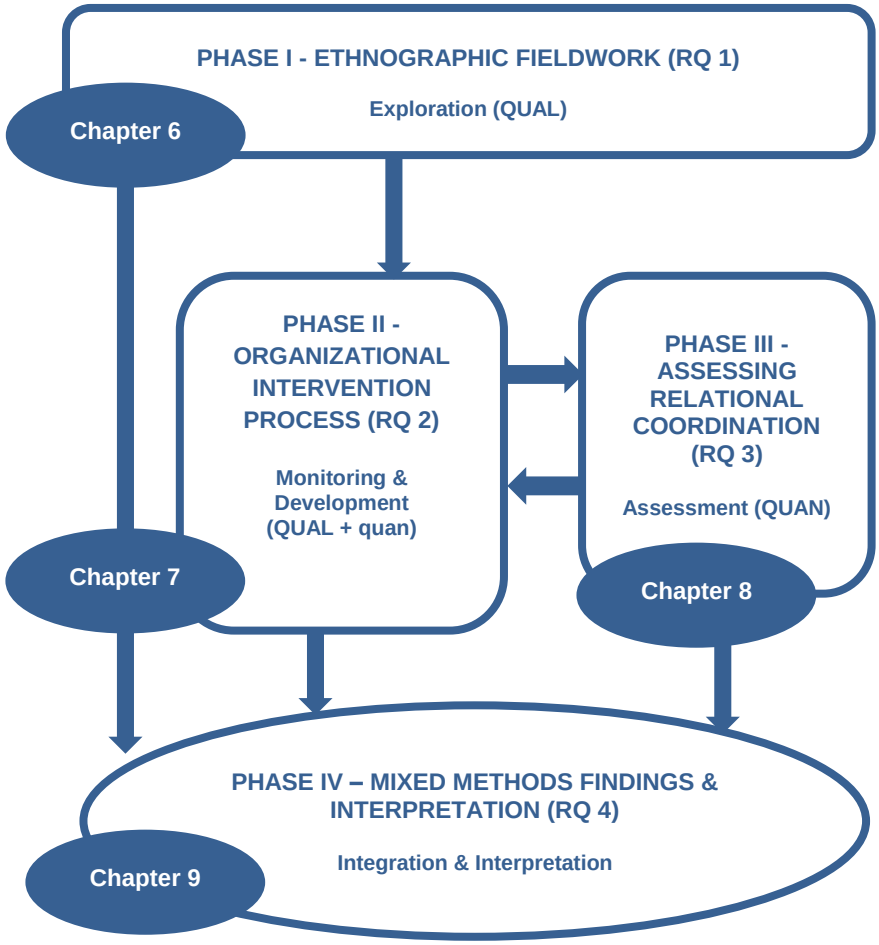


Figure 12 Overview of the mixed methods study with a multiphase design.

Part III of the dissertation is divided into five chapters. In *Chapter 6. Communication and Relationships*, the ethnographic fieldwork is presented (**PHASE I**). the collaboration, challenges, and improvement possibilities seen in surgical teams are described. This is followed by a presentation of the different communication and

relationship patterns identified in the interdisciplinary surgical teams collaborating in the operating room. In *Chapter 7. Organizational Intervention Process*, the organizational intervention process using the theory of relational coordination as a tool for improvement is presented and evaluated (**PHASE II**). In *Chapter 8. Assessing Relational Coordination and Safety Culture,* the analyses and results derived from the measurements of relational coordination and safety culture during an organizational intervention process are presented (**PHASE III**). Then, in *Chapter 9. Integrated Mixed Methods Findings and Interpretation,* the findings, interpretations, and conclusions from each phase of the study are integrated and presented in narrative weaving discussions and joint displays (**PHASE IV**). This integration at the interpretative level enabled the "zooming out of practice" movement, and it provided recommendations for improvement of interdisciplinary teamwork. Finally, Part III concludes the study and presents the implications for both practice and future research in *Chapter 10. Conclusion and Implications*.

The integration of the data and findings through methods occurred through building, while the integration of the mixed methods findings at the interpretative level occurred through narrative weaved discussions and joint displays, as illustrated in Figure 12.

The first integration process occurred through building, when the data and findings derived from the ethnographic fieldwork conducted during **PHASE I** informed the data collection approach applied in the organizational intervention process in **PHASE II**, as described in section *7.1.1 Screening and Planning Intervention I.*

The second integration process also occurred through building, when the data derived from the customization workshop held during the organizational intervention process in **PHASE II** informed the data collection approach used in the assessment of relational coordination in **PHASE III**, as described in section *7.1.2 Customizing the RC Survey.*

The third integration process occurred through building, this time when the data and results derived from the measurement of relational coordination at Time 1 during **PHASE III** informed the organizational intervention process in **PHASE II**, as described in section *7.2 Feeding Back Results and Prioritizing Next Steps.*

The final integration process occurred through narrative weaved discussions and joint displays, when the data from **PHASE I**, **II**, and **III** were brought together for analysis, comparison, and interpretation in **PHASE IV**, as presented in *Chapter 9. Integrated Mixed Methods Findings and Interpretation.*

CHAPTER 6. COMMUNICATION AND RELATIONSHIPS

In this chapter, I address the first research question: *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?* by presenting the analyses, findings, interpretation, discussion, and partial conclusion derived from the ethnographic fieldwork conducted during PHASE I.

Qualitative content analysis, a recognized method for analyzing text data obtained from interviews, focus groups, and observations has been used in the analysis processes during this phase. I have used the definition of qualitative content analysis, given by Hsieh and Shannon (2015, p. 1278), namely "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes and patterns," with the purpose of providing knowledge and understanding of communication and relationships in surgical teams. The qualitative content analysis has examined the language, terms, and activities in order to organize the large amount of text into a manageable number of categories that describe similar meanings or particular concepts. This analysis process, usually referred to as coding, has enabled me to review what the data are expressing. In the iterative analysis process, it became clear to me that the qualitative data from the interviews and the qualitative data obtained from observations were different and therefore should be analyzed differently. The data from the interviews (verbal statements, attitudes, and experiences) were expressed by the health professionals in interview situations separated from the reality of the operating room. The data hence became an expression of "what they say they do". The data from the observations (acts of speech, nonverbal expressions, and activities) were expressed by the health professionals in real teamwork situations in the operating room. To the extent that it was possible for me as an observer to capture their statements and activities, the data in these cases became an expression of "what they actually said and what they did."

First, I listened to all the sound records and read all the data texts repeatedly so as to obtain a sense of the content and the whole. During these initial analytic movements, a range of questions were applied to the data materials, and a variety of attempts were made to organize, code, or categories data. The fieldnotes and transcriptions of the interviews were organized as verbatim text in NVivo (version 10), a computer software program for qualitative data analysis. Second, the transcriptions of the interviews and fieldnotes were read and a simple coding process was conducted (Coffrey and Atkinson, 1996), as presented in section *6.1. Communication and Relationships in Surgical Teams*. Through this analysis process, knowledge concerning the health professionals' attitudes toward collaboration, challenges in collaboration, and improvement of collaboration were obtained. Third, a directed content analysis (Hsieh and Shannon, 2015) based on the theory of relational coordination was conducted, as

presented in sections *6.2. Identification of Communication and Relationship Patterns in Surgical Teams* and *6.3 Different Communication and Relationship Patterns.* Through this analysis process, the health professionals employed in surgical teams were found to have different ways of relating with and communicating to one another, and an identification of the different communication and relationship patterns in interdisciplinary surgical teams in the OR was enabled. Finally, the associated interpretation and discussion are presented, followed by a partial conclusion.

6.1 Communication and Relationships in Surgical Teams

The transcriptions of the interviews and fieldnotes were read, a simple coding process was undertaken, and generic categories and subcategories were generated. Coffrey and Atkinson (1996) use the term coding to refer to indexing the text, a process that links different segments in the data. It is an analytic process in which different levels of complexity can be explored. A choice was made to provide a coding process at the simplest level of complexity immediately after PHASE I by highlighting the text that directly reflects to the themes being talked about during the interviews and the observations. According to Coffrey and Atkinson (1996), coding the data to such generic categories initially adds nothing to the understanding, although this data reduction task will provide an overview of the contents of the texts. This choice to provide a coding process at the simplest level was made because the findings were supposed to serve as useful knowledge for the change team when developing the interventions in PHASE II, as described in *Chapter 7*. The aim was to generate useful knowledge to include in the intervention about health professionals' attitudes toward what constitutes a great collaboration, what challenges collaboration in surgical teams, and how best to improve collaboration. Furthermore, it might be beneficial to capture an insider perspective on the first research question (*What characterizes communication and relationships in interdisciplinary surgical teams?)* before moving to a more detailed analysis. Therefore, I coded the data into the following themes, or as Coffrey and Atkinson (1996) would say, generic categories: "great collaboration," "challenges in collaboration," "improvement of collaboration," as illustrated in Figure 13.

To capture the health professionals' attitudes toward what constitutes, enables, and maintains great collaboration, I read and asked the text the following questions in order to search for what was expressed: "What characterizes interdisciplinary collaboration in surgical teams?" "What emphasizes interdisciplinary collaboration in surgical teams?" and "How to provide great interdisciplinary collaboration in surgical teams?"

To capture the health professionals' experiences of the challenges involved in collaboration in surgical teams, I read and asked the text the following questions to search for what was expressed: "When and how is collaboration challenging?" "What experiences of challenges are there in the daily work performing surgical procedures?,"

“What characterizes the challenges?,” and “How best to react to challenges in collaboration?”

Finally, the health professionals’ attitudes toward the improvement of the interdisciplinary collaboration in the operating room were extracted by reading and asking the text the following questions to search for what was expressed: ”What experiences of the quality of treatment and care provided in the surgical unit are reported?” “How best to improve quality of treatment and care in the surgical unit?” and “How best to improve interdisciplinary collaboration in the surgical unit?”

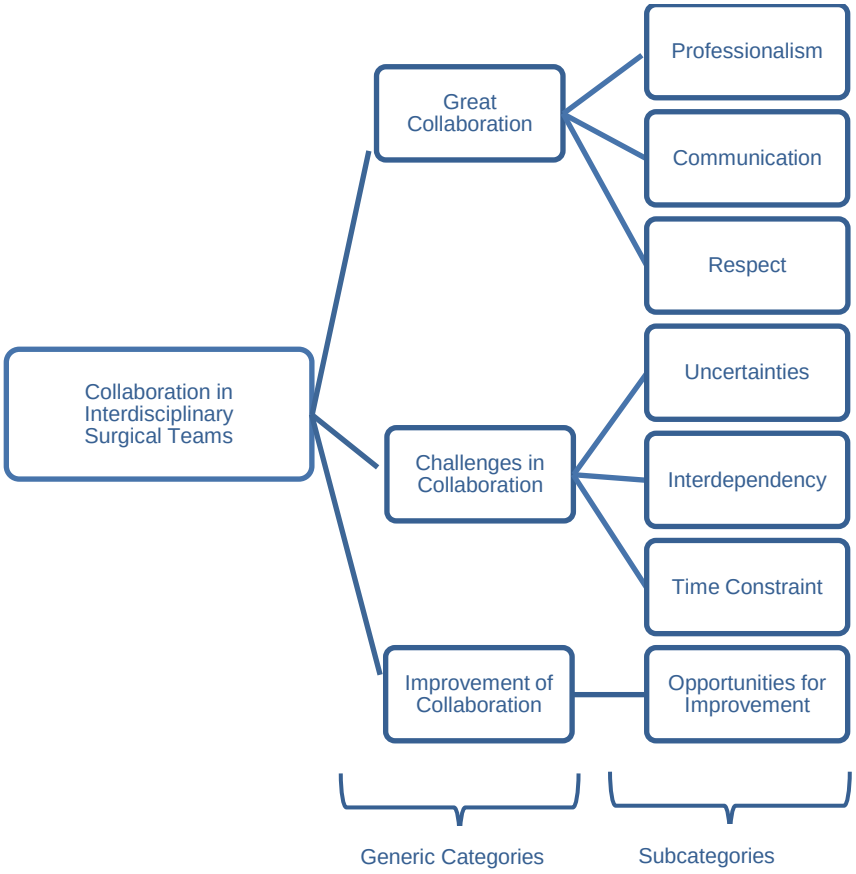


Figure 13 Generic categories and subcategories.

I then read across the highlighted/coded text, which enabled me to expand the simple level of coding and divide the generic categories into subcategories (Figure 13). Some of the labels for the subcategories came directly from the health professionals´ use of

words such as “professionalism,” “communication,” “respect,” and “opportunities for improvement.” Other labels are terms described in the introduction, which I considered expressed points contained in the data texts, for example, “uncertainties,” “interdependency,” and “time constraints.” Most health professionals have experienced challenges caused by logistical problems or the absence of the surgical instruments or materials needed. These challenges are described under the subcategory “uncertainties.”

Finally, I read through the data texts, extracted the essences of the subcategories and prepared a detailed descriptive analysis for each category and subcategory. The findings are presented in the following sections.

6.1.1 Great Collaboration

In this category, the subcategories *professionalism*, *communication*, and *respect* were recurring themes.

6.1.1.1 Professionalism

Generally, the health professionals described the importance of a shared understanding of the core task, respectful and accurate communication, and a high level of professionalism as essential elements of a great collaboration. A consensus existed about the core task and the shared goal: to perform high-quality treatment and care for patients undergoing surgery. This was expressed by an OR nurse during a focus-group interview:

”We are collaborating to perform the best possible pathways for the surgical patients. The patient is always at the center. The surgical procedures and the followed pathway are for the patient. That is what it is all about!” [OR nurse 29]

At the morning planning meetings, during preparation for surgery, and during coffee breaks, the health professionals discussed professional issues. Many of them expressed professional pride and professional commitment. They also understood great collaboration as something that helps to enhance professionalism and make each other better, as described in a focus-group interview by an OR nurse:

> *“If you have a great team, it will affect your professionalism, because you just get more energy and you remember a little better and think a little differently. Maybe you also come up with good ideas.” [OR nurse 34]*

To establish a great collaboration, professionalism is needed. Professionalism within a complex and specialized context, such as the orthopedic surgery areas, is typically described by the involved health professionals, as having specialized knowledge about surgical procedures, instruments, surgical techniques, and patient-related orthopedic challenges. But other skills, such as the ability to collaborate, awareness of the

situation during surgery, and an accessible personality, were also emphasized. This was demonstrated in the dialogue between the OR nurses during preparation for surgery when they discussed how to be an excellent collaborative partner as an OR nurse:

> *The circulating nurse (CN) says, "To be a great OR nurse, you most know the surgical procedures, what is going to happen, what we are going to use, and you have to know the surgeon's preferences." She then asks the surgical nurse, "What is a great OR nurse, in your opinion?" The surgical nurse (SN) answers, "You can be a very skilled surgical nurse, but if you can't cooperate, it is not worth anything! In addition, you must be able to reflect on what is happening along the way. One must be able to argue and stand by your choices. Moreover, you must know what to do if there is something urgent, you must come up with suggestions for how to solve it. You must also engage in what is happening at any time." Then she adds, laughing, "Finally, you must have humor, and I have!" [Team 12.2]*

There was broad consensus among the health professionals that it is essential for a great collaboration that the members of the surgical teams are prepared, equipped with specialized knowledge about surgical procedures and exhibit awareness of the situation. The necessary knowledge and essential skills are also required for health professionals to provide qualified and safe treatment for patients. However, this angle was articulated less frequently.

Another important and recurring factor related to a good collaboration was the atmosphere in the room, which was expressed in different ways, here by a surgeon:

> *"A great collaboration is when the nurses, all of them even the AN nurses, are prepared, and know what it is about. Surgeons can also be unprepared, I know, but it is important. You may be annoyed, if someone says: "Oh, we didn't know" or "We didn't think so!" The patient can actually hear when someone says: "We didn't think so!" Nurses should also be aware of what is going on. They must be attentive, they don't have to attend to the surgeon's every need. It has nothing to do with it, but they must follow the process. And then of course, there shouldn't be too much talk in the OR! It can confuse the patient and create an atmosphere that is not conducive to concentration. I have been in the business for several years, going to the OR is a part of my life, and it is a part of a great collaboration to have a good atmosphere. So, I try not to be to mad if someone is unprepared and annoys me, and I try to avoid letting it shine through too much, because it doesn't promote the process." [SUR 3]*

A relaxed and familiar atmosphere was experienced as an indicator of a great collaboration, since the atmosphere impacts the individual's sense of safety and trust. However, this may have a downside, as expressed in the situation above. In that case, the surgeon highlighted the negative impact of an atmosphere that is too relaxed or

too familiar, with health professionals joking and using small talk, and who are not aware of the patient's need for seriousness and tranquility. This challenge was often dealt with in interviews or contexts where several health professionals were gathered.

6.1.1.2 Communication

One of the key issues in the OR is to ensure that the day's schedule of surgery is completed. To succeed in this, frequent, accurate, timely, and problem-solving communication must take place between surgeons and OR nurses. The OR nurses needed to reflect upon when the communication was timely. As described above, professionalism in OR nursing is based on specialized knowledge, the skills needed to collaborate, and an awareness of the situation. In order to perform this role in a qualified way, the OR nurse must turn to the surgeon several times during the day to obtain information, discuss possible solutions and plan the surgical procedures for the next patient due to undergo surgery, as expressed by an OR nurse:

> *"If something regarding the surgical procedures for the next patient is unclear, you have to catch the surgeon. Because maybe they are not the one who has done the prescription, and therefore they are not prepared to perform the surgery on this patient. I need to think about, when to catch him and say, "What about this patient?" If I catch him at the wrong time, he can't manage and perhaps he is left wondering "What is she talking about? I am concentrating on this!" The best time to ask is in the morning, when the surgeon arrives in the OR. If I am prepared to present the problem, it can be in the mind of the surgeon while operating on the first patient. He may think about the solution and inform me in time. You shouldn't disturb the surgeons too much, they need to concentrate, and you must respect that. You have to wait to ask your questions until they are ready!" [OR nurse 3]*

The understanding of communication as timely was not just a question of whether the communication in question was delayed or initiated prematurely. It was equally an understanding of whether the communication would cause a disturbance or not at the time when it was initiated. These perspectives about the timeliness of communication were also involved in the discussions during a focus-group interview, as expressed by a surgeon:

> *"You should never contact the surgeon at the beginning of the surgical procedures. I have been told this by an experienced OR nurse. You must wait until "his shoulders are dropped." Because only then does he have a handle on what he's doing. Then you can ask the questions about everything else." [SUR 1]*

Problem solving is considered an essential part of performing high-quality surgical procedures in the OR. Questions about how best to solve problems and how to communicate in the surgical teams when shared decision making was needed were expressed often and clearly by the health professionals, although many described it as

challenging due to different approaches to addressing complex and acute situations, interpersonal dynamics, and the tone of voice in the OR, as described by an OR nurse:

> *"It is very important that we speak properly to each other, no matter how hectic the situation is. The tone of voice in the OR is surprisingly special, but you get used to it. I don't like it when people shout. It is important that we help each other, and we function as a team. Nobody is more important than any other person there. I also appreciate that we don't point fingers at each other. We have to talk to each other, we must have a dialogue and help each other. I like that we constantly have a dialogue about what is going to happen! For the most part, we are good at the planning part. But there are just some combinations that do not work quite so well! And it marks you immediately. It does! In reality, it depends on individuals. And one can also notice that there are some surgeons and some OR nurses that doesn't fit together! Then the surgeon is right up in the red zone even before we start, and it spills over! I don't like it at all. [OR nurse 33]*

A problem-solving way of communicating was considered to be an appropriate way to take responsibility for the joint core tasks as well as for shared decision making. This was observed not only in tense situations, but also in daily conversations, where solutions to surgical problems had to be found quickly. This consideration was expressed by an experienced OR nurse:

> *"If I see a problem, I try to ask "What can we do?" instead of talking about the problems again and again, but without doing anything. I would rather come up with a proposal for a solution and say, "Can we try to do so and so?" in order to get something through. Again, you all have to take responsibility for what to do to solve problems!" [OR nurse 3]*

However, diversity appeared again, because a finger-pointing, blaming, and shouting form of communication was also observed in the surgical units and expressed by the health professionals during the interviews. In such situations, the health professionals debated whether they should confront their colleagues about the inappropriate behavior or simply let it pass. A useful example in this regard was expressed by an OR nurse during a focus-group interview:

> *"Once I was the coordinating nurse and a surgeon came to my office. He was very angry and shouted at me, because his patient wasn't called to the OR. I chose to close my ears. When he was gone, I called his manager. I told him about the situation, what had been said, and that I wanted him to know, how the decisions were made, and then I asked him to manage the situation themselves." [OR nurse 6]*

6.1.1.3 Respect

Respect for each other's professionalism is considered crucial for great interdisciplinary collaboration, including respect between professions and between different specialties. Respect could be expressed in different ways, and it could also be lacking. Respect was described very shortly and simply in this statement from an anesthesiologist during a focus-group interview:

> *"What characterizes our teamwork is a great respect for each other's professionalism, but sometimes it is missing. Respect, I think, is such a great keyword!" [ANE 3]*

Mutual respect and the way it was expressed during the everyday life in the OR varied. The health professionals experienced a high degree of mutual respect most of the time, although situations were also observed in which respect was missing, or hostility occurred. In such situations, it became clear that the shared goals of the task faded, and more functional goals appeared, as expressed by an AN nurse in a focus-group interview:

> *"Sometimes, it all comes together, while other times we work in our own camp. We can't come through or above boundaries to each other. These days are the frustrating days. The other days are going well." [AN nurse 16]*

This statement was supported by an anesthesiologist in an interview:

> *"When you have to deal with lots of changes and uncertainties, mental surplus and focus on a shared goal are needed. From an anesthesiologist's point of view, one must have a helicopter view of the OR, but sometimes you are against forces that are only looking at their own OR. That is a challenge, and a dilemma you can be caught in. If you only have eyes for your own patients, and the rooms for surgery are limited, then some sort of fight between sections may occur. That is my experience. Then it is difficult to predict the schedule of surgery, since you have many changes in the schedule during the day and some patients are going to wait for surgery for a long time." [ANE 3]*

When the health professionals were talking about these issues, respect, and familiarity were often mentioned being connected. To make decisions, to be flexible, and to be safe and speak up, were all considered easier when the members of the surgical teams were familiar with each other, as described by an OR nurse during a focus-group interview:

> *"When we are familiar with each other. You know who you are dealing with, and you also know, when you are allowed to do something, and when you will get smacked. It means everything to me! Talking together and listening to each other. Then, they [surgeons] get the most out of me. Then, I will work ten times better.*

Feeling unsafe and uncomfortable, it won't go particularly well. If the surgeon is familiar with his staff – professional and personal, he wouldn't need to use his energy to think "I must keep an eye on this and that. I have to make sure it is all right." Then, he can use his energy on other things. If we know each other, we use less energy worrying. You can even have a great time on the job – and it has a great effect, it makes me feel safe!" [OR nurse 34]

During a focus-group interview, an OR nurse with many years of experience in the operating room talked about the mutual respect between nurses and surgeons, when they know each other very well due to several years of collaboration:

"It is a sort of human acceptance of each other. It means something to me – very much. Because you feel equal in one way or another. When you can talk and socialize a little, and so… I choose my fights with care. There must be something to build on. I mean trust and so on. Trust and respect. And you have to assume, that the other person is responsive to what you are going to say. If you expect to meet a wall, then you don't go for it. You will pull back. You don't want to waste energy on such cases." [OR nurse 30]

Repeatedly, the health professionals mentioned individual factor when reflecting on the issues of respect and great collaboration. Individual factors such as temper, mood, engagement, and the ability to cooperate were all considered to influence the experiences of teamwork. This diversity was expressed by a newly employed OR nurse:

"In our group of nurses, a kind of old-fashioned hierarchy exists. Somebody has status, and somebody doesn't. Experience gives status. Someone who is very experienced has dignity. But someone could be very experienced and very testy, and they don't have much status, I think." [OR nurse 33]

The individual factors considered to impact on the collaboration showed up in different ways. Experienced colleagues who were willing to share their experiences were described as role models and experts who exhibited dignity, which positively impacted the teamwork climate. Yet, dealing with individual factors could be challenging, as expressed by another experienced OR nurse:

"It is hard to tackle, if a surgeon from one moment to the next changes attitude, from being honeyed to be uncomfortable with a colleague. It's hard to tell him "Do you know that it's actually very unpleasant when you exhibit those sudden mood changes when we are operating? It is difficult to deal with. "I do not know if he is actually aware of it." [OR nurse 3]

6.1.2 Challenges in Collaboration

In this category, the subcategories *uncertainties*, *interdependency*, and *time constraints* were recurring themes.

6.1.2.1 Uncertainties

The participants descripted a very complex and changing clinical practice. The quality and effectiveness of job performance were experienced as particularly challenging due to frequent changes and uncertainties in the daily surgical program, the lack of availability of required instruments, and the high degree of interdependency among the health professionals in the surgical teams and across units in the hospital. The participants experienced the uncertainty and changeable practice ambivalently. On the one hand, the unpredictability gave rise to great job satisfaction, while on the other hand, it was a source of frustration, with both perspectives being expressed by an experienced OR nurse:

> *"Our job is varied. You don't know what you are going to do. The job is varied and unpredictable, and that is the reason why I find it attractive and satisfying to work in this operating room. For me it is a positive challenge. Of course, there are days where it is too much." [OR nurse 5]*

Through the observations and the interviews, it became obvious that the participants were proud of their task performance, while the emergent character of the work provided a great deal of meaningfulness to the health professionals, as expressed by an experienced AN nurse:

> *"We have responsibility for the scheduled surgical procedures and for the urgent procedures. We have tasks related to traumatized patients coming to the hospital, patients with cardiac arrest, or patients in need of immediately respiratory assistance. Anything…. Variation, I have always thought of it as enriching." [AN nurse 14]*

Frustrations related to uncertainty and coordination failures were clearly expressed by the participants in a surgical team performing surgical procedures:

> *"The surgeon asks the OR nurse "Why isn't the patient in the OR now?" The OR nurse answers "Always the same here. Perhaps the patients haven't been seen by the anesthesiologist yet!" The surgeon shakes his head and says "Incredible! What if the staff in the control tower at the airport didn't know that the flight will land in five minutes? What would happen then? Incredible!" [Team 26]*

When the health professionals described the unpredictability of their daily task performance, the challenges related to the lack of availability of instruments and surgical materials were very often mentioned, as declared by an OR nurse:

> *"The greatest surprise is whether we have the things we need. Are the instruments sterile or have they been used the day before? Lots of unforeseen things we can't do anything about. We have to deal with whether we can operate on the patient or not. It's really something you get annoyed about because it's the same problem every time. You can't help getting angry. You have to say "Sorry, we are delayed!" or "Could we make some changes and move forward?" [OR nurse 3]*

Sometimes, uncertainties and challenges arise in terms of having staff with the necessary skills present in order to complete the surgical procedures. In concrete terms, sometimes the surgeons are unaware of who should be their assistant until very late in the preparations for the surgical procedures, which can result in delays in surgery. Such challenges were expressed by several health professionals, for example, by a surgeon:

> *"You have to start from the beginning all the time. We have new staff that constantly need to be trained, and there is always the possibility of sterility rupture. I would like to say that I'm glad that the pilots are not new every time they are in their cockpit. Sometimes, I think we work unprofessionally in a hospital, even if it's people we are dealing with – or as I usually say, "It is only people, we are dealing with!" We have to be focused, and sometimes I don't want to be assisted by a student. One must concentrate on the core task, so if you also need to train an assistant in everything from avoiding striking the mask to something else, or if they don't have the physical strength needed, it will be hard to finish, and it may well tip over!" [SUR 3]*

Thus, the uncertainties in the collaboration in the OR had many faces, each demanding different actions from the health professionals. They had to perform these actions in order to maintain the surgical schedule and the flow in the OR.

6.1.2.2 Interdependency

At all times, the interdependency that exists among the health professionals in surgical teams and across units in the hospital was highlighted. The need for coordination and communication was highly emphasized, and the participants expressed their intentions to share knowledge and collaborate in achieving the common goal: high-quality care and high-quality patients' outcomes. Every day, the health professionals experienced a high degree of interdependency in the surgical teams. When observing the preparation prior to surgery, it was clear that the health professionals were striving to do their best in terms of performing their part of the task. A pronounced perception existed that it was very important for the surgical procedures to be completed in a qualified manner, with everyone doing their best. This was expressed when an OR nurse reported on her efforts to be prepared:

> *"It is important for the teamwork that I am able to do my stuff. I must prepare. Because you can feel it immediately if something is new and you haven't seen it many times before. Then, perhaps I will be horsing around thinking "What is that for a handle?" Then, some surgeons will sigh! I will say to myself "Come on, you can do better!" What I am doing is writing and drawing in a notebook every day before going home how best to "prepare the surgical tables" by looking at my colleagues and by looking at the schedule for tomorrow. Then, I will study the drawings and my notes at home and learn. When I arrive in the morning, I am as prepared as I can be." [OR nurse 31]*

The interdependency between the health professionals in the OR had many forms, such as collaborators being prepared and competent, as in the above examples. Another form of interdependency was associated with a timely exchange of knowledge, information, and prescriptions, as expressed by a surgeon:

> *"There are a lot of instruments that OR nurses need to catch from outside the OR. Often, they are running in and out of the room, saying they didn't know this and that. But it is also because of us [surgeons]. We are the ones doing the prescriptions for the preparation of the surgical procedure. And often the prescription is not applicable – we change our decisions during the surgical procedure and therefore it is not possible for the OR nurses to be appropriately prepared – because we don't know what solutions we will end up with. I am relaxed about this, it is just the way it is!" [SUR 3]*

However, feelings associated with frustrations, anger, and resignation were also reported when talking about interdependency and having to depend on collaborators with whom you aren't familiar, as described by another surgeon:

> *"It is very challenging for the collaboration that we, as surgeons, are like gypsies, one day here and one day there. We aren't familiar with the nurses, not at all. It is impossible due to the way our work is organized. Today, I am with a colleague, but otherwise we never speak with any colleagues. There is a big difference between whether we are operating with a colleague where we can engage in professional sparring along the way or if we are with a student who doesn't know what is going on. I am rarely in this unit; therefore, I have nothing to say, I am never involved in the decisions." [SUR 4]*

6.1.2.3 Time Constraints

Time is a non-deniable factor associated with the performance of surgical procedures in the complex and specialized OR. The health professionals talked about time in many different terms, such as "time for the first patients to be in the OR in the morning," "time of incision," "time for the transition of patients in the OR," "time for the preparation of surgical procedures," and "time for patients to be anesthetized." They also described time as being constraining and challenging, since the demands of all these different "times" were to be as soon as possible and as short as possible. For example, a mention of the time made in the surgical team:

> *The SN was preparing the tables for surgical procedures and she was telling her newly employed colleague, the CN, that time was an issue today. She claimed "We have used too much time for the morning meeting today. We have to hurry, we have just been scolded for it. They have just checked our "time of incision" every Thursday and only three out of 50 patients have been on time. It doesn't work. Today, we must focus and be on time!" They work quickly on the preparation and talk together about an upcoming course. [Team 14]*

Having to work under time pressure while at the same time experiencing that the work is done ineffectively was one way of describing the challenges related to time. Different initiatives and structural changes intended to manage the time constraints had been introduced, but time and efficiency remained challenging, as a surgeon explained:

> *"We have had challenges with the time in this unit for several years. We are always late, and it is not effective at all, but the collaboration is okay. A lot of initiatives for improving the efficiency have been introduced during that time without success, and people don't care anymore, it can't be better." [SUR 11]*

Another point of view was that time in the OR was filled with unpredictability that one must navigate in the best possible way. There was a lack of control, but by working together, the tasks would always be completed. An OR nurse reflected on this point of view:

> *"Time is very important here for us. When performing complex surgical procedures, the time for preparing patients for anesthesia is very long, and we also have time for preparing the table with surgical instruments, and sometimes the patients must have an analgesic blockade after surgery. Thus, we are occupying the OR for hours, and a lot of time is wasted, so we are using the OR too little for surgical procedures. But I do not feel time-pressured, like when I was on the ward, where I was pushed not to accomplish my tasks. I accomplish my tasks. Maybe, I am not finishing what was expected, but I don't go home and still have lots of tasks I haven't completed." [OR nurse 5]*

6.1.3 Improvement of Collaboration

In this category, the subcategory *opportunities for improvement* was highlighted as a theme.

6.1.3.1 Opportunities for Improvement

When the health professionals expressed their recommendations for the improvement of collaboration in the surgical units, attitudinal, structural, and procedural changes were mentioned. Improvements could be fostered by changes in attitudes, so collaboration was to a greater extent guided by shared goals and shared responsibilities, as mentioned by the anesthetist [ANE 3] in the previous quote (p. 86), as well as by an AN nurse:

> *"We could do better, but I don't know how. The team collaboration in the OR could be improved. We could change the attitude to "It's OUR patient, not mine or yours but OURS!" We have to look at it as a shared responsibility for the patient and make it all flow! We have to meet and talk about it in the morning." [AN nurse 1]*

Changes in attitudes and a profound shared responsibility for the quality of the treatment provided to patients were also seen as an opportunity for strengthening

shared knowledge. Both the surgeons and the OR nurses proposed the establishment of weekly interdisciplinary meetings with the purpose of sharing specialized knowledge and qualifying the preparation and performance of surgical procedures. The proposal was based on the belief that specialized knowledge was overlooked in the preparation and planning of surgical procedures, as expressed by an OR nurse preparing for surgical procedures:

> *The CN and SN are preparing for a complex surgical procedure and talking about the specific instruments to be used. The CN says, "It can be very difficult for the surgeons to figure out what materials and instruments we have in this unit, because they work in so many different units. When they are going to write a prescription for surgery, they have to write which materials and instruments must be available in the OR. They may not know what we have in this unit. It can be difficult because, maybe, it isn't the surgeon who wrote the prescription for surgery who is going to operate on the patient. Thus, the surgeon writing the prescription makes decisions for other surgeons. Surgeon x has proposed that, OR nurses should participate in weekly preparation meeting with surgeons, because we are the ones who best know, which materials fit together, and which materials and instruments are available in the unit. It is necessary to secure the complex surgical procedures!" [Team 29]*

A structural challenge to collaboration was also commented on by a surgeon:

> *"It would be optimal if we ourselves had seen the patient in the outpatient clinic. In principle, I think that you should always see the patient you are going to treat, but that is impossible. If the surgical procedures aren't complicated, it doesn't matter, but it should be that way. If possible, I always schedule the patients I meet in the outpatient clinic to my own schedule. If they have consulted me and I have examined them, I want to treat them myself." [SUR 8]*

Other objectives for achieving a better collaboration could be met by fostering interdisciplinary meetings, for example, by ensuring the implementation of new procedures and practices in order to provide high-quality treatment to patients, as expressed by a surgeon:

> *"It would be great if, every half a year or so, we arranged shared and interdisciplinary meetings about what is happening on the "hip front," what is happening on the "knee front," what procedures are going to be implemented, if there are any new initiatives or new instruments, and so on!" [SUR 1]*

Interdisciplinary meetings are needed, as are monodisciplinary meetings. Inter-colleague meetings among the workgroup of surgeons performing hip arthroplasties were implemented. In these case-based discussion meetings, shared decision-making

and future treatment procedures are agreed upon. Yet, room for contemplation and discussion was difficult to establish, as an OR nurse expressed:

> *"We don't have a lot of quality projects. We are doing a great job, but we don't reflect so much. More time for contemplation and discussion would be great! In the afternoon, when we are finished in the OR, we are too tired to discuss things. It would be better to focus on some topics together and to think slightly more in general." [OR nurse 5]*

When focusing on the improvement of collaboration and patient safety, structural and procedural changes were requested to support and strengthen the health professionals' opportunities to learn from failures. Safe surgical procedures during check in (before "incision time") and check out (after "closing time") were implemented as accurate communication safety procedures in the unit. Other procedures, such as debriefing after surgery including shared reflection on what has happen during surgery, what could have been done in a more appropriate way, and what lessons have been learned, were observed and initiated only very rarely. The need to jointly learn from failures was stated by an experienced AN nurse:

> *"We have to learn from our failures. If we don't, something is wrong. We MUST learn from our mistakes and failures. Our mistakes often have something to do with the surgical materials. Something the OR nurses have overlooked, then we have to wait, it's annoying! Of course, we could be the ones who have overlooked something. The patient's condition may change, we have to do further radiological examinations or call the cardiologist, or something like that. This could also be called a mistake or failure, but it is the patient's safety. We have to treat the patient safely. Why was it not discovered before? Why has nobody been aware of it? We could have acted on it! In general, I think we have to learn from our mistakes and failures. You have to recognize what the problem is. Could it have been avoided? Could we have done something differently?" [AN nurse 17]*

Finally, the health professionals in the OR suggested the need to focus on the faster and more effective training of newly employed OR nurses. As described in the introduction and previously in this section, the surgical teams are characterized by a high degree of interdependence. When a highly specialized team has to work effectively together, it becomes vulnerable if some team members are unprepared, untrained, or incompetent. Therefore, the training of newly educated surgeons or newly employed OR nurses was considered very important for the quality of interdisciplinary collaboration, as articulated by an experienced OR nurse:

> *"You must make demands on the nurses in training. You must show and tell them what to do, and you must emphasize their responsibility. If they receive the training they require, and you are accurate and concrete in your guidance, then they could*

be trained in the orthopedic specialty in a year. Currently, it takes eighteen months or two years, and even then, people are still unsure." [OR nurse 3]

The data and findings from this part of PHASE I are integrated with PHASE II by ways of what Fetters et al. (2013) called building, as described in *Chapter 7*. After having presented the analyses and findings from the simple coding process, the analyses and findings from the directed content analysis using the theory of relational coordination are presented in the next section.

6.2 Identification of Communication and Relationship Patterns in Surgical Teams

A directed content analysis based on the theory of relational coordination was conducted. When using the theory in the analysis, I was inspired by Høyer (2015) and the metaphor of using theory in an analysis as a *can opener* for identifying and opening up the field of study by drawing on other approaches. The analysis process led to the identification and description of different communication and relationship patterns observed in interdisciplinary surgical teams in the operating room. In the directed content analysis, I followed a five-step process, as illustrated in Figure 14.

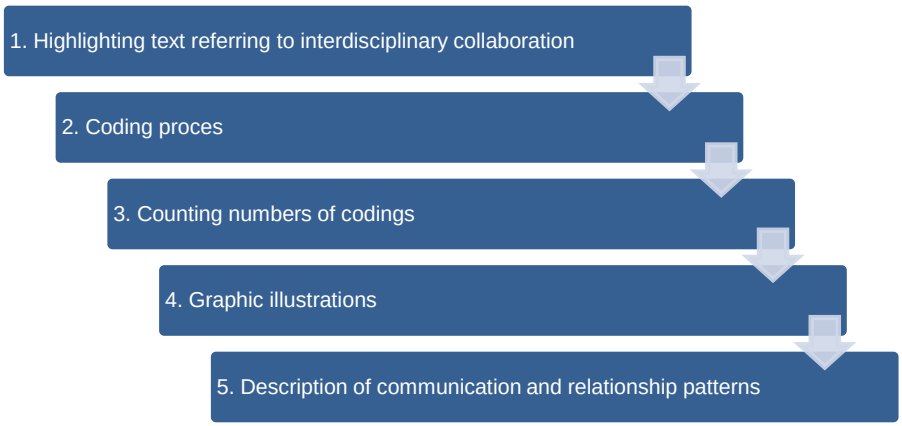


Figure 14 Directed content analysis, an analytical process in five steps.

In the first step, the texts in the fieldnotes referring to collaboration in interdisciplinary surgical teams in the operating room were highlighted.

In the second step, the highlighted texts were coded using the theory of relational coordination. As described in *Chapter 3* (p. 26 - 27), there may be strong as well as

weak communication and relationships across the different workgroups in the same team (Gittell, 2009). The different communication and relationship dynamics in Figure 4 (p. 27) show, which dimensions are included in strong and weak communication and relationship dynamics. Going forward, I refer to these, respectively, as appropriate and inappropriate dynamics among the health professionals who are part of the same work process. The presence of appropriate and inappropriate dynamics of communication and relationships was coded in each of the 39 fieldnotes describing 39 surgical procedures performed by 39 surgical teams. Four of the 39 surgical procedures were performed by the same surgical teams. Since each individual patient undergoing a surgical procedure is unique, I have analyzed each surgical team assigned to each surgical procedure. The teams were labelled with a number from 1 - 35, and the teams that were observed twice were labelled with two numbers (e.g., *Team 5.1* and *Team 5.2*). At the start of the coding process, it quickly became clear to me that it was impossible to code the communication dimensions frequent/infrequent, since the communication was ongoing. Therefore, these dimensions were excluded from the further analyses. During the analysis process, I moved continuously and dialogically between the theory of relational coordination and the empirical materials (Tavory and Timmermanns, 2014).

In one category, the presence of **appropriate communication and relationship dynamics** was coded. This was divided into three **communication dimensions**, namely accurate, timely, and problem-solving communication, as well as three **relationship dimensions**, shared goals, shared knowledge, and mutual respect. The coding systems containing text from the fieldnotes, which provide examples of how the text was coded for appropriate communication and relationship dynamics, are shown in Table 11 (p. 96).

In another category, the presence of **inappropriate relationship and communication dynamics** was coded. This was divided into three **communication dimensions,** namely inaccurate, delayed, and finger-pointing communication, as well as three **relationship dimensions**, functional goals, specialized knowledge, and disrespect. The coding systems containing text from the fieldnotes, which provide examples of how the text was coded for inappropriate communication and relationship dynamics, are shown in Table 12 (p. 97).

Thus, the coding process has been conducted based on repeated readings of the fieldnotes combined with memories of the exact situations observed. I have reflected on the advantage of having co-researchers to make parallel codings of the field notes, but have rejected this possibility, since the fieldnotes do not capture all the memories and experiences of the situation. Instead, the coding systems have been discussed with co-researchers to ensure uniformity in the coding process throughout all the fieldnotes.

Category 1: Appropriate Communication and Relationship Dynamics	
Shared goal	*Surgeon asks "How long will it be before you are ready to take the next patients?" Surgical nurse (SN) responds "We may as well go on at once, we just need to clean and make over our preparation." AN nurse adds "Also for our part!" Surgeon answers "Then it's a deal, it's what we do!" [Team16]*
Shared knowledge	*The CN and SN have just realized that the repulsive saw is missing [a specific instrument usually used for that type of surgery]. The saw will be in the OR in 1½ hours at the earliest. The SN and AN nurse are talking together to coordinate the new time perspective. They agree, that the SN might clear the situation with the surgeon. The CN calls the surgeons and asks, "The patient is in OR now, would you please come and mark the hip? But there is an issue, the repulsive saw is missing and will be here about 1½ hours at the earliest. They [AN nurses] would like to perform the spinal anaesthesia now". They talk on the phone a little. The CN informs SN and AN nurse and says, "He will come now, and he doesn't care about the saw. We can move on now". [Team 24]*
Mutual respect	*OR-Nurse 34 and OR-Nurse 36 are preparing the next surgical procedure and talking about how to allocate the day's work. OR-Nurse 34 says "Shall I take the first [be the surgical nurse], then you can see how I manage, and you can do it yourself afterward?" OR-Nurse 36 answers "Yes, we can do that, but I would like to take the cemented hip. Yesterday, I was the surgical nurse for three "cementless hips." I need training with the cementing, so I would really like to do that." OR-Nurse 34 says "Okay, that's fine. I'll take the first two and you take the hip and the last patient with the fasciotomy!" OR-Nurse 36 says "Okay!" [Team16]*
Accurate communication	*The AN nurse is reading from a paper – name of the patient, ID number, and type of surgical procedure. She mentions "Ciproxin has been given". Surgeon replies: "Yes, superb and no expected surgical implications. Estimated time for the surgical procedure, half an hour!" [Team 16]*
Timely communication	*The surgeon takes off his gloves, just finishing the surgical procedure. The CN says "Look at these pictures (X-rays) – it is from the next patient! What did we agree about? What are we going to do?" They talk about which type of hip replacement materials they are going to use for the next patient. They walk to the closet and look at the different types, boxes, and materials. And they make a choice and decide together. [Team 12]*
Problem-solving communication	*The SN says "Oh, these two, () they **don't** fit together!" The CN thinks and says "Oh, NO, we have to stop him [the surgeon]. The head [one part of the replacement materials] he has chosen doesn't fit in". She knocks on the door to the room, where the AN nurse is preparing the patient for aesthesia and says, "Wait a minute!" Then she calls the surgeon. The CN and SN discuss the size of the replacement materials and what to do now. The CN says "He will come, and he is very annoyed that the person who prescribed the operation was so focused on the thighbone part when the patient's acetabulum is so damaged. They are talking about which solutions they should go for. The surgeon arrives, and together they discuss the possibilities and decide. "We will continue! Never going down on equipment!" the surgeon exclaims. [Team 29]*

Table 11 Coding system for the directed content analysis, showing text from the fieldnotes coded for the dimensions associated with appropriate communication and relationship dynamics.

Category 2: Inappropriate Communication and Relationship Dynamics	
Functional goal	*The Surgeon says "I will stick to my fundamental views on this case in terms of unpacking. It is important to think about saving money; we just take the stuff into the OR and pack it up if we need it." The CN replies "Okay, but if it isn't prepared, you'll blame me if we need it during the intraoperative phase!" [Team 13]*
Specialized knowledge	*The SN says "If it is surgeon x operating, he would like to have Number 4 [suturing thread] and he would like to have those knife blades!" "Okay, yes," the CN answers and finds the thread and blades. "He has some whims, I think!" the SN says to her colleague. "I call it ideas," the CN replies and continues "In my opinion, you should adapt to the working place – to some degree. I have tried it once, I had been busy and had fetched lots of instruments and placed them in the box because he wanted them there. But he never used them. So, I am finished doing that!" [Team 18]*
Disrespect	*The AN nurses are preparing the patient for anaesthesia. The OR nurses are waiting, and one of them says "These AN nurses are the sharpest. Look at them!" When asked "In what sense, sharpest?" the OR nurse replies "Look at her, look at her rapid movements. She is so rapid and…" She stops talking. The question was repeated "In what sense? The most proficient or?" The OR nurse explains, "No, they are probably very skilled, but they are also very tough. I don't say anything. You get yelled at if you do something. I am quiet when I am working with them!" [Team 16]*
Inaccurate communication	*A newly employed SN prepares for the surgical procedure and the CN [experienced supervisor] asks "I need to know, should I keep an eye on you?" The SN asks "What exactly do you mean?" The CN replies "I am wondering, how far you are in your training and how much can you manage by yourself? Am I supposed to tell you what to do, or do you know what is going to happen?" The SN answers "I am so far into my training that I know what to do and I would like to do it myself. But you should know that I perhaps need more time to prepare. You should tell me if I need to do something. I would like to do it myself; it is the best way of learning and training for me!" The CN replies "You have to ask me if you need something." "Okay, I will do so," the SN says and continues "Those articles we are going to use, is it x [hip replacement article]?" The CN answers "I expect it is, I think, but I don´t know, I have never tried it before!" she shrugs and walks away. [Team 9]*
Delayed communication	*The CN says to the surgeon "Could we talk about the next patient? She is going to have a cementless hip replacement. Do we have what is needed for that surgical procedure?" The surgeon answers "I haven't seen the patient, I must do that first!" he CN groans "I am nearly losing my overview, we have so many things going on today!" [Team 12]*
Finger-pointing communication	*The AN nurse enters the OR and says to OR nurse "I am sorry about my reaction before. It wasn't good. But it is incredible that we had to stop because the INR hasn't been controlled [INR levels - an essential component in the management of patients receiving blood- thinning treatment]. We have asked for it all day. So annoying! It is not my responsibility! Someone has been asleep, and so here we are!" [Team 31]*

Table 12 Coding system for the directed content analysis, showing text from the fieldnotes coded for the dimensions associated with inappropriate communication and relationship dynamics.

In the third step, the number of codings for all the dimensions in each of the 39 identified surgical teams was counted. The aim of the counting process was to retrieve the data segment categories under the same codes in order to measure and map the incidence of different codes. The counting process was inspired by Coffrey and Atkinson and (1996), who described how code-and-retrieve procedures can be used to analyze data in quasi-quantitative ways, by measuring and mapping their incidence. The counting process resulted in a number of codings for the presence of communication and relationship dimensions (+RC) associated with appropriate dynamics, as well as a number of codings for the presence of communication and relationships dimensions (÷RC) associated with inappropriate dynamics, for each team. The duration of the surgery was noted. The number of codes counted for each surgical team was accordingly time-adjusted and set as codes/60 minutes. Table 13 shows an example of this step in the analysis process, presenting the codes for *Team 27,* who performed a hip revision arthroplasty (a complex surgical procedure) for patient - with an operation duration of 150 minutes.

Codes for Communication and Relationship Dimensions in *Team 27*			
Dimensions associated with **appropriate dynamics**	(+RC) *n*	Dimensions associated with **inappropriate dynamics**	(÷RC) *n*
Shared goal	18	Functional goal	1
Shared knowledge	3	Specialized knowledge	-
Mutual respect	16	Disrespect	3
Accurate communication	10	Inaccurate communication	2
Timely communication	23	Delayed communication	-
Problem-solving communication	5	Finger-pointing communication	2
Total (+RC) Codes	75	Total (÷RC) Codes	14
(+RC) codes pr. 60 minutes	30	(÷RC) codes pr. 60 minutes	5,6

Table 13 Codes for communication and relationship dimensions associated with appropriate and inappropriate dynamics for Team 27, with the duration of a complex surgical procedures being 150 minutes.

The numbers of codes for communication and relationship dimensions associated with appropriate and inappropriate dynamics were counted and inserted into a table in order to obtain an overview of the codes counted for all the surgical teams. Table 14 shows the numbers of codes for the 24 surgical teams performing surgical procedures categorized as routine surgery.

Numbers of Codes for Surgical Teams Performing Routine Surgery						
Team	Surgery Unit	(+RC) *n*	(÷RC) *n*	Duration minutes	(+RC) *n* /60 min.	(÷RC) *n* /60 min.
1	I	39	0	75	31.2	0
3	I	7	7	30	14	14
4	I	27	6	100	16.2	3.6
5.2	I	25	1	75	20	0.8
6	I	19	4	85	13.4	2.8
7	I	49	9	90	32.7	6,0
8	I	35	1	100	21	0.6
9	I	49	34	135	21.8	15.1
10	I	38	14	95	24	8,8
11.1	I	38	3	60	38	3
11.2	I	38	0	120	19	0
12.1	I	41	18	80	30.8	13.5
12.2	I	37	14	75	29.6	11.2
13	I	12	10	60	12	10
14	I	38	3	100	22.8	1.8
15	I	25	5	100	15	3.0
16.1	I	28	21	65	25.9	19.4
16.2	I	21	23	70	18	19.7
17	I	39	30	120	19.5	15
19	I	37	12	100	22.2	7.2
20	I	35	13	80	26.3	9.8
22	II	38	1	60	38	1
23	II	67	0	150	26.8	0
31	II	44	3	60	44	3
Total		826	232	2085	23.8	6.7

Table 14 Number of codes (*n*) for communication and relationship dimensions associated with appropriate and inappropriate dynamics in surgical teams performing routine surgical procedures.

Table 15 shows the number of codes for communication and relationship dimensions associated with appropriate and inappropriate dynamics for the 15 surgical teams performing surgical procedures categorized as complex surgery.

Number of Codes for Surgical Teams Performing Complex Surgery						
Team	Surgery Unit	(+RC) *n*	(÷RC) *n*	Duration minutes	(+RC) *n* /60 min.	(÷RC) *n* /60 min.
2	I	21	20	120	10.5	10
5.1	I	55	5	155	21.3	1.9
18	I	48	28	120	24	14
21	I	82	1	190	25.9	0.3
24	II	85	2	205	24.9	0.6
25	II	166	8	300	33.2	1.6
26	II	102	10	225	27.2	2.7
27	II	75	14	150	30	5.6
28	II	41	35	170	14.5	12.4
29	II	160	8	340	28.2	1.4
30	II	112	2	210	32	0.6
32	II	81	9	240	20.3	2.3
33	II	69	33	180	23	11
34	II	54	48	150	21.6	19.2
35	II	128	8	255	30.1	1.9
Total		1279	231	3010	25.5	4.6

Table 15 Number of codes for communication and relationship dimensions associated with appropriate and inappropriate dynamics in surgical teams performing complex surgical procedures.

In the fourth step, the different surgical teams were illustrated graphically in a matrix wherein the presence of communication and relationship dimensions (+RC) associated with appropriate dynamics was marked on the horizontal axis and the occurrence of communication and relationship dimensions (÷RC) associated with inappropriate dynamics was marked on the vertical axis. The medians inserted into the matrix divide the matrix into four quadrants.

Thus, a surgical team, such as Team 27, with 30 codes for (+RC)/60 minutes and 5,6 codes for (÷RC)/60 minutes could be presented graphically in a scatterplot by two numbers (30) on the horizontal axis and (5.6) on the vertical axis.

Figure 15 illustrates a matrix wherein all the surgical teams are inserted according to the numbers of (+RC) and numbers of (÷RC). The red lines indicate the medians.

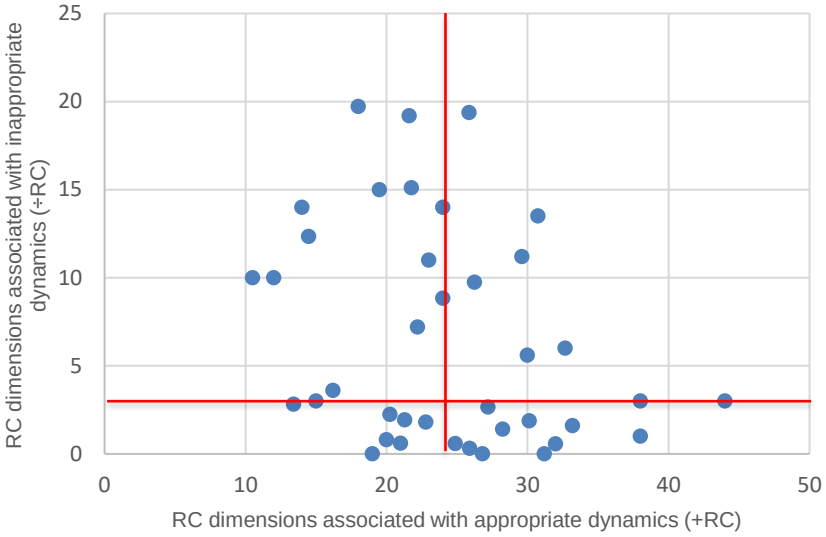


Figure 15 Surgical teams marked by the numbers of codes for communication and relationship dimensions associated with appropriate and inappropriate dynamics. Red lines show the medians.

Due to inserting the medians (horizontal median = 24, vertical median = 3), the matrix illustrates how four quadrants occurred, as illustrated in Figure 16.

I. One quadrant showing the surgical teams with a high number of codes for communication and relationship dimensions associated with appropriate dynamics, and a low number of codes for communication and relationship dimensions associated with inappropriate dynamics. Labelled Type 1: High (+RC), Low (÷RC).
II. One quadrant showing the surgical teams with a low number of codes for communication and relationship dimensions associated with appropriate dynamics, and a low number of codes for communication and relationship dimensions associated with inappropriate dynamics. Labelled Type 2: Low (+RC), Low (÷RC).
III. One quadrant showing the surgical teams with a low number of codes for communication and relationship dimensions associated with appropriate dynamics, and a high number of codes for communication and relationship dimensions associated with inappropriate dynamics. Labelled Type 3: Low (+RC), High (÷RC).
IV. One quadrant showing the surgical teams with a high number of codes for communication and relationship dimensions associated with appropriate dynamics, and a high number of codes communication and relationship dimensions associated with inappropriate dynamics. Labeled Type 4: High (+RC), High (÷RC).

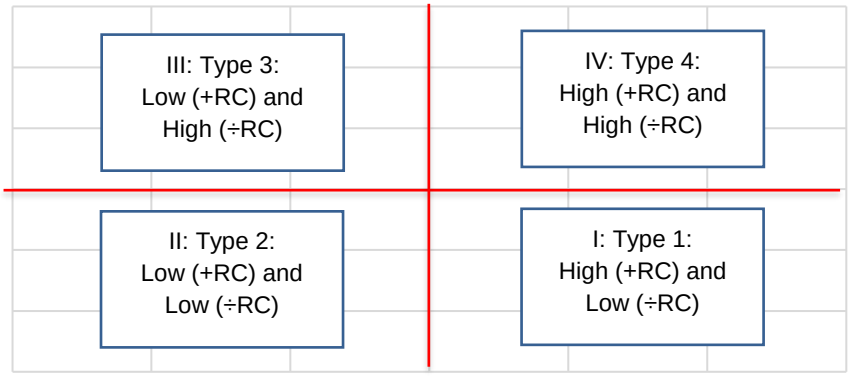


Figure 16 Types of communication and relationship dynamics based on numbers of codes for (+RC) and (÷RC).

After having identified the four different communication and relationship dynamics, it became interesting to explore these different types of commonalities, differences, patterns, and structures.

The different types followed the same pattern when considering at how the numbers of codes were distributed among the communication and relationship dimensions associated with appropriate dynamics, as shown in Table 16. The shared goal was the relationship dimension with the highest number of codes, while timely communication was the communication dimension with the highest number of codes for all four types. Similarly, shared knowledge was the relationship dimensions with the lowest number of codes, while problem-solving communication was the communication dimension with the lowest number of codes for all four types. When looking at the communication and relationship dimensions associated with inappropriate dynamics, the tendencies were the same. Disrespect was the relationship dimension with the highest number of codes for three of the four types, while delayed communication was the communication dimension with the highest number of codes. Finally, specialized knowledge was the relationship dimension with the lowest number of codes for all types, while inaccurate communication was the communication dimension with the lowest number of codes.

However, the types differed from each other on several occasions. Type 1 and Type 4, both with a high number of codes for appropriate communication and relationship dimensions, differed in terms of the number of appropriate codes for accurate and timely communication, as well as the number of inappropriate codes for disrespect and delayed communication.

Type 2 and Type 3, both with a low number of codes for appropriate communication and relationship dimension, differed in terms of the number of appropriate codes for

mutual respect, as well as the number of inappropriate codes for functional goal, disrespect, delayed communication and finger-pointing communication.

An overview of the numbers of codes for all communication and relationship dimensions in the four different types of communication and relationship dynamics is presented in Table 16.

Different Communication and Relationship Patterns				
	Mean of codes in Type 1	Mean of codes in Type 2	Mean of codes in Type 3	Mean of codes in Type 4
Shared goal	7.9	4.7	4.7	7.4
Shared knowledge	2.5	2.0	1.3	2.5
Mutual respect	4.5	3.1	2.0	3.5
Accurate communication	5.2	2.6	2.9	4
Timely communication	9.5	5.6	6.3	8.0
Problem-solving communication	2.4	1.2	1.2	2.2
Functional goals	0.1	0.4	2.2	0.9
Specialized knowledge	0.2	0.1	0.5	0.8
Disrespect	0.2	0.4	5.2	5
Inaccurate communication	0.2	0.1	0.7	0.9
Delayed communication	0.4	0.9	3.4	2.2
Finger-pointing communication	0.3	0.1	1.3	1.0

Table 16 Mean of communication and relationship codes in the four different types.

Another way of illustrating the differences between the four types of communication and relationship patterns, as inspired by Losada and Heaphy (2004), was to calculate the ratio between the numbers of positive and negative communication and relationship codes per hour (P/N ratio) for each of the 39 surgical teams. The numbers of positive and negative codes per hour are listed in Table 16. The P/N ratios for all the teams are shown in Figure 17.

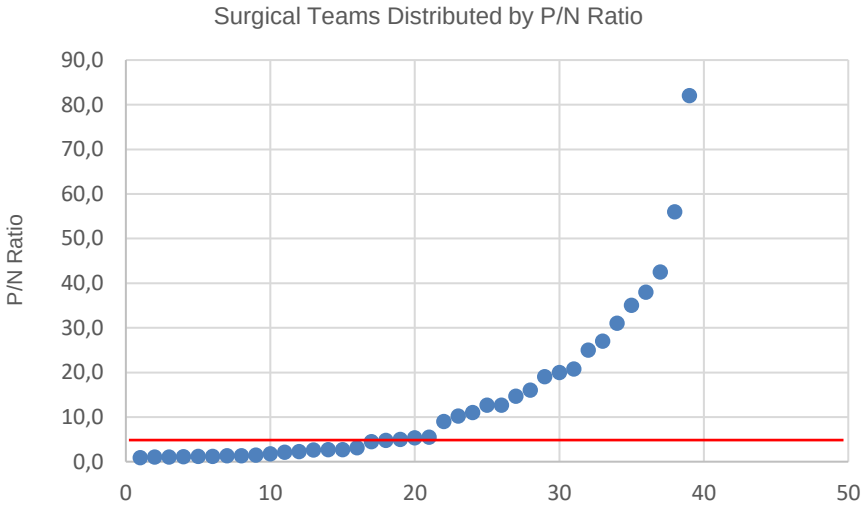


Figure 17 Surgical teams (Teams 1 - 35) illustrated by the P/N ratio, with the median (median = 5.4) marked with a red line. Each dot represents a surgical team.

The different types of teams were distributed at opposite ends of the ratio scale. Type 1 and Type 2 were found to have the highest P/N ratio, with the P/N ratio ranging from 4.5 to 100, while Type 3 and Type 4 had the lowest P/N ratio, ranging from 0.9 to 5.4. The frequencies of the P/N ratios are shown in Figure 18, as distributed by the type of team.

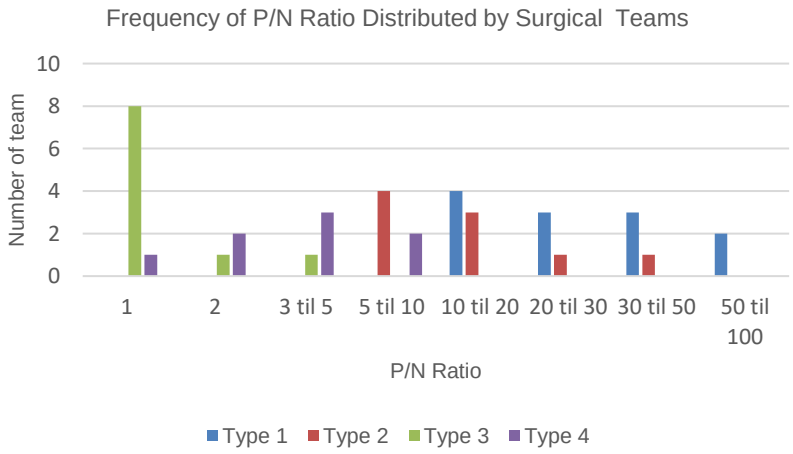


Figure 18 Frequency of surgical teams with a P/N ratio ranging from 1 to 100, as distributed by type of team.

The four types also differed in terms of the level of complexity of the surgical procedures performed. Type 1 included teams that performed the most complex surgical procedures, and the fewest routine surgical procedures. Only three of the 15 complex surgical procedures were performed by Type 2 and Type 4. Only one of the six surgical procedures performed by teams with Type 4 communication and relationship dynamics was categorized as a complex surgical procedure. Figure 19 shows the routine or complex surgical procedures performed, as illustrated in a scatterplot.

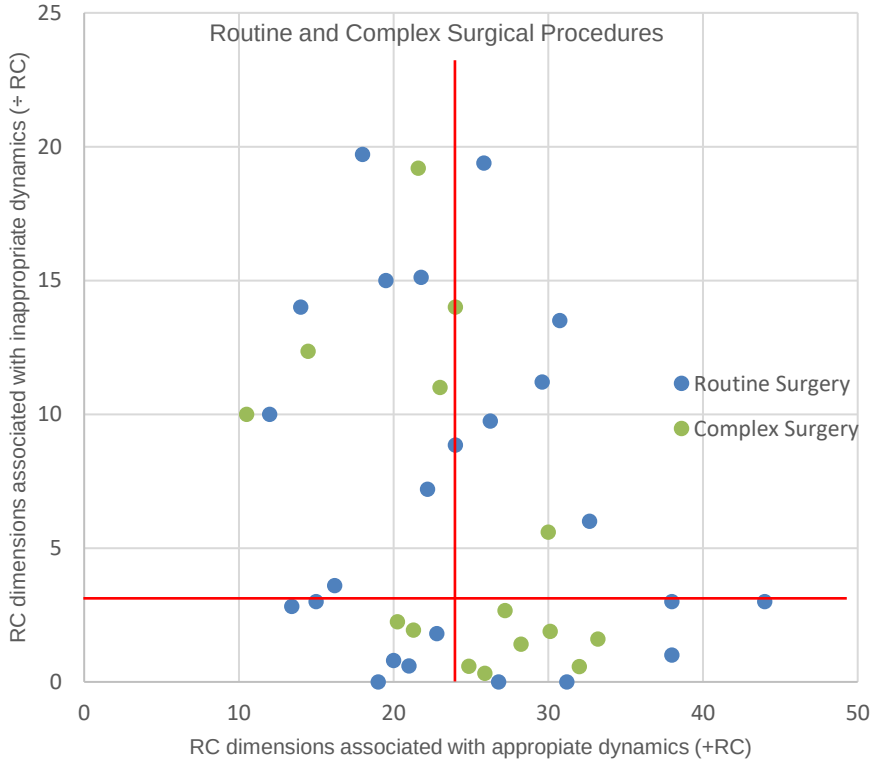


Figure 19 Routine and complex surgical procedures performed, as illustrated in a scatterplot - marked by the numbers of codes for appropriate and inappropriate communication and relationship dynamics. Red lines show the medians.

After having performed these analytical movements, that is, coded, retrieved, counted, and mapped, I moved on to the final step of the directed content analysis and read the notes derived from observations of teams in each of the four quadrants of the matrix. During this step, I captured and described what characterized the communication and relationships of the teams in each quadrant in order to identify the different communication and relationship patterns. This step is discussed in the following section.

6.3 Different Communication and Relationship Patterns

The following four types, which were identified based on the directed content analysis, represent the different patterns of communication and relationships seen in the daily task performance within surgical teams:

- Proactive and intuitive communication (Type 1).
- Silent and ordinary communication (Type 2).
- Inattentive and ambiguous communication (Type 3).
- Contradictory and highly dynamic communication (Type 4).

The naming of the types captures the specific patterns that characterize communication and relationships within the interdisciplinary collaboration in these types of surgical teams.

In the following, each citation of an observation or interview statement has been assigned a reference number for one of the 39 surgical teams observed or one of the participants, that is, practicing as a surgeon (SUR), operating room nurse (OR nurse), surgical nurse (SN), circulation nurse (CN), nurse assistant (NURASS), anesthesiologist (AN), or nurse anesthetist (AN nurse).

6.3.1 Type 1: Proactive and Intuitive Communication

Communication and relationships seen in these surgical teams were characterized by a broad acceptance of shared goals, a pronounced expression of mutual respect, and timely and precise communication focused on solving the problems at hand. Frequently, these teams collaborated with patients who underwent complex surgery of a long duration. The level of complexity stressed the need for shared responsibility in order to manage the daily surgery schedules in the best possible way. Communication and relationship dynamics in these teams were therefore marked by participants being proactive and intuitive.

This type of *proactive* communication and relationship dynamic appeared when the staff articulated the challenges they anticipated might arise during the surgical procedures, and when they tackled the challenges in an upfront fashion through shared interdisciplinary decision making and problem-solving communication. The considerations of preparation and planning for the daily surgical schedule are expressed by a surgical nurse who was part of several of these teams:

> *"I start my daily work by getting an overview. What are we going to do? Who are going to work together? Which patients and how many? Who are the AN-nurses and the surgeon? I try to get an overview of what is going to happen. Then I say to myself that it is my responsibility to make the work flow in this OR as well as possible and we have to do it together. I don't think a particular person should lead the OR, because we all see things differently. There is also a lot going on outside*

the OR that I must react to. For example, the instruments we need to get before proceeding with the surgical procedure. But I try to concentrate on my OR and to get it moving as efficiently as possible, so some patients can be dealt with." [OR nurse 3]

Typically, the members of the team discussed the preparation of all the surgical procedures for which they were responsible at the beginning of the working day. In situations where unforeseen events (e.g., patients' conditions, lack of instruments, replacement materials, or surgical assistants needed) may cause surgical complications, cancellation, or a delay of surgery, the members of the team exchanged their reflections, involving all the team members' experience and expertise. Together, they searched for the best possible solution and made appropriate decisions. Communication and relationships were characterized by a proactive and intuitive approach, as demonstrated in these team activities in the OR:

The CN knows exactly which types of materials connect, although it is a very rarely used and expensive instrument. She is talking loudly to her colleagues and the surgeon about how and what to do. The SUR is listening; he mentions the possible solutions and chooses materials for the replacement of the hip. However, the SUR is very concerned about the vulnerable condition of the patient's bones. "It is quite thin!" he says. The AN nurse enters the room and asks if they may sedate the patient. The CN answers, "Yes, we have just made our decisions about the surgical procedure and choice of materials. You may do so!" The AN nurse replies, "Okay, then we will begin sedation of the patient!" The NURASS works confidently with a rapid and steady hand during their preparation for the surgical procedure. She talks about her reason for acting and gives the SN much advice. The NURASS gets the full attention of the others [CN and SN]. They are listening and responding to her ideas. The CN prepares the transportable x-ray appliance and says, "We should probably prepare ourselves for the possibilities that it will be done under radiolucency, when the patient's bone tissue is so thin!" [Team 29]

The team members knew one another, and they considered what was important for each other's task execution. This was made visible when the AN nurse took over tasks from the circulating nurse with the purpose of helping and creating flexibility, as well as enabling an appropriate flow during the surgical procedures. Remarkable, it was also seen when the surgeon involved the surgical team members in the surgical technique and the OR nurse paid meticulous attention to the surgeon's preferences and skills, as illustrated in this situation:

The surgical procedure has just begun. The SUR says, "We start!" The SUR shows the SURASS how to hold the retractors. The SN works quietly. The SUR tells the SURASS what he sees, what he is doing, and why. He speaks softly, so the patient cannot hear him. [The patient is under local anesthesia]. Together, they talk about the condition of the patient's knee. The SUR describes what he is going to do next.

The SN focuses and prepares for what she predicts will be SUR's next move or need. She stands on the surgeon's right side. The SUR drills the nail into the thighbone and says, "I would like to have a…" The SN hands it to him before he has pronounced the name of the instrument. The SUR saws the bone. He wants to pull out a nail, but it is stuck. The SN hands the SUR an instrument to pull the nail out. Again, the SUR talks softly to the SURASS about the surgical technique. The SN holds the surgical instrument that she predicts is going to be used next; she closely follows the SUR movements and action. She is right in her predictions and hands over the instrument without speaking when it is needed by the SUR, as though she knows exactly what his next move is going to be. [Team 23]

The above example also illustrated the OR nurse's specialized knowledge of what was going on and what was going to happen in the following seconds. She was proactive in her preparation, and the surgeon did not need to say anything. The collaboration consisted of countless activities between the surgeon and the OR nurse, and the communication was wordless and intuitive. Typically, these teams expressed mutual respect, both verbally and non-verbally, as illustrated in the communication between the surgical nurse and the circulating nurse while preparing for the surgical procedures:

The SN asks the CN for advice about the materials and the preparation. The CN answers, "We will wait to unpack the materials until we know what the surgeon wants to have. SN says: "I don't know, which instruments and materials I have to unpack, but I am calm. Because X [first name of the surgeon] can manage and he is so nice and very helpful in guiding and teaching during surgical procedures. He never gets annoyed or mad if you don't know." The CN comments, "Yes, it is going to be fine, and it is also very exciting to wait and see what we are going to use! And yes, he is excellent." [Team 26]

Often, these types of teams collaborated during surgery that involved a high degree of complexity, which underlined the benefit of proactive and intuitive communication and coordination when problem solving was required. This is clearly illustrated in a situation where two OR nurses are preparing for a rare and complicated surgical procedure. They have to adapt several rarely used surgical instruments, and they need to unpack a variety of custom-made replacement materials:

Suddenly, the SN nurse says, "Oh, these two… they don´t fit together!" The CN thinks and say, "Oh, NO, we have to stop him [the surgeon]. The head [one part of the replacement materials], he has chosen doesn't fit in." She walks quickly to the place where the AN nurse is preparing the patient for anesthesia and says, "Wait a minute!" Then, she walks in a hurry to the phone and calls the SUR. The CN and SN discuss the size of the different parts of the replacement materials and what to do now. The CN says, "He will come, and he is very annoyed that the person who prescribed the operation was so focused on the thighbone part, when the patient's acetabulum is so damaged." They continue talking about which solutions they

should opt for. The SUR arrives, and together they discuss the possibilities and decide. "We will continue! Never going down on equipment!" SUR exclaims. [Team 29]

Finally, a remarkable display of responsibility for the interdisciplinary learning environment within the operating room was observed when an experienced OR nurse greeted and gave instructions to the surgeon's assistants regarding the scheduled surgical procedures, as well as when the senior surgeons were educating the surgical assistants or showing great patience toward the newly employed OR nurses.

6.3.2 Type 2: Silent and Ordinary Communication

Communication and relationships seen in these surgical teams were characterized by shared goals and mutual respect. Frequently, these teams were collaborating with patients who underwent routine surgery lasting only a short duration, which demanded less exchange of opinions, matching of expectations, and problem solving. Communication and relationships in these teams were therefore characterized as being less dynamic and more silent than in the other types of teams.

This type of *silent* communication and relationship dynamic appeared when the team members performed the safe-surgery procedures at time-out and check-out. Often, the verbal exchange of information during such procedures was very brief in these teams, lacking the articulation of details regarding the surgical procedures, expected challenges, or estimated duration of surgery. This was demonstrated in the following brief dialogue:

The SUR asks the AN nurse, "Time-Out?" The AN nurse reads the name and number of the patient and the SUR replies, "Yes." [Team 8]

Sometimes the check-out procedures were completely lacking, despite the department's safe surgery guidelines.

Another *silent* expression of communication was visible during the surgical procedures. In such cases, the verbal exchange between team members was informative and instructive, and it lacked preceding interdisciplinary discussions about solutions, uncertainties, or expected surgical challenges according to the patient undergoing surgery in the OR, as demonstrated in the example below:

The SUR picks up the instrument from the table and puts it back again. Unusually, the table is placed between the SUR and the SN. Sometimes, the SN hands the instruments to the SUR and collects small bone pieces from the SUR's tweezers using a piece of tissue. Occasionally, the SUR says what he needs to have. He uses the ball joint reamer [instrument for milling the acetabulum] and says, "54," to which the SN replies, "Yes" and hands the instrument to the SUR. Once more, the SUR uses the ball joint reamer and says, "I need a larger number!" He gets the

instrument, uses it, and says to CN, "We get a 60!" The CN nurse points to a room outside the OR and asks the SN, "It's outside, isn't it?" The SN answers, "Yes, and it must be the one without holes!" [Team 14]

Although the communication and relationship dynamics in these teams were often silent during the surgical procedures, a lively conversation was observed between the OR nurses during the preparation for the surgical procedures. Typically, there was much talk about the instruments and the materials needed, as well as much talk about personal issues and the social life in the unit, and much small talk, as demonstrated in this short dialogue:

The SN asks SUR, "What have you been doing this weekend, when you didn´t go skiing with the rest of us in Norway?" The SUR tells her that he has attended christenings in the family, and they chat a little about giving names to children. The CN asks SUR, "How old is your firstborn child?" The SUR answers shortly and they focus on the surgical technique again. [Team 4]

The members of these teams were often familiar with one another, as well as with the scheduled surgical procedure. The routine nature of the surgical procedures performed by these teams influenced the topics of conversation in terms of what needed to be discussed and prepared for. The team members rarely talked about surgical challenges and complications, although they always sought to be prepared for the most commonly encountered variations concerning hip and knee replacement materials and the surgeon's choice of instrument. This was expressed in the act of communication below:

The SUR takes off his gloves, having just finished the surgical procedure. The CN says, "Look at these pictures [X-rays]. They are from the next patient! What did we agree about? What are we going to do?" Then, they talk about which type of hip replacement materials they are going to use for the next patient. They walk together to the closet and look at the different replacement materials and instrument boxes. They make a choice and decide together. [Team 12.1]

The team members in these teams were acting in accordance with, and in a manner geared toward accomplishing, a shared goal. This goal was not always obvious, exact, and clear; rather, it was implicit and rarely expressed verbally. The team members exhibited awareness and considerations of what was important for the task performance, as well as for each other's function and for the patient's outcome, as expressed in the following exchange of words:

The CN says to SUR, "Would you like us to release the tourniquet [decouple the blood pressure cuff] now or would you prefer that we wait a little?" The SUR answers, "We wait!" Then, the AN nurse says to the CN, "When you release the tourniquet, please tell me, because I think she is a person [the patient] who could

present bradycardia when we release the tourniquet!" "Yes, of course – I will do!" the CN replies. [Team 5.1]

Finally, it was found that conversations typically focused on ordinary social issues, which was a characteristic of these teams. The familiarity, the routine tasks, and the knowledge of one another all fostered an atmosphere of fellowship and safety, which was occasionally disturbed by a sarcastic or ironic tone of voice in the OR, as demonstrated in the following situation when the surgeon entered the OR in the morning:

The SN says when preparing for the surgical procedures, "I am not sure about this. I haven't done it before!" and the CN answers, "No, but you have seen it." The SN continues, "It is a new kind of surgery and I am fumbling a little, which instruments we are going to use? Does X [she says the first name of the surgeon] use these suturing needles?" The CN answers, "I don't remember. The preparation for the surgical procedures goes on this way, with the OR nurses discussing the best solutions. They are on time and ready for the surgical procedures to go ahead. The AN nurse asks, "Should I call x [surgeon]?" "Yes, please" SN replies. The AN nurse leaves the OR and returns immediately after. The SUR has been waiting outside the door and was ready. When he enters the OR, the CN says, smiling, "Now we are ready!" The SUR replies," That's good, I was unsure about what might have happened in here, and I was wondering if you were going to finish soon!" [Team 5.1]

Hearing a teasing tone such as this was not uncommon, no matter what type of surgical team was observed. *"This way of speaking together in the OR is a part of our culture, we are aware of the tone, but sometimes it appears to be too much." [OR nurse 25]*

6.3.3 Type 3: Inattentive and Ambiguous Communication

Communication and relationships in these surgical teams were characterized by team members being guided by shared goals and functional goals, by team members expressing distrust and disrespect rather than mutual respect, as well as by team members using finger-pointing communication rather than problem-solving communication. These teams were collaborating with patients who were undergoing routine as well as complex surgery of a short duration. Communication and relationship dynamics in these teams were marked by the participants being inattentive to each other, as well as by ambiguous speech actions.

This type of *inattentive* communication and relationship dynamic appeared when an inattentive OR nurse was unprepared to follow the surgeon and anticipate his next move during the surgical procedure, or when it was impossible for the OR nurses to get hold of the surgeon prior to surgery, with the consequence that solving any outstanding issues related to the surgical technique was delayed:

> *The SN and CN are preparing for surgical procedures for an ongoing arthroscopy of a patient's right knee and a knee replacement in her left knee. The CN nurse asks, "Should we prepare for the arthroscopy afterward?" The SN answers, "We just take one at a time!" The CN nurse follows up, "What size should it be? Have you asked about that?" She continues to complain about a colleague in the team. The CN and SN make eye contact, nodding to each other and keep quiet. The SN answers, "No, I don't know. Would you please call X [first name of the surgeon] and ask him?" The CN calls the SUR, but he doesn't answer the call. Now the OR nurses are unpacking a box, looking inside and talking about the surgical instruments. They are not familiar with the contents of the box. They discuss what is needed, and they are very much in doubt about what is going to happen. The CN nurse calls the OR nurse outside the OR: "We can't catch our surgeon, and we don't know what instruments and sizes of materials we are going to use. Could you please find him and ask him what size: small, medium, or large? So, we can finish our preparation." [Team 2]*

The members of these teams were committed to meeting their own functional goals and, to a lesser extent, aware of the need to guide their activities toward achieving a shared goal. A lack of attention and knowledge was revealed in terms of what each team member needed in order to do a qualified job. This was apparent in the differences in the team members' perspectives of what was the most effective and efficient way of preparing for surgical procedures:

> *The SUR enters and completes a very short check-in procedure with the CN and AN nurse. The CN nurse says loudly, "We have prepared for a cemented arthroplasty X [she names a specific procedure], and for this procedure we have these materials!" She points to the materials on the table and continues, "Then we have prepared for an uncemented arthroplasty Y [she names another specific procedure] and for this procedure we have these materials!" She points to the materials on another table. The SUR replies, "What if it is a Z arthroplasty [he names a third specific procedure], what have you prepared for that procedure?" The CN answers, "We haven´t prepared for that procedure, today!" The SUR response," Well, why not? That is too bad!" The CN answers quickly, "You can´t have it!" The SUR then comments, "I will stick to my fundamental views on this case about unpacking. In general, I think it is important to think about saving money; we just take the stuff into the OR and pack it up if we need it." The CN responds, "Okay, but if it isn't prepared, you would blame me if we need something during the intraoperative phase!" [Team 13]*

The communication between the health professionals in these teams was distinctly different from the communication observed in the other teams. Sometimes, interpersonal communication was inaccurate and inappropriate, while other times, the tone of voice was characterized by a lack of respect:

The team is performing the check-in safety procedure when a very young medical student enters the OR and the SUR claims loudly, "You look very nice!" He mentions the first name of the medical student, who has to act as the surgeon's assistant. The SN continues the check-in procedure "Antibiotic, is it given?" The AN nurse answers, "No, it has to be given after the biopsy!" The SUR adds, "Exactly". The AN nurse says to SUR, "You'll tell me when I am allowed to inject the antibiotics, right?" The SUR says, "YES, and you will remind me to tell it! It is something one can forget!" The SUR continues, "Can I say something regarding the next patient if it is suitable now?" The SN says, "Yes, but do we have time for the next patient today?" The SUR replies, "YES, we do. We are on track! The next patient should not be sedated!" He continues, now very loudly, "Are you listening?" and he follows up by forcefully mentioning the first name of the AN nurse. The AN nurse responds with a single word, "Yes." Then, the SUR asks the SURASS very pleased, "What have you been doing since last time we saw each other [one hour ago]?" She answers, "Just rested and got a glass of water." The SUR doesn't respond to the answers; he has directed his attention on the SN, who is working by his side connecting the suction line and the surgical coagulator. The SN is struggling with the lines; she is focused because the lines have become tangled together. The SUR says very loudly and with an ironic tone of voice, "No, no, now you have to STOP! You must be true to your own principles! Do you hear? Before, you told me that it doesn't work to make a Dick Turpin's knot [a specific way of tying a knot], and now you are standing there tying a double bowline knot – yourself!" [Team 34]

Several of these teams were working in an atmosphere that featured a touch of uncertainty, which could be attributed to the ambiguous form of communication and the frequent use of irony, sarcasm, and capricious attitudes related to individual team members. These attitudes were sensed, when observing the team, when a newly employed OR nurse and a senior surgeon were collaborating:

The surgical procedure has just begun. The SN stands on a step stool and she has two instrument tables ahead. She is going to jump down from the stool if she has to reach the instruments on the tables behind her. The SUR asks, "Do you have a sand pillow?" and the SN answers, "Yes, here!" The SUR asks, "Do you have a scissors and a tweezer?" He gets the instruments. The SUR asks again, "Then, I must have a thread!" The SN replies with a question, "A lilac?" and the SUR answers, "Yes, or a blue one!" The SUR continues, "Can I get a chisel?" The SN is searching on the tables in front; she jumps down from the stool and searches on the tables behind. The SUR is waiting, and after a little while he says loudly, "The nurse can't find the chisel." After waiting a little longer, he continues, "The fact that she cannot find it, I view as a sign that she opposes me!" The SN is quiet, and she finds the chisel. The collaboration goes on in the same way for minutes. Then the SUR asks for an instrument, the SN scans the tables and jumps the step stool up and down. Finally, the SUR says, "Wouldn't it be easier if you roll the tables to me?"

The SN answers, "I didn't expect you to use it!" and the SUR respond, "I always do. ALWAYS!" Now the CN interposes, "Isn't he nice to you, x?" [She mentioned the first name of the SN]. Halfway through the surgical procedure, the SUR exclaims loudly, "This is a mess! The conclusion of the surgery today must be: It is fantastic that the surgeon finished at all!" The tense atmosphere continued. [Team 28]

An ambiguous or sarcastic form of communication was used in certain situations, as a response to colleagues being inattentive in terms of the surgical procedures being performed, as demonstrated in the example below:

Just before time-out and incision time, the SUR says, addressing the SN, "Are you joining a senior scheme? Since you need help from a third OR nurse today?" The SN ignores the questions [no replies]. The SUR says to AN nurse, "We inject the local anesthesia now?" and the AN nurse asks, "Is it Bupivacain? "No!" the SUR replies. The CN asks the SN, "I need your password to the journal again?" The SN snaps, "Orgh!" The SUR now asking CN, "The camera is too close to my glasses!" and OR nurse x moves the camera. The SN says to the CN, "When you have got the time, I need a blue mat." She continues to address the CN, "You may soften the light!" The CN doesn't respond and the SN repeats, "Hey [she calls the name of the CN twice], you may soften the light!" The CN softens the light. The SUR asks CN, "Could you raise the bed?" The CN raises the bed. The SN says, " We need a shaver!" The CN can't find a shaver. She is looking in all the cabinets. She is walking from one part of the room to another, searching for a shaver. The SUR says loud, "It is outside!" The CN brings in the shaver and walks to the computer to write in the journal. The SN calls again, "Hey [she calls the name of the CN], will you power "the milling" [a surgical milling machine]?" The CN doesn't respond, she stays at the computer focusing on her writing. Then, she suddenly discovers that they are about to run out of flushing fluid. Now she is searching everywhere for the fluid without finding it. She runs out of the OR and returns with the fluid – and replaces the bag. She returns to the computer. A new AN nurse enters the room, smiling, and asks the SUR, "X [She says his first name], are you finished now?" The SUR replies loudly, "Thank you so much for asking me, the others in this room are more keen on talking together or doing anything other than being concerned about completing the procedure on this patient!" [Team 3]

However, when the teams were performing very complex surgical procedures, an accurate and timely expression of communication was observed during both the time-out and check-out procedures. An example from a time-out procedure can be seen in the following exchange between an AN nurse and a surgeon, which occurred just prior to incision time:

The AN nurse is reading from a paper: Patient´s name, ID number, and type of surgical procedure. Finally, she mentions that Ciproxin [an infection-prevention medicine] has been given. The SUR replies, "Yes, superb, and no expected

surgical implications. Estimated time for the surgical procedure: half an hour!" [Team 16.2]

Yet, when routine surgery was performed, the safe surgery procedures were often poor, inaccurate, or even missing.

6.3.4 Type 4: Contradictory and Communication

Communication and relationships seen in these surgical teams were characterized by being very contradictory. Indeed, several contradictions existed in these teams between the surgical team members, including being guided by shared goals or functional goals, showing disrespect to colleagues or responding to disrespect from colleagues with respect, and blaming others or solving problems with others when problems occurred. Frequently, these teams were collaborating with patients who were undergoing routine surgery of only a short duration. Communication and relationships in these teams were characterized by being very dynamic due to the contradictions in both collaborative behavior and personality differences.

This type of *contradictory* and *highly dynamic* communication and relationship dynamics appeared when the communication varied from being respectful, accurate, and problem-solving, to being sharp or ironic, as shown in the following situation:

The SUR and SURASS are trying to reduce the hip joint but it doesn't work out. The SUR exclaims loudly, "No, dammit, the monkey hand [nickname for a certain instrument], NOW!" The SN takes the offered instrument and manipulates the leg, and it snaps into place. The SUR says, "Minus 4 [size of the hip material]!" and the SN finds it. Together, they check the size, and the SUR responds in a sarcastic tone, "THANK YOU!" The SN is quiet and focused on her tables and the instruments. Beyond the exchange of words regarding the instruments, there was no communication between the SN and SUR. At the end of the surgical procedures, the SN asks the SU, "Should I fill out the paperwork, or is it something you do?" The SUR answers shortly, "Something I do!" [Team 18]

Occasionally, it was difficult to determine whether the participants expressed mutual respect or not because of the ironic tone of the communication. This is demonstrated in the following dialogue between a senior surgeon and an OR nurse, who were familiar with each other:

The SUR says, "Hey, what is that? Are you not used to hurry out there in the country where you live?" The SN becomes quiet and the AN nurse comments, "You have met your match today!" The SUR laughs and the SN answers, "I am completely confused today with all the different types of implants and the talk about cementing or not cementing (surgical procedures). I have completely lost my overview!" [Team 12.2]

An atmosphere of insecurity could sometimes be sensed during the surgical procedures, and it was clarified in the interviews conducted after the observation. The participants had discovered different strategies for managing tense or strained situations in the OR. Some chose silence and focused on their tasks. For example, [SUR 1] *"I freeze the situation or kill the discussion by not participating"* or [OR nurse 5] "*I keep my mouth shut."* Others opted for confrontation using a tough tone [OR nurse 5] "*I would tell the person that my limits are exceeded, or I would say "I have a sense that you are a little annoyed today, what is it about? Something at home or just the DAY?"* Alternatively, some chose to adopt a problem-solving approach, such as this AN nurse:

> "*Someone yells and shouts about how bad things are going. Perhaps I have been there before myself. Now, I say maybe it isn't well-functioning, but you should move back, take it easy, and try to talk about it together." [AN nurse 14]*

Episodes of disrespectful behaviour were also observed in these teams in different forms, such as team members having a minor temper tantrum, using disrespectful language, arguing loudly in a commanding tone, and humiliating other team members by shaming them for being incompetent or being unprepared. Immediately after a surgical procedure during which this kinds of disrespectful episode was observed, an OR nurse expressed her reflections about the situation:

> *"For the most part, we are good at the planning part. But there are just some combinations that do not work well! And it marks you immediately. It does! In reality, it depends on individuals. And one can also notice that there are some surgeons and some OR nurses that doesn't fit together! Then, the surgeon is right up in the red zone even before we start, and it spills over! I don't like it at all. In my opinion, it is unprofessional of all parties involved, and it results in a very annoying mood all day. It might be hard, to be in for a full day. Because the room would explode if you say just one wrong word, or people jump down the throats of each other if something is upside down. In these situations, I am aware to not do anything wrong, since I know that the whole thing explodes." [OR nurse 33]*

Typically, these teams were involved in routine operations, so solutions to technical or instrumental challenges were rarely required. The participants in these teams often talked about topics that were irrelevant to the operation. In some cases, these conversations served as invitations to newcomers to participate in the community of the surgical team. In other cases, the personal conversations between individual team members were of a nature that excluded other the team members, who then became quiet:

> The *SUR asks the CN if she had a new haircut. She answers, "Yes, and haven't you lost weight?" The SUR replies, "Yes, I am going to complete a marathon, so I must". The newly employed SN, the surgeon assistant, and the AN nurse are quiet*

and focus on their tasks. The conversation about running continues, while they work with the surgical procedure and the CN quit by saying to SUR, "You have so much confidence and charm!" [Team 16.1]

After having presented the third and final stage of analysis, wherein the different types of communication and relationship dynamics in interdisciplinary surgical teams are presented, the associated analyses and findings are interpreted and discussed in the following section.

6.4 Interpretation and Discussion

In PHASE I, an ethnographic fieldwork was conducted in order to address the first research question: *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?* The first research question was based on the assumption that relational coordination in surgical teams will be observed in the team activities performed during surgical procedures in the operating room in the form of communication and relationships between health professionals.

When the health professionals talked about interdisciplinary collaboration in surgical teams, they talked about what constitutes a great collaboration, which challenges are experienced during collaboration, and how best to improve the collaboration. According to the health professionals, a great collaboration is constituted by **professionalism** (specialized knowledge and skills, ability to collaborate, awareness of the patient, and the situation during surgery), **the quality of the communication** (frequent, accurate, timely, and problem-solving communication) and **mutual respect**. Challenges occur that, according to the health professionals, are attributed to **uncertainties** (changes in the daily surgical schedule, patients' conditions before and during surgery, lack of the availability of instruments, materials, or staff required), **interdependency** (misconceptions or coordination flaws), and **time constraints**. Finally, the health professionals emphasized that the interdisciplinary collaboration was good, although **improvement in collaboration** could be beneficially initiated through attitudinal, structural, and procedural changes.

Four different types of communication and relationship dynamics in surgical teams were identified, and the study may indicate a connection between communication and relationship patterns in surgical teams and the level of complexity involved surgery.

In the surgical team that was said to exhibit **proactive and intuitive communication** (Type 1), communication and relationship dynamics were characterized by a broad acceptance of shared goals, a pronounced expression of mutual respect, and timely and accurate communication focused on solving the problems at hand. In these teams, a shared sense of responsibility was supported by the health professionals being

proactive and intuitive. Frequently, these teams were performing surgical procedures with a high level of complexity, which increased the need for shared responsibility.

In other surgical teams, which were said to exhibit **silent and ordinary communication** (Type 2), communication and relationship dynamics were characterized by shared goals and mutual respect. In these team, less exchange of opinions and problem-solving communication was observed between the health professionals, while communication and relationships were less dynamic and more silent than in the other teams observed. Frequently, these teams performed routine surgery of only a short duration.

In the surgical teams that exhibited **inattentive and ambiguous communication** (Type 3), communication and relationship dynamics were characterized by the health professionals being guided by shared goals and functional goals, which resulted in the surgical team members being inattentive to each other. Moreover, they were characterized by the health professionals expressing disrespect to each other rather than showing mutual respect and using finger-pointing communication rather than problem-solving communication, which resulted in the surgical team members expressing themselves ambiguously. These teams performed routine as well as complex surgery of a short duration.

Finally, in surgical teams that exhibited **contradictory and highly dynamic communication** (Type 4), communication and relationship dynamics were characterized by being contradictory. Contradictions were seen between being guided by shared goals or functional goals, between expressing disrespect or showing respect, and between blaming others or solving problems with others when difficulties occurred. These contradictions gave rise to highly dynamic relationships, and differences in personality influenced how the health professionals responded to the contradictions. Frequently, these teams preformed routine surgery of only a short duration.

Taken together, these results provide important insights concerning communication and relationship dynamics and performance within surgical teams in operating rooms.

The identification of different communication and relationship patterns in surgical teams at the micro level, provides perspectives on communication and relationships that occur between health professionals in surgical teams. That is, relationships between work roles, but also between unique individuals. The role-based relationships are in line with the appropriate and inappropriate communication and relationship dynamic described in the theory of relational coordination (Gittell et al., 2000; Gittell 2009), which must be considered to be given and inevitable, since the theory was used as the theoretical framework in the qualitative directed content analysis during this research phase. The ethnographic fieldwork, which explored the interdisciplinary collaboration between health professionals in the OR, at the micro level, created

opportunities to determine distinctions regarding communication and relationships in the most literal sense in order to see and describe: "How does it look?" The identification of different communication and relationship patterns in surgical teams generated knowledge about how the relationships in surgical teams are not only role-based but in fact both role-based and person-based. The person-based factors were made visible in the observed surgical teams, when the health professionals expressed respect for each other, not only respect for their colleagues' task performance and professionalism, but also pronounced respect for each other as unique individuals (Type 1), as well as when the health professionals communicated using a familiar tone (Type 2). The person-based factors were made visible, when the team members were unfocused during the surgical procedures (Type 3), thus failing to show the professionalism that is vital for good collaboration. Finally, the influence of the person-base factors was observed encounters between health professionals when disrespect was ignored and met with silence (Type 4). The impact of communication and relationship dynamics being both role-based and person-based in the interdisciplinary collaboration added nuance to the theory of relational coordination. The possibility of extending the relational coordination theory with these perspectives had been argued, but not shown before by Gittell (2012b). Whether role-based relationships are based on positive personal relationships or vice versa remains unknown. Perhaps these relationship ties are part of the same construct? Further exploration concerning the basis of relational coordination ties at the micro level, as well as how to integrate the functional (role-based) and the personal relationships in order to improve interdisciplinary collaboration, are proposed.

The findings from PHASE I support the conclusions of previous research, which underlined the circumstances in which interdisciplinary teamwork in surgical teams is seriously challenged by working conditions characterized by interdependence, uncertainties, and time constraints (Gittell et al., 2000; Nawaz et al., 2014; Sørensen, 2011; Sørensen et al., 2014). Generally, the health professionals described a very complex and changing clinical practice. The quality and effectiveness of their job performance was experienced as particularly challenging due to frequent changes and uncertainties in the daily surgical program, as well as a high degree of interdependency among the health professionals in the surgical teams and across the units in the hospital. The uncertainties were surrounded by ambivalent feelings. On the one hand, the unpredictability gave rise to great job satisfaction, while on the other hand, it was the source of frustrations. These ambivalent feelings might be compared to the span between challenges and protections, as described under the heading: *"I love my job!"* in Sørensen's (2011) ethnographic study focusing on operating room nursing. Sørensen (2011) presented a span embracing different elements of collaboration and performance in the OR, such as a privilege to be an OR nurse/a trial to be a ward nurse[12], to be proactive/to be reactive, to get a kick out of the uncertainties/to be fixed in the routine. In Sørensen's (2011) study, the challenges and opportunities of being

[12] The OR nurses take care of one patient at a time for a short period. In contrast, the ward nurses take care of many patients at a time for a long period.

an OR nurse, are compared with challenges and opportunities by being a ward nurse. In this study, the health professionals pointed out the challenges and opportunities of being a surgical team member tasked with performing surgical procedures in a context characterized by interdependence, uncertainties, and time constraints. Moreover, they pointed out that such uncertainties can give rise to both "getting a kick" and "underlying frustrations." The health professionals working in surgical teams that exhibited communication and relationship patterns such as Type 1 and Type 2 might have established relationships that enabled solutions to be found and frustrations to be prevented. Conversely, the health professionals working in surgical teams that exhibited communication and relationship patterns such as Type 3 and Type 4 might have unsustainable relationships that kept them from solving problems smoothly as a team and fueled underlying frustrations. Future studies should extend the insights concerning how different levels of uncertainties, interdependency, and time constraints influence the communication and relationship dynamics in surgical teams at the micro level and vice versa.

The four different types of communication and relationship dynamics identified can be interpreted as a reflection of appropriate and inappropriate interpersonal team dynamics in surgical teams. The captured reflections showed how different dynamics may occur in surgical teams, as well as how team members master being part of a team in different ways. According to Vincent et al. (2004), it is crucial to study error but also to study teamwork and how threats to patient safety are successfully managed within interdisciplinary collaboration in surgical teams. Observing interdisciplinary collaboration during this phase enabled the identification of different communication and relationship patterns in surgical teams, reflecting what communication and coordination in surgical teams looked like, when it succeeded, and when it was not successfully achieved. It is possible to learn from all this. To be a great collaborative partner, the health professionals emphasized the need for specialized knowledge, the ability to collaborate, and an awareness of the patient and the situation during surgical procedures in order to perform highly complex surgical procedures. These requirements may be associated with skills such as situational awareness, decision making, communication, teamwork, and leadership, which are contained within the non-technical skills concept identified in several prior studies focusing on interdisciplinary teamwork in the operating room (Fletcher et al., 2002, 2004; Vincent et al., 2004; Yule et al., 2006a, 2008; Michell and Flin, 2008; Michell et al., 2011; Flin and Patey, 2011; Lyk-Jensen et al., 2014, 2016).

As described in the introduction, different behavior measurement systems have been developed to assess these non-technical skills needed by health professionals in surgical teams. In contract to these prior studies, the observations made during the ethnographic fieldwork in PHASE I were focused on the interpersonal dynamics and interpersonal communication in surgical teams, and they were less focused on measuring the behavior of individuals. This resulted in descriptions of appropriate and inappropriate interpersonal team dynamics – and of the communication and

relationship dynamics needed for surgical teams to collaborate in order to perform surgical procedures with high complexity in a qualified way. Therefore, it may be suggested that observation of relational coordination in surgical teams can produce valuable knowledge about how teamwork can be improved at the micro level, as well as how communication and relationship dynamics in surgical teams in the OR can be qualified. This may point to a future need for the development of a tool for observing the behavioral markers of interpersonal dynamics in surgical teams based on communication and relationship dimensions included in the theory of relational coordination.

The finding that there might be connections between health professionals' experience of mutual respect and the communication and relationship patterns seen in surgical teams seems to be consistent with prior research, which found associations between communication and relationships and team members' experience of mutual respect and trusting one another (Kurmann et al., 2012; Kurmann et al., 2014; Nawaz et al., 2014; Edmondson, 2012; Kaldheim and Slettebø, 2016). As described in *Chapter 3*, Edmondson (2012) underlined the need for trust and respect in order for surgical teams to improve their quality and effectiveness, using the term psychological safety to describe a climate in teams in which team members trust each other and feel free to express relevant thoughts, observations, and feelings. Based on this notion of psychological safety, an atmosphere characterized by open and authentic communication is created that enables health professionals to speak up, collaborate toward a shared goal, and experiment and develop new solutions (Nembhard and Edmondson, 2012). Despite the identified benefits of psychological safety, health professionals might hesitate to speak up, since they may be concerned about losing face or damaging their reputation. However, this study indicated that there might be other challenges associated with establishing psychological safety in surgical teams in the OR, namely complex challenges characterized by uncertainties, interdependency, and time constraints, as described by the health professionals during the observations, informal talks, and interviews. Moreover, challenges were observed when interpersonal dynamics overruled the situation in the OR, and inappropriate or even disrespectful communication patterns dominated speech acts, as seen in the surgical teams that exhibited inattentive and ambiguous communication and relationship patterns (Type 3), as well as the teams that exhibited contradictory and highly dynamic communication and relationship patterns (Type 4). Finally, challenges associated with differences in personality, status, and experience were observed in these teams. In surgical teams that exhibited proactive and intuitive communication and relationship patterns (Type 1) and those that exhibited silent and ordinary communication and relationship patterns (Type 2), the mutual respect observed seemed to minimize the influence of potential challenges stemming from differences in personality, status, and experience. These findings further support the concerns raised by Leape et al. (2012a) regarding the effects of disrespectful behavior, when they concluded that disrespectful behavior posed a threat to patient safety and poisoned the well of collegiality and collaboration in the surgical team. According to Leape et al. (2012a, 2012b),

collaboration in surgical teams will not be effective and efficient without mutual respect. Therefore, the creation of a culture of respect in health care is necessary to secure patient safety and foster an appropriate culture of safety. Yet, how should an organizational intervention process be constructed in order to facilitate the creation of a culture of respect wherein health professionals feel a sense of psychological safety? The question of how, specifically, a culture of respect could be created and maintained at the micro level in surgical teams remain relatively unexplored. This seems to indicate important issues in relation to improving relational coordination and safety culture at the micro level between health professionals in surgical teams in the OR, as well as important topics for future research.

According to the health professionals, mono- and interdisciplinary discussions and systematical learning from failures are needed in order to improve both the interdisciplinary collaboration in surgical teams and the quality of patient treatment. During the observational study, the health professionals expressed several times the need for an exchange of reflections and debriefing. However, initiatives intended to convene such meetings of the surgical team were never observed. This request for the exchange of reflections or debriefing in the team seems to be in consistent with recent studies (Nawaz et al., 2014; Kaldheim and Slettebø, 2016). Nawaz et al. (2014) highlighted the crucial importance of feedback and interdisciplinary reflections in relation to improving the efficacy and effectiveness of surgical teams and learning from experience in order to secure patients safety. However, for successful feedback and learning to be practiced in the operating room, all the health professionals need to be open-minded about criticism and prepared to listen to one another. Although, instances of debriefing or feedback failed to appear in the interdisciplinary surgical teams observed, exchanges of reflections following surgical procedures and learning from experience were common between the newly employed OR nurses and the experienced OR nurses, as well as between the AN nurses. These learning activities were comparable with the concept of the *Learning Cycle in Orthopedics* presented by Nawaz et al. (2014), which contained four steps in a cyclical learning process: *diagnose*, *design*, *act*, and *reflect*. This might be a useful model for implementation in surgical teams with the purpose providing a learning environment and teaming, and it is assumed to be especially profitable for surgical teams that exhibit *inattentive and ambiguous communication* patterns (Type 3) and those that exhibit *highly dynamic relationships and protective exchanges of meaning* (Type 4). However, the implementation of the systematic use of feedback and learning processes in the OR might create opportunities for improvement of mutual trust in all types of surgical teams, as well as enhancement of the outcomes of providing complex patient care. Such learning processes should be facilitated by surgeons, who should adopt the appropriate leadership roles for fostering successful feedback and teaming in surgical teams in the OR, as recommended by Nawaz et al. (2014). The organizational and management structures within the hospital might influence the surgeons' ability, attitudes, and possibilities to undertake a horizontal and learning leadership role, as proposed by both Nawaz et al. (2014) and Edmondson (2012). Variations in

department affiliation (working conditions and hours) and management affiliation between the health professionals working in surgical teams (between surgeons and nurses) might challenge the conditions necessary for obtaining a profound and much-needed knowledge of each other's competencies, for creating environments for effective teamwork, and for enabling an appropriate leadership role. Further exploration and experimentation are needed to implement the structural, relational, and/or work process initiatives needed to enable and support an appropriate leadership role within surgical teams.

Furthermore, the coordination behavior observed in the teams that exhibited proactive and intuitive communication and relationship patterns (Type 1) and silent and ordinary communication and relationship patterns (Type 2) supports previous studies concerning this particularly clinical context with a focus on adaptive coordination strategies in surgical teams. (Bogdanovic et al., 2015) The findings, which focused on coordination behavior in the operating room, highlighted the need for task management prior to and during surgical procedures to be directed against planning, discussing, and prioritizing. The findings further emphasized that the information management should include patient-related information, situational assessment, and shared decision making, while the leadership of the surgical team should be managed by the performing surgeon through the surgical procedures. However, all health professionals in OR carried responsibility for their tasks and the leadership role might shift from one health professional to another depending on situational needs. Nevertheless, the comparison also shows significant differences. Bogdanovic et al. (2015) described adaptive strategies based on semi-structured interviews conducted with operating room nurses at a Swiss university hospital, focusing on what constitutes and what facilitates qualified coordination during the preoperative period in the OR. The present study described communication and relationship based on the observation of behavior and semi-structured interviews conducted with health professionals. This could result in a significant qualitative difference, while there may be differences between what the health professionals say they do and what they prefer, and what they actually do during their daily task performance. The adaptive coordination strategies underlying the surgical teams' task management as presented by Bogdanovic et al. (2015), could be consistent with the coordination strategies used by the surgical teams characterized as exhibiting proactive and intuitive communication (Type 1), as observed in the present study. It might be that team members in teams characterized as exhibiting inattentive and ambiguous communication (Type 3) also wished to be guided by appropriate adaptive coordination strategies, although they were disrupted and disturbed due to inappropriate interpersonal relationships and a lack of mutual respect. The findings of the present ethnographic fieldwork add perspectives on what coordination within surgical teams looks like, when it succeeded, and when it was not successfully achieved.

The coordination behavior seen in the different teams observed, as well as the collaboration challenges described by the health professionals, could also be

associated with the challenges attributed to the adaptive capacity in surgical teams (Sørensen, 2011). The adaptive capacity in surgical teams was found to be dynamic and influenced by both changes in the physical environment, such as the equipping and size of the operating room, as well as the presence and supply of instruments and materials, and the interpersonal relationships that exist between the surgeon, OR nurses, and AN nurses. Sørensen (2011, p. 86) used the metaphors: *The Battle for the Space, the Battle for the Equipment, and the Battle for the Time* to describe the challenges observed in the physical environments in a surgical unit. Such metaphors were also expressed by the health professionals in this study. If the health professionals experienced battles for space, equipment, and time in relation to their collaboration and coordination with colleagues in the physical environments outside the operating room (in the surgical unit), these battles might influence the adaptive capacity in the OR, and they might explain the tendency to be guided by functional goals rather than shared goals, as well as to blame each other rather than solving problems together. This mechanism was described by the health professionals in the observations, formal talks, and interviews in the present study. Thus, environmental dimensions influenced the adaptive capacity, the coordination behavior, and communication and relationship patterns. These findings suggest that environmental and structural dimensions influence the communication and relationship patterns seen in surgical teams, although further research is needed to explore the impact of these dimensions on the interdisciplinary collaboration in surgical teams, as well as to prevent these dimensions from affecting the adaptive capacity in surgical teams.

The first research question that informs this study sought to explore what characterizes communication and relationships in interdisciplinary surgical teams, as well as which communication and relationship patterns can be seen in such teams. Different patterns were identified, and the ratio between the appropriate and less appropriate communication and relationship dynamics observed was obtained by calculating the positive/negative relational coordination ratio (P/N ratio). The teams that exhibited proactive and intuitive communication and relationship patterns had the highest P/N ratio, while the teams with inattentive and ambiguous communication and relationship patterns had the lowest P/N ratio. These findings are consistent with those of Losada and Heaphy (2004), who relied on a positivity/negativity ratio (P/N ratio) to find differences between high-performance teams and low-performance teams in a qualitative observation study focusing on business teams. The high-performance teams were characterized by team members showing appreciation for and encouragement to other members, as well as creating the emotional space needed for expansive possibilities for action and creativity. In contrast, the low-performance teams were characterized by team members generating a restrictive emotional space created by a lack of mutual respect, distrust, and cynicism. While Losada and Heaphy's (2004) study was conducted in the business sector, this study was conducted in the field of health care. Losada and Heaphy's (2004) observations were conducted in a computerized lab designed for team research, while the observations in this study were conducted in the operating rooms in reality. Losada and Heaphy (2004) coded during

the observations according to a coding scheme, while in this study, the observations were conducted using ethnographic principles and the coding was conducted afterward in the analysis process. Qualitative observations of surgical teams performing surgical procedures in reality, which are based on a coding scheme using the theory of relational coordination as a framework, might be fruitful in extracting new knowledge about appropriate and inappropriate communication and relationship dynamics at the micro level. This knowledge could be useful in relation to improving the collaboration, safety culture, and patient outcomes in surgical units.

The findings of the present study show that the four distinct types of communication and relationship dynamics occur with unequal frequency in relation to surgical procedures with a low and a high level of complexity. Surgical procedures with a high level of complexity were performed by surgical teams that exhibited Type 1 or Type 3 communication and relationship dynamics, as seen in in 11 out of 15 cases, while surgical procedures with a low level of complexity were performed by all the teams. The teams that exhibited Type 2 and Type 4 communication and relationship dynamics were performing surgical procedures with a low level of complexity in ten out of 13 cases. It is therefore likely that connections exist between communication and relationships and the level of complexity in surgical procedures, although it is from an epistemological point of view beyond the purpose of this ethnographic study to examine correlation and causality between relational coordination and level of complexity.

The combination of findings discussed above provides support for the assumption that proactive and intuitive communication patterns in surgical teams, as seen in Type 1, might contribute positively to the safety culture in the operating room, and they could possibly influence both surgical performance and patient safety. Therefore, learning from these teams might provide the potential for improving efficiency and effectiveness in the surgical teams, which may enhance the quality of treatment and patient outcome. This is an important issue for future research. Furthermore, it is of essential importance to prevent inappropriate dynamics, such as the inaccurate and disrespectful communication and relationship patterns as seen in Type 3 surgical teams, which exhibited inattentive and ambiguous mode of communication.

6.5 Strengths and Limitations

There are several limitations to the study conducted during PHASE I. First, the data were obtained from observations performed in two highly specialized orthopedic surgical units performing hip and knee arthroplasty surgery, with the same group of surgeons, the same management team, and within the same university hospital, but in two geographically different places and with different levels of complexity. A higher degree of diversity and stronger generalizability could have been taken into account with a multi-case study design. However, the extension of the observations of

interdisciplinary teamwork in a few selected ORs facilitated an in-depth study that generated a very rich amount of data, which would have been very difficult to capture if many surgical units were involved (Hammersley and Atkinson, 2007). Even though knowledge derived from a single case study cannot be formally generalized, it can enter the collective process of knowledge accumulation in a given field and thereby be valuable (Flyvbjerg, 2001, 2006; Delmar, 2010). Second, in any ethnographic study, the relationships between the participants being observed and the observer are crucial. Therefore, bias might be associated with the possibility of team members communicating and performing in an artificial or unusual way due to the observer being present in the operating room, could exist. The assumptions underlined in the methods used for data collection within ethnography are, according to Hammersley and Atkinson (2007), to study the interaction between participants in their everyday context. In this study, I was present in each of the surgical units for 25 days during a period of four months, and the team members were observed during three to ten surgical procedures that lasted for one to six hours per procedure. Acting or communicating in an artificial or unusual way in the collaboration with colleagues during surgical procedures over such a long period is likely impossible. Third, the deductive approach applied during the coding phase of the content analysis presented some challenges. I, as the researcher, may have been particularly focused on capturing and interpreting perspectives in the direction of the predetermined theoretical concepts, and I may have been blinded to the risk that new perspectives were not intercepted. To overcome some of the limitations related to neutrality and trustworthiness a coding scheme was developed and discussed with other researchers. Finally, in Denmark, there may be relatively low hierarchical relationships in the OR between surgeons and nurses when compared to other geographical and cultural context. In Denmark, it is, for example, common for nurses to refer to surgeons by their first name, and vice versa. This study was limited to the context of Denmark, and further cross-cultural research is needed to explore the recognizability and applicability in clinical contexts in other health-care systems.

Using a directed content analysis based on the theory of relational coordination as a theoretical framework offered supporting evidence for the theory of relational coordination. In this case, the supporting evidence was presented by offering descriptive evidence of different communication and relationship patterns across different interdisciplinary teams in the same unit, by showing codes with examples, and by presenting a variety of participants' quotations expressing appropriate and inappropriate communication and relationship dynamics. The different communication and relationship patterns seen across team at the micro level within an organization offered an extended view and help to enrich the theory of relational coordination. In addition, the directed approach made explicit the reality that I, as the researcher, worked from a certain theoretical point of view. Yet, the application of this theory may also represent a limitation and a major source of bias (Hsieh and Shannon, 2015). The use of a theoretical framework may be a source of error, since it may have influenced the analysis and interpretation in an inappropriate manner. As a researcher, I could be

"seduced by the theory" to be more concerned with the interpretations and findings that were supportive of the theory than the interpretations that challenged the theory, or I may have been “blinded by the theory” and hence neglected or overlooked other aspects.

6.6 Partial Conclusion

The objective during PHASE I was to explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark. In this partial conclusion, I address the first research questions: *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?*

The health professionals working in the observed surgical teams are performing surgical procedures in a context of variable complexity. It is a context characterized by frequent changes and uncertainties in the daily surgical program, a high degree of interdependency among team members, and a strong focus on the use of both time and resources. According to the health professionals in surgical team, a great collaboration in surgical team is constituted by professionalism, mutual respect among health professionals, as well as frequent, accurate, timely, and problem-solving communication. Four different types of communication and relationship dynamics were identified within surgical teams, and the study may indicate a connection between communication and relationship patterns in surgical teams and the level of complexity in surgery. The findings support the assumption that proactive and intuitive communication patterns in surgical teams, as seen in Type 1, might contribute positively to the safety culture in the operating room, and they may influence both the surgical performance and patient safety. Therefore, learning from such teams might improve the efficiency in surgical teams and enhance the quality treatment and patient outcomes. Taken together, these results provide important insights concerning communication and relationship dynamics and performance in surgical teams in operating rooms.

The study conducted during PHASE I complements previous studies concerning relational coordination in interdisciplinary teamwork in the OR, since the ethnographic study has created opportunities to examine relational coordination at a micro level. Exploring the interaction patterns that exist between the members of interdisciplinary teams at the micro level facilitates a differentiated dynamic picture of the quality of teamwork, rather than a static snapshot provided by measurements showing high or low relational coordination at the macro level. The findings of the ethnographic fieldwork contribute additional knowledge by using participant observations as a method for exploring the communication and behavior of surgical team members in their daily task performance during surgical procedures, and thereby identifying four different patterns of communication in contexts of variable complexity. The findings

show that communication and relationships at the micro level in surgical teams are based on role relations as well as personal relations and intersubjective work experience between team members. The impact of communication and relationship dynamics being found to be both role-based and person-based in interdisciplinary collaboration adds nuance to the theory of relational coordination. Further exploration of the basis of relational coordination ties at the micro level, as well as further experiences of how best to integrate the functional (role-based) and the personal relationships in order to improve interdisciplinary collaboration, are proposed.

The challenges faced by the surgical teams, such as interdependence, uncertainties, and time constraints, were found to stimulate both the sense of success and the emergence of frustration influenced by communication and relationship patterns used. Future studies could extend the insights concerning how different communication and relationship dynamics in surgical team influence health professionals' ability to navigate and master uncertainties, interdependency, and time constraints in a complex clinical context.

The observation of surgical teams performing surgical procedures in context of variable complexity enabled the identification of appropriate and inappropriate interpersonal team dynamics in interdisciplinary surgical teams. The findings of the present ethnographic fieldwork add perspectives about how coordination within surgical teams looks like, when it succeeded and when it was not successfully achieved. Further qualitative observations of relational coordination in surgical teams could produce valuable knowledge regarding how teamwork at the micro level can be improved and how the communication and relationship dynamics in surgical teams in OR can be qualified. This points to a future need to develop a scheme based on the theory of relational coordination that can be used to mark behavior and actions when communication and relationship dynamics in surgical teams are observed.

The findings also support the assumption that there might be connections between health professionals' experience of mutual respect and the communication and relationship patterns seen in surgical teams. Mutual respect between health professionals is needed in order for surgical teams to work efficiently and provide a safety culture. Future studies could explore how organizational intervention processes intended to facilitate the creation of a culture of respect are initiated and maintained.

Mono- and interdisciplinary meetings and the systematic use of feedback and "learning from failure" processes are demanded by the health professionals in surgical teams in order to both improve team collaboration and qualify surgical procedures. Additionally, to implement these learning and knowledge exchange meetings successfully, appreciative and engaging leadership role is required. Further exploration and experimentation are needed to implement structural, relational, and/or work process initiatives so as to enable and support an appropriate leadership role in surgical teams.

CHAPTER 7. ORGANIZATIONAL INTERVENTION PROCESS

In this chapter, I address the second research question: *How is the theory of relational coordination used units as a tool for improvement in organizational intervention processes in surgical units?* by presenting the findings, interpretations, discussions, and a partial conclusion derived from the monitoring and evaluation of the organizational intervention conducted in PHASE II.

In PHASE II, an organizational intervention process in a surgical unit that extended over a period of two years (June 2014 to June 2016) was followed. The theory of relational coordination and the Relational Model of Organizational Change (Gittell et al., 2011; Gittell, 2016) were used as tools for prioritizing and designing the interventions that were to be implemented (Figure 20). As presented in *Chapter 3*, the relational model includes relational interventions, structural interventions, and work process interventions. In the model, the relational interventions are described as interventions intended to initiate new ways of connecting with one another or transforming relationships, such as creating safe spaces, relational mapping, or coaching. The structural interventions are defined as interventions intended to structure new ways of organizing the collaboration, such as team meetings, shared procedures, and shared information systems. Finally, the work process interventions are defined as initiatives intended to assess and improve the work processes, for example, improvement model such as the Model of Improvement (PDSA) (Langley et al., 2009) or Lean Production (Scoville and Little, 2014).

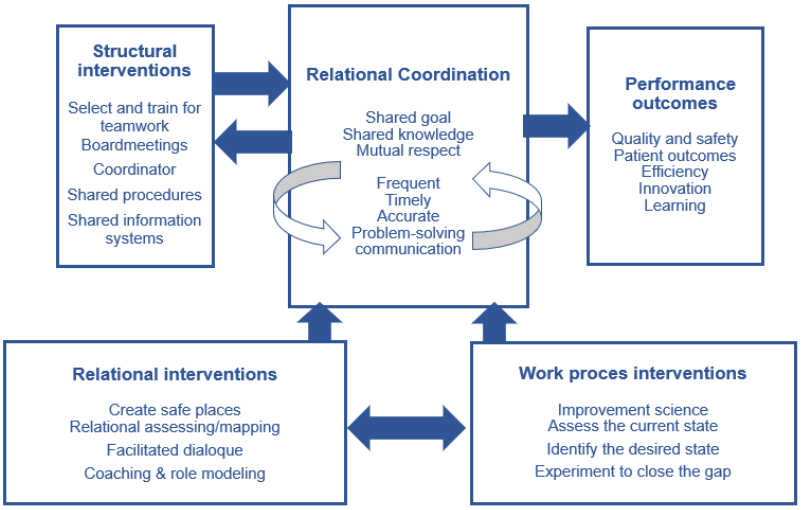


Figure 20 The Relational Model of Organizational Change, as adapted from Gittell (2016).

Moreover, the framework for evaluation of organizational interventions (Nielsen and Abildgaard, 2013) was used in PHASE II to scaffold the analyses and interpretation of the evaluation of the interventions. The framework is described in *Chapter 4* and illustrated in Figure 21.

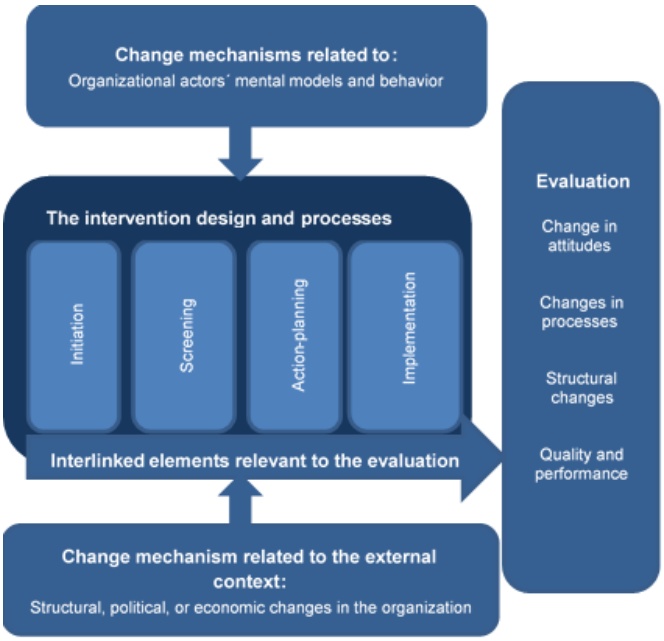


Figure 21 Framework for evaluation of organizational interventions, as inspired by Nielsen and Abildgaard (2013).

The data collection and analyses were conducted based on participation in meetings with the change team, the management groups, and health professionals employed in the surgical unit. An overview of the meetings held with the change team (C1-C12), the management group (M1-M4), and all the health professionals (HCP) (introduction meeting, kick-off meeting, and status meeting) is presented in the timeline shown below (Figure 22). The timeline also shows the distribution of the RC Survey at Time 1, Time 2, and Time 3 (measurement of relational coordination), as well as the phases contained within the intervention process (initiation, screening, action-planning, implementation, and evaluation). Moreover, the changes seen in the external context, including structural changes, are inserted into the figure as a process box at the timeline. These structural changes were implemented concurrently and added information about the change mechanisms related to the external context, which was important when evaluating the intervention.

Several analytical movements have taken place during the organizational intervention process. Very frequently, the analytical processes were going on during the change

team meetings through discussions, reflections, and questions asked. These analytical movements were written in notes describing the process and the initiatives for capturing the discussions, reflections, and conclusions – to the extent possible (Nielsen and Abildgaard, 2013; Spradley 1980). Some of the notes were shared with participants in the change team, while some notes were analytical reflections for use in the analyses and interpretation processes during PHASE II.

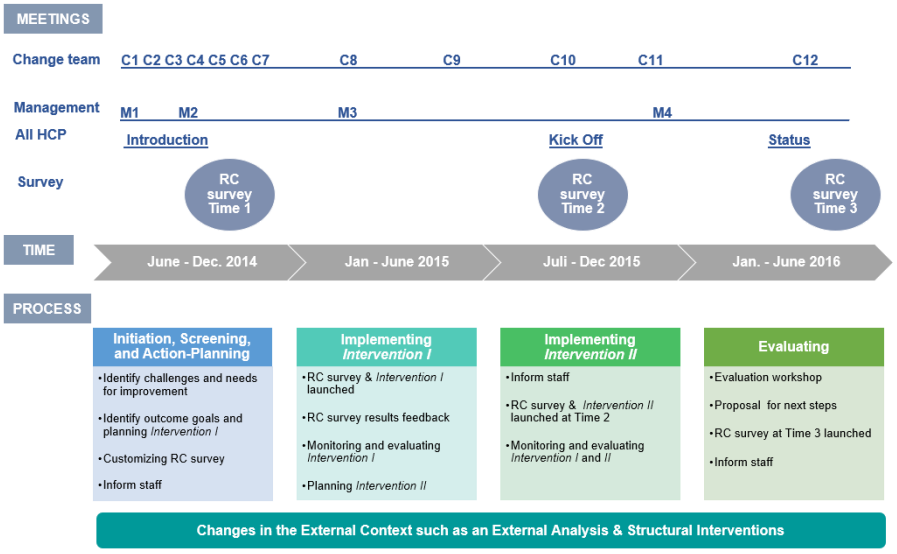


Figure 22 The organizational intervention process from June 2014 to June 2016, including marks for meetings held with the change team (C1 - C12), with the frontline and senior management (M1 - M4), and with all the health professionals (HCP) employed in the surgical or anesthesia unit (Introduction, Kick off, and Status).

In order to ensure a more complete understanding of the intervention process, as well as to provide recommendations for improvements in future organizational change processes, the qualitative data obtained from the intervention processes during PHASE II will be articulated, analyzed, and discussed through a series of points of interest. This will be followed by a discussion and a partial conclusion.

The first point of interest describes how the organizational change process was initiated and how *Intervention I* was developed and implemented, as presented in section *7.1 Initiating an Organizational Intervention Process.* In this part, the initiation, screening, and action-planning phases embedded in the framework for evaluation of organizational interventions are presented and analyzed. The initiation phase is the starting point for an organizational intervention, during which the intervention plan is developed, and the participants to be involved in the change process are designated.

In the screening phase, the requirements for improvement and problem areas are identified, and the baseline measurements for evaluating the intervention effects are conducted. In the action-planning phase, the intervention initiatives are designed. The second point of interest describes the results feedback process, as presented in section *7.2 Feeding Back Results and Prioritizing Next Steps.* In this part, the results feedback process, which is considered to be a relational intervention, is described, followed by a presentation of how the change team used the baseline measurements of relational coordination to plan the next intervention effort, namely *Intervention II*. The third point of interest focuses on the change team's experiences and evaluations of the organizational intervention process, supplemented by the performance outcome data obtained from national registers of quality in orthopedic surgery, as presented in section 7.3 *Experiences from the Intervention Process.* In this final point, the experiences expressed by the change team are captured, with a focus on the successes and challenges during the intervention process. Information is added concerning the changes in work processes, structural changes, relational changes, changes derived from the external context, and performance outcomes. Based on the interpretation and discussion of these points of interest, the second research question will be addressed, and the implications for practice are presented in the partial conclusion.

7.1 Initiating an Organizational Intervention Process

The organizational change process was initiated by both senior management and the frontline managers of the orthopedic clinic and the anesthetic clinic. The decision to initiate an organizational change project was partly the result of a decision by the senior management (a "top-down" decision) and partly due to a change initiative stemming from the frontline managers and health professionals (a "bottom-up" initiative). Thus, the process was initiated in collaboration between managers and employee representatives. On the one hand, the senior management of the orthopedic clinic wanted to strengthen interdisciplinary collaboration by initiating an intervention based on the theory of relational coordination including follow-up research. On the other hand, the frontline managers wanted to ensure better collaboration between health professionals in the operating room, as well as better collaboration in planning and scheduling the surgical procedures within the surgical unit, an aim supported by the senior management of the anesthetic clinic. The different perspectives concerning the need to initiate an organizational change process were exchanged, and a common overall framework for the intervention was agreed on a joint meeting in August 2014. The stated purpose was to change the team organization in order to improve quality, efficiency, and continuity in the surgical pathways, taking into account the needs of the individual patient. The intervention was named *Team Organization in the Surgical Unit.* A mandate[13], describing the purpose, design, and organization was produced, and a change team was established. The change team was composed of senior and frontline

[13] *Kommissorium, Teamorganisering [Commission, Team Organization] July 2014*

managers and employee representatives from the workgroups of OR nurses and AN nurses. No employee representatives from the workgroups of surgeons and anesthesiologists were included. One senior manager had experiences of similar team organizational interventions, and those experiences were expected to be used during the process.

During the initiation phase of the process, the connection between PHASE II and PHASE III of the Ph.D. project and the team organizational intervention was discussed with the senior management and frontline managers. A decision was made to introduce and use relational coordination theory and the associated methodology in the intervention process. The role of the researcher was clarified and described in a plan[14] of action. As a researcher, I was invited to a) participate in the change team meetings, b) present the findings of the fieldwork (PHASE I) so as to share knowledge and thereby inspire the development and design of intervention initiatives, c) facilitate a workshop in order to customize the RC Survey, d) measure relational coordination and safety culture before, during, and after the organizational intervention, e) facilitate a feedback process based on the results of the RC Survey at Time 1, and f) facilitate an evaluation workshop following the implementation of the organizational intervention. In September 2014, a task schedule[15] was provided and the first initiatives involved in the intervention were expected to be launched in Surgery Unit II in December 2014, which meant that the screening and action-planning phases had to be conducted throughout that half-year period, as illustrated in the timeline (Figure 22, p. 131).

7.1.1 Screening and Planning *Intervention I*

During the screening phase, the change team discussed the challenges that they experienced, and the preliminary findings of the fieldwork were presented in order to clarify the challenges faced in the surgical unit and the need for change. In this way, the change team explored the current state of collaboration and work processes, and the first step in the work process intervention was taken. The following challenges were highlighted by the change team:

- The first patient scheduled to undergo surgical procedures arrived at the OR too late in the morning (later than 7:45 AM). The preparation of the patient for surgery was delayed due to missing blood test results, missing anesthesia or surgical prescriptions, or else the patient had not received the prescribed medicine.
- The time between the patient's arrival in the OR and the surgical incision time was extended, meaning that the time between surgical procedures in the OR was extended (the time from one patient leaving the OR to the next patient being ready for surgery), which resulted in an inefficient use of the operating room capacity.

[14] Interdisciplinary team collaboration in the surgical unit, September 2014
[15] Projektplan for Teamorganisering O-OP& O-AN [Project Plan, Team Organization], July 2014

- The waiting time for patients with femoral neck fracture was too long.
- The planning of the daily surgical schedule was too unsystematic, and continuity was lacking.

Many of these challenges occurred as a result of conditions, circumstances, and collaboration between health professionals outside the OR (in the surgical unit more broadly), although they were experienced to affect the interdisciplinary collaboration in the surgical teams inside the OR. There was clear accordance between the challenges described by the change team and the findings of the ethnographic fieldwork (PHASE I), which were presented to the change team during the intervention process. In the fieldwork, the health professionals described the importance of a shared understanding of the core task and collaboration guided by the shared goal, that is, to provide high-quality treatment and care for the patients undergoing surgery. According to the health professionals, collaboration in the surgical team was not always guided by shared goals, and specialized knowledge was overlooked during the preparation and planning for surgical procedures. The challenges that arose from being guided by functional goals rather than being guided by shared goals were also observed in the teams that exhibited inattentive and ambiguous communication (Type 3). Thus, the findings of the fieldwork showed that from the health professionals perspectives, the challenges involved in interdisciplinary collaboration largely derived from challenges in the relationships between surgical team members (functional goals and specialized knowledge). These challenges resulted in patients not being ready for surgery, the inefficient use of the operating room capacity, inaccuracy in surgical prescriptions, a prolonged waiting time before surgery for some groups of patients, and uncertainties associated with planning the surgical schedule. During the ethnographic fieldwork, the desire for improvement was raised by the health professionals in several regards:

- Changes in attitudes and a more profound sense of shared responsibility for the quality of the patients' treatment were seen as opportunities for strengthening shared knowledge between workgroups and across units.
- The establishment of weekly interdisciplinary meetings with the purpose of sharing specialized knowledge and qualifying the preparation and performance of the surgical procedures was proposed.
- Initiatives were requested to support and strengthen the health professionals' opportunities to learn from failures. Debriefing after surgery, including shared reflection, was proposed to be fruitful in terms of improving collaboration and the performance of surgical procedures in the future.

During the screening phase, further exploration of the challenges was required, and various initiatives were initiated in order to clarify the extent of the problems and thereby obtain insights into the current state of collaboration and work processes. Meetings between senior and frontline managers of the surgical unit and frontline managers of the orthopedic wards were held in order to discuss the challenges associated with patients being ready and prepared for surgery in the morning across

units. These meetings could be considered to be facilitated dialogues or relational interventions as defined in the Relational Model of Organizational Change. The fieldnotes from PHASE I were explored to clarify what happened in situations when the time between patient's arrival in the OR and the surgical incision time was extended, with the aim of identifying possible solutions for these problems. This exploration during the screening phase could be seen as a work process intervention as defined in the Relational Model of Organizational Change (Gittell, 2016). During the action-planning phase, several activities were initiated and performed by the change team. At the change team meetings, the theory of relational coordination and the process for using the RC Survey as a tool for prioritizing interventions were introduced and discussed. Furthermore, the hypothesis that increased relational coordination would positively affect the quality of care was discussed. In a continuation of this discussion, the change team exchanged perspectives about what the desired quality improvement would look like. The change team expected and wanted the quality improvement to include the following:

- Patients at the OR at 7:45 AM.
- Earlier surgical incision time.
- More efficient use of the operating room capacity.
- More accuracy in surgical prescriptions.
- More patients with femoral neck fracture to be operated on within 24 hours of their arrival in the hospital.

The change team discussed how best to assess improvement, and they concluded that the resources needed for concrete measurements of progress were lacking, although the intervention process should be evaluated along the way by monitoring the quality outcomes listed above. At a meeting with OR nurses and AN nurses, the theory of relational coordination was introduced, and information about the distribution, completion, and consequences of the RC Survey was provided. In December 2014, the screening and action-planning phases were completed, and *Intervention I* came to include the following initiatives:

- Organization of daily interdisciplinary planning meetings (board meetings).
- Daily designation of an OR coordinator in each operating room.
- Implementation of daily debriefing in the OR.
- Extended collaboration with the orthopedic ward - writing new shared procedures for preparing patient for surgery.

Thus, *Intervention I* included both structural, relational, and work process initiatives, as shown in an adapted version of the Relational Model of Organizational Change in Figure 23.

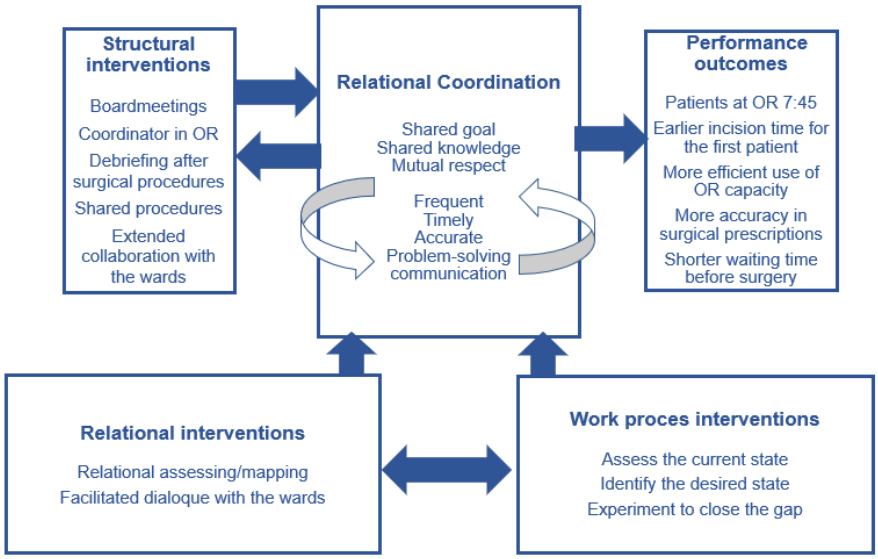


Figure 23 *Intervention I* inserted into the Relational Model of Organizational Change, as inspired by Gittell (2016).

The structural initiatives included organizing daily board meetings, designating a daily OR coordinator in the OR, and writing new shared procedures for preparing patients for surgery in collaboration with the orthopedic ward. The relational initiatives included providing relational assessment/mapping during a results feedback meeting with the change team, health professionals sharing experiences and providing feedback to each other in daily debriefings in the OR, and sharing knowledge in an extended collaboration with the orthopedic wards. The initiatives targeting work processes included exploring the current state of work processes, identifying the desired state of work processes, and planning interventions to close the identified gap. All the initiatives were expected to improve both relational coordination and performance outcomes.

7.1.2 Customizing the RC Survey

As described previously, the RC Survey was used to measure communication and relationships across the workgroups performing orthopedic surgical procedures in the OR, as based on a dual purpose. First, the measures should be shared with the participants in the change team in order to allow them to reflect on current patterns of relational coordination and thereby allow them to help design the intervention, as recommended by Gittell (2016). In this way, the measurement of relational coordination should be used in a prioritization process guiding the development and design of *Intervention I* and *Intervention II*. Using the measures of relational coordination in this way is presented as a relational intervention in the Relational Model of Organizational Change, and it is described in the principles of relational coordination as tools for change (Box 1, p 28). Second, the measurement of relational coordination should be used in PHASE III as a baseline measurement.

The customizing process was conducted at a change team meeting in which the participants in the change team reflected on the definition of the focal work process and the functional workgroups involved. A work process for which tasks, procedures, and outcomes were well understood by all the involved health professionals in the orthopedic surgical unit was chosen and, articulated in the following way:

> "*Tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital".*

Several functional workgroups of health care providers were involved in carrying out this work process: surgeons (SUR), surgeon assistants (SURASS), coordinating surgeons (COORSU), anesthesiologists (ANE), operating room nurses (OR nurses), nurse anesthetists (AN nurses), coordinating nurses (COORNU), and nurse assistants (NURASS). The network of workgroups surrounding the defined work process is shown in Figure 24.

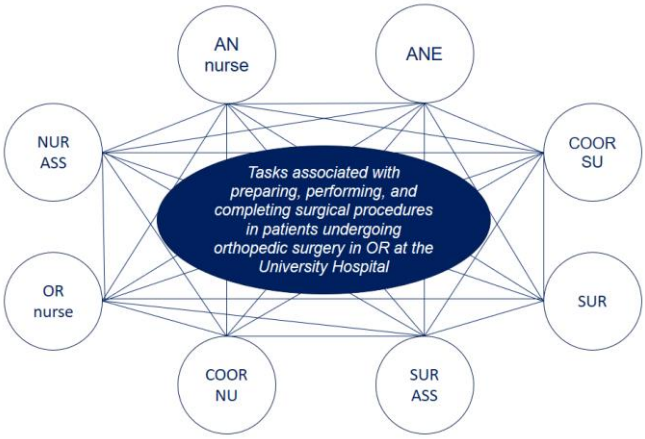


Figure 24 Network of workgroups involved in the work process

Several workgroups that were involved more peripherally in the work process, such as orderlies, secretaries, laboratory technicians, and other technicians, were omitted from the survey. This limitation was adopted to reduce the workgroups involved in the survey, with the aim being to only include those workgroups in direct contact with the patients undergoing surgical procedures in the operating room. However, an exception was made with regard to this limitation, since there was a great desire on the part of the change team to measure relational coordination between the functional workgroups in direct contact with the patients undergoing surgical procedures in the operating room and the nurses in the orthopedic wards. This desire derived from the experienced challenges in relation to the collaboration between nurses in the operating room (OR nurses and AN nurses) and nurses in the orthopedic wards, which could result in delays. Therefore, nurses in the orthopedic wards were included in the survey in the sense that respondents of the survey were asked to answer each of the

questions regarding their coordination with nurses in the orthopedic ward, although the nurses in the orthopedic wards themselves were not respondents to the survey, which resulted in one-way measures of relational coordination between nurses in the orthopedic wards and all the other workgroups. After having defined the work process and selected nine functional groups in the customizing workshop, a customized RC Survey was completed using the survey tool available from the analytics company Relational Coordination Analytics, Inc.[16] (RCA, 2018). The template for the customized survey including the questions, response options, and converted values for response options, as are shown in Table 17.

RC Dimension	Survey Question
Frequent communication	*How frequently do people in each of these groups communicate with you about tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital?* *1 = not nearly enough, 3 = not enough, 5 = just the right amount, 4 = too often, 2=much too often*
Timely communication	*Do they communicate with you in a timely way about tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital?* *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always*
Accurate communication	*Do they communication with you about tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital?* *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5=always*
Problem-solving communication	*When there is a problem with tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital, do people each of these groups blame others or work with you to solve the problem?* *1 = always blame, 2 = mostly blame, 3 = neither blame nor solve,* *4 = mostly solve, 5=always solve*
Shared goals	*Do people in each of these groups share your goals for tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital?* *1 = not at all, 2 = a little, 3 = somewhat, 4 = a lot, 5 = completely*
Shared knowledge	*Do people in each of these groups know about the work you do with tasks associated with preparing, performing, and completing surgical procedures in patients undergoing orthopedic surgery in the OR at the university hospital?* *1 = nothing, 2 = a little, 3 = some, 4 = a lot, 5 = everything*
Mutual respect	*Do people in these groups respect the work you do with tasks associated with preparing, performing and completing surgical procedures in patients undergoing orthopedic surgery in OR at the University Hospital?* *1=not at all, 2= rarely, 3=occasionally, 4= often, 5=constantly*

Table 17 Customized RC-Survey with work process inserted.

[16] Relational Coordination Analytics, Inc. (RCA) is an analytics company founded to support the measurement of relational coordination. RCA is closely connected to the Relational Coordination Research Collaborative, an international network of researchers, practitioners, and consultants working with improvement processes across industries using the theory of relational coordination as a framework. The use of the measurement tool requires certification, which I acquired by attending a workshop (two days) and the subsequent completion of an examination process in 2013.

The RC Survey was distributed to a total of 150 health professionals. Afterward, *Intervention I* was launched, as shown in the timeline (Figure 22, p. 131).

7.2 Feeding Back Results and Prioritizing the Next Steps

The second point of interest describes the results feedback process, as well as how the change team used the results of the RC Survey at Time 1 in their design and action-planning for the next intervention effort, *Intervention II*. As previously mentioned, the feedback process was considered to be a relational intervention, as defined in the Relational Model of Organizational Change.

7.2.1 Results Feedback Process

When the measurement of relational coordination was completed, a feedback process based on the results from the RC Survey at Time 1, as inspired by the principles of relational coordination as tools for change (Box 1, p 28), was on the agenda at a change team meeting. A dialogue-based exploration was facilitated, including relational assessment and relational mapping (Gittell, 2016). Afterward, the results of the measurement of relational coordination were presented to the change team, emphasizing that the results reflect a snapshot that could be helpful in the further improving work. Through a feedback dialogue, the change team reflected on the survey results, defining the strengths and weaknesses. The results of RC Survey at Time 1 are shown in Figure 25, illustrating how the seven RC dimensions were rated on a Likert scale ranging from one to five (values given in Table 17, p. 138).

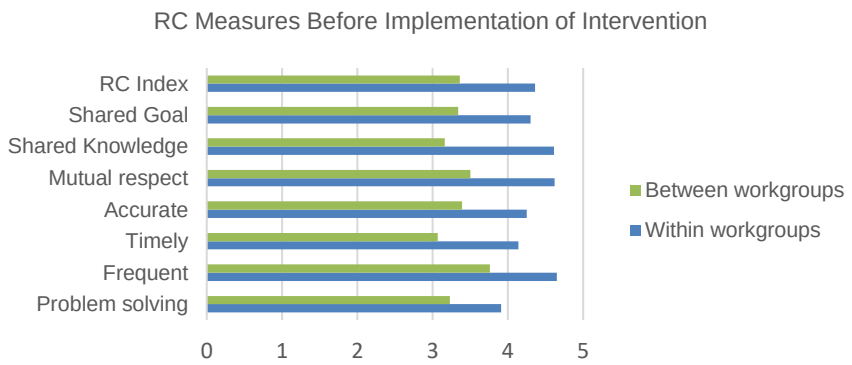


Figure 25 Results of the RC Survey at Time 1 used to support *Intervention I*, design *Intervention II*, and as a baseline measurement in PHASE III. The bars indicate the mean of the ratings.

The **within** workgroup measures of relational coordination (RC) are based on the responses given by respondents about their own workgroup (e.g., OR nurses' ratings of OR nurses). The **between** workgroup measures of RC are based on the responses

given by respondents about workgroups they are not a part of themselves (e.g., all other work groups' ratings of OR nurses).The results showed much stronger relational dynamics **within** the workgroups than **between** the workgroups. The results further showed that the frequency of communication (3.76) and mutual respect (3.50) **between** the health professionals collaborating in Surgery Unit II were rated the highest, indicating the strengths of collaboration in the surgical teams, even though they are still much lower than 4.0, which is considered a strong RC tie (RCA, 2015; Gittell, 2016). Shared knowledge (3.34), problem-solving (3.23) and timeliness (3.07) in communication were the RC dimensions rated the lowest, indicating the greatest possibilities for improvement. The change team members expressed recognition of the picture of collaboration presented by the results. Further analyses of the RC Survey at Time 1 are presented in *Chapter 8.*

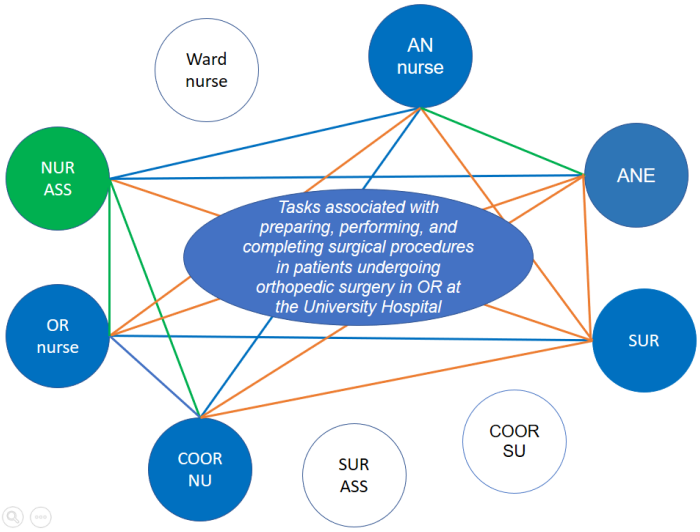
Given that the **within** relational dynamics were already strong, less attention was paid to them during the intervention. The change team initially focused on how the findings could be used to support and argue for *Intervention I* with reference to the Relational Model of Organizational Change (Figure 23, p. 136). They reflected on how the initiatives involved in *Intervention I* could be seen as initiatives intended to improve the relational coordination dimensions. Shared goals and timely and accurate communication were expected to be improved by structural and work process initiatives, such as board meetings, designation of a daily OR coordinator, and the adjustment of procedures for patients' preparedness before surgery in *Intervention I.* Shared knowledge, problem-solving communication, and mutual respect were expected to be improved by structural and relational initiatives, such as implementing ongoing debriefing in surgical teams and extending the collaboration with nurses in the orthopedic ward during *Intervention I.*

The change team compared the relational assessment of the current state of the collaboration that they had been drawn through relational mapping (Gittell, 2016, pp. 201-205) prior to presentation of the results of the RC Survey at Time 1 with the network map given by the results of the RC Survey (Figure 26, p. 141). Discrepancies were found within the change team, since several members of the change team imagined the collaboration ties to be stronger than the results showed. As shown in the network map (Figure 26), the RC scores of relational coordination dynamics between the surgeons and OR nurses indicated a moderate collaboration (blue line), when using the norms for weak, moderate, and strong ties given by RCA in 2015 (RCA, 2015; Gittell, 2016, p. 208).

The ties **between** the surgeons and all the other workgroups were rated as "moderate" (blue line) or "weak" (orange line). The RC scores **between** the coordinating nurses and the AN nurses and OR nurses were rated as "moderate" collaboration ties. The tie between the OR nurses and AN nurses was rated as a "weak" collaboration tie.

The color of the bubbles indicated strong (green), moderate (blue) or weak (orange) collaboration ties **within** the workgroups. No further initiatives were planned to improve

the collaboration ties within workgroups in Surgery Unit II. Further description, explanation, and interpretation of the results of the RC Survey at Time 1 are presented in *Chapter 8*.



	Within workgroups	Between workgroups
Weak	< 4.0	<3.5
Moderate	4.0 - 4.5	3.5 – 4.0
Strong	> 4.5	> 4.0

Figure 26 Network map showing strong (green), moderate (blue), or weak (orange) relational coordination dynamics **between** the health professionals in the OR at Time 1. No collaboration ties were mapped to the workgroups of coordinating surgeons, surgeon assistants, and ward nurses, since these workgroups were not included as respondents. All the surgeons in Surgery Unit II were included in the RC Survey as members of the workgroup of surgeons because most of them worked as both surgeons, surgeon assistants, and coordinating surgeons. Below are norms for weak, moderate, and strong collaboration ties from the 2015 © Relational Coordination Analytics Inc., RC Survey 2.0 (RCA, 2018).

The time available for conducting the feedback process was short, and the participants were only slightly involved in the process. The shortness of time and the lack of involvement could be attributed to various reasons, which will be described and discussed in the discussion part of this chapter.

The change team determined to maintain the initiatives contained in *Intervention I* and to monitor the change process over the following six months. After six months, the initiatives should be evaluated, and further initiatives for *Intervention II* should be planned and implemented.

7.2.2 Prioritizing and Planning *Intervention II*

At a change team meeting in June 2015, *Intervention I* was evaluated, as shown in the timeline in Figure 22 (p. 131). Due to organizational changes, a new senior manager had assumed the role of chairman of the change team. The change team discussed the problems experienced and evaluated the implementation of *Intervention I*. Establishing and maintaining the initiatives from *Intervention I* had proven to be difficult. The initiatives that had the greatest priority, and mostly involved the change team, were initiatives intended to meet the need for patients to attend the OR on time in the morning. If the arrival of the first patient scheduled to undergo surgery was delayed, it had a major effect on the efficiency of the surgical unit, and it became challenging to ensure the appropriate use of both the health professionals and the available operating rooms. In the first few weeks after *Intervention I* was launched, there was a shared commitment to pursue the goal, although that commitment began to fade after a month or two.

The performance of Surgery Unit II had received; in the time just prior to the implementation of *Intervention I*, attention from the hospital management and from the political side. The attention was sharpened by press coverage regarding the surgical unit´s handling of a particularly busy weekend, when traumatized patients had been waiting for surgery for longer than usual.[17] The top management launched an external analysis, including measurements of different indicators, with the purpose of monitoring whether the first patient arrived in the OR by 7:45 AM at the latest, and if not, why. The external analysis resulted in further structural interventions in Surgery Unit II, such as a change in the attendance time for OR nurses, the implementation of a "red protocol" in the OR to document present conditions resulting in delays, and the establishment of the functional role of coordinator, intended to be responsible for coordinating the distribution of acute patients in the orthopedic surgery clinic.

When reviewing the four initiatives included in *Intervention I* after six months, the change team summarized and concluded, that there was still much to do to implement and maintain the initiatives (Appendix 7). Based on the evaluation of *Intervention I*, the results of the RC Survey at Time 1, and the external analysis, the change team wanted to prioritize further initiatives to be implemented during *Intervention II*:

- A coordinating nurse visible at the board area all day.
- Meetings of the surgical teams in the OR between 7:30 and 8:00 AM.
- Qualification of the surgical prescription through new shared procedures.
- Qualification of the procedures for instruments and sterility.

The next steps in the organizational change process were planned. *Intervention II* was presented in September 2015 by the change team at a *kick-off meeting* to which all the

[17] An article describing complaints made by patients and relatives in the regional newspaper *Nordjyske*, May 21, 2014.

health professionals in the surgical unit were invited, as shown in the timeline in Figure 22 (p. 131)

7. 2.3 Monitoring the Intervention Process after 12 Months

The initiatives were evaluated again one year after *Intervention I*. At this meeting, an optimistic dialogue between motivated change team members was witnesses. The change team discussed how the interventions were implemented, as well as how to support and maintain the changes. A short summary of how the initiatives were implemented is presented in the following, supplemented with quotations from the change team:

The **Interdisciplinary meetings** (board meetings) were successfully implemented, as described by one of the coordinating nurses:

> *"The atmosphere is significantly calmer in the OR hallway now and it is quieter in the operating rooms, which is often expressed positively by doctors as well as nurses. The board meeting is very useful for the anesthesiologists when they must conduct the anesthesia journal. At the meeting they get something to assume and to go after. The anesthesiologists also say it is more efficient that they should only address one person in the OR hallway [coordinating nurse]. Today, the coordinating surgeons have more knowledge about the acute patients, which is important when we plan the surgical schedule. So slowly, things are happening for the better!"* [AN nurse 40]

The planning of the surgical schedule at the board meeting the day before was also found to have implications for other work processes. The surgical prescriptions and the anesthesia journal were increasingly conducted in the ambulatory, so more patients were prepared for surgery on time. A year after launching *Intervention I*, according to the change team, it was successfully executed that the first patient arrived in the OR at 7:45 AM at the latest, to the great satisfaction of all. The change team agreed to collect positive stories about how the unit managed to achieve better planning, get started on time, and be better prepared in order to create positive narratives within the surgical units.

The appointment of an OR **coordinator** to be responsible for the shared planning of the schedule in the surgical teams, including initiating a **daily meeting in the OR between 7:30 and 8:00 AM,** was less successful. The previous pattern manifested again. In the first few weeks after *Intervention II* was launched, there was a shared commitment to meet in the morning and plan the schedule of surgery for the day, although that commitment faded after a month. A template, including agenda items for the morning meeting, was prepared when the initiative was launched. After three months, there was a need to recall the agenda items and discuss why the morning meeting was important and how it should be maintained. Moreover, a reminder of why the implementation of a coordinator function in the operating room and a coordinating nurse in the OR hallway would be beneficial, was needed. The change team found that

the appointment of a OR coordinator and the establishment of morning meetings were really useful and effective, since the initiatives were carried out during the first month. The following comments were expressed by an OR nurse and an AN nurse, who were members of the change team:

> *"We collaborated better in the OR. We identified the challenges and the opportunities when planning the surgical schedule and we discussed particular concerns for the individual patient."* [OR nurse 4]

> *"At the morning meetings in the OR, the AN nurses informed the OR nurses about what they were particularly challenged by, and so did the OR nurses. It was much easier to collaborate when you knew what was at stake for the others."* [AN nurse 39]

The change team agreed to make a joint effort to get the coordinator function and morning meetings in the OR re-established, as well as to discuss why a daily interdisciplinary meeting being held in the morning was important and emphasize the benefits of these activities.

Extending the collaboration with the orthopedic ward was very successfully implemented. The orthopedic ward was doing great work in preparing patients for surgical procedures. According to the change team members, the collaboration was very positive. The change team agreed to acknowledge this great effort by informing their collaborators in the orthopedic wards that they had experienced a huge advance. Today, according to the change team, patients are prepared on time, except for a few cases, which is of major importance for the completion of the surgery schedule and for collaboration within the surgical unit.

One year after the launch of *Intervention I*, no initiatives were provided to implement **debriefing** processes after surgical procedures with the purpose of reflecting on the task performance and the interdisciplinary collaboration at the end of the day's teamwork. There were likewise no initiatives provided to **qualify the surgical prescription and the procedures for instruments and sterility.**

7.3 Experiences from the Intervention Process

The final point of interest focuses on the successes and challenges experienced by the change team during the intervention process. The experiences were discussed and expressed in a final evaluation workshop held with the change team, which was inspired by the methods used in the evaluation process in a meta-study concerning relational coordination in Danish Hospitals, referred to as Story Lab (Edwards, 2014). The evaluation process focused on the following questions:

- What has been implemented, what has been successful, and what has been challenging?
- What significant events have occurred in the surgical unit? Changes in work processes? In relationships?
- What is now to be done? Proposals for *Intervention III*?

In addition, the team assessed the extent to which the desired outcome goals, as described in the initiation process below, had been met.

- Patients in the OR at 7:45 AM.
- Earlier surgical incision time.
- More efficient use of the operating room capacity.
- More accuracy in surgical prescriptions.
- More patients with femoral neck fracture operated on within 24 hours after their arrival at the hospital.

The initiatives included in *Intervention I* and *Intervention II* are inserted in the adapted version of the Relational Model of Organizational Change (Figure 27) and described in the following sections. Data concerning the performance outcomes derived from the change team's qualitative assessment of the intervention during the final evaluation workshop and from the national registers of orthopedic performance and quality indicators.

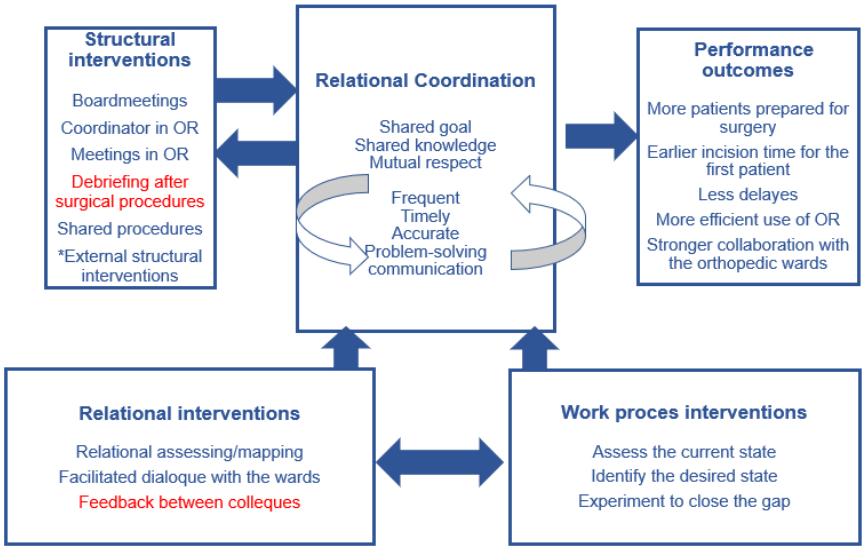


Figure 27 Initiatives included in *Intervention I* and *Intervention II* and the outcomes of the interventions, as assessed by the change team and the external analysis. The initiatives marked in red, were considered to be needed, but not implemented.

7.3.1 Successful Implementation

The change team assessed the implementation of interdisciplinary board meetings to have been successfully. The meetings are now an important communication platform for planning the surgery schedule for the following day, which has secured the first patient's arrival in the OR at 7:45 AM at the latest. Shared decision making regarding the logistical challenges associated with patients undergoing surgical procedures the following day, together with shared responsibility for planning the schedule, had resulted in fewer delays and an earlier incision time for the first patient undergoing surgical procedures in the schedule. This improvement was expressed by one of the coordinating nurses in the change team:

> *"Surgeons and anesthesiologists emphasize that communication and coordination in the OR hallway are much easier and more efficient today. The surgeons place a very strong emphasis on the collaboration concerning making good surgical schedules and finding solutions. This effort works very well, and it is a marked improvement. But everybody needs to be faithful to the schedule. The coordination task occurs at the board, and the schedule must be followed."* [AN nurse 40]

The change team also assessed the implementation of a daily coordinator role in the OR, as well as the organization of a planning meeting in the OR between 7:30 and 8:00 AM, to have been successful. An intensified effort over the last six months had resulted in meetings being held to everyone's satisfaction. An attitude existed on the part of the surgical teams to collaborate in a more appropriate teamwork in the OR in order to complete the surgical schedule in a more qualified way. However, there existed a desire that the surgeons would be more involved in the planning meetings in the OR in the morning. Finally, the extended collaboration with the orthopedic wards was highlighted as having been successfully implemented, particularly with regards to the patients being better prepared for surgical procedures and fewer delays. In addition, one of the external structural interventions, namely the employment of a stakeholder to coordinate the distribution of acute patients in the orthopedic surgery clinic, was considered to be highly beneficial.

The change team emphasized that collaboration had improved, and the following outcome goals were met: patients arrive in the OR at 7:45 AM (i.e., on time), more patients are prepared, earlier surgical incision time, more efficient use of the operating room capacity, more patients with femoral neck fractures are operated on within 24 hours of arrival at the hospital, and stronger collaboration with the orthopedic wards. These performance outcomes are inserted into Figure 27.

7.3.2 Challenging Implementation

The structural intervention, namely the establishment of debriefing processes following surgical procedures, had proved challenging. Debriefing after surgical procedures was also considered to be a relational intervention, since the introduction of debriefing

would facilitate dialogue and feedback between colleagues. When this initiative was discussed at the change team meetings, there was agreement as to the need for the surgical teams to reflect upon the day's teamwork, but concrete activities to support the implementation of debriefing were lacking. Furthermore, debriefing after surgery, as an intervention initiative, was not defined, and the structural frame for the debriefing sessions was not described or incorporated. The resources and energy were instead dedicated to structural interventions, such as implementing the coordinator function in OR and planning morning meetings in the OR. Another structural intervention, namely qualifying the surgical prescriptions by conducting new shared procedures, had also proved challenging. This structural initiative might influence the relationships between health professionals, since shared knowledge is needed to qualify the prescriptions. The need for greater accuracy in surgical prescriptions was expressed by the OR nurses in the fieldwork, and it was recognized by the OR nurses and the surgeon manager in the change team. The change team had assigned a small group to be responsible for reviewing and preparing procedures for qualifying surgical prescriptions, but the group did not complete the job. These change initiatives both targeted the strengthening of shared knowledge, mutual respect, and problem-solving communication in the surgical teams. The change team concluded that the initiatives intended to strengthen the accuracy of communication and shared knowledge had not received sufficient attention, and therefore the aim of qualifying surgical prescriptions was not achieved.

7.3.3 Significant External Changes in the Surgical Unit

During the organizational intervention process, several external changes occurred. Some of these external changes were highlighted by the change team in the final evaluation workshop, as remarkable changes during the intervention period (Appendix 7). These changes were considered remarkable, because they had influenced the health professionals' performance of their daily tasks. There were probably further external influences, although they were not expressed at the evaluation workshop or captured along the way. One remarkable external change seen during the intervention period was the external analysis initiated by the top management of the hospital (from March to December 2015). The focus of the external analysis was on exploring and assessing the capacity utilization through time observations, which resulted in changes in the attendance time for OR nurses, the implementation of a "red protocol" in the OR to document present conditions resulting in delays, and the establishment of a new work function as a coordinator responsible for coordinating the distribution of acute patients with in the orthopedic surgery clinic. Another remarkable external change during the period was the top management's intensified focus on the time before surgery for patients with femoral neck fracture. This increased focus was also discussed in the change team when initiating *Intervention I*, and it was expressed in one of the outcome goals. In December 2014, just prior to the launch of *Intervention I*, new national evidence-based quality indicators concerning "operation delays" for this particular category of patients were introduced (Danish Interdisciplinary Register for Femoral Neck Fracture, 2014). These indicators measured the percentage of patients

being operated on within 24 or 36 hours of arrival at the hospital. In spring 2016, initiatives intended to reduce the waiting time before surgery for patients with femoral neck fracture were initiated in parallel with the intervention process, as described in PHASE II (Region Nordjylland, 2016, 2017).

7.3.4 What next?

Following the assessment and evaluation of the intervention, the change team decided to maintain and follow the improvement track. They emphasized the importance of the greater involvement of all interdisciplinary collaborators, and they sought to prioritize and select new improvement initiatives. The change team proposed to focus on initiatives intended to reduce the time between patients in the OR in order to improve the exploitation of the surgical capacity. A new improvement board in the surgical unit was found to be a useful tool for prioritizing and monitoring improvement initiatives in the future.

7.3.5 Evaluation of the Intervention Process

As the final item on the evaluation agenda, the change team evaluated the intervention process, emphasizing the importance of organizational interventions having strong management anchorage and project management. Considering the change initiatives in light of the theory of relational coordination had resulted in the identification of new perspectives. The project organization and the meetings held by the change team had helped the interventions to be maintained and adjusted. At times, it had proven difficult to maintain the initiatives and spend sufficient resources on the project, since several leadership changes had occurred, as well as because the surgical unit was required to implement several external changes initiated by the senior management and top management of the hospital.

7.3.6 Performance Data and Quality Indicators

Data reflecting the performance outcomes in Surgery Unit II from January 2015 to June 2016 were not available at the final evaluation meeting in May 2016, and therefore were not discussed with the change team. However, quantitative data presenting the performance of hip and knee arthroplasty and “operation delays” for patients with femoral neck fracture are presented in the tables below. These data are found in the clinical databases containing the annual reports of the clinical specialties. In the period from January 2015 to December 2016, Surgery Unit II increased the number of hip and knee arthroplasties performed, with a 20.8% increase in primary hip arthroplasty, a 34.1% increase in hip revision arthroplasty, and a 14.4% increase in knee arthroplasty (Danish Hip Arthroplasty Register, 2017; Danish Knee Arthroplasty Register, 2017). The increases in performance of these orthopedic surgical procedures, which are proportionally larger than the increases seen at the national level, are shown in Table 18 and Table 19 below.

Performance Measures of Hip Arthroplasty from 2014 - 2016								
	2014		2015		2016		Increases from 2014 – 2016	
	Primary *n*	Revision *n*	Primary *n*	Revision *n*	Primary *n*	Revision *n*	Primary %	Revision %
Denmark	9415	1372	9674	1321	10.413	1440	10.6%	5%
Surgery Unit II	77	85	62	102	93	114	28.8%	34.1%

Table 18 Performance data concerning hip arthroplasties performed from 2014 to 2016, obtained from the Danish Hip Arthroplasty Register (2017).

Performance Measures of Knee Arthroplasty from 2014 - 2016				
	2014	2015	2016	Increases from 2014 - 2016
	n	*n*	*n*	%
Denmark	9109	9324	9202	0.1%
Surgery Unit II	97	67	111	14.4%

Table 19 Performance data concerning knee arthroplasties performed from 2014 to 2016, obtained from the Danish Knee Arthroplasty Register (2017).

Furthermore, the quantitative data obtained from the national register of quality in the orthopedic specialty indicated increased quality in terms of the treatment and care of patients with femoral neck fractures in the period from January 2015 to December 2016 in Surgery Unit II (Danish Interdisciplinary Register for Femoral Neck Fractures, 2017). These quality indicators increased proportionally more in Surgery Unit II than they did at the national level, as shown in Table 20.

"Operation Delay" for Patients with Femoral Neck Fracture				
	The percentage of patients being operated on within 24 or 36 hours of arrival at the hospital			
	Dec. 2014 - Nov. 2015		Dec. 2015 - Nov. 2016	
	24 hours	36 hours	24 hours	36 hours
Denmark	68%	84%	69%	85%
Surgery Unit II	47%	71%	57%	81%

Table 20 "Operation Delay", a quality indicator showing the percentage of patients with femoral neck fracture being operated on within 24 or 36 hours of arrival at the hospital. Data obtained from the Danish Interdisciplinary Register for Femoral Neck Fractures (2017).

The improvement in treatment and care seen for this category of patients was an outcome goal of the presented organizational interventions (*Intervention I and II*), as well as of the external organizational changes initiated by the senior management in spring 2016. The percentage of patients with femoral neck fracture being operated on within 24 hours of arrival at the hospital have increased from 47% in 2015 to 57% in 2016, while the percentage of patients being operated on within 36 hours of arrival at the hospital increased from 71% to 81% in the same period. The data also indicated that the percentages of patients with femoral neck fracture being operated on within 24 or 36 hours of arrival at the hospital in Surgery Unit II in 2015 were considerably lower than at the national level. These gaps were significantly smaller. The quality-related challenges concerning the treatment and care of this group of patients have attracted considerable attention; hence the treatment and care have been given a significant boost in quality.

7.4 Interpretation and Discussion

During PHASE II, an organizational intervention process was followed in order to address the second research question: *How is the theory of relational coordination used as a tool for improvement in organizational intervention processes in surgical units?* The second research question was based on the assumption that interventions identified and developed from the challenges experienced by health professionals, as well as from measures of relational coordination, will provide the best starting point for the implementation of organizational interventions.

For this reason, an organizational intervention process with the purpose of improving quality, efficiency, and continuity in the surgical pathways, and considering the needs of the individual patient, was followed and documented during PHASE II. The intervention, which was initiated and implemented over a period for two years, improved the interdisciplinary collaboration in surgical teams in different ways. Several outcome goals were achieved. More patients were prepared for surgical procedures, resulting in less delays and the more efficient usage of the operating room capacity. Additionally, more patients with femoral neck fractures were operated on within 24 hours or 36 hours of arrival at the hospital. Moreover, the cross-disciplinary collaboration with the orthopedic wards was improved. The goals of qualifying the surgical prescriptions and the implementation of daily debriefing sessions were not achieved. The presented points of interest made it possible to illuminate different areas of the organizational intervention process, namely the initiating, screening, and action-planning phases, as well as the feedback and prioritizing processes, the implementation phase, and the final evaluation. The theory and measurement of relational coordination were used in the intervention process as diagnostic tools for informing organizational changes and prioritizing the initiatives to be implemented during the improvement process. *Intervention I*, which was based on the health professionals' experienced challenges and the findings of the ethnographic fieldwork

conducted in PHASE I, was planned and launched before the measures of relational coordination in the surgical units were available. Therefore, the measures of relational coordination from the RC Survey at Time 1 were not used as prioritizing tools during the initiation and screening phases, which was the initial and most optimal intention. The launch of *Intervention I* was accelerated, so the measurement of relational coordination prior to it was impossible.

The measures of relational coordination were used during the implementation process as a frame for understanding the change initiatives as elements supporting the improvement of the dimensions of relational coordination, and thereby the relational coordination in the surgical teams. For example, the measures indicated that initiatives could be implemented to improve shared knowledge, as well as timely and problem-solving communication. The establishment of daily board meetings to plan the surgical schedule, discuss and solve logistical challenges, and collaborated to achieve concrete and shared goals was seen as an initiative for improving these dimensions of relational coordination. The theory of relational coordination and the Relational Model of Organizational Change also proved useful during the intervention process for illustrating how the initiatives were part of an overall picture of improvement. During the process of planning *Intervention II*, the measures of relational coordination were discussed and used as an argument for maintaining the initiatives from *Intervention I* and planning additional initiatives to further improve relational coordination in the surgical teams. The use of relational coordination measures during the intervention process is considered to be a relational intervention. Recently, Gittell (2016) proposed that relational coordination measures in this manner can provide a shared understanding of what is needed, that is, they can serve as a diagnostic tool to recognizing improvement opportunities. However, if a relational intervention using measurements as a diagnostic tool, is to be used successfully, an open-minded and dialogue-based exploration is needed, supported by relational leadership (Gittell, 2016; Resnick et al., 2016). In Surgery Unit II, the dialogue-based exploration of the measures of relational coordination was conducted at a change team meeting. As described previously, the time available was short, and the participants were only slightly involved in the process. The lack of commitment may be attributed to current challenges within the surgical unit, which likely occupied the minds of the participants. These current challenges and the resultant disturbances were expressed by members of the change team when the feedback meeting began, and they were the reason for the meeting being shortened. The low level of engagement in the feedback process may also be attributed to a lack of readiness on the part of the change team to discuss the experience of weak collaboration ties between close collaboration partners in the OR, even though the picture of challenging collaboration ties between workgroups was recognized. If such readiness had been present, the time for discussion could possibly have been found and prioritized. Finally, it may also have affected the engagement in the feedback process that the managers in the change team had already indicated during the initiation phase of the intervention that structural interventions were a priority. The low level of engagement on the part of the change team in the feedback

process may have impacted the value of using RC measures as a tool for prioritizing and planning the next step in the intervention process.

Hence, during in the feedback process, the change team only captured the contours of the picture of relational coordination in the surgical unit. There was leadership support for the use of relational coordination measures in the intervention process from the senior management group, but not all participants from that group participated in all meetings, so leadership support for the process was less visible to the change team. Recognizing that changes within organizations take place in complex and ever-changing contexts, it must be emphasized that commitment, time, dialogue, and leadership support are all crucial for facilitating a relational intervention. An intervention may advantageously include relational assessment and mapping in order to provide an opportunity for health professionals to make sense of their own relational coordination data and enable them to screen, prioritize, plan, and implement an intervention intended to improve both interdisciplinary collaboration and patient outcomes.

The experiences and the evaluation of the process in the surgical unit made it clear that the interventions were guided by the health professionals' experienced challenges, as well as by the desired outcomes of the intervention. The relational coordination measures were found to be less guidance for the process, than initially intended. Comparing the intervention process in Surgery Unit II with the relational intervention presented and described by Gittell (2016) using the principles of relational coordination as tools for change (Box 1), the weak and underprioritized steps in this change process were the time constraints during the dialogue-based feedback reflections on the survey results defining strengths and weaknesses. In addition, the process might have been more successful if the use of the Relational Model of Organizational Change and the assessment of relational coordination had been more integrated within the intervention process and carried out prior to the design of *Intervention I*. This seems to be a crucial point when seeking to use the model and the assessment as diagnostic tools during organizational change processes. The theory of relational coordination and the Relational Model of Organizational Change suggest a combination of structural, relational, and work process interventions best support organizational changes (Gittell, 2016). Despite previous empirical data and experiences concerning the effect of these processes, there remains a paucity of evidence regarding how best to use the Relational Model of Organizational Change in combination with the relational intervention presented by Gittell (2016). It is also important to consider the inclusion of initiatives such as the creation of safe spaces, relational mapping, relation assessment, facilitated feedback dialogues, and the shared prioritizing and determining of the next steps. Moreover, insights into how to initiate, facilitate, and maintain an engaging improvement process in a health care context characterized by time constraints, interdependency, and uncertainty are needed.

Capturing different perspectives concerning the initiation and screening process, as described in the framework for evaluation of organizational interventions, might represent an additional advantage of the relational intervention process when using the relational coordination theory for organizational change. These perspectives might help to ensure the most appropriate project organization, with both leadership support and engagement from the health professionals close to the patients and at the core of function, and they might serve to identify challenges as experienced from different perspectives (health professional, frontline manager, and senior manager), which was also emphasized by Nielsen and Abildgaard (2013). This is all important knowledge when designing and planning improvement initiatives that are targeted toward what is needed.

Another perspective relevant to the discussion might be the use of methodological tools from the field of improvement science when planning and implementing work process initiatives within organizational change processes. The monitoring of progress in the work processes was not prioritized in this organizational intervention, which resulted in improvement data being missing and a lack of emphasis on the changes within the unit. The using of methodological tools from the field of improvement science would provide improvement data that could be used in the intervention process (Langley et al., 2009). Such data will enable the health professionals to monitor the improvement, which might stimulate and strengthen their engagement in the change process.

Finally, it can be difficult to assess whether change efforts based on relational coordination measurements have been useful and effective, since the associated changes in the relational coordination-based process took place in a complex and very changeable context, where external influences had a major impact on the processes. This challenge was also described by Logan (2016), in reference to complexity theory. Surgical units within university hospitals are complex adaptive systems constituted and influenced by individuals working together. Adopting a pragmatic approach, reality is interactionally constructed. The responses to organizational changes, both internal and external, can be interpreted as interactions between individuals and their environments, as well as between individuals (Biesta and Burbules, 2003). The outcomes of the initiated organizational interventions are therefore unpredictable. This is in concordance with prior studies highlighting how responses to organizational improvement interventions can be attributed to both the intervention itself and to changes in the organizational culture (Institute of Medicine, 2000; Gibbons et al., 2006; Sacks et al., 2015).

7.5 Strengths and Limitations

The initiatives included within the organizational interventions originated from different data sources, including a) the health professionals' experiences of the challenges and

needs for improvement, b) the frontline and senior management's perceptions of those challenges and their expectations for the future task performance, c) the findings of the ethnographic fieldwork, d) the relational coordination measures, and e) national registers of quality in orthopedic surgery. This mix of perspectives, ranging from the senior management to the health professionals closest to patients and either expressed directly or originating from research findings, represents a multifaceted collection of empirical data, which were a strength of the initiation, screening, action-planning, implementation, and evaluation phases of the present organizational intervention. The findings of the ethnographic fieldwork supported the change team during the screening and planning phases. The accordance between the experiences and challenges expressed by the change team and the challenges expressed by the health professionals during the fieldwork strengthened the decisions regarding which initiatives should be included and implemented in *Intervention I*. The same could be said about the accordance between the challenges expressed by the change team and the relational coordination measures. The intervention was monitored throughout the process in change team meetings, while repeated measures of relational coordination and safety culture were performed to assess the sustainability of the changes in collaboration and culture. Repeated assessment, implementation in a clinical setting, the use of established theory as a basis for the intervention, and the participation of all staff members are considered to be strengths of this part of the study, as supported by the criteria for assessing the quality of implementation studies provided in a review article concerning interventions intended to improve the surgical culture (Sacks et al., 2015).

However, the design of the qualitative evaluation of the organizational intervention also had certain limitations. The collected and described experiences of successes and challenges in the process arise mostly from participation in the change team meetings, as well as from conversations with the participants in the change team. Only limited data concerning the performance outcomes were included. Thus, no data have been collected that directly represent the health professionals' attitudes toward and experiences of the change process. It might have strengthening the comprehensive evaluation of the intervention if the health professionals had been interviewed or observed 16 months after the implementation of the intervention. Yet, the attitudes and experiences of the health professionals closest to the patients and the core tasks were included in the screening and planning processes.

The use of relational coordination measures as a diagnostic tool was less marked during the screening and planning processes, which was partly due to those processes being forced and the change team being less engaged in the results feedback process, and partly due to decisions having already been made early in the process about what should be initiated. Additionally, the relational coordination measures were only available after *Intervention I* had been launched. This may have had an impact on the change team's engagement within the feedback process, since they were not at this time prepared to initiate further action. The change team used the measures to

understand and argue for the initiatives included in *Intervention I*, but initiatives intended to support the improvement of the weak collaboration ties seen between some of the involved workgroups were not prioritized as a new effort. The relational coordination measures might have proved a stronger diagnostic tool for establishing dialogues between members of the change team, as well as between the change team and the health professionals, if such dialogues had been given more time, energy, and space during the process. The application of the Relational Model of Organizational Change offered an illustration of the various implemented initiatives. This illustration facilitated the change team's understanding of the entire process. Although the current study is based on only a single case, the findings suggest the use of relational mapping and relational assessment in organizational change processes in order to prioritize and provide an overview of the required improvement initiatives.

The fact that the intervention was initiated, screened, and planned in collaboration between managers and employee representatives might be considered a strength, since the intervention initiatives were tailored to the needs guided by employee´s expertise to a certain extent. There have been periods in which the implementation was met with great commitment, as well as periods in which the implementation was neglected, and current behavior patterns have emerged. Despite this, the change team managed to continue and maintain the organizational intervention throughout the two-year period, with almost the same participants apart from the chairman of the change team.

Another uncertainty stems from the fact that some health professionals were informed both verbally and in writing about the theory of relational coordination, the RC Survey and the study, whereas others were only informed in writing about the RC Survey and the study. This may have influenced the relational coordination measures.

Finally, I have followed and reflected on the verification strategies used to test the validation and reliability in PHASE II, as presented in *Chapter 5* (pp. 64-65) from the beginning and throughout the intervention process, which is a strength worth mentioning when highlighting the strengths and limitations of PHASE II. Moreover, the findings derived from PHASE I and PHASE II were shared with the change team, frontline managers, and senior managers, while reflections concerning recognizability and applicability were also captured.

7.6 Partial Conclusion

The objective during PHASE II was to explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units. In this partial conclusion, I address the second research questions: *How is the theory of relational coordination used as a tool for improvement in organizational intervention processes in surgical units?*

An organizational intervention process including initiation, screening, action-planning, implementation, and evaluation processes, as managed by a change team within a surgical unit, was followed during a two-year period. By following the organizational intervention, insights are provided into the processes of intended improvement within a complex health care organization characterized by uncertainties, interdependency, and time constraints.

The theory and methodology of relational coordination have been used as tools for improvement during the process. Relational coordination measures were found to be useful as a diagnostic tool for the improvement and identification of collaboration challenges between the workgroups working together on a core task. The experience gained from the use of this tool indicates that it influences the effect of the application that relational coordination measures is incorporated early in the intervention process. The experience derived from the process also emphasizes that it is very important in relation to the effect of the intervention that the process is guided by the desired outcome goals. Thus, the experiences emphasize the importance of the principles guiding the use of relational coordination as tools for change (Box 1, p. 28), as described by Gittell (2016): Organizing and setting goals and frames for the organizational change process, introducing relational coordination, and dialogue-based exploration of current state of relational coordination through relational mapping.

An observation of practice might be used advantageously prior to the assessment of relational coordination due to providing insights into a concrete practice, as well as the challenges that might exist. Together with the “organization's own experiences of challenges,” the insights derived from observations of practice can be combined with the measurement of relational coordination. This allows for the understanding and assessment of the measurements to become more nuanced and useful when interventions are to be designed and planned.

Finally, the theory of relational coordination and the Relational Model of Organizational Change offered an illustration of the various initiatives implemented useful for a change team throughout the process. Likewise, the framework for evaluation of organizational intervention offered the systematic monitoring of the intervention process, including the external change mechanism to be used in a comprehensive evaluation of the organizational intervention, which will be presented when integrating mixed methods at the interpretation level during PHASE IV.

CHAPTER 8. ASSESSING RELATIONAL COORDINATION AND SAFETY CULTURE

In this chapter, I address the third research question: *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention using the theory of relational coordination as a tool for improvement?* by presenting the analyses, findings, interpretations, discussions, and conclusions derived from the assessment of relational coordination and safety culture during an organizational intervention.

During PHASE III, descriptive and statistical analyses were conducted based on data collected from two surveys measuring relational coordination (RC Survey) and safety culture (SAQ-DK). The RC Survey was distributed before (Time 1), during (Time 2), and after (Time 3) an organizational intervention was implemented, while the SAQ-DK was distributed during (Time 2) and after (Time 3) the intervention. The surveys were used to assess whether any changes in health professionals' attitudes toward interdisciplinary collaboration and safety culture occurred during an organizational intervention. Moreover, the measurements of RC were applied to reflect the current state of the collaboration ties between health professionals in surgical teams, which is considered to be important information when planning and implementing interventions intended to improve interdisciplinary collaboration.

The analyses and results of the surveys are described, compared, and discussed in the following sections. First, analyses of the response rates and tests for reliability and validity of the RC survey and SAQ-DK Survey are performed. These analyses generated knowledge about the sample distribution, the health professionals' willingness to answer and engage with the surveys, and the validity of the survey tools. The results are presented in sections *8.1 Response Rate* and *8.2 Test of Reliability and Validity.* Second, analyses of RC are conducted, in which any changes over time are explored, and the strong and weak collaboration ties within and between health professionals in the OR are identified. These results are presented in section *8.3 Assessment of Relational Coordination*. Third, analyses of the health professionals' attitudes toward safety culture are conducted, in which any changes over time are explored, and the strong and weak dimensions of safety culture are identified. These results are presented in section *8.4 Assessment of Safety Culture.* Fourth, a comparative analysis between the construct of RC and the construct of safety culture is conducted, in which the correlation between the concepts is explored. These comparative analyses generated knowledge about the connection between health professionals' attitudes toward the interdisciplinary collaboration they are part of and their attitudes toward the safety culture, which the collaboration is embedding within. These results are presented in section *8.5 Comparing Relational Coordination and Safety Culture*. Finally, the analyses and results are discussed, and the third research question is addressed, in section *8.5 Interpretation and Discussion.*

8.1 Response Rate

The data derived from all the analyses conducted during the assessments included the completed responses. There were 150 invited respondents at both Time 1 and Time 2, and 137 invited respondents at Time 3, giving a total at 437 invited respondents to the RC Surveys, and a total of 287 invited respondents in the SAQ-DK surveys. The response rates varied over time. At Time 1, 92 respondents completed the survey, at Time 2, 74 respondents completed the survey, while at Time 3, 48 completed the survey. In total, 214 responses were completed, resulting in a response rate[18] of 49%. A total of 222 responses were deleted due to being missing (51%). The percentage of partial responses was 3.2%, as shown in Table 21.

Responses to the Surveys Over Time								
	Time 1		Time 2		Time 3		Total	
	n	%	*n*	%	*n*	%	*n*	%
Invited respondents	150	100	150	100	137	100	437	100
Partial responses	4	2.6	2	1.3	8	5.8	14	3.2
No responses	54	36.0	74	49.3	81	59.1	209	47.8
Complete responses	92	61.3	74	49.3	48	35.0	214	49.0

Table 21 Distribution of surveys and responses for all the workgroups over time. The RC Survey was distributed at Time 1, Time 2, and Time 3, while the SAQ-DK was distributed at Time 2 and Time 3.

The number of completed responses decreased from 61.3% (Time 1) to 35% (Time 3), which is considered to be a huge change over time in terms of the response rate. The response rates decreased over time for all the workgroups, except for the coordinating nurses. A table showing the response rates distributed by the workgroups over time is presented in Appendix 8 (Table A). Thus, the distributions of the invited respondents to the workgroups varied over time, as did the response rates. When comparing over time and across workgroups, the differences in the sample distributions and response rates may be considered. The respondents invited to the surveys were participants in one of three large workgroups (OR nurses, surgeons, AN nurses), or in one of three small workgroups (anesthesiologists, nurse assistants, coordinating nurses). To obtain a more detailed view of the variations, the percentage distribution of the invited respondents is compared to the percentage of respondents who completed the survey in each of the workgroups included in the surveys. Comparing the distribution of "respondents invited" with the distribution of "respondents responding" by workgroups at Time 1, only a small variation was visible, as illustrated in Figure 28. This supports the representativeness of the sample distribution when compared to the population of interest (health professionals employed in the surgical unit who were invited to

[18] The response rate is defined as the number of respondents who completed the survey divided by the number of respondents invited, expressed as a percentage.

participate in the survey). At Time 2 and Time 3, larger variations were visible when comparing these distributions. Resulting in a possible response bias that must be considered (Draugalis et al., 2008).

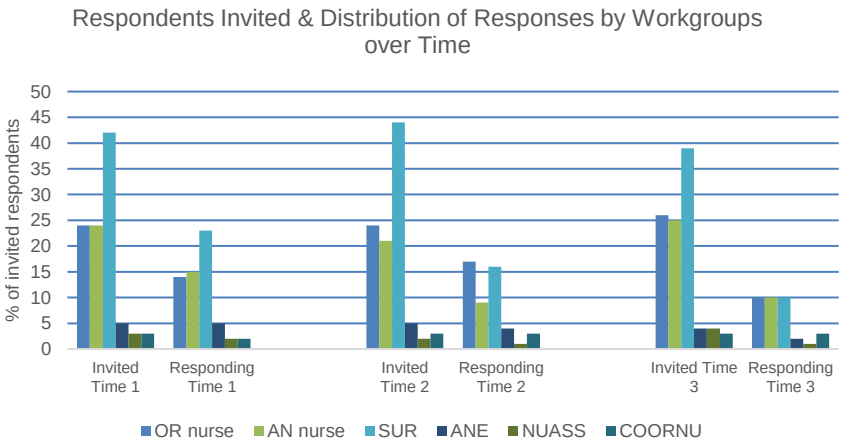


Figure 28 Distribution of respondents invited and distribution of respondents responding at Time 1, Time 2, and Time 3 by workgroups.

The distribution of responses by workgroups at Time 2 differed in that proportionately more OR nurses were responded to the survey than surgeons and AN nurses, increasing from OR nurses delivering 23% of the completed responses at Time 1 to them delivering 34% of the completed responses at Time 2 (Appendix 8, Table A). The distribution of responses by workgroups at Time 3 also differed in that proportionately less surgeons responded to the survey than OR nurses and AN nurses, increasing from surgeons delivering 38% of the completed responses at Time 1 to them delivering 29% of the completed responses at Time 3. Looking at the large workgroups included in the survey, the surgeons also exhibited the largest change in response rate over time, decreasing from 56% at Time 1 to 26% at Time 3. The change in the distribution of respondents by workgroups over time resulted in proportionately fewer responses from surgeons being included in the measurements at Time 3, which could influence any changes in RC over time, depending on whether or not there were differences in the measures of RC across the workgroups. In order to correct for unequal and changing response rate a weighting of RC scores for site-level aggregation are calculated, in which individual responses are weighted according to the size of their function in the unit, described in the *Guidelines for Theory, Measurement and Analysis* (Gittell, 2012a). Only marginal differences were found between weighted and unweighted site-level RC scores at all times (Appendix 8, Table P).

To explore for potential response bias comparisons between respondents answering the survey only once and respondents answering the survey more than once were conducted. No significant differences were found in the RC measures rated by the

respondents who answered the survey once and the respondents who answered more than once, as shown in Appendix 8 (Table B). Thus, the respondents who responded more than once to the survey did not answer the questions more positively or more negatively than the respondents who only responded to the survey once. Therefore, the risk of response bias attributed to the decreasing response rate was assumed to be minimized.

The study sample of health professionals who completed the RC Survey more than once was also used to examine any statistical differences in the RC index and in the RC dimensions over time. The number of completed responses for this study sample varied slightly: 47 respondents completed the survey both Time 1 and Time 2, 33 respondents completed it at both Time 2 and Time 3, and 36 respondents completed it at both Time 1 and Time 3. A total of 26 respondents completed the survey all three times. A table showing the response rate for the respondents who responded more than once distributed by the workgroups over time is presented in Appendix 8 (Table C).

Further considerations about the sample distribution and changes in the response rate over time are discussed later in section *8.7 Strengths and Limitations.*

8.2 Test of Reliability and Validity

8.2.1 The RC Survey

In order to assess the strengths of the RC Survey, the survey was tested for internal consistency, structural validity, and content validity (Valentin et al., 2013). Testing for interrater agreement and reliability, an expression of the level of similarity between responses from different respondents, was not performed in this study, since there was no comparison made between sites.

Internal consistency, an expression for the correlation between items in a survey measure, was assessed using Cronbach's alpha test. According to Valentine et al. (2015), a Cronbach's alpha value of 0.7 indicates moderate consistency between items for a newly developed survey, although a higher value of 0.9 is an advantage of tested surveys. According to Tavokol and Dennick (2011), an acceptable alpha value falls within a range of 0.70 to 0.95. Cronbach's alpha tests were conducted for the RC Surveys separately (RC Survey at Time 1, Time 2, and Time 3), and for all the RC Surveys, including all responses. All the alpha values were high, ranging from 0.83 to 0.86, which suggests that the surveys had a high level of reliability. The Cronbach's alpha values assessed over time are shown in Appendix 8 (Table D).

Structural validity is an expression concerning the extent to which the items in a survey have a high covariance structure, thereby reflecting the dimensionality of the same construct. To provide evidence that all the items in a survey belong to one factor, a

variety of results from the factor analysis should be reported (Valentine et al., 2015). Ideally, the values of the factor loadings should be > 0.40 (Ford et al., 1986; Valentine et al., 2015), while the eigenvalues should be > 1.0 (Valentine et al., 2015), to meet the standards for structural validity. When conducting the factor analyses, the factor loadings on Factor 1 for all communication and relationship dimensions included in the RC Survey were found to be larger than 0.40 (ideally >0.40), while the eigenvalues for Factor 1 were > 1.0 for all the surveys. This confirming that the relational coordination index (RC index) meets the standards for structural validity. The results of the factor analysis are shown in Appendix 8 (Table E)

Content validity expresses the requirement for a survey to reflect the substantive realities of the construct of interest (Valentine et al., 2015). Ideally, content validity is established by the triangulation of methods used to study the same phenomenon of interest. In the analysis process during PHASE IV, the survey results were compared and integrated with the findings obtained from other sources, such as observations and interviews. In addition, the respondents' reviews of the RC measures at Time 1 were obtained during PHASE II, as described in the results feedback process (p. 140).

8.2.2 The SAQ-DK Survey

To assess the strengths of the SAQ-DK, the survey was tested for both reliability and validity, with a focus on internal consistency and inter-scale correlation (Kristensen et al., 2015a; Kristensen, 2016a).

To examine the internal consistency, that is, the correlation between the items included in the survey, the Cronbach's alpha test was utilized. Kristensen (2016a) proposed a cut-off for acceptable reliability of an alpha value > 0.7, which is consistent with previously reported values ranging from 0.70 to 0.95 (Tavokol and Dennick, 2011). Cronbach's alpha tests were conducted for the SAQ-DK surveys separately, as well as for all the SAQ-DK surveys, including all the responses. The Cronbach's alpha value was 0.92 for both surveys, which suggests that the survey had a high level of reliability, as shown in Appendix 9 (Table A).

To examine the inter-scale correlations, that is, the extent to which the items in the SAQ-DK had a high correlation with each other, the Pearson's correlation coefficients were calculated. The stress recognition scale correlated negatively with the team climate and safety climate, with Pearson's r ranging between ÷0.19 and ÷0.20 ($p < 0.05$), which indicates statistically significant correlation. The stress recognition scale also correlated negatively with the other scales, although no significant statistical correlation was found. For all the other scales, the Pearson's correlations showed significant positive correlations, with the correlation coefficients ranging between 0.34 and 0.60; which indicated strongly statistically significant correlation ($p < 0.01$). The results of the Pearson's correlation analysis are shown in Appendix 9 (Table B).

Further considerations regarding the reliability and validity are discussed later in section *8.7 Strengths and Limitations.*

8.3 Assessment of Relational Coordination

To assess RC in a surgical unit, analyses are conducted in which any changes over time are explored, and the strong and weak collaboration ties within and between workgroups in surgical teams in the OR are identified. RC was assessed using the RC Survey before, during, and after an organizational intervention was implemented. The health professionals included in the surgical teams were asked to answer questions about the frequency, accuracy, timeliness, and problem-solving approach to communication, as well as the extent to which shared goals, shared knowledge, and mutual respect were experienced, with respect to each of the workgroups involved in tasks associated with preparing, performing, and completing surgical procedures on patients undergoing orthopedic surgery in the OR. The questions are shown in Appendix 3.

The descriptive and statistical analyses were conducted using Excel 2016 and Stata 14.0, computer software programs for quantitative data analysis. For each of the communication and relationship dimensions, the mean scores and standard deviations were calculated. The utilized calculation process was guided by *Relational coordination: Guidelines for theory, measurement and analysis* (Gittell, 2012a). Given that there are different attitudes toward the permissibility of calculating the mean and standard deviation of ordinal data (Abelson, 1995; Kuzon et al., 1996; Norman, 2010), the calculation of the mean and standard deviation was chosen for several reasons. The analyses are conducted based on the assumption that the data are normally distributed, and further assuming that the items have interval properties. Adopting a pragmatic stance, calculating the mean as a value has been useful in the organizational intervention process for determining the character and the differences in scores of communication and relationships within and between workgroups, and across times. The calculation of the mean has also been very useful for determining the weak and strong collaboration ties and RC dimensions when applying the results of the RC Surveys to prioritizing interventions. Furthermore, calculating the means and standard deviations of the data obtained from the RC Survey is an approved statistical analysis for the measures of RC (Gittell, 2012a), which provides opportunities to compare this study with previously conducted studies wherein the measurements of RC were used.

8.3.1 Change in Relational Coordination Over Time

The health professionals' ratings of RC, as expressed by the RC index, were found to change over time. The changes over time are described in the following section by the progress in RC when assessed eight months after implementation of intervention, while a decline in RC is assessed 16 months after implementation.

8.3.1.1 Progress in Relational Coordination

RC was improved in the surgical unit some eight months after implementation of the intervention, as indicated by the strong statistically significant increase in the RC index (p = 0.0082). The increase is mainly attributable to an improvement in the frequency (p = 0.0010) and timeliness (p = 0.0130) of the communication between health professionals in surgical teams. However, the increases in the measures of the other RC dimensions were not statistically significant. The findings were based on independent group t-test comparisons of the RC index and the seven dimensions over time, as shown in Appendix 8 (Table F), supplemented by the statistically stronger paired t-test, as illustrated in Table 22. This latter analysis included measures from the 47 respondents who responded at both at Time 1 and Time 2.

Comparisons of RC Index and Seven Dimensions Between Time 1 and Time 2								
	Time	n	t	df	Sign	mean	SD	mean diff
RC index	1	47	÷2.77	46	0.0082**	3.53	0.46	+0.16**
	2	47				3.69	0.46	
Frequent communication	1	47	÷3.52	46	0.0010**	3.93	0.64	+0.29**
	2	47				4.22	0.63	
Timely communication	1	47	÷2.58	46	0.0130*	3.13	0.74	+0.26*
	2	47				3.39	0.57	
Accurate communication	1	47	÷1.09	46	0.2829	3.54	0.86	+0.13
	2	47				3.66	0.69	
Problem-solving communication	1	45	÷1.30	44	0.1992	3.41	0.77	+0.14
	2	45				3.55	0.72	
Shared goal	1	46	÷0.82	45	0.4143	3.59	0.56	+0.08
	2	46				3.67	0.65	
Shared knowledge	1	46	÷1.27	45	0.2103	3.30	0.51	+0.10
	2	46				3.40	0.52	
Mutual respect	1	46	÷1.15	45	0.2583	3.73	0.64	+0.10
	2	46				3.84	0.53	

Table 22 Paired t-test comparisons of the RC Index and the seven dimensions between Time 1 and Time 2. Significance level *p-value < 0.05, ** p-value < 0.01.

When analyzing the RC measures, the frequency of communication in the unit was found to be very appropriate (Time 1, 3.88), and this dimension became stronger over time (Time 2, 4.17, and Time 3, 4.11), as shown in Appendix 8 (Table G). This meant that the health professionals in OR considered to a significantly greater extent frequency of communication about the tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery to be

appropriate eight months after implementation of the intervention than they did before. The ways in which the health professionals were communicating with one another were proved less satisfactory. More accuracy and timeliness of communication were desirable, and both communication dimensions became stronger during the intervention. At Time 2, the health professionals were found to rate the timeliness of communication about the tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery significantly higher than they did prior to the implementation of *Intervention I.* Moreover, the communication could be more problem-solving if in problematic situations the participants were less concerned with blaming each other (Time 1, 3.29). This communication dimension became stronger during the intervention (Time 2, 3.38), although it stayed at the same level as before when measured some 16 months after intervention was launched (Time 3, 3.25). Finally, it seems important in the light of the specialized complex context to emphasize that the health professionals had relatively low scores on the dimension of shared knowledge at all times (Time 1, 3.34; Time 2, 3.39; Time 3, 3.23). An expression of this attitude was made visible by the survey question: "*Colleagues have some knowledge about the work I do with tasks associated with preparing, preforming, and completing surgical procedures to patients undergoing orthopedic surgery in the OR."* The minimal fluctuations in the health professionals' ratings of this dimension indicated that the intervention did not influence their knowledge of what is importance for each other's task performance.

The RC ratings (RC index) were found to vary across workgroups. The RC measures derived from the three large workgroups (OR nurses, AN nurses, surgeons) were all increased eight months after implementation of the intervention, although the changes over time were not statistically significant. The difference in the RC index across these workgroups remained the same, as shown in Figure 29.

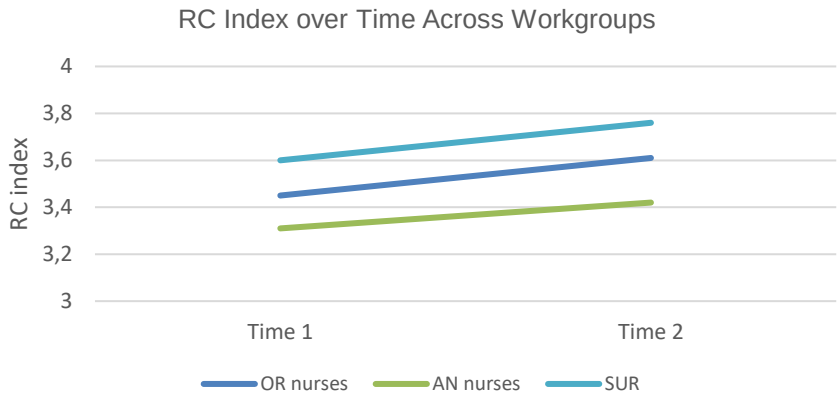


Figure 29 RC index measured before (Time 1) and eight months after implementation of intervention (Time 2) across workgroups.

At all times, the surgeons rated the RC higher (Time 2, RC index 3.76) than the other workgroups included in the survey, while the AN nurses rated the RC lower (Time 2, RC index 3.42) than the other workgroups. The difference in the RC index between the surgeons and the AN nurses during this time period was statistically significant (p < 0.0008). These findings may influence the assessment of the change over time in the RC index if the changes in the sample distribution over time are considered, since proportionately less surgeons were included in the survey at Time 3. These findings are discussed further in section *8.7 Strengths and Limitations*. Analyses have been conducted for all the workgroups, but in order to ensure anonymity in the smaller workgroups (less than five respondents), the results from those groups were excluded from the following tables. Moreover, the small workgroups might be considered to be more sensitive to low response rate; therefore, these measures must be considered subject to great uncertainty.

8.3.1.2 Decline in Relational Coordination

A decline in the RC rating during the period from eight to 16 months after implementation of the intervention was identified, as the results showed a statistically significant difference in the RC index (p = 0.0387) between Time 2 and Time 3, as shown in Table 23.

Comparisons of the RC Index and RC Dimensions Between Time 2 and Time 3								
	Time	n	t	df	Sign	mean	SD	mean diff
RC index	2	33	2.16	32	0.0387*	3.70	0.44	÷0.27*
	3	33				3.43	0.54	
Frequent communication	2	33	1.65	32	0.1090	4.25	0.52	÷0.25
	3	33				3.99	0.75	
Timely communication	2	33	1.11	32	0.2747	3.42	0.55	÷0.17
	3	33				3.25	0.66	
Accurate communication	2	32	1.04	31	0.3053	3.79	0.62	÷0.20
	3	32				3.59	0.74	
Problem-solving communication	2	31	0.82	30	0.4174	3.48	0.72	÷0.11
	3	31				3.37	0.82	
Shared goal	2	32	2.21	31	0.0344*	3.64	0.68	÷0.33*
	3	32				3.31	0.70	
Shared knowledge	2	32	2.16	31	0.0385*	3.46	0.57	÷0.24*
	3	32				3.22	0.57	
Mutual respect	2	32	2.01	31	0.0527	3.81	0.51	÷0.24
	3	32				3.57	0.63	

Table 23 Paired t-test comparisons of the RC index between Time 2 and Time 3. * *p-value* < *0.05.*

This decline was mainly attributable to a decrease in the strength of the relationships between the health professionals in the surgical teams, which was indicated by statistically significantly lower scores for the relationship dimensions of shared goals (*p* = 0.0344) and shared knowledge (*p* = 0.0385). The measures of all other RC dimensions also decreased, but statistical significance was not found. Again, the findings were based on independent group t-test comparisons of the RC index and the seven dimensions between Time 2 and Time 3, as shown in Appendix 8 (Table H), supplemented by the statistically stronger paired t-test, as illustrated in (Table 23). This latter analysis included measures from the 32 respondents who responded at both Time 2 and Time 3.

Analyzing the RC measures for this time period revealed that the health professionals had some knowledge (Time 2, 3.46) about what was important for each other's task performance, although this important knowledge decreased during the same period (Time 3, 3.22). This meant that the health professionals in the OR scored the shared knowledge about tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery significantly lower 16 months after implementation of *Intervention I* than they did eight months after. Moreover, the same professionals rated the shared goals significantly lower than they did eight months earlier.

Another change was identified, as the difference between the OR nurses' rating of RC and the AN nurses' rating of RC became larger some 18 months after implementation of the intervention, as illustrated in Figure 30. Now, the difference in the RC index derived from the AN nurses was statistically significantly different from the RC index derived from the OR nurses (*p* = 0.0359) and the surgeons (*p* = 0.0030).

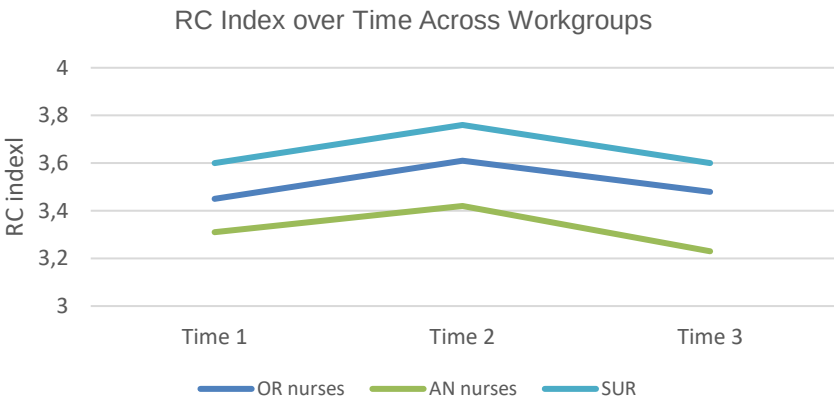


Figure 30 RC index measured eight months (Time 2) and 16 months after implementation of intervention (Time 3) across workgroups.

8.3.1.3 Long Term Changes in Relational Coordination

RC remained the same in the surgical unit 16 months after implementation of the intervention, since no statistically significant differences in RC were found when comparing the RC index before and after implementation of the intervention. This means that no evidence exists that the health professionals working in the OR 16 months after implementation of interventions scored the RC dimensions concerning tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery differently than they did prior to the implementation of interventions. However, the statistically significant increases and decreases in the RC index seen during the intervention are findings that contribute very useful knowledge about RC at the micro level during an organizational intervention, which will be discussed further in section *8.6 Interpretation and Discussion.*

8.3.2 Identifying Strong and Weak Collaboration Ties

The use of the RC Survey to measure communication and relationship dynamics in Surgery Unit II also enabled the exploration of the patterns of RC within and between workgroups. The within workgroup measures of RC are based on the responses given by participants about their own workgroup (e.g., OR nurses' ratings of OR nurses), while the between workgroup measures of RC are based on the responses given by participants about workgroups that they are not a part of themselves (e.g., all other workgroups' ratings of OR nurses). These patterns can reveal whether there were any workgroups with stronger internal collaboration than the others, as well as whether there were differences between the collaboration within and between workgroups in the OR. For all workgroups, the RC index within workgroups indicated a stronger collaboration than the RC index between workgroups, as shown in Table 24.

RC Index Within and Between Workgroups Over Time					
		Time 1	Time 2	Time 3	All time
		RC index (mean)	RC index (mean)	RC index (mean)	RC index (mean)
RC index	Within	4.28	4.38	4.26	4.31
	Between	3.33	3.48	3.42	3.41
OR nurses	Within	4.50	4.52	4.35	4.47
	Between	3.65	3.76	3.75	3.71
AN nurses	Within	4.36	4.38	4.25	4.34
	Between	3.56	3.80	3.58	3.65
Surgeons	Within	4.08	4.20	4.05	4.11
	Between	2.99	3.05	3.05	3.03

Table 24 RC index within and between workgroups over time.

The largest difference in ratings of RC within workgroups and between workgroups was seen in the workgroup of surgeons. The surgeons rated the collaboration within their own groups much higher (RC index 4.11) than the other workgroups rated their collaboration with the surgeons (RC index 3.03), which is considered to be a huge difference. The difference indicated that the surgeons had much stronger collaboration ties with their peers than with others. The same applied to the other workgroups. The differences in the RC index within and between workgroups are statistically significant (p = 0.0000). The OR nurses had the highest RC ratings when rating their own workgroup (within RC index of 4.47), while the surgeons had the lowest RC ratings when rating their own workgroup (within RC index of 4.11). The same situation was found measuring the RC dimensions between workgroups. The workgroup of OR nurses had the highest RC ratings when rated by all the other workgroups (between RC index of 3.71), while the surgeons had the lowest RC ratings when rated by all the other workgroups (between RC index of 3.03). This indicated that the surgeons have the weakest collaboration ties, and the OR nurses the strongest collaboration ties, with their colleagues in the surgical unit.

Another way of exploring and visualizing patterns of RC within and between workgroups is to create a matrix showing within workgroup collaboration ties and between workgroup collaboration ties (Table 25), as inspired by Gittell (2016) and Relational Coordination Analytics, Inc. (RCA 2016). The matrix enabled the exploration of the strength of the collaboration ties between each of the involved workgroups by showing how each workgroup rated each of the other workgroups, as well as how it was rated by the others. The numbers in the matrix cells indicate the mean of the RC index, while the color codes used to illustrate the norms for weak, moderate, or strong ties based on norms from Relational Coordination Analytics, Inc. (RCA, 2016). The collaboration ties between the three large workgroups collaborating closely to the patients undergoing surgery were at Time 1 identified as weak or moderate, which highlighted major improvement possibilities for the interdisciplinary collaboration.

Matrix RC Index Between Workgroups at Time 1				
Ratings by	Rating of			
	RC index	OR nurses	AN nurses	SUR
	OR nurses	4.50	3.56	3.31
	AN nurses	3.35	4.36	2.72
	SUR	3.83	3.40	4.08

	Within workgroups	Between workgroups
Weak	< 4.0	<3.5
Moderate	4.0 - 4.5	3.5 – 4.0
Strong	> 4.5	> 4.0

Table 25 Relational coordination matrix at Time 1 (baseline measures) indicating strong and weak collaboration ties based on the norms for weak, moderate, and strong collaboration ties from 2015 © Relational Coordination Analytics Inc., RC Survey 2.0 (RCA, 2018).

The matrix shows the results from Time 1 that were used in the feedback process during PHASE II to develop *Intervention II* (p. 139), as described in *Chapter 7*.

Differences were found in the workgroups' ratings of each other, which indicated the presence of non-reciprocal collaboration ties. This was seen in the collaboration between the OR nurses and surgeons, when the OR nurses rated the RC of the surgeons as a weak tie (RC index 3.31) and the surgeons rated the RC of the OR nurses as a moderate collaboration tie (RC index 3.83). The strengths of the collaboration ties between the workgroups were also found to change slightly during the intervention period (Appendix 8, Table I and Table J). The collaboration ties between the two workgroups of nurses improved during the intervention process, which was particularly evident in the increased rating of the RC of the OR nurses given by the AN nurses (from 3.35 before the intervention was implemented to 3.54 some 16 months after). A different picture was found in relation to the collaboration ties between the AN nurses and surgeons, since the ties between these workgroups got weaker over time. The RC ratings of the AN nurses by the surgeons decreased slightly over time from 3.40 before intervention to 3.31 some 18 months after implementation, while the RC ratings of the surgeons by the AN nurses decreased over time from 2.72 to 2.53. The ties between the OR nurses and the surgeons remained unchanged over time. No statistically significant changes in collaboration ties between workgroups over time were found.

Further exploration of the non-reciprocal collaboration ties might be important in relation to better understanding the possibilities available for improvement of interdisciplinary collaboration. The workgroups of surgeons, OR nurses, and AN nurses are the groups that collaborate closest in treating patients who are undergoing surgery in the OR. Traditionally, the surgeons are placed higher in the hierarchical system than the nurses and, as described in the introduction, diversity in status between team members in the OR can be challenging (Edmondson, 1996, 2003; Tucher and Edmondson, 2003; Nembhard and Edmondson, 2006). Therefore, further analyses of the collaboration ties between these workgroups were conducted using independent group t-test comparisons of the RC index across workgroups, as shown in Table 26 (p. 170). The surgeons rated the OR nurses (p = 0.0000) and AN nurses (p= 0.0000) statistically significantly higher than both nurse workgroups rated the surgeons. When examining the difference between how the surgeons and the workgroups of nurses were rated the RC of each other, differences appeared in relation to all the dimensions included in the construct of RC, as shown in Appendix 8 (Table L and Table M). There were also differences in terms of which RC dimensions were scored lowest when the workgroups rated each other. The measures from the surgeons indicated that the relational dimensions were challenging when they rated the AN nurses. The surgeons experienced that the AN nurses only shared their goals with regard to the core tasks to a certain extent (shared goal rated from 2.86 to 3.41), and that they only had some or little knowledge about what was important if the surgeons were to do their best (shared knowledge from 2.85 to 3.09).

Comparisons of RC Index Between the Large Workgroups in OR							
RC index	*n*	t	df	Sign.	mean	SD	mean diff
Surgeons' rating of OR nurses	72	4.62	131	0.0000**	3.82	0.08	+0.53**
OR nurses' rating of surgeons	61				3.29	0.08	
Surgeons' rating of AN nurses	71	6.30	118	0.0000**	3.46	0.73	+0.81**
AN nurses' rating of surgeons	49				2.66	0.63	
Surgeons' rating of OR nurses	72	3.93	141	0.0029**	3.82	0.08	+0.36**
Surgeons' rating of AN nurses	71				3.46	0.73	
OR nurses' rating of AN nurses	61	2.10	108	0.0188*	3.69	0.61	+0.23*
AN nurses' rating of OR nurses	49				3.45	0.53	

Table 26 Independent group t-test comparisons of the RC index between workgroups that collaborate closest when treating patients undergoing surgery in the OR. Significance level * *p-value* < 0.05, ** *p-value* < 0.01.

Conversely, the AN nurses expressed that they rarely or only occasionally experienced mutual respect from the surgeons (mutual respect from 2.15 to 2.43), and that they experienced the surgeons to mostly use blaming communication rather than problem-solving communication when problems with the core task arose (problem-solving communication from 2.00 to 2,38). The same trends were found between the surgeons and the OR nurses, albeit with higher ratings.

Whether RC was measured before, during, or after the intervention, the measurements indicated that the surgeons assessed their collaboration with the nurses significantly higher than vice versa, both in terms of the ways they related to one another and the ways they communicated with one another. It was also found that the surgeons rated their collaboration with the OR nurses significantly higher than they rated their collaboration with the AN nurses ($p = 0.0029$). Finally, the OR nurses were found to rate the AN nurses statistically significantly higher ($p = 0.0188$) than the AN nurses rated the OR nurses. Thus, all the collaboration ties between health professionals who collaborated the closest when treating patients undergoing surgery are characterized as non-reciprocal. The significant differences might have influenced whether the collaboration was experienced appropriately or problematically, which will be discussed further in section *8.6 Interpretation and Discussion*. The findings highlight a major possibility for improving both the communication and relationships between these workgroups in the OR.

After having explored RC across workgroups in the OR and identified the strong and weak collaboration ties, it might be useful also to explore whether attachment to different clinics had an impact on how the health professionals assessed the RC of one

another. This is relevant and useful because the surgical unit was organized into specialized clinics, as described in the presentation of the context of the study and shown in the organizational diagram (Figure 8, p. 50). This means that the health professionals who were collaborating in the operating rooms, were employed in different clinics, and therefore, belonged to different senior management groups. The surgeons and OR nurses were employed in the orthopedic clinic, while the anesthesiologists and AN nurses were employed in the anesthetic clinic. When assessing RC in the OR, different collaboration ties were found, as shown in the matrix below illustrating the RC scores between workgroups collaborating in different clinics (Table 27).

RC Ratings Across Clinic and Between Professions in the OR					
	Rating of				
		Surgeons	OR nurses	Anesthesiologists	AN nurses
Rating by	Surgeons (orthopedic clinic)	4.11	3.82	3.54	3.46
	OR nurses (orthopedic clinic)	3.29	4.47	2.75	3.69
	Anesthesiologists (anesthetic clinic)	2.64	3.43	4.34	4.12
	AN nurses (anesthetic clinic)	2.66	3.45	3.97	4.35

RC within	RC within clinics and between professions	RC across clinics and within professions	RC across clinics and between professions
4.30	3.72	3.50	3.04

Table 27 Matrix illustrating the RC index within and across clinics and within and across professions in the OR.

First, collaboration ties within workgroups (RC index 4.30), which were based on measures of RC derived from the responses given by participants about their own workgroup (e.g., surgeons' ratings of surgeons), are colored dark green in the matrix. Second, collaboration ties within clinics and between professions (RC index 3.72), which were based on measures of RC derived from the responses given by participants about workgroups within their own clinic they were not a part of themselves (e.g., surgeons' ratings of OR nurses), are colored light green in the matrix. Third, collaboration ties across clinics and within professions (RC index 3.50), which were based on measures given by the participants about workgroups belonging to another clinic than themselves, but with the same profession as themselves (e.g., surgeons' ratings of anesthesiologists), are colored dark blue in the matrix. Finally, collaboration

ties across clinics and between professions (RC index 3.04), which were based on measures given by the participants about workgroups belonging to another clinic than themselves and from professions they are not a part of themselves (e.g., surgeons' ratings of AN nurses), are colored light blue in the matrix. The RC index shown in each cell was calculated based on data derived from all the observations (n = 197) of all the workgroups of surgeons, OR nurses, AN nurses, and anesthesiologists.

Independent group t-test comparisons of the RC index across clinics and between professions were conducted, which indicated strong statistically significant differences, as shown in Appendix 8 (Table N). The RC within (4.30) was found to be higher than all the other combinations of collaboration ties in the matrix, including workgroups collaborating in the same OR (3.72, 3.50, and 3.04), which confirmed the findings of the previous analyses of the RC within being higher than the RC between workgroups. The comparisons of RC across clinics in this analysis explored whether organizational and specialized affiliations affect the experience of collaboration. The RC within clinics and between professions was found to be statistically significant higher than the RC across clinics and within professions (p = 0.0002).

In other words, health professionals with different professional backgrounds belonging to the same senior management group and the same clinical specialty have stronger collaboration ties than health professionals with the same professional background belonging to different senior management groups and different specialties. This might indicate that joint management affiliation or joint specialty is more important for the quality of collaboration than affiliation through a professional community, which will be discussed later in section *8.6 Interpretation and Discussion*, since these findings may have implications for future organization in the OR. The weakest collaboration ties in the OR were found between workgroups that belonged to different professions, were affiliated with different management groups, and specialized in different specialties (collaboration between surgeons and AN nurses & collaboration between OR nurses and anesthesiologists).

Health professionals from two clinical specialties are collaborating in the OR. While they each practice the specialized treatment of patients undergoing surgical procedures, the interdependency is significant, as described in PHASE I, although the overall responsibility for treatment is imposed on the surgeons. In Surgery Unit II, the surgeons are the patient-responsible physicians designated to carry the overall responsibility and overview of a given patient's treatment at the hospital. These patients are admitted to wards in the orthopedic clinic. In addition, the work areas of the surgeons and anesthesiologists differ in other ways. The anesthesiologists are often only present in the OR when initiating the anesthesia, or if they are called on in situations requiring special attention and treatment. The group of anesthesiologists is considerably smaller than the group of surgeons, who are present in the OR throughout the perioperative period. These differences in both function and responsibilities may affect interdisciplinary collaboration in the OR across clinical specialties.

To explore the differences in the measures of RC between health professionals who specialize in different specialties (and who are employed in different clinics), independent group t-tests were conducted. First, a strong statistically significant difference was found in the measures of RC ($p = 0.0000$) when the health professionals who specialized in orthopedics and the health professionals who specialized in anesthesia assessed the RC of one another, as shown in Table 28. These findings indicated the presence of non-reciprocal collaboration ties between workgroups from different clinical specialties.

Comparisons of RC Index Between Clinical Specialties in the OR							
	n	t	df	Sign	RC index Mean	SD	Mean diff
HCP orthopedics' rating of HCP anesthesia	131	4.50	193	0.0000**	3.18	0.83	+0.59**
HCP anesthesia' rating of HCP orthopedics	64				2.65	0.63	

Table 28 Independent groups t-test comparisons of the RC index across clinical specialties, with *p-value < 0.05, ** p-value < 0.01 Health professionals (HCP) from orthopedics rating of HCP from anesthesia and vice versa.

Second, analyses of RC across clinics were conducted, and the health professionals in the orthopedic clinic were found to assess the RC in the surgical unit statistically significantly higher than the health professionals in the anesthetic clinic ($p = 0.0005$), as shown in Table 29, and in Appendix 8 (Table K).

Comparisons of RC Index Across Clinics in the OR							
	n	t	df	Sign	RC index Mean	SD	Mean diff
HCP orthopedic clinic	133	3.54	195	0.0005**	3.59	0.50	+0.25**
HCP anesthetic clinic	64				3.34	0.42	

Table 29 Independent groups t-test comparisons of the RC Index across clinics, with *p-value < 0.05, ** p-value < 0.01.

The results of the assessment of RC between clinical specialties and across clinics showed strong as well as moderate and weak collaboration ties between health professionals performing surgical procedures in the same operating room. The identified collaboration ties were characterized as being non-reciprocal.

The final collaboration ties to be explored during this phase were the ties between health professionals in the OR and nurses in the orthopedic wards. Although the

collaboration with nurses in the orthopedic wards does not take place on a face-to-face basis in the OR, the collaboration is nevertheless included in this study, since strengthening these relationships was prioritized during PHASE II. The measures of RC between health professionals in the OR and nurses in the wards changed over time according to the same pattern as the other RC measures over time, with increases seen eight months after and decreases seen 16 months after the interventions. However, the change over time seen in these analyses showed no statistically significant differences. All the workgroups in the OR rated collaboration ties with the ward nurses as weak collaboration tie at all times, as shown in Appendix 8 (Table O). As *Intervention I* included an expanded collaboration with the nurses in the orthopedic wards, it was relevant to elaborate further on the relationships between the workgroups in the OR and the nurses in the orthopedic wards. Shared knowledge was the dimension identified as being the weakest between the nurses in the wards and the workgroups in the OR. The workgroup of nurses in the OR, who made telephone contact with the ward nurses about concrete patient-related tasks if needed, rated the shared knowledge of the ward nurses very low prior to the intervention (shared knowledge rated by the OR nurses 1.61 and rated by the AN nurses 1.71). This indicates that both the OR nurses and AN nurses assessed that the nurses in the orthopedic wards knew very little about what the nurses in the OR did in relation to tasks associated with preparing, performing, and completing surgical procedures to patient undergoing surgical procedures. These findings support the challenges associated with the collaboration between health professionals in the OR and nurses in the orthopedic ward that were expressed during PHASE II, which will be discussed further in *Chapter 9*.

The results of the assessment of RC will be discussed later in section *8.6 Interpretation and Discussion*, together with the results of the assessment of safety culture.

8.4 Assessment of Safety Culture

In order to assess the health professionals' attitudes toward safety culture in a surgical unit, analyses are conducted in which any changes over time are explored and the strong and weak dimensions of safety culture are identified. The attitudes toward safety culture were assessed using the Danish language version of the Safety Attitudes Questionnaire survey, the SAQ-DK (Kristensen et al., 2015a; Kristensen 2016b), during and after an organizational intervention was implemented. As described previously, the SAQ-DK was first available after implementation of *Intervention I*, and therefore a baseline measurement was not conducted prior to the intervention, which had initially been intended.

The health professionals included in the surgical teams were asked to express their attitudes to statements (items) concerning the following dimensions: teamwork climate, safety climate, job satisfaction, perceptions of management, working conditions, and

stress recognition; and to further five statements (items) outside these dimensions, as shown in Appendix 4. All analytics were conducted using Excel 2016 and Stata 14.0, which are computer software programs for quantitative data analysis.

For each of the safety culture dimensions, the percentage of respondents with a positive attitude (% positive), as well as the mean scale scores, were calculated. First, the responses were categorized as (% positive) and (% negative). The percentage of positive responses stemmed from answers such as "Agree slightly" or "Agree strongly," while the percentage of negative responses stemmed from answers such as "Disagree slightly" or "Disagree strongly." The answers given on a five-point Likert scale were converted to the values placed within brackets: *1 = Disagree strongly (0), 2 = Disagree slightly (25), 3 = Neutral (50), 4 = Agree slightly (75), and 5=Agree strongly (100).* A few items were negatively worded and, therefore, reverse scored. In order to calculate the proportion of (% positive), the observations with measures ≥ 75 were counted for each item and each scale/dimension of the questionnaire. Next, the measures of safety culture were analyzed by calculating and comparing the differences in the mean scale scores. Individual mean scale scores were calculated according to the average score of the scaled items for each safety dimension. When analyzing data derived from the SAQ-DK, the items are assumed to have interval properties and be normally distributed. These calculation processes were conducted following the guidance of the *Manual for Analyzing Safety Attitudes Questionnaire*, DK (Kristensen, 2016b). In order to follow the guidelines for analyzing the SAQ-DK and secure the respondents' anonymity, analyses were only conducted and presented in relation to data derived from workgroups with more than five participants (Kristensen, 2016b).

8.4.1 Changes in Attitudes Toward Safety Culture Over Time

The health professionals' attitudes toward safety culture were found to change over time, as expressed by the proportion of health professionals with positive attitudes when assessed eight and 16 months after implementation of an organizational intervention, as presented in Figure 31.

The proportion of respondents with positive attitudes varied across the dimensions. The dimension of working conditions[19] was the dimension with the largest proportion of responses indicating positive attitudes at both times. The safety climate[20] and the perception of management were the dimensions[21] with the least positive responses at both times. Differences in the proportion of respondents with positive attitudes were

[19] Working conditions included attitudes toward statements about the introduction to the task and workplace including supervision when newly employed, about the information available when needed for making decisions about patients' treatment and care, and about how proposals for improving patient safety are received and followed-up by the management (Appendix 4).
[20] Safety climate included attitudes toward questions about the safety of patients, about handling and discussing adverse advents, and about speaking up if worried about patient safety.
[21] Perceptions of management included attitudes toward statements about support from the management group, the management groups' capacity for problem solving, and staffing when compared to tasks and numbers of patients.

found over time. The proportion of respondents with positive attitudes toward safety climate decreased by more than 8% over time (from 25.3% to 16.7%). The proportion of respondents with positive attitudes toward the dimensions of job satisfaction (from 52% to 43.8%) and working conditions (from 60% to 54.2%) decreased by more than 5% between Time 2 to Time 3. Finally, the proportion of respondents with positive attitudes toward the dimension of stress recognition, which was a dimension that correlated negatively with the other dimensions, also increased by more than 5% (from 56.6% to 61.7%) from Time 2 to Time 3.

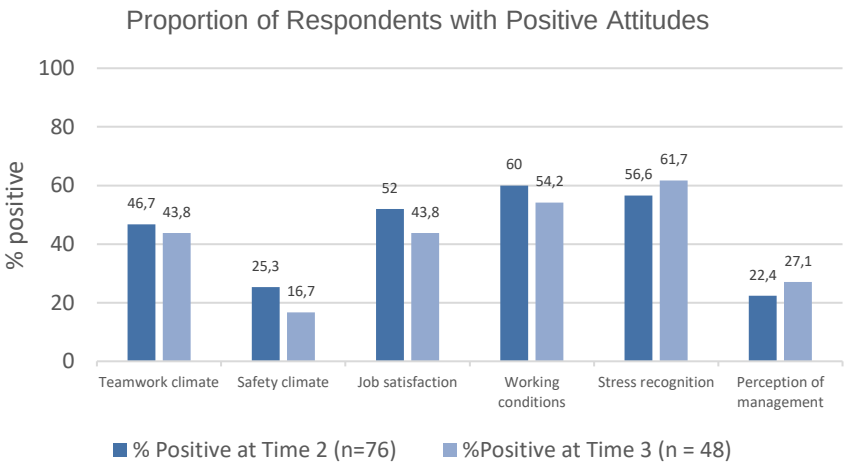


Figure 31 Proportion of positive attitudes toward dimensions included in the SAQ-DK over time.

The same situation was found when calculating and comparing the differences in the mean scale scores over time, as shown in Appendix 9 (Table C, Table D). The dimensions of working conditions (mean scale score of 71.1 increased to 71.4) and job satisfaction[22] (mean scale score of 70.1 decreased to 66.5) were identified as the strongest at all times, except for stress recognition, which was the negatively correlated dimension (mean scale scores of 68.7 increased to 72.7). In this analysis, safety climate was also identified as a weak dimension at both times (mean scale scores of 57.4 at Time 2 decreased to 54.0 at Time 3). No statistically significant differences over time were found after conducting independent group t-test and paired t-test comparisons of the dimensions included in the construct of safety culture.

Finally, changes in attitudes toward safety culture over time were analyzed by workgroups in order to explore the differences in attitudes over time between the large workgroups (surgeons, OR nurses, and AN nurses) collaborating in the OR.

[22] Job satisfaction included attitudes toward questions about being satisfied with the job and proud of the workplace.

When calculating and comparing the proportion of respondents with positive attitudes toward all the dimensions included in the construct of safety culture, differences over time and across workgroups were found. Figure 32a and Figure 32b shows the proportions of respondents with positive attitudes toward the dimensions of teamwork climate[23] and safety climate.

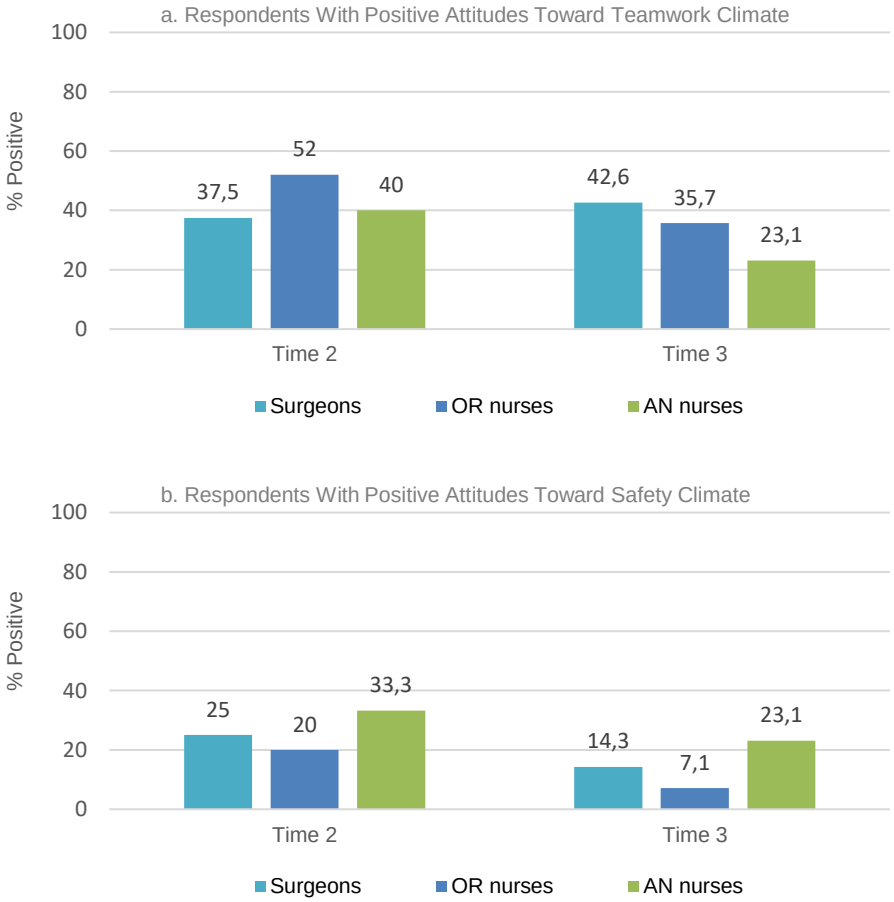


Figure 32 a-b Workgroups closest to patients undergoing surgery with positive attitudes toward teamwork climate and safety climate at Time 2 and Time 3. Surgeons (Time 2, n = 24; Time 3, n = 14), OR nurses (Time 2, n = 25; Time 3, n = 14), and AN nurses (Time 2, n = 15; Time 3 n = 13).

[23] Teamwork climate included attitudes toward statements about collaboration, support and problem-solving in order to provide safe treatment and care to patients and speaking up if patient-related problems occur.

The proportion of nurses with positive attitudes toward teamwork climate decreased by more than 16% from Time 2 to Time 3, while the proportion of surgeons with positive attitudes toward teamwork climate increased by more than 5% during the same period (Figure 32 a). The proportion of respondents with positive attitudes toward safety climate from these workgroups decreased during the same period by more than 10% (Figure 32 b). All this indicates a large change over time, as well as large differences between surgeons and nurses. The relevant considerations in this regard will be discussed in section *8.6 Interpretation and Discussion.*

Further explorations of the differences in attitudes toward safety culture across workgroups were conducted using independent groups t-test comparisons of the mean scale scores. These analyses showed statistically significant differences when comparing the mean scale scores of the dimensions of working conditions and perception of management. No significant differences in the mean scale scores were found for any of the other scales. Comparisons of the mean scale scores for working conditions showed statistically significant differences between the OR nurses and AN nurses ($p = 0.0345$), as well as between the AN nurses and surgeons ($p = 0.0004$), as shown in Table 30. This indicates large differences in attitudes toward working conditions between the surgeons and nurses collaborating in the OR at Surgery Unit II. The findings from the assessment of safety culture will be discussed later in section *8.6 Interpretation and Discussion.*

Comparisons of Mean Scale Scores Across Workgroup								
Scale	Workgroup	n	t	df	Sign.	mean	SD	mean diff.
Working conditions	OR nurses	39	1.9	75	0.0652	72.2	18.8	8,5
	Surgeons	38				63.7	21.1	
Working conditions	OR nurses	39	÷2.2	65	0.0345*	72.2	18.8	÷9,9*
	AN nurses	28				82.1	18.3	
Working conditions	AN nurses	28	3.7	64	0.0004**	82.1	18.3	18.4**
	Surgeons	38				63.7	21.1	

Table 30 Independent groups t-test comparisons of the mean scale scores across workgroups for the dimension of working conditions, with * *p-value* <0.05, ** *p-value* <0.01.

8.5 Comparing Relational Coordination and Safety Culture

After having assessed RC and the attitudes toward safety culture in the surgical unit, a comparative analysis between the construct of RC (RC index) and the dimensions included within the construct of safety culture was conducted. The Pearson's correlation coefficients were calculated. The results of these analyses demonstrated that RC and safety culture were correlated. The RC index was correlated with all the scales included in the SAQ-DK, except for the scale of perception of management. The

Pearson's correlations indicated significantly strong positive correlation between the RC index and team climate (r = 0.33, p = 0.0002), safety climate (r = 0.37, p = 0.0000), job satisfaction (r = 0.34, p = 0.0001), and working conditions (r = 0.26, p = 0.0034). Furthermore, a significantly strong negative correlation was found between the RC index and the stress recognition (r = ÷0.24, p = 0.0085). The highest correlation was found between the RC index and safety climate (r = 0.37), which was defined as moderate correlation, according to the norms of moderate correlation when *r is* between 0.30 and 0.70 (Ratner, 2009). The perception of management was not statistically significantly related to the construct of RC. The results from Pearson's correlations are shown in Table 31.

Correlation Between Relational Coordination and Safety Culture								
	Teamwork climate	Safety climate	Job satisfaction	Stress recognition	Perception of management	Working condition	Without category	RC index
Teamwork climate	1							
Safety climate	0.58**	1						
Job satisfaction	0.55**	0.57**	1					
Stress recognition	÷0.19	÷0.28**	÷0.08	1				
Perception of management	0.34**	0.52**	0.41**	0.01	1			
Working conditions	0.49**	0.59**	0.57**	÷0.06	0.43**	1		
Without category	0.56**	0.60**	0.48**	÷0.10	0.48**	0.49**	1	
RC index	0.33**	0.37**	0.34**	÷0.24**	0.12	0.26**	0.28**	1

Table 31 Correlation between the RC index and the scales included in the SAQ-DK, as tested by Pearson's correlations. ** p < 0.001, (n=124).

The RC index and the safety climate dimension were both strongly negatively correlated with the stress recognition dimension, with their respective correlation coefficients being on ÷ 0.24 and ÷ 0.28. The results of the comparisons of relational coordination and safety culture are interpreted and discussed in the next section.

8.6 Interpretation and Discussion

During PHASE III, relational coordination and safety culture were measured before, during, and after the implementation of an organizational intervention in order to

address the third research question: *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention process using the theory of relational coordination as a tool for improvement?* The third research question was based on the hypothesis that the implementation of interventions identified from the health professionals' measures of RC within and between workgroups will reinforce the interdisciplinary collaboration over time. The findings during this phase add to the sparse international literature concerning the improvement of RC in interdisciplinary surgical teams over time using the theory and methodology of RC as tools for improvement.

8.6.1 Improved Relational Coordination

One of the most interesting findings to emerge from the analysis was the statistically significant improvement in the RC index from Time 1 to Time 2. Eight months after implementation of *Intervention I*, the health professionals working in the surgical unit scored the frequency and timeliness of communication about the tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery significantly higher than prior to the implementation of *Intervention I.* Thus, the health professionals experienced a significant improvement in the ways they communicated with one another following the implementation of *Intervention I.* The intervention specifically focused on structural initiatives such as the introduction of board meetings, the designation of a daily OR coordinator, and the development of new shared procedures to ensure patients are ready for surgery. The changed communication patterns, which were characterized by more appropriate frequency and timeliness of communication, might be interpreted as reflections of the structural changes and changes in work processes initiated at the start of the intervention, as described in *Chapter 7*.

Another important finding was the significant decline in the RC index seen from Time 2 to Time 3. Sixteen months after implementation of *Intervention I*, the health professionals working in the surgical unit scored the degree of shared goals about tasks associated with preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery significantly lower than they did eight months after implementation of *Intervention I*. Moreover, they also rated the degree of shared knowledge about the tasks significantly lower than they did eight months after implementation of *Intervention I*. The significant improvement in RC achieved after the first eight months was no longer experienced by the health professionals. This resulted in the RC among the health professionals remaining at the same level as prior to the intervention, albeit with some variations across the RC dimensions. The communication dimensions were slightly stronger than before, while the relationship dimensions were slightly weaker than before. The interpretation of unchanged communication and relationship patterns is not clear, although the lack change may have something to do with the character of the initiated interventions. In the sense, that the improvement that may be attributed to the structural initiatives and changes in work processes was found to be less sustainable and more superficial. If relational

interventions had been implemented, the changes in relationships might have been attributed to a more profound improvement of relational coordination over time and thereby a more sustainable organizational improvement. These considerations are discussed again in *Chapter 9*, when the findings and interpretations derived from PHASE I, PHASE II, and PHASE III are integrated at the interpretation level.

Thus, no statistically significant differences were shown in the RC index when it was comparing before and after implementation of interventions. These results seem to be consistent with the findings of other research that found an improvement during the first period of an organizational intervention, but documented a return to the starting point at a later period after the implementation (Forse et al., 2011). In a systematic review of interventions intended to improve the surgical culture, the median follow-up for the 47 included studies was nine months. Several studies followed the effect of the interventions on the surgical culture for a long time after the interventions were implemented, although only a few studies reported positive outcomes to be sustained for more than one year (Sacks et al., 2015). Such tendencies in the change processes highlight the importance of a sustained focus on communication and relationships in order to secure the sustainability of the interventions so as to improve the interdisciplinary collaboration in surgical teams. Another study emphasized that strong leadership support is considered to be crucial if team-enhancing interventions in surgical units are to persist over time (Paull et al., 2009). There are however, other explanations and interpretations associated with the changes in the RC index over time. The health professionals might have been more aware of their collaboration and hence reflected more on their attitudes toward high-performance collaboration. In this way, the interventions could have created expectations for more appropriate future collaboration, which may not have been met. These findings highlight the need for further research focusing on how improvements in surgical units can be maintained and allowed to continue to evolve.

8.6.2 Collaboration Ties Between Workgroups

The RC within workgroups was found to be significantly higher than the RC between workgroups in OR at all times, which is in agreement with prior research findings concerning the RC among nurses and other health professionals (Havens et al., 2010). Some of the most compelling findings concerned the non-reciprocal collaboration ties between workgroups in the OR. The collaboration ties were identified as non-reciprocal when two workgroups rated the RC of one another significantly different, as seen between the surgeons and OR nurses, between the surgeons and AN nurses, and between the OR nurses and AN nurses. Non-reciprocal collaboration ties were also identified between health professionals affiliated with different clinical specialties (orthopedic and anesthesiology). How do we understand and interpret the dynamic behind these non-reciprocal collaboration ties? What kinds of relationships are these collaboration ties reflecting? What impact do these sorts of ties have on the interdisciplinary collaboration in the OR? A possible interpretation could be that the existence of non-reciprocal collaboration ties between the health professionals in the

OR may reflect the diversity in status (length of education, clinical specialty, clinical experience), power differences (allocation of responsibility), or hierarchical systems in the OR. These diversities might render it particularly challenging for team members in surgical teams to speak up about ideas, questions, and concerns (Edmondson, 2003), which might in turn pose a threat to patient safety.

Status or specialty-related differences may also explain why the workgroup of AN nurses was the workgroup that rated their collaboration with the other workgroups lowest. Their assessment of RC was significantly lower than that of the other major workgroups when measured 16 months after the implementation. The AN nurses were specialized in another clinical specialty and organizationally affiliated with another clinic and management group than their closest collaborators in the OR, namely the surgeons and OR nurses, who had joint specialization and joint management. In the OR, the individual workgroups have well-defined functions and responsibilities. The AN nurses are responsible for the patients' anesthesia, including monitoring and stabilizing the patient's vital condition during surgical procedures. This responsibility was delegated by the responsible anesthesiologists, who were only present in the OR if there were special considerations and challenges related to the anesthesia of the patient. Therefore, the AN nurses might be particularly dependent on their own willingness to speak up, as well as particularly vulnerable to being listening to and understood by their collaborators during surgical procedures. The AN nurses' assessments of RC may be interpreted as a reflection of their experiences that the other workgroups do not respect their professionalism highly enough, or that they do not have the necessary knowledge of what is essential in relation to providing high-quality anesthetic care. This interpretation is supported by the very low ratings of mutual respect and problem-solving communication found when the AN nurses rated the surgeons.

Surprisingly, the results of this study indicated that health professionals from different professions who were employed in the same clinics had stronger collaboration ties, than health professionals from the same professions who worked across clinics. This was for example the case when collaboration ties between the surgeons and OR nurses were found to be stronger than collaboration ties between the surgeons and anesthesiologists. It is possible that the less strong collaboration ties when measuring the RC across clinics and within professions may be interpreted as distance due to different organizational positions or distance created by the clinical specialization. However, the less strong collaboration can also be attributed to the fact that the health professionals are both “separated” by organization and “separated” due to clinical specializations. Finally, the non-reciprocal collaboration ties seen between the health professionals from the orthopedic specialty and the health professionals from anesthesia specialty might indicate the existence of status or power differences between the specialties involved in the treatment and care of patients undergoing surgery in the OR. Inappropriate relationships or conflicts between surgeons and anesthesiologists have previously been explored and discussed in research concerning surgical teams in the OR (Katz, 2007), highlighting the fact that the OR is

a location where two physicians, who are equally educated, are simultaneously sharing responsibility for one patient. Both physicians are completely dependent upon the right decisions being made, as the patient's life may depend on it. These physician specialists in each area may consider the patient's situation from different angles, and they may disagree as to what the right decision may be (Attri et al., 2015). Any status differences between the clinical specialties may impact the relationships in the collaboration. These findings have important implications for recommendations concerning the improvement of collaboration in surgical teams. An obvious improvement opportunity would therefore be to strengthen the non-reciprocal ties through relational interventions that stimulate the formation of more reciprocal collaboration ties. Reciprocal collaboration ties would be preferable, while minimizing status differences in the OR is supposed to strengthen the health professionals' psychological safety and thereby stimulate their willingness to speak up. This presumption leans on the significant association between psychological safety and professional status, as described by Nembhard and Edmondson (2006). Further research could extend the insight into existing non-reciprocal collaboration ties in the OR and provide valuable knowledge about the status-deriving interactive dynamics that exist between health professionals in surgical teams in order to minimize the challenges related to status differences.

The significant differences seen in the assessment of the collaboration between surgeons and nurses in this study support the findings of previous research focusing on collaboration between surgeons and OR nurses. In a cross-sectional study, wherein operating room personnel from 60 American hospitals were surveyed using the SAQ, similar results concerning the differences in attitudes toward collaboration between surgeons and OR nurses were found (Makary et al., 2006). An expanded version of the SAQ was used in the American study, which provided the opportunity to measure the health professionals' attitudes toward teamwork between workgroups in the operating room. This operating room version of the SAQ (SAQ-OR) included statements that specifically addressed the tasks and challenges that may arise in relation to the collaboration and safety culture of a surgical unit. This version of the SAQ was not validated in a Danish language, therefore, the decision was made to use the short generic version of the SAQ in this study. In the American hospitals, the surgeons rated their collaboration with the AN nurses higher than their collaboration with the OR nurses, while the AN nurses rated their collaboration with the surgeons higher than the OR nurses. These findings differ from those presented in this study, which may be explained by structural differences or differences in the AN nurses' functions in the OR when comparing the health-care systems in the USA and Denmark. The discrepancy in attitudes toward collaboration between surgeons and OR nurses can mirror other differences, such as status, gender, experiences, and relationships with patients. It could also be an expression of discrepancy in attitudes toward what defines great collaboration in the OR. Nevertheless, it is relevant to dive deeper into these discrepancies in attitudes toward teamwork among the triad of health professional closest to patients undergoing surgery. These aspects are discussed when integrating the findings from PHASE I, II, and III in *Chapter 9*. Moreover, the

differences highlight the non-reciprocal relationships that exist within the interdisciplinary collaboration in the OR, as well as the methodological challenges in aggregating measures of relational coordination in surgical teams. If these measures are used as a prioritizing tool in order to develop an intervention, awareness and curiosity are needed to make clear whether the measures are mirroring the attitudes of all the workgroups, or if the measures are covering large differences in attitudes toward collaboration. These perspectives emphasize the importance of discussing the results feedback in a group that includes senior managers, frontline managers, and frontline professionals from all professions in order to understand and interpret the measures in the most conducive way.

Another finding to emerge from the analysis was the existence of challenging collaboration ties between ward nurses and nurses in the OR. Comparing these findings with the findings from an American study measuring nurse-reported experiences of relational coordination with other care providers including nurses from other units (Havens et al., 2018), the nurses in the OR experienced relational coordination with ward nurses to be considerably lower. In this study, the mean of the RC index varied from 2.42 to 2.72 over time when the nurses in the OR rated the ward nurses, while in the American study, the mean of the RC index was 3.0 when the nurses rated nurses from other units than their own. These collaboration ties were defined as weak ties with delayed communication and little knowledge about what was important for each other's tasks in relation to preparing, performing, and completing surgical procedures to patient undergoing orthopedic surgery. These relationships may be partly explained by the fact that the specialization within the nursing profession, along with a changeable everyday life in the orthopedic units, enhanced the interdependency among the nurses in the surgical unit and the ward nurses, as suggested by Nembhard and Edmondson (2006). If this interdependency between nurses in the ward and nurses in the OR is met with la ack of knowledge, delays in the exchange of information, a lack of preparation of patients undergoing surgery, or cancellations, then the collaboration ties are challenged. The interdependency between nurses from different units in terms of providing optimal nursing care for patients undergoing surgery requires a high level of knowledge about each other's task performance, a high level of flexibility, and mutual understanding of the situation, which could be improved by collaborative learning within workgroups from different professions and different units (Nembhard and Edmondson, 2006). These results match those observed by Gittell (2012b), indicating that collaboration ties between health professionals within "professional siloes" are stronger than ties between health professionals across "professional siloes."

The findings concerning the non-reciprocal collaboration ties between workgroups in the OR contribute to the existing theory of relational coordination, by adding knowledge about collaboration ties at the micro level. Knowing that an affiliation with the same management group created closer collaborative relationships between team members than an affiliation with team members from the same profession who are affiliated to another management group might have practical implications for future structural

interventions in surgical units. Further, knowing that the specialization of the health professionals leads to a lack of knowledge about what is important for each other's task performance might have practical implications for future improvement interventions intended to prioritize relational interventions. As these results are based on a single case study and a relatively small sample, additional studies are needed to develop a full picture of the strengths of the collaboration ties in surgical teams.

8.6.3 Strong and Weak Relational Coordination Dimensions

The RC dimensions were at no time rated to be at the highest end of the spectrum by the health professionals working in Surgery Unit II. Comparing the measures between workgroups to the norms for weak, moderate, and strong collaboration ties based on RC data provided by Relational Coordination Analytics, Inc. (RCA) (Table 25), it was found that the ratings made by health professionals in Surgery Unit II were considerably lower than those from the units included in the benchmark norms from RCA. There is no benchmark data for RC in surgical units in Denmark. However, the RC measured in this study was lower than the RC measures documented in a cross-sectional study conducted in orthopedic units performing hip and knee arthroplasty in nine hospitals in the USA, which were based on 336 respondents (Gittell et al., 2000). In the American study, the mean of the RC index varied from 3.86 to 4.22 across the nine hospitals, and shared knowledge, mutual respect, and frequent communication were found to be the dimensions with the lowest means. In this study, the mean of the RC index varied from 3.47 to 3.62 over time, and shared knowledge, timely, and problem-solving communication were found to be the dimensions with the lowest means. Whether Surgery Unit II differed from the American orthopedic units due to mostly providing complex hip and knee arthroplasty (revision arthroplasty) and rarely providing routine hip and knee arthroplasty (primary arthroplasty) is unknown. Differences were also found in the procedures applied for the distribution of the RC Survey. In the American study, the RC Survey was answered by care providers who had clinical or administrative responsibility for total joint arthroplasty patients, including physicians, nurses, physical therapists, social workers, and case managers. Thus, there was a wide field of respondents. In Surgery Unit II, the RC Survey was answered by care providers who had clinical responsibility for total joint arthroplasty for patients undergoing surgery in the OR, including surgeons, anesthesiologists, OR nurses, AN nurses, nurse assistants, coordinating nurses, and nurses in the ward. Therefore, the identified differences may be attributed to differences in the units' patient enrollment, in the study design and applied procedures, or in the structural and cultural differences between the health-care systems in the USA and Denmark. The differences might also be related to the assessments of relational coordination applied in the units. However, it is impossible to make definite determination in this regard; hence, further research across countries, cultures, and health-care systems might have relevance.

It is somewhat surprising that health professionals working together in the same physical locations in a context characterized by interdependency, uncertainties, and time pressure rated the RC dimensions relatively low between workgroups. This is

surprising because previous research has emphasized the need for surgical team members to prevent poor communication (Siu et al., 2016) and adapt quickly to advanced problem solving and complex surgical treatment of patients in order to secure high-quality care and patients safety (Nawaz et al., 2014). Shared knowledge is a necessary relationship dimension in such situations where fast-paced action is required. The fact that these RC dimensions were rated as moderate collaboration ties by the surgical team members, rather than being assessed as strong ties might also challenge the development of adaptive coordination strategies during unexpected situations in the OR. Prior studies have found such strategies necessary in order to secure high-quality treatment and care for patients (Sørensen, 2011; Bogdanovic et al., 2015). Yet, mutual respect, as well as frequent and accurate communication were found to be the strongest dimensions in all the samples in this study, albeit with large differences across workgroups. The fact that the relationship dimension of mutual respect was rated at the highest end of the spectrum – except for the AN nurses' and anesthesiologists' ratings of surgeons was certainly a strength in this interdisciplinary collaboration situated within a traditional hierarchical health-care system. The assessment of RC in this specific surgical unit showed that there was potential for great improvement in the future if a strong focus was placed on strengthening the shared knowledge among health professionals in the OR and emphasizing the importance of building communication forms that are timely and problem-solving. Further experiences and research are needed that focus on how best to explore, develop, and implement initiatives intended to strengthen these communication and relationship patterns in interdisciplinary surgical teams in close collaboration with the health professionals on the frontline. Further interpretation and discussion of the assessments of relational coordination are presented in *Chapter 9*, when the findings from PHASE I, II, and III are integrated at the interpretation level.

8.6.4 Improved Safety Culture

The findings concerning the measurement of safety culture showed no statistically significant increases or decreases in safety culture during the last eight months of the organizational intervention period, which was the period when safety culture was measured. Whether or not an improvement of safety culture would have been found during the organizational intervention, if safety culture had been measured prior to the implementation is inherently uncertain. The results showed that the assessment of safety culture decreased during the last period monitored (from Time 2 to Time 3), as indicated by a decrease in the percentage of health professionals with positive attitudes toward safety culture, except for the perception of management scale. However, the decrease in mean scale scores was not statistically significant. The safety climate was the scale with the largest decrease in the percentage of health professionals with positive attitudes changing from 25.3% at Time 2 to 16.7% at Time 3, that is, a decrease of 8.6%, which is a very big decline. The safety climate and perception of management scales were the scales with the lowest percentage of positive attitudes. These results match those observed in previous studies, which also found these scales to be rated the lowest by health professionals (Kristensen et al.,

2015a; Kristensen, 2016a). In a cross-sectional study conducted in Denmark, the SAQ-DK was distributed to one psychiatry and five somatic hospitals, including 925 respondents (Kristensen et al., 2015a). In this study, the percentage of health professionals with positive attitudes toward the safety climate was 45.4%, and perception of management was 42.6%. This sample included respondents from 31 clinical areas, but no significant differences was found across the somatic and psychiatric units (Kristensen et al., 2015a). Whether or not significant differences existed across different clinical areas, such as surgery, intensive care, and internal medicine, was not analyzed. The challenges associated with comparing measures of safety culture across cultures, hospitals, and units are highlighted by Pronovost and Sexton (2005), who noted very large variations. When comparing 100 hospitals, the variation in the level of safety climate ranged from 40% to 80% positive, while when comparing 49 work units within a hospital (with an overall percentage of 55% positive), the variation in the level of safety climate ranged from about 20% to 100% (Pronovost and Sexton 2005). The assessment and improvement of safety culture provides the greatest benefit if focused on the unit or clinical level (Schwendimann et al., 2013). Therefore, it may be unreliable to benchmark measures from Surgery Unit II with measures from the cross-sectional study conducted in other hospitals and clinical areas in Denmark.

The purpose of measuring safety culture during this phase was primarily to evaluate the interventions that focused on strengthening interdisciplinary collaboration in the OR and track any changes over time. In this case, the purpose of using a safety culture assessment was less to identify areas for improvement of safety culture, and more to sharpen awareness of patient safety in the unit. These factors may explain the lack of changes seen over time in this study. The use of safety culture assessments as a tool for improving patient safety has been discussed for several years (Nieva and Sorra, 2003; Pronovost and Sexton, 2005; Kristensen, 2016a). Indeed, safety culture assessments can be used for the purpose of identifying areas for improvement, sharpening awareness of patient safety, planning, and evaluating intervention programs targeting safety culture topics. One of the main points in these discussions was that in order to achieve the benefit of using safety culture assessments, health-care organizations must involve key stakeholders and plan safety improvements based on current data. Safety culture assessments capture quantitative measures of health professionals' attitudes toward safety culture in here and now situations or "snapshots." To obtain a deeper understanding of the safety culture within an organization, qualitative data are needed, such as qualitative interviews with health professionals or observations of health professionals' task performance. These aspects are discussed in *Chapter 9* when integrating the findings from PHASE I, II, III.

Finally, it was interesting to note that working conditions and perception of management scales, the percentage of health professionals with positive attitudes differed significantly across workgroups. This was seen when comparing the AN nurses with the other large workgroups of surgeons and OR nurses. The AN nurses

comprised the workgroup that was most positive toward working conditions and perception of management. However, due to the small sample size, caution must be exercised, since the findings might not offer a general picture of differences in attitudes between health professionals in the OR. Further, a cross-sectional study conducted in surgical units might provide a fuller picture of these differences in attitudes between the health professionals closest to patients undergoing surgery. However, surgical units with a small percentage of health professionals having positive attitudes toward safety climate, as was the case in Surgery Unit II, might benefit from further interventions aimed at strengthening the weak dimensions of safety culture.

8.6.5 Relational Coordination and Safety Culture

The findings of the comparative analyses showed statistically significant positive correlations between the construct of RC and most of the scales included in the SAQ-DK such (i.e., teamwork climate, safety climate, job satisfaction, and working conditions), as well as statistically significant negative correlation to with the scale of stress recognition. The comparative analyses were inspired by the work of Edmondson (2012), who expressed the vital connection between the concept of teaming and psychological safety. As described previously (p. 31), psychological safety is defined as an organizational climate in which team members feel free to communicate their reflections, thoughts, and feelings without fear of being punished or convicted. The concept of psychological safety is, according to Edmondson (2012), linked to the concept of safety culture. Several items included in the safety climate dimension in the SAQ-DK addressed questions about the health professionals' attitudes toward safety climate, focusing on the courage to speak up and learning from failures. The respondents' answers mirrored their agreement with statements such as: a) *I would feel safe being treated here as a patient, b) Medical errors are handled appropriately in this clinical area, c) In this clinical area, it is difficult to discuss errors, d) I know the proper channel to direct questions regarding patient safety in this clinical area, e) I receive appropriate feedback about my performance, f) I am encouraged by my colleagues to report any patient safety concerns I may have,* and *g) The culture in this clinical area makes it easy to learn from the errors of others.* Reflecting on these statements, the correlation between RC, psychological safety, and safety culture is by no means uninteresting from a practical point of view. Improvement initiatives based on data derived from measurement of RC may, in addition, foster improvements in psychological safety and thereby improve safety culture by engaging team members in learning from failures and encouraging them to speak up. This should result in an improvement in patients' outcomes. The findings of the present study supported the results of a cross-sectional study conducted in the software, electronics, and finance industries showing that RC appeared to be significantly associated with psychological safety in organizations and, further, that RC promotes learning from failures by enhancing psychological safety (Carmeli and Gittell, 2009). Carmeli and Gittell (2009) measured and compared RC, psychological safety, and failure-based learning behavior. It could be argued that different concepts are discussed when comparing this study using the SAQ-DK to assess safety culture with Carmeli and Gittell´s (2009)

study in which an adapted version of Edmondson's (1999) seven-item team psychological safety scale was used, including the sample items: *1) If you make a mistake in this organization, it is often held against you* (reverse scored item), *2) It is safe to take a risk in this organization,* and *3) No one in this organization would deliberately act in a way that would undermine my efforts*. Although the formulations of the statements in the assessment tools differ, they are both closely centered around safety climate. If safety climate and RC are causally connected as theorized by Carmeli and Gittell (2009), maybe safety climate decreased in Surgery Unit II from Time 2 to Time 3, because RC was found to decrease significantly from Time 2 to Time 3. The non-reciprocal collaboration ties that exist between surgeons and nurses might also influence the health professionals' attitudes to safety climate and may explain the low proportion of respondents with positive attitudes to safety climate at all times.

In the present study, the assessment of safety climate derived from measures during and after an intervention targeting improvement of interdisciplinary teamwork. The study involved a relatively small sample. The development of an assessment tool including items from the RC Survey, the SAQ, and Edmondson's psychological safety scale items (1999) could be suggested as a way of diagnosing interdisciplinary collaboration and safety culture in order to identify areas for improvement at the clinical level and evaluate patient safety progress. Further cross-sectional studies with larger study samples that explore the associations between RC, psychological safety, and safety culture during improvement interventions are needed. It could be interesting to explore if implementation of relational interventions intended to improve the mutual respect among surgeons and nurses in surgical teams (such as relational mapping and debriefing sessions after surgery) would strengthen the mutual respect, transform non-reciprocal collaboration ties that may exist, as well as change the health professionals' attitudes to safety climate positively. The findings will be further discussed in *Chapter 9* when integrating the findings from PHASE I, II, and III.

8.7 Strengths and Limitations

There was a moderately high response rate for RC Survey I, the baseline measurement initiated as a useful tool for prioritizing and adjusting *Intervention I*. Yet, the low to moderate response rates for the surveys distributed at Time 2 and Time 3 resulted in limitations for the study. However, a response rates below 30% is not uncommon when using internet-based survey tools with health professionals (Leong et al., 2017; Dykema et al., 2013; Dobrow et al., 2008). The major change in the response rates can be attributed to various aspects, and it might be interpreted in context of those aspects. As described previously (p. 147 - 148), several external changes occurred, resulting in structural changes and changes in work processes in the surgical unit. Some of these changes might have had an impact on the health professionals' working conditions, working time, and employment security. This might in turn have affected the health professionals' attitudes toward participating in the

measurement of collaboration and safety culture, and it might have affected their engagement in the organizational intervention. If the huge changes seen over time in relation to response rate are attributed to the health professionals being less interested and engaged in the organizational intervention, it might have an impact on the outcomes of the intervention, which may be important to reflect upon during the comprehensive evaluation of the organizational intervention. The increased focus on task performance in the surgical unit on the part of the top management might also have had influenced the health professionals' willingness to respond on the survey if the surveys were considered to be a further measurement tool used by the management. The communication of the intention behind measuring the interdisciplinary collaboration might have been inadequate, resulting in declining response to the survey. Finally, the electronic distribution might cause some respondents to refrain from answering the surveys, due to worrying about whether or not their anonymity was preserved.

However, the fact that several health professionals responded to the survey more than once (with a variation from 22% to 33%) made it possible to conduct more valuable statistical tests. Another explanation for the low response rates could be the fact that the surveys distributed at Time 2 and Time 3 contained considerably more questions than the survey distributed at Time 1, since those surveys included questions from both the RC Survey and SAQ-DK, and therefore they were more time-consuming. Yet, the fact that the partial response rate was only 3% (Table 21, p. 158) may indicate that quite a few respondents started to reply and then subsequently dropped out because a) there were too many questions, b) there was a time constraint, c) the questions were incomprehensible, or d) the questions were not relevant. Several surgeons responded to the RC Survey at Time 1 saying that it was irrelevant for them to answer the survey because they worked only part time in the surgical unit. The group of surgeons worked under different conditions than the other workgroups involved, since the surgeons worked in all the surgical units in the clinic, thereby reducing the number of working hours they spent in Surgery Unit II. This issue led to consideration of whether or not the right people were invited to complete the questionnaire. Further, attempts were made to take it into account during the subsequent distributions of the surveys at Time 2 and Time 3, although this did not have an effect on the response rate for surgeons.

As previously pointed out, the change in the distribution of respondents over time, which resulted in proportionately fewer responses from surgeons at Time 3, might influence the results concerning whether or not the changes in RC differ across workgroups. In the analyses, the surgeons were found to be the workgroup that rated the RC within the surgical unit the highest of all the workgroups. Thus, a distortion of responses may have occurred over time, indicating limitations associated with response bias to be possible. The RC index might have been higher at Time 3 if more surgeons had responded.

Both the internal consistency and the structural validity of the RC Survey were good, while the qualitative data derived from PHASE I and PHASE II substantiated the RC

measures found in PHASE III, thereby ensuring content validity. The results of the reliability and validity tests were comparable with previous international findings concerning the RC Survey (Gittell, 2002b; Gittell et al., 2000; Gittell et al., 2010). The internal consistency of the SAQ-DK was good and comparable with previous international findings concerning the SAQ survey (Schwendimann et al., 2013; Kristensen et al., 2015a, 2015b). The inter-scale correlation test showed moderate correlation coefficients between the scales, which were lower than previous findings concerning the SAQ-DK (Schwendimann et al., 2013; Kristensen et al., 2016a, 2016b), although Pearson's correlations indicated strongly significant correlation between all the scales, except for one scale that was lowly negatively correlated. These arguments supported the good internal validity of the study.

The study monitored a longitudinal organizational intervention process, which can provide valuable knowledge about how intervention processes can lead to improvement. However, it is impossible to draw causal conclusions when using a longitudinal design to explore organizational processes in a complex context. The findings may be somewhat limited by the fact that the implementation of interventions took place over a long period, which may have resulted in parallel initiatives and events influencing the implementation of the interventions. These uncertainties are discussed further in *Chapter 9*, when integrating the findings from PHASE I and PHASE II.

Furthermore, the questions in the RC Survey required the respondents to rate the behavior of other health professionals, as opposed to other measurement tools wherein the measures are self-reported. This is expected to limit the social desirability bias when assessing relational coordination (Gittell, 2012a). Conversely, some statements (items) in the SAQ-DK required respondents to rate the behavior of other professionals, although other statements asked the respondents to rate their own behavior. Self-reported measurements can cause participants to assess the items as higher than the reality, which may impact the results when assessing safety culture.

The derived measurements from the RC Survey and SAQ-DK can be considered as "snapshots." For example, the assessment of the mutual respect between a given respondent and a group of peers from the same or another profession may be colored by concrete collaborative situations that occurred just prior to answering the questionnaire. Such recency bias may exist. Therefore, it was considered a strength in this study that it was possible to repeat the measurements and provide paired statistical analyses that supported the findings of the simple independent two sample t-test comparisons of the RC index even though the study sample was relatively small.

Finally, the health professionals' attitudes toward the intervention might be an important factor when assessing their attitudes toward the improvement of RC and safety culture during an intervention process. On the one hand, the Hawthorne effect might explain the improvement in the RC index over time (eight months after), since the health professionals' attitudes toward collaboration could have been influenced by

their awareness of being observed and their attitudes being measured (Wickström and Bendix, 2000). On the other hand, a low RC rating could be a way of sending a message of dissatisfaction if the health professionals felt that their desire for improvement was not met in the intervention, or a way of protesting the demands of efficiency.

8.8 Partial Conclusion

The objective during PHASE III was to assess whether relational coordination and safety culture in a surgical unit are improved during an organizational intervention process. In this partial conclusion, I address the third research questions: *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention process using the theory of relational coordination as a tool for improvement?* The RC index was found to be significantly higher rated by all the workgroups some eight months after implementation of *Intervention I.* This increase was mostly explained by the significantly higher rating of the frequency of communication. However, the improvement had disappeared some 16 months after implementation of *Intervention I.* When assessing the safety culture, a decrease in the ratings of teamwork climate and safety climate was also identified during the period from eight to 16 months after implementation of *Intervention I*. The question of how to explain these changes over time by focusing only on the measures of RC and safety culture is uncertain, therefore the changes are further explored and discussed in *Chapter 9*.

Several of the collaboration ties between the workgroups collaborating in the OR were characterized as being non-reciprocal. The surgeons rated their collaboration with both workgroups of nurses in the OR significantly higher than vice versa. Finally, it appeared that the health professionals in the OR who specialized in different clinical specialties rated each other significantly differently. Whether the non-reciprocal collaboration ties might be interpreted as differences in status, power, responsibility, gender, or education levels remain unknown, but what is known is that such ties existed between health professionals collaborating around the patients undergoing surgery in the OR. All these non-reciprocal collaboration ties might have influenced the character of interdisciplinary collaboration in surgical teams.

The RC Survey was found to be useful for measuring collaboration and teamwork, as well as for identifying strong and weak collaboration ties between and within workgroups collaborating around a core task. The RC Survey can also be useful for evaluating interventions targeting the improvement of interdisciplinary collaboration. The construct of RC was statistically significantly positively correlated with most of the dimensions included in the SAQ-DK (i.e., teamwork climate, safety climate, job satisfaction, and working conditions), although it was negatively correlated with the stress recognition dimension.

CHAPTER 9. INTEGRATED MIXED METHODS FINDINGS AND INTERPRETATION

In this chapter, I address the final research question: *How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?* by integrating the findings from each phase of this mixed methods study.

During PHASE IV, the qualitative and quantitative data and findings from PHASE I, II, and III are integrated at the interpretative level using a narrative weaving approach. This specific type of integration connects, compares, and contrasts the findings with each other thematically, since the qualitative and quantitative data and findings are weaved back and forth around similar themes (Fetters et al., 2013; Guetterman et al., 2015). The representations of the integration results are described in what Creswell and Plano Clark (2018) referred to as narrative discussions and joint displays. In this integrated data analysis, the content areas associated with relational coordination, safety culture, and performance outcomes are structured and identified in relation to the time before, during, and after an organizational intervention. This leads to the integration results being reported in narrative discussions under the identified themes: *collaboration in need for transformation*, *experiences during an intervention process*, and *evaluation of an organizational intervention*. After presenting these narrative discussions, the findings are presented in mixed methods joint displays (Table 32, Table 33, and Table 34). Bringing the findings together through these visual means will generate knowledge that goes beyond the findings obtained from the separate phases of the study. These analytical integration and representation procedures are chosen to achieve the coherence of the qualitative and quantitative findings, that is, to conduct a valuable "fit" of data integration, as guided by the concepts of confirmation, expansion, and discordance (Fetters et al., 2013). Finally, the integrated findings are interpreted and discussed, enabling the comprehensive evaluation of the organizational intervention and recommendations to be made for future improvement interventions in complex health-care settings characterized by uncertainty, interdependency, and time constraints.

9.1 Collaboration in Need for Transformation

This narrative discussion shows the needs for transformation of interdisciplinary collaboration in surgical teams, which is also presented in a joint display in Table 32 (p. 197). The health professionals working in surgical teams perform surgical procedures in a context of variable complexity. It is a context characterized by frequent changes and uncertainties in the daily surgical program, a high degree of

interdependency among team members, and a strong focus on time and resource consumption (PHASE I). A shared understanding of the core task, respectful and accurate communication, and a high degree of professionalism were found to be essential dimensions for a great collaboration (PHASE I). The health professionals emphasized that the interdisciplinary collaboration was good, although improvement could be beneficially initiated through attitudinal, structural, and procedural changes (PHASE I). The measurement of RC between the health professionals in the surgical unit before the intervention confirmed these findings (PHASE III). The RC index prior to the intervention was found to be 3.47, indicating mediocre relational coordination between health professionals in the surgical unit. The assessment of RC also expanded the health professionals' experiences by highlighting the strengths and weaknesses in the interdisciplinary collaboration. The RC index within workgroups (4.28) was found to be significantly higher than the RC index between workgroups (3.33) in the OR ($p < 0.0000$). These RC measures implied that collaboration ties between health professionals from different functional workgroups were weak, which indicated improvement potential in the form of designing interventions that were specifically targeted toward collaboration between workgroups. Moreover, shared knowledge (3.34) and timely (3.07) and problem-solving communication (3.23) were found to be the RC dimensions with the lowest means. This indicates that improvement possibilities existed in the shape of planning initiatives targeted toward strengthening the health professionals' relationships and their knowledge of what is essential for each other's task performance, thereby enabling more timely and problem-solving communication.

The exploration of communication and relationships in surgical teams using ethnographic principles in practice (PHASE I) confirmed and expanded the findings gathered from the health professionals' measurements of relational coordination. Different communication and relationship patterns were identified when the surgical teams were observed in OR, namely *proactive and intuitive communication* (Type 1), *silent and ordinary communication* (Type 2), *inattentive and ambiguous communication* (Type 3), and finally *contradictory and highly dynamic communication* (Type 4). The health professionals included in surgical teams characterized as Type 1 showed behaviors that would serve as excellent role models for collaborators in exemplary collaboration relationships, since the surgical teams with proactive and intuitive communication patterns were guided by shared goals and expressed a pronounced mutual respect in the way they related to one another. In these teams, the health professionals met any challenges upfront through shared decision making and problem-solving communication. In addition, in combination, the health professionals' specialized knowledge of the clinical specialty, their knowledge of what was important for each other's task performance, and their knowledge of each other as individuals were an excellent starting point for great interdisciplinary collaboration. Therefore, learning from such teams might improve the relational coordination in surgical teams and enhance both the quality of treatment and patient outcomes. In contrast, the health professionals included in surgical teams characterized as Type 3 showed behaviors

that should be prevented and avoided, since the surgical teams with inattentive and ambiguous communication were observed to demonstrates behavior associated with inappropriate communication and relationship dynamics. The inappropriate behavior could be partly attributed to the tone of voice being disrespectful, ironic, or ambiguous, and partly to the communication being inaccurate and finger-pointing. Such ways of relating and communicating with one another create an atmosphere of uncertainty. It might be valuable to prevent these patterns in order to improve relational coordination among health professionals in surgical teams. Hence, the findings showed a great diversity at the micro level in terms of ways in which the health professionals related to one another and communicated with one another. A diversity in relational coordination between the health professionals was also found during the assessment of the RC between workgroups (PHASE III). In contrast, the diversity was here identified in non-reciprocal collaboration ties between workgroups in the OR. The surgeons rated their collaboration with the AN nurses significantly higher than vice versa ($p < 0.0004$), while the surgeons also rated their collaboration with the OR nurses significantly higher than vice versa ($p < 0.0086$). Non-reciprocal collaboration ties were also identified between health professionals affiliated with different clinical specialties prior to the intervention (orthopedic and anesthesiology) ($p < 0.0012$), indicating great potential for the improvement of relational coordination between workgroups, as well as between clinical specialties in surgical units.

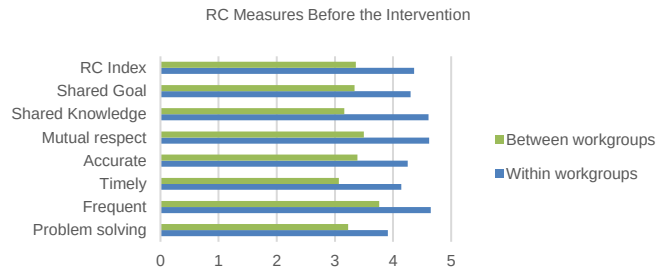
Paying sufficient attention to the safety culture and the health professionals' experiences of psychological safety was another important perspective when exploring the interdisciplinary collaboration in surgical teams. Mutual respect between health professionals was found to be crucial for great collaboration, as well as important for a safety culture to be developed and sustained (PHASE I). The assessment of RC added knowledge about how mutual respect in the surgical unit prior to the intervention was experienced by the health professionals (PHASE III). In general, the RC dimension mutual respect was 3.5, although this dimension was considerately lower when the AN nurses (2.43) or OR nurses (3.19) rated the surgeons, which indicates that both workgroups of nurses experienced the respect they received from the surgeons to be inappropriately low. The health professionals working in surgical teams expressed a need for profound shared responsibility for the quality of treatment, as well as a need to learn from failures (PHASE I). According to the health professionals, these needs might be met by the establishment of interdisciplinary meetings or debriefing sessions after surgery. There was a desire for some sort of dialogue-based space, which might facilitate the exchange of experiences, feedback to be given and received, concerns and ideas to be shared, and lessons to be learned from failure. When observing the surgical teams performing surgical procedures in the OR, debriefing sessions were seen to be missing, while safe communication procedures such as "check-in" and "check-out" were conducted in more or less accurate ways.

Although the health professionals considered problem-solving communication to be an appropriate way of sharing responsibility and decision making (PHASE I), prior to the

intervention this RC dimension was measured to be 3.29, which indicated that problem-solving communication could be used to a greater extent in the surgical unit (PHASE III). Blaming communication patterns were also observed in the surgical teams (PHASE I). Such patterns were observed when the health professionals exhibited disruptive behavior and the tone of voice used turned out to be ambiguous, sarcastic, or disrespectful (Type 3). In tense situations, the health professionals considered whether they should confront their colleagues about the inappropriate behavior or whether they should let it pass. These observations and considerations expressed the health professionals' experiences of the safety climate indicated the need for transformation.

The change team responsible for future organizational interventions concluded that the improvement of the quality of treatment and the efficiency of work processes were needed (PHASE II). Prior to the intervention, the surgical unit was performing 6.2% of revision hip arthroplasty surgery (complex surgical procedures) and 1.1% of knee arthroplasty surgery in Denmark (PHASE II). The need for improvement was confirmed by health professionals describing the challenges faced in the surgical unit due to patients not being ready for surgery, the inefficient use of the operating room capacity, the inaccuracy of surgical prescriptions, the prolonged waiting time prior to surgery for some groups of patients, and uncertainties associated with planning the surgical schedule (PHASE I).

The integration findings provided a more comprehensive picture of the challenges associated with interdisciplinary collaboration in surgical teams, and they highlighted and verifying the need for interdisciplinary collaboration to be transformed. The integration findings showed confirmation between the findings gathered during the three phases. Observation of communication and relationships in interdisciplinary surgical teams (*what was observed*) confirmed the health professionals' measurement of relational coordination (*what was measured*), as well as the health professionals' experiences of the challenges involved in interdisciplinary collaboration in the surgical unit (*what was said*). The integration findings also expanded the findings gathered during the three phases. Observations of communication and relationships in surgical teams and health professionals' experiences of interdisciplinary collaboration proved useful in explaining the measures of relational coordination in the surgical unit. Furthermore, knowledge that non-reciprocal collaboration ties exist between surgeons and nurses in the OR based on the assessment of relational coordination might bring new insight into the understanding of the different communication and relationship patterns identified from the observations of surgical teams. Finally, the integration findings expanded the findings from the three phases by suggesting different possibilities for improving interdisciplinary collaboration in surgical teams. The narrative discussion, entitled *Collaboration in Need for Transformation,* was based on the thematic integration of findings from the three phases PHASE I, II, and III. A joint display representing the comparison of the qualitative and quantitative findings is presented in Table 32.

<table>
<tr><th colspan="2">Collaboration in Need for Transformation</th></tr>
<tr><td colspan="2">Relational Coordination</td></tr>
<tr><td>Qualitative Findings PHASE I</td><td>Identification of different communication and relationship patterns:
Proactive and intuitive communication (Type 1).
Silent and ordinary communication (Type 2).
Inattentive and ambiguous communication (Type 3).
Contradictory and highly dynamic communication (Type 4).
Learning from surgical teams demonstrating high relational coordination when collaborating (Type 1) and preventing collaboration demonstrating low relational coordination as seen in surgical teams (Type 3).</td></tr>
<tr><td>Quantitative Findings PHASE III</td><td>The RC index within workgroups (4.28) was significantly higher than the RC index between workgroups (3.33). Between workgroups, shared knowledge (3.16), timely (3.07), and problem-solving (3.23) communication dimensions were rated the lowest.
 

Non-reciprocal collaboration ties were found between workgroups in the OR. Surgeons rated the AN nurses ($p < 0.0004$) and OR nurses ($p < 0.0086$) significantly higher than vice versa.</td></tr>
<tr><td colspan="2">Safety Culture</td></tr>
<tr><td>Qualitative Findings PHASE I</td><td>Need for transformation expressed by health professionals:
More profound shared responsibility for quality of treatment.
Wider use of problem-solving communication to increase shared decision making.
Foster willingness to speak up and learn from failures.
Need for transformation was observed when:
Blaming communication and disruptive behavior in surgical teams prevailed (Type 3).
Safe communication procedures such as “check-in” and “check-out” were conducted in more or less accurate ways.
Debriefing sessions after surgery were never practiced.</td></tr>
<tr><td colspan="2">Work Processes and Performance</td></tr>
<tr><td>Qualitative Findings PHASE I, II</td><td>Health professionals described challenges associated with task performance, such as: a) patients not being ready for surgery, b) inefficient use of the operating room capacity, c) inaccuracy in the surgical prescriptions, d) prolonged waiting time before surgery for some groups of patients, and e) uncertainties associated with planning the surgical schedule.

Change team expressed need for improvement of quality and efficiency.</td></tr>
<tr><td>Quantitative Data PHASE I</td><td><table>
<tr><th colspan="4">Performance Measures of Hip and Knee Arthroplasty 2014</th></tr>
<tr><td></td><td>Primary Hip
n (% of DK)</td><td>Revision Hip
n (% of DK)</td><td>Knee
n (% of DK)</td></tr>
<tr><td>Denmark</td><td>9415</td><td>1372</td><td>9109</td></tr>
<tr><td>Surgery Unit II</td><td>77 (0.8)</td><td>85 (6.2)</td><td>97(1.1)</td></tr>
</table></td></tr>
</table>

Table 32 Joint display - *Collaboration in need for transformation.*

9.2 Experiences During an Intervention Process

This narrative discussion captures the experiences during an organizational intervention process, as also presented in a joint display in Table 33 (p. 200). The organizational intervention was initiated with a set of experienced challenges (PHASE II) and different attitudes regarding which improvement efforts were needed (PHASE I and PHASE III). The experiences and attitudes confirmed and expanded each other, which might provide a beneficial platform for tailoring an organizational intervention that fits the organization's needs. Such needs can be identified from a managerial perspective (PHASE II), as well as expressed from an employee perspective (PHASE I and PHASE III). Resulting in an organizational intervention initiated and designed in a process that embraced both bottom-up and top-down perspectives. The change team responsible for the organizational intervention concluded that the improvement of quality, efficiency, and continuity in the surgical pathway were all needed (PHASE II). Specifically, the change team wanted improvements to take the form of a) patients being prepared for surgery on time, b) more efficient use of the operating room capacity, c) more accuracy in surgical prescriptions, and d) shorter waiting time prior to surgery for patients with femoral neck fracture. These desired outcomes were consistent with the needs for improvement in the surgical unit as expressed by the health professionals (PHASE I) when they described the challenges associated with task performance. However, the health professionals also expressed their desire for attitudinal changes targeted toward strengthening shared knowledge between workgroups and facilitating opportunities to learn from failures (PHASE I). The findings derived from the exploration of the interdisciplinary collaboration were integrated when the intervention initiatives at the start of the organizational intervention process were designed by the change team (PHASE II), and debriefing after surgery was included in the intervention. However, when planning the intervention, the change team prioritized the implementation of structural initiatives intended to support collaboration, as well as initiatives designed to achieve more efficient work processes in relation to surgical procedures (PHASE II). The use of improvement science, methodology, and tools for monitoring changes in work processes during the intervention was omitted by the change team due to a lack of resources. However, the relational coordination theory, methodology, and measurement tools were expected to be used during the organizational intervention (PHASE II). As the intervention process was accelerated, the baseline measures of relational coordination intended to be used as a prioritizing tool were unavailable when needed (PHASE II). This resulted in the intervention being designed and implemented without the opportunity to incorporate knowledge from the assessment of RC. After the implementation of the intervention, a results feedback process was conducted in which the measures of RC were presented and a diagnostic tool for planning further improvement initiatives was offered. The change team used the measures of RC (PHASE III) to confirm and argue for the relevance of the change initiatives already implemented (PHASE II). In discordance with the results of the baseline measurement of the RC between workgroups, indicating improvement possibilities in relation to strengthening the relationships between workgroups (PHASE

III), the change team decided to downsize the relational interventions during the intervention process (PHASE II). The health professionals' assessment of relational coordination (RC index) increased significantly (paired t-test Table 22) during the intervention, increasing from 3.53 to 3.69 when measured eight months after implementation of intervention (PHASE III). The increase in the RC index was primarily attributable to increases in frequent (from 3.93 to 4.22) and timely (from 3.13 to 3.39) communication. These results were confirmed by the change team when outlining positive changes such as more patients being prepared for surgical procedures, which resulted in less delays, more efficient use of the operating room capacity, and better collaboration with the orthopedic ward nurses (PHASE II). However, the change team also indicated that some initiatives had failed. Change initiatives targeting the strengthening of shared knowledge between health professionals and initiatives enabling learning from failures, such as the qualification of the surgical prescriptions and implementation of daily debriefing sessions were missing (PHASE II). The assessment of the health professionals' attitudes toward safety culture during the intervention (PHASE III) confirmed the need to improve the safety culture that was identified prior to the intervention (PHASE I). Safety climate, one of the dimensions in the construct of safety culture, was assessed to be very low, with only 25% of health professionals responding with positive attitudes (PHASE III). The results of the assessment of safety culture also confirmed the change teams' experiences of initiatives strengthening shared knowledge and enabling learning from failures to be needed but missing during the intervention process (PHASE II). During the intervention, the change team experienced difficulties maintaining the change initiatives and spending resources on the intervention. These difficulties were attributed to leadership changes, external requirements for organizational changes, and increased attention on performance outcomes (PHASE II). Further, during the intervention, the proportion of revision hip arthroplasty surgery performed in the surgical unit increased from 6.2% to 7.7% when compared with the total number performed in Denmark (PHASE II). The quality indicator of "operation delay," which outlined the percentage of patients with femoral neck fracture being operated on within 24 hours of their arrival at the hospital, was considerable lower in the surgical unit (47%) during the intervention than the average percentage in Denmark as a whole (68%), indicating possibilities for the improvement of the quality of treatment in the surgical unit. The integration findings added knowledge about the various experiences and challenges by using relational coordination theory and methodology during an organizational intervention process in a surgical unit within a Danish university hospital. The integration findings showed accordance between findings on improvement of relational coordination between health professionals during an organizational intervention. The assessment of safety culture during the intervention confirmed and expanded the experiences of a steadily unmet need for improvement of safety climate. The second narrative discussion, entitled *Experiences During an Organizational Intervention,* was based on a thematic integration of the findings from PHASE I, II, and III. A joint display representing the comparison of the qualitative and quantitative findings is presented in Table 33.

Experiences During an Organizational Intervention

Relational Coordination

Qualitative Findings PHASE II

Change team experienced communication and relationships between nurses in the OR and nurses in the orthopedic ward to be improved, and interdisciplinary collaboration within OR to be improved*: "The atmosphere is calmer in the OR hallway and in the OR now, which is often expressed positively by doctors and nurses."*

Quantitative Findings PHASE III

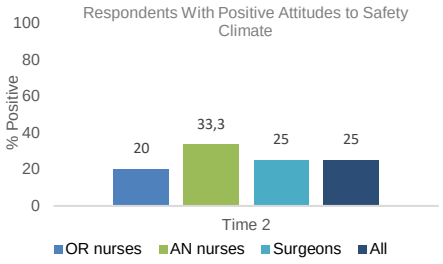
RC index (from 3.33 to 3.69; $p < 0.0082$), **frequent** (from 3.93 to 4.22; $p < 0.0010$), and **timely communication** (from 3.13 to 3.39; $p < 0.0130$) were statistical significantly higher when measured eight months after implementation of intervention than before.

Safety Culture

Qualitative Findings PHASE I, II

Before the intervention, the health professionals had emphasized that learning from failures during debriefing sessions after surgery was needed (PHASE I). The change team experienced that improvement initiatives such as interdisciplinary meetings and debriefings after surgery, which would enable health professionals to share knowledge, experiences, reflections, concerns, and ideas, had been challenging to implemented and were hence lacking (PHASE II).

Quantitative Findings PHASE III



On average, 25% of health professionals in the surgical unit responded with positive attitudes toward safety climate during the intervention, which is considered to be a very small proportion.

Work Processes and Performance Outcomes

Qualitative Findings PHASE II

A year after the implementation, the change team experienced that more patients were prepared for surgery on time and the OR capacity was used more efficiently due to improved planning and coordination at the interdisciplinary board meetings. Surgical prescriptions were still inaccurate, and qualification was needed.

Quantitative Data PHASE II

Performance Measures of Hip and Knee Arthroplasty 2014-2015				
	Revision Hip, *n (% of DK)*		Knee, *n (% of DK)*	
	2014	2015	2014	*2015*
Denmark	1372	1321	9109	9324
Surgery Unit II	85 (6.2)	102 (7.7)	97(1.1)	67 (0.7)

"Operation Delay" for Patients with Femoral Neck Fracture Dec. 2014 – Nov. 2015		
	24 hours	36 hours
Denmark	68%	84%
Surgery Unit II	47%	71%

Quality Indicator: The percentage of patients being operated on within 24 or 36 hours of arrival at the hospital

Table 33 Joint display – *Experiences during an organizational intervention.*

9.3 Evaluation of an Organizational Intervention

This narrative discussion covers the evaluation of an organizational intervention with the purpose of improving interdisciplinary collaboration, as also presented in a joint display in Table 34 (p. 203). Organizational intervention initiatives were implemented over a given period. The intervention was initiated, screened, planned, and implemented concurrently with organizational changes and external requirements (PHASE II). To obtain a more complete evaluation, these aspects are integrated into a comprehensive interpretative evaluation of the organizational intervention, as inspired by the framework for evaluation of organizational intervention (Nielsen and Abildgaard, 2013). The effect of the change initiatives was expected to be reflected in changes in health professionals' attitudes toward interdisciplinary collaboration and safety culture, changed structures, and changed work processes in the surgical unit.

Several changes were seen in the surgical unit throughout the organizational intervention period (PHASE II and PHASE III). The change team experienced that both the interdisciplinary collaboration in the OR and the cross-disciplinary collaboration with the orthopedic wards were improved (PHASE II). During the intervention, these experiences were confirmed by significantly increased measures of relational coordination between health professionals in the surgical unit (PHASE III). After the intervention, the assessments of relational coordination were in discordance with the qualitative experiences expressed by the change team (PHASE II), since the RC measures some 16 months after the implementation (RC index 3.49) remained at the same level as they were prior to the intervention (RC index 3.47) (PHASE III). The assessment of RC also expanded the experiences concerning the intervention outcomes by adding knowledge about the character of collaboration ties between workgroups, since the collaboration ties between the surgeons and nurses and across the clinical specialties at all times were found to be non-reciprocal, and therefore still an area for improvement.

However, the change team also indicated that some initiatives had failed (PHASE II). Change initiatives targeted at strengthening the shared knowledge between health professionals and initiatives intended to enable learning from failures were missing. The failed implementation of initiatives designed to facilitate a learning culture by establishing debriefing sessions after surgery was confirmed when comparing the measures of health professionals' attitudes toward safety culture during and after the intervention (PHASE III). The proportion of health professionals with positive attitudes toward safety climate decreased from 25% during the intervention process to only 17% after the intervention had been implemented.

Positive changes in performance outcomes over time were found. The experienced changes appeared following the successful implementation of structural interventions and changes in work processes expressed by the change team at meetings during and after the implementation of the intervention (PHASE II). According to the change team,

the intervention initiatives improved the interdisciplinary collaboration in surgical teams in different ways. Several outcome goals were achieved, since more patients were prepared for surgical procedures, which resulted in less delays and the more efficient use of the operating room capacity. The change teams' experiences of positive changes in work processes were in discordance with the findings gathered from the assessment of RC, with the RC measures remaining at the same level as prior to the intervention (PHASE III). However, data obtained from the Danish Hip Arthroplasty Register and from the Danish Interdisciplinary Register for Femoral Neck Fractures indicated the improvement of performance outcomes following the implementation of intervention (PHASE II). The proportion of revision hip arthroplasty surgery performed in the surgical unit increased from 6.2% to 7.9% after the implementation of the intervention when compared with the total number of surgeries performed in Denmark (PHASE II). The quality indicator of "operation delay," outlined the percentage of patients with femoral neck fracture who were operated on within 24 hours (from 47% to 57%) or 36 hours (from 71% to 81%) of arrival at the hospital, was considerable higher after the implementation of the intervention.

The integration findings enabled the comprehensive evaluation of an organizational intervention in a surgical unit within a Danish university hospital. The integration findings showed confirmation, expansion, and discordance between the findings concerning the evaluation of an organizational intervention. The findings related to positive changes in outcomes gathered from experiences expressed by the change team were confirmed by the performance and quality indicator data obtained from the national register. However, these findings were in discordance with the assessments of the health professionals' attitudes toward interdisciplinary collaboration (RC) in the surgical unit, showing no positive changes over time if compared before and after the implementation of intervention. The integration of the findings expanded the available knowledge by providing a comprehensive evaluation, including identifying the improvement dynamic during the intervention.

The third narrative weaved discussion, entitled *Evaluation of an Organizational Intervention,* was based on the integrated interpretation of selected themes and findings derived from the three studies PHASE I, II and III. A joint display presenting the comparison of the qualitative and quantitative findings is presented in Table 34.

Evaluation of an Organizational Intervention

Relational Coordination

Qualitative Findings PHASE II

The change team experienced communication and relationships between nurses in the OR and nurses in the orthopedic wards to be improved, and interdisciplinary collaboration in the OR to be improved*: "The atmosphere is calmer in the OR hallway and in the OR now, which is often expressed positively by doctors and nurses".*

Quantitative Findings PHASE III

RC index (from 3.70 to 3.43, *p* < 0.0387), **shared goals** (from 3.64 to 3.31, p < 0.0344) and **shared knowledge** (from 3.46 to 3.22, p < 0.0385) were statistically significantly lower 16 months after the implementation than eight months after the implementation.

Matrix RC index Between Workgroups at Time 3

Ratings by	Rating of: OR nurses	AN nurses	Surgeons
OR nurses	4.35	3.64	3.30
AN nurses	3.54	4.25	2.53
Surgeons	3.80	3.31	4.05

No statistical differences between the RC index before (3.47) and after (3.49) the intervention.

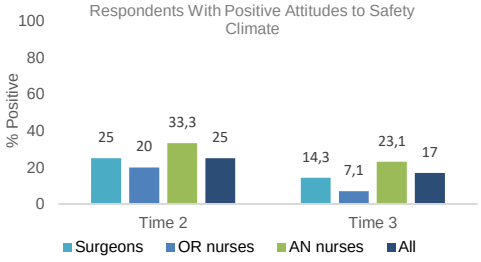
Non-reciprocal collaboration ties between surgeons and nurses in the OR and across clinical specialties identified at all times.

Safety Culture

Qualitative Findings PHASE I, II

Before the intervention, the health professionals had emphasized that learning from failures during debriefing sessions after surgery was needed. The change team experienced that improvement initiatives such as interdisciplinary meetings and debriefings after surgery, which would enable health professionals to share knowledge, experiences, reflections, concerns, and ideas, had been challenging, and the implementation of debriefings failed.

Quantitative Findings PHASE III



The average of health professionals in the surgical unit responding with positive attitudes toward safety climate decreased from 25% to 17% during the intervention.

Work Processes and Performance Outcomes

Qualitative Findings PHASE II

A year after the implementation, the change team experienced that more patients were prepared for surgery on time and the OR capacity was used more efficiently due to improved planning and coordination at the interdisciplinary board meetings. Surgical prescriptions were still inaccurate, and qualification was needed.

Quantitative Data PHASE II

"Operation Delay" for Patient with Femoral Neck Fracture				
	Dec. 2014 - Nov. 2015		Dec. 2015 - Nov. 2016	
	24 hours	36 hours	24 hours	36 hours
Denmark	68%	84%	69%	85%
Surgery Unit II	47%	71%	57%	81%

The percentage of patients being operated on within 24 hours or within 36 hours of arrival at the hospital.

Table 34 Joint display – *Evaluation of an organizational intervention*

9.4 Interpretation and Discussion

In PHASE IV, findings from PHASE I, II, and III were integrated in order to address the fourth research question: *How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?* The fourth research question was based on the assumption that performing the metaphorical movement of "zooming in" on practice from different angles will enable us to understand the here and now of the situated practice in interdisciplinary teamwork. An understanding of collaboration at the micro level useable to provide recommendations for improvement of collaboration in interdisciplinary teams, thereby performing the metaphorical movement of "zooming out". The findings are integrated at the interpretative level in order to explore how organizations, managers, and health professionals in surgical teams can all transform the way they relate and communicate with one another with the purpose of meeting everyday challenges in the OR and providing recommendations to improve interdisciplinary collaboration in a complex clinical context. In the following, the integrated mixed methods findings represented in the three narrative discussions, namely *Collaboration in Need for Transformation*, *Experiences During an Intervention Process*, and *Evaluation of an Organizational Intervention* are interpreted and discussed.

9.4.1 Collaboration in Need for Transformation

The relational coordination theory and methodology supplied tools for the identification of different communication and relationship dynamics in surgical teams at the micro level. In this way, the theory, model, and measurement tools enabled a comprehensive understanding of the interactive dynamics among health professionals collaborating in surgical teams. The findings of the integration emphasized that the challenging interdisciplinary collaboration in surgical teams was in need for transformation.

The health professionals reported a range of challenges associated with performing surgical procedures in a complex context characterized by frequent changes and uncertainties in the daily surgical program, a high degree of interdependency among team members, and a strong focus on time and resource consumption, which is in line with the findings of previous research concerning interdisciplinary collaboration in surgical teams (Nawaz et al., 2014; Nembhard and Edmondson, 2006; Gittell, 2009). The health professionals highlighted that a shared understanding of the core task, mutual respect, accurate communication, and a high degree of professionalism were all essential dimensions for great collaboration in surgical teams. In line with this, Weller et al. (2014) emphasized the importance of improving communication and sharing clinical information between health professionals in order to meet the challenges associated with interdisciplinary teamwork in health care. Confirming the need to improve communication and relationships in surgical teams, different

communication and relationship patterns were identified when observing the interpersonal interactions between surgical team members at the micro level. Some surgical teams exhibited appropriate communication and relationship dynamics when performing surgical procedures, which was worth imitating. In contrast, some surgical teams showed inappropriate patterns, which was worth preventing. The diversity observed in the health professionals' ways of relating and communicating with one another were also confirmed by differences in the health professionals' attitudes toward the interdisciplinary collaboration in surgical teams, as reflected in the measures of relational coordination between and within workgroups. These findings highlight improvement possibilities in terms of designing organizational interventions that are specifically targeted toward a) learning from surgical teams with proactive and intuitive communication (Type 1) in order to increase shared goal, shared responsibility, and problem-solving communication in interdisciplinary surgical teams, and b) preventing inattentive and ambiguous communication patterns in surgical teams (Type 3) so as to increase safety climate and quality of patient care. Future experimental studies aimed at transforming communication and relationship patterns in interdisciplinary surgical teams are proposed.

In suggesting the need for more profound shared responsibility, a strengthening of shared knowledge, shared reflections, and learning from failures, the health professionals were addressing other important challenges inherent within the interactive dynamics in surgical teams. Such challenges might be attributed to the increased specialization and structural changes in team composition that result in health professionals collaborating with a fluid and shifting mix of interdisciplinary collaborators in the OR. This temporary nature of surgical teams influences the collaboration, as well as the elusiveness of psychological safety within health-care teams (Nembhard and Edmondson, 2012). In line with this, prior research indicates that the fluid structures of team composition seem to challenge the teams' adaptive capacity (Sørensen, 2011), as well as the interactive dynamics among team members (Leach et al., 2009). The fluid team composition challenges familiarity in surgical teams and it might explain health professionals' expressed desire to strengthen shared knowledge and promote mutual respect among team members. This is in line with research assessing performance in surgical teams that emphasized how the ad hoc composition of surgical teams negatively influences the team's effectiveness and cohesiveness (Leach et al., 2009). These results call for increased attention to be paid to improve communication and relationships in surgical units between health professionals at the micro level. This claim is also supported by a study that recently reported correlation between relational coordination and nurse outcomes, such as emotional exhaustion, personal efficacy, job satisfaction, and work engagement (Havens et al., 2018). Havens et al. (2018) found that nurses' experiences of mutual respect were the RC dimension most important for their personal efficacy. In addition, the planning of the surgical schedule and the composition of surgical teams should be amended in such a way as to maximize the frequency of health professionals working together.

The occurrence of challenging interactive dynamics among surgical team members is also supported by the finding that interdisciplinary collaboration in surgical teams was shown to be characterized by non-reciprocal relationships between health professionals belonging to different workgroups and different clinical specialties in the OR. These results reflect those of Rydenfält et al. (2012), who also found professional orientation and specialization to be factors influencing interdisciplinary collaboration in surgical teams. Different interpretations, which can occur due to differences in professional identities, might lead to communication failures and misunderstandings in the OR. Such differences in health professionals' identities may explain the non-reciprocal relationship dynamic in surgical teams identified in this study. Differences in hierarchical status, power, or experience may offer further possibilities for interpreting the non-reciprocal collaboration ties seen between surgical team members. Hierarchy, status, and power are all important considerations when focusing on interactive dynamics in surgical teams, as stated by Graham (2009) when exploring health professionals' perceptions of hierarchical status. In addition, profession-derived status has been found to be positively associated with psychological safety in cross-disciplinary health-care teams (Nembhard and Edmondson, 2006). Psychological safety in teams encourages team members to speak up, stimulates the collaboration in a positive direction, and facilitates experimentation and learning from failures (Nembhard and Edmondson, 2012). Hence, psychological safety influences the organizational learning, organizational performance, and the work environment.

In line with this, the health professionals' assessment of relational coordination was found to be significantly correlated with the health professionals attitudes toward safety climate in the surgical unit, as well as to several other dimensions of the construct of safety culture. These findings call for increased attention to be paid to the non-reciprocal collaboration ties between health professionals' collaborating in surgical teams, since differences in professional-derived status might exist. Moreover, the findings emphasize the importance of placing a greater focus on relational interventions intended to support the strengthening of relationships between health professionals across professions, clinics, and clinical specialties in surgical units when initiating organizational change processes. Implementing relational intervention initiatives might provide opportunities to increase shared knowledge, improve safety climate, and use problem-solving communication to a greater extent. Furthermore, relational interventions might provide opportunities to minimize the boundaries across professions and units.

9.4.2. Experiences During an Intervention Process

The findings of the integration added knowledge regarding the identified experiences and challenges by using the relational coordination theory and methodology in an organizational intervention process in a surgical unit at a university hospital in Denmark. The integration findings pointed to valuable recommendations for initiating, screening, planning, and implementing organizational interventions guided by the relational coordination theory and methodology.

The organizational intervention in a surgical unit was initiated and designed in a process that embraced both bottom-up and top-down perspectives. This was in line with Nielsen et al. (2010a) who recommended that interventions should combine managers' (top-down solutions) and employees' (bottom-up experiences of challenges) views of the needs and desired outcomes in order to successfully shape and understand the effect of organizational interventions. The intention behind initiating and designing an organizational intervention based on both bottom-up and top-down perspective is encapsulated in the Relational Model of Organizational Change. This way of engaging clinicians and managers at different levels within a health-care institution has been successfully used in other similar organizational interventions (Resnick et al., 2016; Gittell, 2016). These findings contributed the recommendation to engage health professionals from different levels within the hospital in the intervention process in order to design intervention initiatives targeted at what is actually needed.

In line with previous research concerning intentional efforts to change the organizational culture and strengthen relationships across workgroups (Suchman et al., 2011; Hornstrup, 2015; Resnick et al., 2016; Logan, 2016; Gittell, 2016), relational coordination theory and the associated measurements have been useful during the organizational intervention. The principles of relational coordination were used as tools for change (Gittell, 2016) in a progressive process including several dialogue-based discussions held by the change team responsible for the intervention. These discussions were regarded as feedback processes, since the findings derived from the interviews, observations, and measurements were presented to the change team with the intention of enriching, inspiring, and adding nuance to the organizational intervention so that the initiatives were aimed at what was really needed. These iterative feedback processes taking place during change team meetings might be recognized as elements of the formative evaluation process described by Willert (2015). According to Willert (2015), formative evaluation is characterized by close collaboration between the evaluator and the people/organization whose efforts are being evaluated, and it includes reflective feedback processes that can be considered as value-creating intervention. The iterative integration of the findings during the intervention process in the surgical unit was intended to add value during the intervention process. Experiences derived from the intervention process identified the challenges associated with the application of the principles of relational coordination as tools for change in the surgical unit, such as: a) accelerating the implementation time of the intervention, thereby resulting in baseline measures of relational coordination not being available when needed, b) conducting the results feedback process under inappropriate conditions, and c) downsizing the relational interventions (relational mapping). Capturing these experiences during the interventions is in line with the approach of Stetler et al. (2006), who highlighted the potential uses of formative evaluation. A summative evaluation based on performance outcome measurement is essential but insufficient in terms of meeting need for a comprehensive evaluation of an organizational intervention, as described in the framework for evaluation of organizational interventions (Nielsen and Abildgaard,

2013). In addition, formative evaluation enables systematic modifications to be made to the intervention initiatives, thereby increasing the possibilities for the outcomes to be successful (Nielsen et al., 2010a). These findings highlight the available improvement possibilities by using relational coordination theory and methodology in combination with formative and summative evaluative practice. In addition, the findings emphasize the importance of a shared commitment to the use of principles of relational coordination as a tool for change when initiating organizational interventions, so appropriate time/resources are allocated.

During the intervention process several work processes were improved, and the health professionals' assessment of relational coordination increased significantly. The changes in structures, work processes, and relationships during the intervention process were monitored in an experience-based fashion by members of the change team, and quantitative registrations of the quality indicators for monitoring changes over time were omitted. The use of an evidence-based improvement methodology, such as the Model of Improvement, provides knowledge to an organization regarding whether a change is actually an improvement (Langley et al., 2009). The use of outcome measurements might have added more accurate assessments of positive changes in the work processes that could have been used during the process. The visualization of such positive changes might have a positive impact on the health professionals' engagement, as suggested by Langley et al. (2009). In line with Gittell (2016) when describing work process interventions, included in the Relational Model of Organizational Change. These experiences showed that attention must be paid not only to defining goals for intervention outcomes, but also to implementing the monitoring of the desired outcomes when designing an organizational intervention.

According to Nielsen and Abildgaard (2013), frontline and senior managers play a vital role as organizational actors during the intervention process. This also corresponds to earlier research using the principles of relational coordination in an organizational intervention program in hospitals (Resnick et al., 2016), which noted that leadership readiness was crucial to the success of the intervention. During the intervention process in the present study, the management and change team were challenged by changes in the senior management, external requirements for organizational changes, and increased external focus on performance outcomes. A more continuous presence at the change team meetings and more visible support for the intervention on the part of frontline and senior managers might have positively influenced the intervention outcomes. Prioritizing initiatives targeting the weak and non-reciprocal collaboration ties between workgroups in the surgical unit might have had a positive impact on the outcome. Similarly, the adaptation of the intervention so that it also was targeted toward strengthening safety climate, might have been an appropriate and supportive management response to the results derived from the measurement of safety culture during the intervention. In addition, the change team could have been constituted in a more appropriate way. Nielsen and Abildgaard (2013) stated that employee participation in organizational intervention processes helps to ensure ownership of the

intervention, takes advantage of employees' specific knowledge about the work processes, and ensures the implementation of the initiatives in the existing structures. When seeking to ensure the more successful implementation of the intervention within the present surgical unit, the inclusion of frontline surgeons and anesthesiologists might have had a positive influence on the success of the intervention outcomes. These findings point to the importance of constituting a change team that facilitates partnership between employees and managers at different levels in order to effectively use relational coordination theory and methodology to improve interdisciplinary collaboration and performance.

9.4.3 Evaluation of an Organizational Intervention

The findings of the integration contributed to a comprehensive interpretative evaluation of an organizational intervention within a surgical unit at a Danish university hospital. The integration findings suggested valuable recommendations when seeking to evaluate organizational interventions guided by relational coordination theory and methodology.

The organizational intervention using the principles of relational coordination as a tool for change improved the interdisciplinary collaboration in different ways. The effect of the intervention was expressed by members of the change team assessing that several outcome goals were met some 16 months after the intervention was launched. Structural initiatives that targeted changes in work processes were successfully implemented in the surgical unit. Moreover, the quality indicator of "Operation delay for patients with femoral neck fracture," which was gathered from a national register, indicated a marked improvement in the treatment of such patients. These findings can be contrasted with those concerning an intervention intended to enhance the operating room capacity by increasing the OR throughput via a change in work processes (O'Donnell et al., 2017). The implementation of parallel processing in surgical units at an Irish university hospital did not result in an increase of the OR throughput, or a decrease in time used for purposes other than surgery, as expected (non-operative time). However, in the present study, the change initiatives targeting the desired strengthening of shared knowledge between health professionals in the OR and initiatives facilitating learning from failures through debriefing sessions after surgery was found to be challenging, and the implementation of these initiatives failed. The failed implementation of debriefing sessions after surgery may be explained by the fact that the concept of debriefing after surgery was neither defined nor described. This finding is contrary to that of a previous Dutch study in which debriefing after surgery was successfully implemented in five surgical units, resulting in an improved teamwork climate (Leong et al., 2017). The effect of the present intervention was also visible in the significantly increased measures of relational coordination between the health professionals in the surgical unit, when measured eight months after the implementation. In contrast to the change team's experiences, the health professionals' assessment of relational coordination remained the same as before when measured some 16 months after the intervention was launched. Furthermore,

the measurement of safety culture enabled the assessment of changes in the organizational actors' attitudes over time. Apart from the missing baseline measures of safety culture, the measures of safety culture during and after the intervention showed the same change tendency as the measures of relational coordination. Thus, the measures of the health professionals' attitudes toward interdisciplinary collaboration and safety climate indicated that both interdisciplinary collaboration and safety climate had deteriorated during the final part of the intervention period. An understand of these contradictory findings could be that the intervention was not aimed at all the improvement needs and, further, that some needs for change were easier to meet than others more profound. These findings call for attention to be paid to the design and implementation of interventions targeted toward what is needed, systematically monitored, and adapted during the process in order to achieve the outcome goals for improvement.

When evaluating interventions intended to improve interdisciplinary collaboration in surgical teams, it might be difficult to determine which intervention initiatives were the most successful in improving collaboration. On the one hand, profound changes in the relationships between health professionals might be more sustainable than changes in the frequency of communication. On the other hand, structural initiatives resulting in changes in communication patterns might have an impact on the health professionals' engagement with the work processes, meaning that working more toward shared goals and showing mutual respect will follow. This argument points to the dynamic that exist between communication and relationship dimensions in the theory of relational coordination, and it also calls into question what should be initiated first and what should follow (Gittell, 2016). Structural interventions intended to support the improvement of work processes and facilitate the improvement of relationships, or relational interventions intended to improve interpersonal relationships so that health professionals know how to use those structural interventions in an appropriate way. A review of interventions intended to improve the surgical culture discussed the issue of which interventions were most successful at improving the surgical culture, and it highlighted that the successful improvement of culture is likely to be more site-specific than intervention-specific (Sacks et al., 2015). If the successful implementation of interventions depends on the context and organizational culture, it is likely important that the intervention is addressed toward the challenges experienced by the health professionals facing the patients. This might explain the recommendation expressed in the review article that interventions in surgical settings may benefit from a bottom-up approach (Sacks et al., 2015). The review also emphasized the synergistic relationships between delivering high-quality care and fostering a positive culture, as expressed in the sentence: "Delivering high-quality care reinforces positive culture, which in turn reinforces high-quality care." (Sacks et al., 2015, p.464). This dynamic captures very similar issues to the dynamic described between relational coordination and high-quality performance in the theory of relational coordination. Gittell et al. (2010) presented the view that relationships among employees together with human capital and motivation, are important causal mechanisms through which high-

performance work systems influence performance outcomes. These findings highlight the benefits of designing and implementing organizational interventions that address and target the challenges experienced by the health professionals facing the patients. In addition, the findings emphasized that assessments of relational coordination before, during, and after the implementation of an organizational intervention were useful in terms of evaluating interventions targeting the improvement of interdisciplinary collaboration.

The achieved outcome effects described by the change team may have had a positive effect on the performance of the surgical procedures, since the challenges in collaboration described by the health professionals were supposed to be minimized. This may explain the increased measures of relational coordination between the health professionals when measured some eight months after launch of intervention. However, these positive changes in work processes might not have influenced the relationships between the health professionals, since increased knowledge of what is important for each other or changed ways of respect of one another were expressed. This may have led to health professionals' expectations for improved collaboration not being met, as reflected in the decreased measures of relational coordination some 18 months after launch of intervention. As the framework for evaluation of organizational intervention presented by Nielsen and Abildgaard (2013) emphasizes, many factors may influence health professionals' attitudes and behaviors, not least factors related to task performance being situated in a context characterized by organizational, political, and economic changeability. Furthermore, the conflicting initiatives, such as economic recession and concurrent changes in organizational structures in the surgical unit, highlighted by the change team might have had a crucial influence on the intervention process and the outcomes in both positive and negative terms.

Finally, poor communication strategies during the intervention process might have influenced the health professionals' attitudes toward interdisciplinary collaboration and safety culture, which might in turn have influenced the intervention outcomes. The findings highlighted that the use of relational coordination theory and methodology facilitates the use of both formative and summative evaluation of an organizational intervention. In addition, the integrated findings support the benefits of using a framework for evaluation of organizational interventions that captures the evaluation of both processes during the intervention and outcomes following the intervention. This point to the need for future intervention studies to use relational coordination theory and methodology to experiment and explore comprehensive evaluation methods capturing both process and outcomes.

9.5 Strengths and Limitations of the Mixed Methods Study

In the following section, the strengths, limitations, and methodological considerations are presented and discussed in relation to the findings and interpretations of the

integrated phase of the mixed methods study, as well as with regard to this mixed methods study overall.

Certain limitations and weaknesses during the integration phase of this mixed methods study must be emphasized. To evaluate whether an organizational intervention guided by the theory of relational coordination had improved relational coordination and safety culture in a surgical unit, a framework for evaluation of organizational intervention was used. Qualitative data were collected through participation in change team meetings, while quantitative data were captured through measurements of relational coordination and safety culture. Moreover, it was possible to extract performance outcome data from national registers of orthopedic surgery. It would have strengthened the study if quantitative data related to the performance outcomes and patient outcomes were collected to a greater extent, so that it was possible to conduct comparisons over time between relational coordination and outcome measures. However, using the framework for evaluation of organizational intervention offered a frame for conducting a comprehensive interpretative evaluation of an intervention aimed at improving interdisciplinary collaboration in surgical teams. The key strength of using this framework was that it captured the evaluation of both processes and outcomes. One of the challenges involved in using the framework was that it is very time-consuming (Nielsen and Abildgaard, 2013). Monitoring the processes through participation in change team meetings represented the intentionally way of collecting qualitative data during the intervention. This data collection process enabled data to be captured regarding the change teams' challenges, decisions, and experiences during the process, but it did not capture the challenges, decisions, and experiences outside the change team meetings, between the health professionals on the frontline. Observations of surgical teams or interviews conducted with health professionals during and after implementation of the intervention would have strengthened the data collection, analysis, and interpretation.

Another challenge involved in evaluating an organizational intervention using the specified framework was that it requires the researcher to be sensitive to changes during the process, which might be very difficult in a complex and highly changeable context. Data derived from external organizational changes and concurrently implemented initiatives during the present intervention were only collected through change team members' quotations during change team meetings. As these external changes were not collected or examined independently of the change team, it is difficult to determine the extent to which the external changes have influenced the health professionals' attitudes, the interdisciplinary collaboration, and the performance outcomes. Moreover, it might be very difficult to evaluate this organizational intervention because it contained many different planned initiatives, and it was also influenced by external change initiatives. Such initiatives could both promote and prevent the other's implementation. Finally, Nielsen and Abildgaard (2013) note that the framework was not proposed to be a "one size fits all" framework. In this study design, it was considered a strength that the framework was used as a rough guideline,

and not as a rigorous evaluation framework, since the intervention was implemented in a complex and highly changeable context. In general, the use of an evaluation framework capturing both processes and outcomes was a strength of this mixed methods study's design, analyses, and interpretation.

Measuring relational coordination before, during, and after the implementation of an intervention targeted toward the improvement of interdisciplinary collaboration offered rich data concerning the nature of collaboration ties between health professionals during a change process. However, the simultaneous use of improvement theory and the measurement of performance outcomes would have strengthened the assessment of the effect of the intervention as well as strengthened the validity of the study. The outcome goals were defined early in the intervention process, although the change team decided to refrain from measuring performance outcomes before, during, and after the implementation due to a lack of resources and the low priority assigned to such efforts. Quantitative data concerning patient-related outcomes would have enabled the study of the correlation between changes in relational coordination and patient outcomes, thereby providing important knowledge about the impact of relational coordination on the quality of treatment. Furthermore, the assessment of changes in the health professionals' attitudes toward safety culture throughout the intervention would have been strengthened if the limitations attributed to the missing baseline measures of safety culture were eliminated.

The relatively low attention paid to the impact of leadership on the organizational changes and the organizational culture in this study might represent limitations of this study, which was intended to explore communication and relationships in surgical teams and evaluate an organizational intervention designed to improve interdisciplinary collaboration. Methodological considerations and priorities resulted in the maintenance of a research focus on the communication and relationships between health professionals at the micro level. In addition, the theories of relational coordination, teaming, and safety culture were chosen as theoretical lenses in this study, while other theoretical perspectives on communication and relationships in organizations may have contributed with other perspectives.

Finally, the methodological considerations concerning the strengths and limitations of using mixed methods as a methodological approach should be discussed. A pragmatic ontological and epistemological approach guided this mixed methods study. The pragmatic approach has highlighted the potential for acquiring knowledge through activities and interactions between human beings and their environments (Biesta and Burbules, 2003; Brinkmann, 2006; Greene, 2007), and it has espoused a practice-oriented exploration using a research design that is mixed in such a way that allows the researcher the best possible opportunities to address the research questions and generate useful knowledge (Johnson and Onwuegbuzie, 2004). The purpose of using a mixed methods methodology at the interpretation and reporting levels is to provide recommendations for improving collaboration and safety culture in interdisciplinary

surgical teams. Thus, the aim is to acquire new knowledge by integrating the findings rather than integrating the findings with the purpose of validating those findings.

In this mixed methods study, integration was pursued at the design, methods, interpretation, and reporting levels (Fetters et al., 2013). The longitudinal nature of the study accented the benefits of using a multiphase design in order to enable the exploration of communication and relationships in surgical teams, as well as to develop, monitor, assess, and evaluate an organizational intervention intended to improve interdisciplinary collaboration in surgical units. The term “multiphase” design was used by Creswell and Plano Clark (2011) in their earlier terminology. This term has now been amended, since it was found to be to general (Creswell and Plano Clark, 2018). Today, these mixed methods researchers use a typology of core designs. A multiphase design may include various combinations of exploratory sequential, explanatory sequential, and convergent approaches (Fetters et al., 2013). This multiphase design included both sequential and convergent components. An exploratory sequential approach was used in this study when the findings from PHASE I (health professionals experiences of interdisciplinary collaboration) were connected to and used to build PHASE II, as well as when the findings from PHASE II (development of a measurement tool) were connected to and used to build PHASE III. Further, an explanatory sequential approach was applied in this study when the findings from PHASE III (measurements of relational coordination and safety culture) were connected to and used to build PHASE II. Finally, a convergent approach existed in this study when the findings from PHASE I, II, and III were merged and compared during PHASE IV.

The need to ensure the legitimation (reflexivity, reliability, and validity) of the research process has been described and discussed throughout the dissertation, since legitimation has been viewed as a process. Therefore, legitimation strategies are weaved into every phase of the entire research process, as inspired by the work of Morse et al. (2002) and Onwuegbuzie and Johnson (2011). In the following, a summarizing evaluation of the research process applied in this mixed methods study is presented in order to demonstrate how legitimation has been achieved. The methodological considerations regarding the legitimation of this mixed methods research study are made based on the framework of Onwuegbuzie and Johnson (2011), who preferred the term legitimation rather than validity, since the term legitimation is used by both quantitative and qualitative researchers. To address the specific legitimation threats to the mixed methods design, methods, and integration, Onwuegbuzie and Johnson’s (2011) typology of mixed methods legitimation types was used. The relevant considerations in this regard are associated with the legitimation types: sample integration, inside-outside, sequential, conversion, weakness minimization, and multiple validities. These considerations are presented and discussed in *Chapter 5* and *Chapter 9*.

To address the legitimation type named multiple validities and to secure the quality of this mixed methods study, pertinent strategies were described and complied within each of the mixed methods phases.

In effort to address legitimation of the qualitative components of the mixed methods study, pertinent qualitative verification strategies are implemented integrally during PHASE I and PHASE II. These strategies serve to verify and determine the validity and reliability of qualitative research, and they are inspired by the work of Morse and Mitcham (2002), Morse (2015), and Brinkmann and Kvale (2015). Attention has been paid to ensuring methodological coherence, being persistent, sampling the participants who best represent the research topic, collecting and analyzing concurrently, thinking theoretically, and checking reflections and interpretations (Morse et al., 2002). These considerations are presented and discussed in more detail in *Chapters 5, 6, and 7*. The qualitative components of the mixed methods study are considered to be trustworthy.

Further, in an effort to address legitimation of the quantitative components of the mixed methods study, pertinent quantitative legitimation strategies are used during PHASE III. The strategies intended to ensure and determine the validity and reliability of quantitative research are inspired by the work of Draugalis et al. (2008), Norman (2010), Gittell (2012a), Valentine and Edmonson (2015), and Kristensen (2015a, 2016b). Particular attention has been paid to the sample size/bias, response/nonresponse bias, strength of the surveys (internal consistency, structural validity, content validity, and inter-scale correlations), and statistical analyses. The relevant considerations are presented and discussed in *Chapter 5* and *Chapter 8*. The tests for the reliability and validity of the surveys indicated high reliability and validity, and comparison of the RC measures between the respondents who answered the surveys once and the respondents who answered more than once showed no difference. In conclusion, the necessary legitimation strategies have been followed, limitations have been considered, and threats to validity have been addressed in the quantitative components of the mixed methods study.

9.6 Partial Conclusion

The objective during PHASE IV was to provide recommendations for improving collaboration and safety culture in interdisciplinary surgical teams. In this partial conclusion, I address the fourth question: *How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?*

The integration findings emphasized that interdisciplinary collaboration in surgical teams is challenging and might need transformation. The findings added valuable knowledge concerning the use of relational coordination theory and methodology in an organizational intervention process in a surgical unit at a Danish university hospital. Finally, the integrated findings provided a comprehensive evaluation of an organizational intervention. The effects of the intervention were reflected in the changes seen in health professionals' attitudes toward interdisciplinary collaboration and safety culture, changed structures, changed work processes, and performance outcomes. Shaping changes in surgical teams is about creating the foundation for the changes. Therefore, understanding of the changes needed and setting the desired goals are crucial in relation to the design and planning of an appropriate change process. Based on the integrated findings, the following recommendations can be highlighted for shaping changes in surgical teams that are aimed at improving interdisciplinary collaboration and safety culture:

- Use relational coordination theory and methodology and design the intervention to include both formative and summative evaluation.
- Constitute a change team that facilitates partnership between employees and managers at different levels and engages health professionals from different professions.
- Design and implement interventions that address the challenges experienced by the health professionals who actually work with patients.
- Ensure the successful completion of the intervention by allocating sufficient time and resources.
- Define the outcome goals and use improvement theory and methodology.
- Measure relational coordination before, during, and after the implementation of the intervention.
- Monitor the intervention process systematically and adapt the intervention during the intervention process.
- Pay attention to the communication and relationships between health professionals at the micro level.
- Include interventions that facilitate proactive and intuitive communication and prevent inattentive and ambiguous communication patterns in surgical teams.
- Prioritize relational interventions intended to support the strengthening of the relationships between health professionals across professions and clinical specialties.
- Pay attention to the collaboration ties between workgroups in the OR, explore whether non-reciprocal collaboration ties exist, and undertake to understand the interactive dynamic.
- Plan the surgical schedule and constitute surgical teams in such a way that the frequency of health professionals working together is maximized.

CHAPTER 10. CONCLUSION AND IMPLICATIONS

The purpose of this study was to create new knowledge about how communication and relationships are practiced in interdisciplinary surgical teams in contexts of variable complexity in Denmark, guided by the theory of relational coordination, as well as to offer recommendations on how best to improve the quality of collaboration and safety culture in surgical teams in the future. The background to the study concerned the desire to explore relational coordination in interdisciplinary collaboration at the micro level, since knowledge of the communication and relationship patterns that exist between health professionals in surgical teams should be valuable in terms of improving the quality of interdisciplinary collaboration and safety culture. The purpose was addressed from different angles, guided by four objectives with associated research questions:

(RQ1): *What characterizes communication and relationships in interdisciplinary surgical teams and which communication and relationship patterns can be seen in such teams?*

(RQ2): *How is the theory of relational coordination used as a tool for improvement in organizational intervention processes in surgical units?*

(RQ3): *Are relational coordination and safety culture in interdisciplinary surgical teams improved during an organizational intervention process using the theory of relational coordination as a tool for improvement?*

(RQ4): *How can perspectives from different angles, namely I) observations of activity and behavior, II) experiences during an organizational intervention process, and III) assessment of health professionals' attitudes regarding relational coordination and safety culture, together facilitate the improvement of collaboration in interdisciplinary surgical teams in the operating room?*

The findings and partial conclusions derived from the four phases of the mixed methods study are presented in the preceding chapters. In this final chapter, these findings are summarized in the final conclusion to the study, followed by implications of the dissertation's findings on both practice and future research.

10.1 Conclusion

In this study, communication and relationships in surgical teams have been explored using ethnographic principles in practice. It can be concluded that surgical teams perform surgical procedures in a context of variable complexity. It is a clinical context challenged by uncertainties in the daily surgical program, a high degree of

interdependency among team members, and a strong focus on time and resource consumption. From the health professionals' perspectives, great interdisciplinary collaboration in surgical teams is constituted by professionalism (specialized knowledge and skills, the ability to collaborate, and awareness of the patient and the situation during surgery), high-quality communication, and mutual respect.

The observations of the surgical teams have added insights into how communication and relationships between health professionals in surgical teams looked like, when it succeeded and when it was not successfully achieved, thereby enabling the identification of appropriate and inappropriate interpersonal dynamics. Four different types of communication and relationship dynamics were identified in surgical teams. Therefore, it can be concluded that while performing surgical procedures, interdisciplinary surgical teams are practicing different types of communication and relationship patterns, namely *proactive and intuitive communication, silent and ordinary communication, inattentive and ambiguous communication*, and *contradictory and highly dynamic communication.* In the surgical team, labelled *Proactive and Intuitive Communication* (Type 1), communication and relationship dynamics were exposed by a broad acceptance of shared goals, a pronounced expression of mutual respect, and timely and precise communication focused on solving the problems at hand. In these teams, the shared sense of responsibility was supported by the health professionals being proactive and intuitive. In the surgical teams, labelled *Silent and Ordinary Communication* (Type 2), communication and relationship dynamics were characterized by shared goals and mutual respect. In these team, less exchange of opinions and problem-solving communication was observed between the health professionals, while communication and relationships were less dynamic and more silent than in the other teams observed. In the surgical teams, labelled *Inattentive and Ambiguous Communication* (Type 3), communication and relationship dynamics were characterized by the health professionals being guided by shared goals, as well as functional goals, which resulted in surgical team members being inattentive to each other. Moreover, these dynamics were characterized by health professionals expressing disrespect to each other rather than showing mutual respect, and using finger-pointing communication rather than problem-solving communication. Often the surgical team members expressed themselves ambiguously. Finally, in the surgical teams labelled *Contradictory and Highly Dynamic Communication* (Type 4), communication and relationship dynamics were characterized by being contradictory. Contradictions were seen between being guided by shared goals or functional goals, between expressing disrespect or showing respect, and between blaming others or solving problems with others when problems occur. The contradictions gave rise to highly dynamic relationships, while differences in personality influenced how the health professionals responded to the contradictions. It can also be concluded that communication and relationships in surgical teams are based on role relations, as well as personal relations and intersubjective work experiences between team members. The diversity observed in the health professionals' ways of relating and communicating with one another in this study highlights improvement possibilities regard to the design

of organizational interventions that are specifically targeted toward learning from surgical teams with proactive and intuitive communication (Type 1), since such teams might contribute positively to the safety culture in operating rooms and influence both the surgical performance and patient safety. It can hence be concluded that learning from surgical teams practicing proactive and intuitive communication patterns, as well as preventing inattentive and ambiguous communication patterns, might improve efficiency in surgical teams and enhance the quality of treatment and patient outcomes.

Communication and relationships have also been assessed by measuring the health professionals' experiences of relational coordination with other health professionals in the operating room. It can be concluded that relational coordination is stronger between health professionals who are part of the same workgroup (within workgroups), than relational coordination between health professionals who are part of different workgroups (between workgroups). In addition, relational coordination is stronger between health professionals who are affiliated with the same clinic/clinical specialties than relational coordination between health professionals who are affiliated with different clinics/clinical specialties. Furthermore, it can be concluded that collaboration ties between workgroups collaborating in the OR are characterized by being non-reciprocal (workgroups experience relational coordination with one another significantly differently). Non-reciprocal collaboration ties are identified between surgeons and OR nurses, as well as between surgeons and AN nurses, and between health professionals affiliated with different clinical specialties in operating rooms.

In this study, the assessment of relational coordination was preceded by fieldwork conducted using ethnographic principles, which provided the opportunity to seek an understanding and interpretation of what these non-reciprocal collaboration ties might reflect. A possible interpretation in this regard might be that the existence of non-reciprocal collaboration ties between health professionals in surgical teams might reflect the diversity in status, power differences, or hierarchical systems. Non-reciprocal collaboration ties might influence the character of interdisciplinary collaboration in surgical teams, and they might create a challenge for team members in surgical teams to speak up with ideas, questions, and concerns, which could in turn pose threat to patient safety. It can therefore be concluded that the existence of non-reciprocal collaborative ties in surgical teams should be paid sufficient attention when improvement targeted interdisciplinary collaboration are needed. When collaboration ties between health professionals working in surgical units are non-reciprocal, the organizational change process should include relational interventions intended to strengthen mutual respect and increase knowledge of what matters in relation to each other's task execution.

A qualitative exploration of how relational coordination theory and methodology can be used as tool for improvement in organizational change in surgical units has also been completed. It can be concluded that relational coordination theory and methodology are useful in organizational interventions as a diagnostic tool for improvement and

identification of challenges in interdisciplinary collaboration in surgical teams. The exploration has shown that the assessment of relational coordination between health professionals in surgical teams might be beneficial as the basis for the development of intervention initiatives aimed at what is actually needed. It can also be concluded that observations of clinical practice and interviews conducted with health professionals at the micro level prior to the measurement of relational coordination in surgical teams can provide significant insights into concrete practice and the challenges that exist. These important insights enable the assessment of relational coordination measures to become more nuanced and more useful when interventions are to be designed and planned. In addition, the Relational Model of Organizational Change offers an illustration of the various initiatives that can be useful implemented throughout the organizational intervention process. Furthermore, it can be concluded that a comprehensive evaluation of an organizational intervention, including both formative and summative assessments, can be captured by a) monitoring the intervention process, b) monitoring any simultaneous external changes, and c) assessing the effects of the intervention as reflected in changes in health professionals' attitudes toward relational coordination and safety culture, changed structures, changed work processes, changes in relationships between health professionals, and performance outcomes.

A quantitative assessment of relational coordination and safety culture in a surgical unit has been conducted before, during, and after the implementation of an organizational intervention using relational coordination theory and methodology as a tool for improvement. It can be concluded that the RC Survey is useful for measuring interdisciplinary collaboration, identifying strong and weak collaboration ties between and within workgroups collaborating on a core task, and evaluating interventions targeted at the improvement of interdisciplinary collaboration. It can also be concluded that the relational coordination changed over time during an organizational intervention using the theory of relational coordination as a tool for improvement. This conclusion is based on the significantly higher relational coordination measures seen some eight months after the implementation of the organizational intervention. This increase in relational coordination indicates an improvement in the interdisciplinary collaboration in the surgical unit after eight months. However, the relational coordination measures were the same as prior to the implementation of the organizational intervention when measured some 16 months later. This change in the relational coordination measures indicates that the achieved improvement was later reversed.

Furthermore, it can be concluded that the construct of relational coordination is statistically significantly positively correlated with the scales included in the construct of safety culture (SAQ-DK), including teamwork climate, safety climate, job satisfaction, and working conditions. The correlation between relational coordination and safety climate indicates that change initiatives targeted toward the improvement of relational coordination might have a positive impact on health professionals' attitudes toward safety culture and vice versa. The health professionals' attitudes

toward safety culture in the surgical unit changed during the organizational intervention process, since decreases in the rating of teamwork climate and safety climate were identified during the period from eight to 16 months after the implementation of the organizational intervention. It can hence be concluded that both health professionals' experiences of relational coordination and their attitudes toward safety culture changed during the organizational intervention. However, the effect of the intervention was also expressed by members of the change team when assessing that several outcome goals were met some 16 months after the intervention was launched, leading to the conclusion that several structural and work process intervention have been implemented successfully. An explanation for these contradictory findings might be that the intervention was not aimed at all improvement needs and, further, that some needs for change were easier to meet than others that were more profound. In this study, recommendations are emphasized for shaping changes in surgical teams that are aimed at improving both interdisciplinary collaboration and safety culture. It can be concluded that organizational interventions should target what is needed, including the challenges experienced by health professionals who deal with patients on a day-to-day basis. In addition, any changes should be monitored and adapted during the process if required to achieve the outcome goals for improvement.

In conclusion, this dissertation contributes to the fields of health services research and implementation science in that it presents findings concerning how interdisciplinary collaboration in surgical teams is practiced at the micro level and, further, it presents recommendations for improving interdisciplinary collaboration in surgical teams.

10.2 Theoretical Contributions

This dissertation contributes to the fields of health services research and implementation science by documenting research concerning interdisciplinary collaboration in surgical units at the micro level through the empirical findings derived from the four phases of this mixed methods study. More specifically, the study adds insight into the different communication and relationship dynamic that exist between health professionals working in interdisciplinary surgical teams, as well as into the non-reciprocal collaboration ties that exist between health professionals in the operating room across both professions and clinical specialties. In addition, the study contributes insights into interpersonal communication and relationship dynamics between health professionals in surgical teams during the implementation of an organizational intervention using relational coordination theory and methodology as a tool for the improvement of interdisciplinary collaboration.

The study contributes to the theory of relational coordination by providing new knowledge about the relational coordination that exist between health professionals in surgical teams at the micro level. First, communication and relationship dynamics at this level were found to be both role-based and personal-based. Second, the use of

relational coordination theory in a directed content analysis was found to be beneficial in terms of identifying different communication and relationship patterns in interdisciplinary surgical teams at the micro level. Third, it was also found that relational coordination measures might reflect very different underlying communication and relationship dynamics between the different workgroups involved in a core task. Fourth, the study contributes new knowledge to the theory of relational coordination concerning how relational coordination and safety climate are positively correlated. Fifth, the study contributes additional new knowledge to the theory of relational coordination regarding the character of collaboration ties that exist between health professionals across both clinical specialties and clinics.

Finally, the study contributes to the science of safety culture by adding new perspectives on how safety culture is correlated with communication and relationship dynamics seen among health professionals in surgical teams.

10.3 Implications for Practice

Interdisciplinary collaboration in surgical teams is challenged by uncertainties in terms of the daily surgical program, the high degree of interdependency among team members, and the strong focus on time and resource consumption. Surgical teams practice different communication and relationship patterns when performing surgical procedures with varying degrees of complexity. In addition, they are characterized by non-reciprocal collaboration ties between surgeons and nurses, as well as across clinical specialties. The findings of the dissertation might be useful in relation to continuous efforts to improve interdisciplinary collaboration in surgical teams, in other clinical practices at the micro level, and in health-care systems around the world. Several actions are proposed to transform communication and relationships in interdisciplinary teams.

The first proposal is to learn from the surgical teams that exhibited proactive and intuitive communication patterns, and to prevent inattentive and ambiguous communication. The identified typology of communication and relationship patterns might offer guidance for the improvement of teamwork in surgical teams, since the typology adds new perspectives concerning what coordination in surgical teams looks like, when it succeeds, and when it is not successfully achieved. When seeking to transform communication and relationships in interdisciplinary surgical teams, it is important to pay sufficient attention to communication and relationships between health professionals at the microlevel.

The second proposal is to promote a collaboration culture attentive to mutual respect among health professionals in surgical teams. The identification of strong and weak collaboration ties between health professionals in surgical teams might be useful as a dialogue-facilitating tool in relational interventions targeted toward the improvement of

interdisciplinary collaboration. In order to transform communication and relationships in interdisciplinary surgical teams, it is important to pay sufficient attention to the collaboration ties that exist between workgroups in the OR, explore whether non-reciprocal collaboration ties exist, and make efforts to understand the interactive dynamics between health professionals.

The third proposal is to organize the collaboration in surgical teams and constitute surgical teams in which the health professionals know each other's skills – their weaknesses as well as strengths to the greatest extent possible. Surgical team members who are familiar with one another might use appropriate communication and relationship patterns more widely. As familiarity within surgical teams also appears to foster open and respectful communication, the collaboration ties between health professionals might be more reciprocal, while the health professionals' psychological safety might be greater. Familiarity within surgical teams seems to be important in terms of meeting the challenges that arise due to collaboration ties being non-reciprocal between professions and across clinics. When seeking to transform communication and relationships in interdisciplinary surgical teams, it is important to prioritize relational interventions intended to support a strengthening of relationships between health professionals across professions and clinical specialties, as well as to plan the surgical schedule and constitute surgical teams in such a way that the frequency of health professionals working together is maximized.

Finally, recommendations can be offered in terms of shaping changes in surgical teams aimed at improving interdisciplinary collaboration and safety culture by using relational theory and methodology as the framework for organizational changes. When initiating, screening, designing, implementing, and evaluating organizational interventions targeted at the improvement of communication and relationships in interdisciplinary surgical team, it is important to constitute a change team that facilitates the partnership between employees and managers at different levels and engages health professionals from different professions. Furthermore, interventions should be designed and developed in order to address the challenges experienced by the health professionals who deal with patients on a day-to-day basis. It might be beneficial to measure the relational coordination before, during, and after the implementation of the intervention so as to identify the strengths and weaknesses in the interdisciplinary collaboration and assess the improvement over time. The goals for the desired outcomes should be defined, and the intervention process should be guided by improvement theory and methodology. Finally, the intervention process should be monitored systematically, and the intervention initiatives should be adapted throughout the process as needed.

10.4 Recommendations for Future Research

Further research concerning interdisciplinary collaboration in surgical teams at the micro level is recommended, including explorations of the non-reciprocal collaboration ties between surgeons and nurses, as well as between health professionals from different clinical specialties in the operating room. It might also be relevant to explore whether the non-reciprocal collaboration ties between health professionals collaborating in surgical teams exist to a greater extent in surgical teams that exhibit inattentive and ambiguous communication patterns than in surgical teams with proactive and intuitive communication patterns.

In addition, more observational studies exploring relational coordination in surgical teams might produce valuable knowledge about how the communication and relationship dynamic in surgical teams in the OR can be qualified. This points to a future need for development of a tool for the behavioral observation of markers of interpersonal dynamics in surgical teams based on the communication and relationship dimensions in theory of relational coordination, which could be used to mark behavior and activities when the communication and relationship dynamics in surgical teams are observed.

Future studies could extend the insights into how different communication and relationship dynamics in surgical team influence the health professionals' ability to navigate and master uncertainties, interdependency, and time constraints in a complex clinical context.

Studies exploring the culture of respect in surgical teams might also be proposed, including studies intended to provide insights into how best to design and implement relational interventions in order to create and maintain trustful and respectful communication and relationship patterns in surgical teams.

In order to qualify treatment and secure patient safety, surgical teams have to establish systematic learning and feedback processes. Further exploration and experimentation are needed to implement structural, relational, and work process initiatives intended to enable and support an appropriate leadership role in surgical teams.

Further explorations and experiences are needed concerning how best to initiate, design, implement, and evaluate relational interventions in surgical teams that are aimed at improving both interdisciplinary collaboration in surgical units and patient outcomes. Finally, research focusing on how the improvement of interdisciplinary collaboration in surgical teams can be maintained and allowed to evolve is recommended.

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Appendix List

Appendix 1

Description of Phases Included in the Mixed Methods Study

Tables illustrating objectives, procedures, and outcomes in each phase of the mixed methods study.

PHASE I - Exploration (January 2014 – December 2014)	
Objective	To explore the communication and relationships in interdisciplinary surgical teams at the micro level in contexts of variable complexity in Denmark.
Procedures	• Selection of settings and participants • Participant observations • Semi-structured interviews • Semi-structured focus-group interviews • Analyses of qualitative data
Outcomes	Observation guides, fieldnotes, interview guides, transcriptions of interviews, descriptions of communication and relationships in interdisciplinary teams, and descriptions of health professionals' attitudes toward collaboration in surgical teams and safety culture.
PHASE II –Monitoring and Development (August 2014 – May 2016)	
Objective	To explore how the theory of relational coordination can be used in organizational intervention processes as a tool for improving the interdisciplinary collaboration in surgical units.
Procedures	• Monitoring an organizational intervention process during the initiation, screening, action-planning, implementation, and evaluation phases • Planning *Intervention I* based on the findings of PHASE I • Customizing the RC Survey • Facilitating results feedback • Prioritizing *Intervention II* based on results of PHASE III • Evaluating the organizational intervention process
Outcomes	Description of an organizational intervention process, customized RC Survey, and a description of an evaluation process.

PHASE III - Assessment (December 2014 – June 2016)	
Objective	To assess whether relational coordination and safety culture in a surgical unit are improved during an organizational intervention process.
Procedures	• Assessing relational coordination via the distribution of the RC Survey before, during, and after an organizational intervention process • Assessing health professionals' attitudes toward safety culture via the distribution of the SAQ-DK during and after an organizational intervention process • Analyzing the quantitative data from the RC Survey • Analyzing the quantitative data from the SAQ-DK • Comparing analyses from the RC Survey & SAQ-DK
Outcomes	Descriptive and statistical analyses of the data, graphical illustrations of the health professionals' collaboration ties, and a comparative analysis of relational coordination and safety culture.
PHASE IV – Integration and Interpretation (August 2016 – Dec 2017)	
Objective	To provide recommendations for improving collaboration and safety culture in interdisciplinary surgical teams.
Procedures	Integration of the qualitative and quantitative data, and the analyses from PHASE I, PHASE II, and PHASE III at the interpretation and reporting level.
Outcomes	Narrative weaved discussions and Joint displays.

Appendix 2

Interview Guide to Focus Group Interviews

Interview guide applied in focus group interviews conducted during PHASE I in the Ph.D. study: *Transforming Communication and Relationships in Interdisciplinary Surgical Teams.*

Overall focus areas:

- What characterizes interdisciplinary teamwork in the surgical units?
- With particular focus on shared goals, shared knowledge, mutual respect and accurate, timely, frequent and problem- solving communication.
- What characterizes patient safety culture in the surgical units?
- What is important for good and efficient teamwork?

1. What characterizes the interdisciplinary collaboration in this surgical unit?
How to describe your core task?
a) **Shared goals:**
What is the most important goals for your work in the surgical unit? Do you experience that you are working after shared goals? Do you have any examples of that? Or examples of working after different goals? How do you discuss different possibilities and solutions, when problem-solving is needed? and how do you make shared decisions when preparing and performing surgical procedures?
b) Shared knowledge:
Do you have knowledge about what is of particular importance to each other's task in dealing with high-quality care and treatment? Any examples of how you use your knowledge about what matters to each other's task? Is there knowledge that you wish your colleagues knew about what matters to you?
c) Mutual respect:
Several of you have told me in different ways that you are experiencing good interdisciplinary collaboration, can you express to what extent you experience mutual respect in your collaboration? How do you show your respect for your colleagues? The concept of trust…. how do you feel or sense trust in your department?
d) Communication:
What characterizes the communication in your surgical unit?
How do you exchange information and knowledge about the different types of surgery and bout the patients? Do you have the knowledge and information needed for the individual patient and the specific type of surgery? How do you communicate when problems arise? How do you give feedback to each other? How do you learn from situations that do not occur in an appropriate way or go ahead?

2. Hvad kendetegner patientsikkerhedskulturen hos jer?
How would you describe the patient safety culture in your surgical unit? Implementation of safe surgery? To what extent and in what way do you think about patient safety in your daily practice? Examples?

3. What is important for a great and efficient teamwork?
Note down on post-it: Aspects that are especially important for me to experience a good teamwork. Exchange of experiences and discussion.
How do you make each other great? According to patient involvement and patient perspectives - how do you acquire knowledge about what matters to the patient? What might qualify the interdisciplinary collaboration?

Appendix 3

The RC Survey in Danish language

Velkommen
Tak fordi du tager dig tid til at udfylde denne korte spørgeundersøgelse. Du bedes udfylde den ud fra dit perspektiv som medlem af gruppen af_____. Vær venlig at overvej alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Det tager ca. 10 minutter at udføre spørgeundersøgelsen. Dine svar vil blive holdt fortrolige.
Vi beder dig om at udføre undersøgelsen inden d._____.

Hyppig kommunikation

Hvor **ofte** taler eller skriver kolleger fra hver af disse grupper med dig om **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)?**
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Ikke relevant*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Alt for sjældent	For sjældent	Lige tilpas	For ofte	Alt for ofte	Ikke relevant
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Rettidig kommunikation

Taler eller skriver dine kolleger med dog om **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)** på de tidspunkter, hvor der er behov for det?
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Aldrig	Sjældent	Nogle gange	Ofte	Altid	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Præcis kommunikation

Taler eller skriver dine kolleger med dig om **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)** på en måde, der er præcis og til at forstå?
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Aldrig	Sjældent	Nogle gange	Ofte	Altid	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Problemløsende kommunikation

Når der opstår problem med **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus),** skyder kolleger fra hver af disse grupper så skylden på andre, eller samarbejder de med dig om at løse problemet?
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Skyder altid skylden på andre	Skyder ofte skylden på andre	Hverken eller	Løser ofte problemet	Løser altid problemet	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Fælles mål

Deler kolleger i hver af disse grupper dine mål for **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)?**
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Slet ikke	Lidt	Til dels	Meget	Fuldt ud	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Fælles viden

Hvor meget **ved** kolleger i hver af disse grupper om dit arbejde med **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)?**
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Ingen ting	Lidt	Noget	Meget	Alting	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Gensidig respekt

Respekterer kolleger i hver af disse grupper dit arbejde med **opgaver i forbindelse med klargøring, operation, og afslutning af de ortopædkirurgiske operationspatienter på (navn på afdeling & sygehus)?**
Ved besvarelsen af disse spørgsmål, skal du sørge for at overveje alle former for kommunikation, herunder personlige møder, telefonsamtaler, e-mails osv.
Vælg *Gælder ikke*, hvis kommunikationen med funktionsgruppen på listen ikke er nødvendig for din rolle.

	Slet ikke	Lidt	Til dels	Meget	Fuldt ud	Gælder ikke
Operationssygeplejersker	○	○	○	○	○	○
Ortopædkirurger	○	○	○	○	○	○
Anæstesisygeplejersker	○	○	○	○	○	○
Anæstesiologer	○	○	○	○	○	○
Assisterende kirurger	○	○	○	○	○	○
Social og sundhedsassistenter	○	○	○	○	○	○
Tavleansvarlige sygeplejersker	○	○	○	○	○	○
Tavleansvarlige kirurger	○	○	○	○	○	○
Sygeplejersker på O-sengeafsnit	○	○	○	○	○	○

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Tak

Tak fordi du valgte at gennemføre vores spørgeundersøgelse. Dine svar er blevet gemt, og vi kan forsikre dig om at din deltagelse og svar vil blive holdt fortroligt.
Såfremt du er færdig med besvarelsen af spørgeskemaet, kan du nu lukke dit browservindue. Hvis du ønsker, kan du gennemgå eller ændre dine besvarelser ved at klikke på tilbage, eller ved at klikke på spørgeskema linket i invitationen du modtog per e-mail.

Appendix 4

The SAQ-DK Survey in Danish Language

	Patientsikkerhedskultur Samarbejdsklima	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
1	*Her værdsættes det, at vi kommer med forslag og ideer*						
2	*Det er svært for mig at få det sagt, hvis jeg oplever problemer i forbindelse med pleje og behandling af patienterne*						
3	*Konfliktløsning blandt ansatte her hos os handler ikke om, hvem der har ret, men hvad der er bedst for patienten*						
4	*Jeg får den hjælp og støtte fra mine kolleger, som jeg har brug for, for at kunne tage mig godt af patienterne*						
5	*Det er naturligt for personalet at stille spørgsmål, hvis der er noget, vi ikke forstår*						
6	*Her arbejder sundhedsfagligt personale sammen som et velfungerende team*						

	Patientsikkerhedskultur - Sikkerhedsklima	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
7	*Jeg ville føle mig tryg, hvis jeg var patient her*						
8	*Vi håndterer utilsigtede hændelser på en hensigtsmæssig måde*						
9	*Jeg ved, hvor og hvordan, jeg kan få svar på spørgsmål om patientsikkerhed*						
10	*Jeg får passende tilbagemeldinger på, hvordan jeg klarer mine arbejdsopgaver*						
11	*Det er svært at diskutere utilsigtede hændelser her hos os*						
12	*Kollegaer opfordrer mig til at sige til, hvis jeg er bekymret for patientsikkerheden*						
13	*Kulturen her hos os gør det nemt at lære af andres utilsigtede hændelser*						

	Patientsikkerhedskultur - Jobtilfredshed	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
14	*Jeg kan godt lide mit arbejde*						
15	*At arbejde her er som at være medlem af en stor familie*						
16	*Her er det godt at arbejde*						
17	*Jeg er stolt over at arbejde her hos os*						
18	*Vi er karakteriseret ved en høj arbejdsmoral*						

		Sikkerhedsklima- Stress erkendelse	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
	19	*Når arbejdsbyrden bliver for stor, går det ud over kvaliteten af mit arbejde*						
	20	*Når jeg er træt, er jeg mindre effektiv*						
	21	*Jeg er mere tilbøjelig til at begå fejl i anspændte eller konfliktfyldte situationer*						
	22	*Træthed forringer kvaliteten af mit arbejde i akutte situationer*						

		Sikkerhedsklima - Opfattelse af ledelse (Frontline Management)	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
	23	*Afsnitsledelsen støtter mig i mit daglige arbejde*						
	24	*Afsnitsledelsen beslutter og gør ikke bevidst noget, som kan forringe patientsikkerheden*						
	25	*Afsnitsledelsen gør et godt arbejde*						
	26	*Afsnitsledelsen tager hånd om personaleproblemer på en konstruktiv måde*						
	27	*Jeg får tilstrækkelig information i rette tid om utilsigtede hændelser, der har relevans for mit arbejde fra afsnitsledelsen*						
	28	*Bemandingen er tilstrækkelig i forhold til antallet af patienter her hos os*						

		Sikkerhedsklima - Arbejdsbetingelser	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
	29	*Nyt personale får en god introduktion*						
	30	*Jeg har normalt adgang til alle de oplysninger, jeg har brug for, for at kunne træffe beslutninger om pleje og behandling*						
	31	*Personale, der er under oplæring inden for mit fagområde, får den nødvendige supervision*						
	32	*Hvis jeg kom med forslag til forbedring af patientsikkerheden, ville ledelsen følge op på dem*						

		Sikkerhedsklima – ikke tilknyttet skala	Helt Enig	Delvis Enig	Neutral	Delvis uenig	Helt uenig	Ikke relevant
	33	*Utilsigtede hændelser påvirker mig følelsesmæssigt på en negativ måde*						
	34	*Vi er gode til at håndtere belastende oplevelser*						
	35	*Vi arbejder sammen som et velfungerende team*						
	36	*Det er svært at få sagt, hvis jeg oplever problemer med kvaliteten af patientbehandlingen*						
	37	*Ved kommunikationsbrist fører det ofte til forsinkelser i patientbehandlingen*						

Appendix 5

Information to Health Professionals in the Surgical Units

Kære

Dette brev er en forespørgsel, om du vil deltage i ph.d. projektet:

Relationel koordinering i et ortopædkirurgisk operationsteam; en undersøgelse af sammenhæng imellem tværfagligt teamsamarbejde og patientsikkerhedskultur.

I første del af projektet gennemføres et feltstudie på to udvalgte ortopædkirurgiske operationsafsnit i (Navn på Klinik og hospital). Feltstudiet har til formål at undersøge, hvad der karakteriserer det tværfaglige teamsamarbejde på udvalgte operationsafsnit med særligt fokus på relationel koordinering og patientsikkerhedskultur.

I feltstudiet vil undertegnede ph.d. studerende Birgitte Tørring være til stede i operationsafsnittene med det formål at gennemføre observationer af den daglige kliniske praksis i de tværfaglige operationsteams og tale med de sundhedsfaglige aktører omkring aktuelle situationer. Ved afslutningen af feltstudiet vil der desuden blive planlagt og gennemført fokusgruppeinterviews med deltagelse af kirurger og operationssygeplejersker. Feltstudiet vil blive gennemført i perioden februar 2014 til oktober 2014.

Feltstudiet og de efterfølgende fokusgruppeinterviews
I første del af feltstudiet gennemføres et antal observationsseancer med et bredt fokus på den daglige kliniske praksis i de enkelte ortopædkirurgiske afsnit. Det betyder, at jeg vil observere den daglige kliniske praksis, som udøves på operationsafsnittet imellem det tværfaglige operationsteam, anæstesipersonale og patienterne. Observationsseancerne vil foregå i en række dagvagter (i tidsrummet kl. 7.30 – 15.30) og i enkelte aftenvagter (i tidsrummet kl. 15.00 – 23.30). Derefter vil observationsseancerne blive mere fokuseret på det tværfaglige samarbejde i de kirurgiske operationsteams. I disse seancer vil jeg følge udvalgte operationsteams (en kirurg og de tilknyttede operationssygeplejersker) igennem en dags operationer.

Jeg er observatør på operationsstuen og deltager således ikke direkte i pleje og behandling. Jeg vil undervejs skrive noter med det formål efterfølgende at kunne beskrive og analysere den daglige kliniske praksis og det tværfaglige samarbejde på jeres operationsafsnit. I forbindelse med afslutning på de enkelte observationsseancer vil jeg gerne stille de sundhedsfaglige aktører enkelte spørgsmål i relation til mine observationer.

Deltagelse i projektet
Deltagelse i projektet betyder for dig, at du kan blive "fulgt af mig", som observatør, igennem en arbejdsdag i forbindelse med din deltagelse i en eller flere operationer eller i forbindelse med konkrete opgaver i relation til de daglige kliniske opgaver.
Du skal vide, at:

- Det er frivilligt for dig at deltage.
- Du kan til enhver tid trække dit tilsagn om deltagelse tilbage eller afbryde din deltagelse uden at skulle begrunde dette. Du skal blot give mig besked herom.
- Oplysninger, du giver i forbindelse med din deltagelse i projektet, vil blive behandlet fortroligt og anonymiseret.
- Oplysninger, som er relateret til patienten, jeg måtte få i forbindelse med observationerne, er ligeledes omfattet af tavshedspligt og vil blive behandlet fortroligt og anonymiseret.

Jeg håber meget, at du har lyst til at deltage. Du har mulighed for at overveje din deltagelse, og jeg vil kontakte dig med henblik på at høre din beslutning vedrørende deltagelse. Har du ønsker om mere information eller har du spørgsmål til deltagelsen, er du meget velkommen til at kontakte mig.
De venligste hilsner

Appendix 6

The Consent Formula

Samtykkeerklæring til deltagelse i ph.d. projektet:

Relationel koordinering i et ortopædkirurgisk operationsteam; en undersøgelse af sammenhæng imellem tværfagligt teamsamarbejde og patientsikkerhedskultur.

Undertegnede bekræfter hermed, at:

Jeg har fået mundtlig information om ovennævnte projekt og jeg har modtaget en skriftlig beskrivelse af projektets baggrund, formål og forskningsmetode.

Jeg er informeret om, at det er frivilligt at deltage, og at jeg til enhver tid kan trække mit tilsagn om deltagelse i projektet tilbage.

Jeg er informeret om, at de oplysninger der fremkommer igennem min deltagelse i projektet vil blive behandlet anonymt og fortroligt både under udarbejdelsen og i den færdige afhandling.

Jeg er informeret om, at den færdige afhandling kan indeholde en eller flere af mine handlinger og/eller udtalelser som operationssygeplejerske/kirurg, som jeg kan genkende.

Jeg er informeret om, at jeg til enhver tid kan kontakte Birgitte Tørring, hvis jeg skulle have spørgsmål vedrørende min deltagelse i projektet.

Jeg giver samtykke til at deltage i forskningsprojektet og har fået udleveret en kopi af denne samtykkeerklæring samt skriftlig information om projektet til eget brug.

_____ _____

Dato Underskrift:

Appendix 7

Description of the Organizational Interventions

Intervention I **(December 2014)**

- Interdisciplinary meetings (board meetings) involving the responsible OR nurse, AN nurse, surgeon, and anesthesiologist were found to be crucial for improving collaboration and using the operating room capacity more efficiently. The daily board meetings were planned to 1.30 PM, and the purpose was to:
  - provide a joint effort to effectuate that the first patient arrived to OR 7:45 AM at latest
  - make shared decisions about logistical challenges regarding patients undergoing surgical procedures for the days to come
  - plan the surgical schedule and distribute the surgical procedures at the operating rooms at board meetings the day prior at 1:30 PM
  - compose the surgical teams to each of the surgical procedures the day prior
- Daily designation of a OR coordinator in each operating room (among the OR and AN nurses in the surgical team) to be responsible for a shared planning of the schedule among the health professionals in the surgical teams.
- Implementation of debriefing, the surgical teams should keep ongoing evaluation of how the schedule was executed and how the collaboration worked.
- Extended collaboration with the orthopedic wards in order to better prepare patients for surgery, and to improve the shared knowledge about the "preparedness" of the patients undergoing surgical procedures.

Intervention II **(September 2015)**

- Coordinating nurse should be visible at the board area all day.
- Surgical team members should meet in OR between 7:30 to 8:00 AM focusing on how to execute the daily schedule of the surgical procedures
- A small interdisciplinary group should review the surgical prescriptions and provide a proposal for qualification of the surgical prescription.
- A small group of OR nurses should provide proposals for a qualification of procedures for instruments and sterility (Content of the boxes for surgery).

External Analysis Initiating Structural Interventions (March 2015):

- Change in attendance time for OR nurses (from 7:30 AM to 7:15 AM) with effect 3 months after launched of *Intervention I*
- Implementation of a "Red protocol" in the OR to document present conditions resulting in delays
- Establishment of a new work function and employment of a coordinator to coordinate the distribution of acute patients in the Orthopedic Surgery Clinic with effect 2 months after launched of *Intervention I*

Significant External Changes in the Surgical Unit (May 2016)

- Merging two anesthesia units (June 2014) and merging two surgical units (Dec. 2014), resulting in greater responsibility for the two frontline managers
- Closing the secretariat function at the surgical unit, resulting in more administrative tasks for the frontline managers at the surgical unit (Sep. 2014)

- Reduction of surgical capacity at the outpatient clinic, resulting in more OR nurses at the surgical unit.
- Increased surgical capacity at the OR for patients undergoing back surgery (Sep. 2014)
- Organizational changes in the top management of both clinics engaged in the intervention process. Two times during the process the CEO of the Orthopedic Clinic (Sep 2014, Feb. 2016) was replaced and one time during the process the CEO of the Anesthetic Clinic (Dec. 2015) was replaced
- Establishing of a management level (with stakeholder function) between the Orthopedic Clinic and the Anesthetic Clinic, a management function without staff responsibility (Sep. 2014)
- Requirements for savings throughout the hospital resulted in waiting time at the recovery room (March 2015)
- Changes in attendance time for OR nurses and surgeons (March 2015, Aug. 2015, March 2016)
- Cancelling agreements on AN nurses escorting emergency patients between hospitals, resulting in staff reduction (July 2015)
- Weekly rounds at Surgery Unit II provided by the top management of the hospital in order to discuss and solve challenges (Aug. 2015)
- Implementing new IT systems to book orderlies, cleaning personnel, and technical support and to register patients (Sep. 2015)
- Training obligation for nurses in education resulting in more training tasks for OR nurses and employment of an OR nurse responsible for training (Oct. 2015)
- Establishing of a “Hip Arthroplasty Team” and expansion of the operating room capacity to these surgical procedures (March 2016)

Appendix 8

Measures and Analyses of Relational Coordination

Responses to the Surveys Distributed by Workgroups over Time									
	Time 1			Time 2			Time 3		
	Invited	Complete	%	Invited	Complete	%	Invited	Complete	%
OR nurses	36	21	58.3	36	25	69.4	35	14	40
AN nurses	36	23	63.9	32	13	40.6	34	13	38.2
Nurse assistants	4	3	75	4	2	50	5	1	20
Coordinating nurses	4	3	75	4	4	100	4	4	100
Surgeons	63	35	55.6	66	24	36.4	53	14	26.4
Anesthesiologists	7	7	100	8	6	75	6	2	33.3
All respondents	150	92	61.3	150	74	49.3	137	48	35.0

Table A. Response rates distributed by workgroups included in the surveys over time.

Comparisons Between Responding Once & More Than Once								
Respondents responding:		n	t	df	Sign	mean	SD	mean diff.
RC Index	Once	60	+ 0.06	212	0.5073	3.49	0.50	+ 0.07
	More than once	154				3.54	0.43	

Table B Comparisons of RC index between respondents responding on the surveys only once and respondents responding on the survey more than once. Independent group t-test showing no statistical significant differences, when statistical significance was defined as $p < 0.05$.

Responses for Respondents Completing RC Survey More Than Once			
	Time 1 & Time 2 n (% of completed)	Time 2 & Time 3 n (% of completed)	Time 1 & Time 3 n (% of completed)
OR nurses	14 (29)	12 (36)	11 (31)
AN nurses	7 (15)	6 (18)	9 (25)
Nurse assistants	2 (4)	1 (3)	1 (3)
Coordinating nurses	3 (6)	4 (12)	3 (8)
Surgeons	18 (38)	9 (27)	10 (28)
Anesthesiologists	3 (6)	1 (3)	2 (6)
All respondents	47 (100)	33 (100)	36 (100)

Table C Response rate for respondent who completed the RC Survey more than once.

Internal Consistency of RC Survey, Cronbach's Alpha Test				
	RC Survey Time 1	RC Survey Time 2	RC Survey Time 3	All surveys
Cronbach Alpha values, α	0.83	0.83	0.86	0.84

Table D Test for internal consistency, Cronbach's alpha values.

Structural Validity of RC Surveys Factor Analysis				
	RC Survey Time 1	RC Survey Time 2	RC Survey Time 3	All RC Surveys
Completed responses	92	74	49	215
Proportion of variance captured by:				
Factor 1	0.91	0.86	0.87	0.95
Factor 2	0.17	0.24	0.22	0.19
Factor loadings – Factor 1:				
Shared goal	0.60	0.71	0.70	0.67
Shared knowledge	0.68	0.57	0.60	0.62
Mutual respect	0.75	0.71	0.78	0.75
Accurate communication	0.75	0.82	0.79	0.78
Timely communication	0.65	0.64	0.62	0.63
Frequent communication*	0.45	0.59	0.72	0.56
Problem-solving communication	0.65	0.58	0.66	0.64
Eigenvalues:				
Factor 1	3.0	3.1	3.4	3.1
Factor 2	0.6	0,	0.9	0.6
Number of factors if eigenvalues > 1	1	1	1	1

Table E Test for structural validity in RC Surveys, factor analysis.

Comparisons of RC Index and Dimensions Between Time 1 and Time 2								
	Time	n	t	df	Sign.	mean	SD	mean diff.
RC index	1	91	÷2.02	163	0.0445*	3.47	0.48	+0.15*
	2	74				3.62	0.44	
Frequent communication	1	91	÷2.67	163	0.0084**	3.88	0.74	+0.29**
	2	74				4.17	0.63	
Timely communication	1	91	÷1.90	163	0.0588	3.18	0.73	+0.20
	2	74				3.38	0.59	
Accurate communication	1	91	÷1.62	162	0.1061	3.50	0.79	+0.19
	2	73				3.68	0.63	
Problem-solving communication	1	90	÷0.77	160	0.4387	3.29	0.73	+0.09
	2	72				3.38	0.68	
Shared goal	1	90	÷1.22	161	0.2255	3.46	0.58	+0.12
	2	72				3.58	0.64	
Shared knowledge	1	90	÷0.64	161	0.5231	3.34	0.56	+0.05
	2	73				3.39	0.52	
Mutual respect	1	90	÷0.81	161	0.4191	3.64	0.63	+0.07
	2	73				3.71	0.52	

Table F Independent groups t-test comparisons of RC index and 7 RC dimensions between Time 1 and Time 2. *$p < 0.05$, ** $p < 0.01$.

RC and RC Dimensions in Time 1, Time 2, and Time 3				
Factors		n	Mean	SD
RC index	1	91	3,47	0,48
	2	74	3.62	0,44
	3	49	3,49	0,52
Frequent communication	1	91	3,88	0,74
	2	74	4,17	0,63
	3	49	4,11	0,71
Timely communication	1	91	3,18	0,73
	2	74	3,38	0,59
	3	49	3,26	0,62
Accurate communication	1	91	3,50	0,79
	2	73	3,68	0,63
	3	49	3,63	0,72
Problem-solving communication	1	90	3,29	0,73
	2	72	3,38	0,68
	3	49	3,25	0,85
Shared goal	1	90	3,46	0,58
	2	73	3,58	0,64
	3	49	3,40	0,74
Shared knowledge	1	90	3,34	0,56
	2	73	3,39	0,52
	3	49	3,23	0,61
Mutual respect	1	90	3,64	0,63
	2	73	3,71	0,52
	3	49	3,57	0,69

Table G Comparisons of RC index and 7 RC dimensions in Time 1, Time 2, and Time 3.

Comparing RC and Dimensions Between Time 2 and Time 3								
		n	t	df	Sign	Mean	SD	Mean Diff
RC index	2	74	1,45	121	0,1502	3.62	0,44	0,13
	3	49				3,49	0,52	
Frequent communication	2	74	0,50	121	0,6148	4,17	0,63	0,06
	3	49				4,11	0,71	
Timely communication	2	74	0,30	121	0,2955	3,38	0,59	0,12
	3	49				3,27	0,62	
Accurate communication	2	73	0,44	121	0,6578	3,68	0,63	0,05
	3	49				3,27	0,62	
Problem-solving communication	2	72	0,89	121	0,3743	3,38	0,68	0,12
	3	49				3,25	0,85	
Shared Goal	2	72	1,48	121	0,1416	3,58	0,64	0,19
	3	49				3,40	0,74	
Shared knowledge	2	73	1,60	121	0,1129	3,39	0,52	0,16
	3	49				3,23	0,61	
Mutual respect	2	73	1,27	121	0,2048	3,71	0,52	0,14
	3	49				3,57	0,69	

Table H Independent Groups T-test comparisons of RC index and 7 RC dimensions in Time 2 and Time 3 with *p*-value <0.05.

Matrix RC Index Between Workgroups at Time 2				
		Rating of		
		OR nurses	AN nurses	Surgeons
Ratings by	OR nurses	4.51	3.83	3.28
	AN nurses	3.56	4.38	2.67
	Surgeons	3.83	3.65	4.08

Table I Relational coordination matrix at Time 2 (eight month after *Intervention I*).

Matrix RC Index Between Workgroups at Time 3				
Ratings by	Rating of			
		OR nurses	AN nurses	Surgeons
	OR nurses	4.35	3.64	3.30
	AN nurses	3.54	4.25	2.53
	Surgeons	3.80	3.31	4.05

Table J Relational Coordination Matrix at Time 3 (16 month *after Intervention I*) 2015 RCA.

Comparisons of RC Index and RC Dimensions Across Clinics								
Clinic		n	t	df	Sign	mean	SD	mean diff
RC	OR	133	3,54	195	0,0005*'*	3,59	0,50	0,25**
	AN	64				3,34	0,42	
Frequent communication	OR	133	2,13	195	0,0342*	4,09	0,71	0,23*
	AN	64				3,86	0,67	
Timely communication	OR	133	1,52	195	0,1291	3,29	0,69	0,15
	AN	64				3,14	3,14	
Accurate communication	OR	132	2,68	194	0,0079**	3,68	0,77	0,30**
	AN	64				3,39	0,64	
Problem-solving communication	OR	130	2,81	192	0,0053**	3,39	0,80	0,32**
	AN	64				3,08	0,60	
Shared goal	OR	131	2,48	193	0,0139*	3,54	0,66	0,24*
	AN	64				3,31	0,55	
Shared knowledge	OR	131	2,33	193	0,0210*	3,38	0,60	0,20*
	AN	64				3,19	0,46	
Mutual respect	OR	131	3,47	193	0,0006**	3,74	0,63	0,32**
	AN	64				3,42	0,55	

Table K Independent groups t-test comparisons of RC index and dimensions across clinics, with *p-value* < 0.05, ** *p-value* < 0,001.

RC Ratings Between Surgeons and OR Nurses Over Time						
	Surgeons' Scores of OR Nurses			OR Nurses' Scores of Surgeons		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
RC index	3.83	3.83	3.80	3.31	3.28	3.30
Frequent communication	4.26	4.54	4.21	3.48	3.52	4.00
Timely communication	3.97	3.87	3.79	3.14	2.96	3.27
Accurate communication	4.00	4.05	4.14	3.43	3.42	3.60
Problem-solving communication	3.42	3.41	3.57	3.19	2.92	2.87
Shared goal	3.36	3.48	3.29	3.48	3.48	3.13
Shared knowledge	3.79	3.43	3.57	3.24	3.32	3.13
Mutual respect	3.97	4.00	4.00	3.19	3.4	3.07

Table L RC ratings between surgeons and OR nurses over time.

RC Ratings Between Surgeons and AN Nurses Over Time						
	Surgeons' ratings of AN nurses			AN nurses' ratings of surgeons		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
RC index	3.40	3.65	3.31	2.72	2.67	2.53
Frequent communication	4.09	4.61	3.93	2,97	3.00	3.00
Timely communication	3.38	3.68	3.14	3.04	2.62	2.54
Accurate communication	3.53	3.77	3.79	3.13	2,92	3.00
Problem-solving communication	3.16	3.27	3,08	2.27	2.38	2.00
Shared goal	2.91	3.41	2.86	2.78	2.62	2.77
Shared knowledge	3.09	2.96	2.85	2.39	2.54	2.23
Mutual Respect	3.45	3.78	3.43	2.43	2.62	2.15

Table M RC ratings between surgeons and AN nurses over time.

Comparisons of RC Index Across Clinics and Across Professions in OR							
	n	t	df	Sign	RC index mean	SD	Mean diff
RC within clinics and within professions	194	11.49	193	0.0000**	4.30	0.52	+0.58**
RC within clinics and between professions					3.72	0.67	
RC within clinics and between professions	196	3.62	195	0.0002**	3.72	0.67	+0.22**
RC across clinic and within professions					3.50	0.70	
RC across Clinic and within professions	195	7.68	194	0.0000**	3.50	0.70	+0.46**
RC across clinics and between professions					3.04	0.78	

Table N Independent groups t-test comparisons of RC Index across clinics and across professions, with **p-value* < 0.05, ** *p-value* < 0.01.

RC Ratings of Ward Nurses at Time 1, Time 2, and Time 3					
	Ward Nurses Rated by				
	Time	OR nurses mean	AN nurses mean	SUR mean	All workgroups mean
RC Index	1	2.25	2.59	3.36	2.88
	2	2,78	2,67	3,48	3,07
	3	2.39	2.66	3.36	2,91
Frequent communication	1	2.70	3.30	4,00	3.54
	2	3,65	3,00	4,26	3,89
	3	3.18	2.82	4.15	3,57
Timely communication	1	2.00	2.65	3.03	2.67
	2	2.10	2.25	3.36	2.72
	3	1.44	2.27	3.08	2.45
Accurate communication	1	2.31	2.83	3.47	2.99
	2	2.74	2.50	3.52	3.05
	3	2.63	2.64	3.58	3.00
Problem-solving communication	1	3.08	2.58	3.18	3.03
	2	3.36	3.10	3.24	3.23
	3	3.00	2.90	2.92	3,03
Shared goal	1	2.64	2.61	3.48	3.06
	2	3.07	3.10	3.36	3.21
	3	2.50	2.60	3.43	3.00
Shared knowledge	1	1.61	1.71	2.86	2.24
	2	2.10	2.45	2.91	2.52
	3	1.33	1.67	2.77	2.20
Mutual respect	1	2.73	2,50	3.57	3.11
	2	2.83	2.90	3.68	3.26
	3	2.50	2.70	3.57	3.26

Table O RC ratings of ward nurses rated by workgroups in OR at all times.

Determining Weights for Site-Level Aggregation for Surgery Unit II at Time 1							
Work group	Workers in work-group	Workers in site	Weighting factor	Mean RC work-group	Inter-mediate score	Weighted site-level RC	Unweighted site-level RC
1	36	150	24	3.31	0.79	**3.48**	**3.48**
2	36	150	24	3.45	0.83	**3.48**	**3.48**
3	63	150	42	3.60	1.51	**3.48**	**3.48**
4	7	150	4.67	3.23	0.15	**3.48**	**3.48**
Determining Weights for Site-Level Aggregation for Surgery Unit II at Time 2							
Work group	Workers in work-group	Workers in site	Weighting factor	Mean RC for work-group	Inter-mediate score	Weighted site-level RC	Unweighted site-level RC
1	32	150	21.33	3.42	0.74	**3.64**	**3.62**
2	36	150	24	3.61	0.87	**3.64**	**3.62**
3	66	150	44	3.76	1.65	**3.64**	**3.62**
4	8	150	5.33	3.40	0.18	**3.64**	**3.62**
Determining Weights for Site-Level Aggregation for Surgery Unit II at Time 3							
Work group	Workers in work-group	Workers in site	Weighting factor	Mean RC for work-group	Inter-mediate score	Weighted site-level RC	Unweighted site-level RC
1	34	137	24.82	3.23	0.80	**3.50**	**3.49**
2	35	137	25.58	3.48	0.89	**3.50**	**3.49**
3	53	137	38.67	3.60	1.39	**3.50**	**3.49**
4	6	137	4.38	3.95	0.17	**3.50**	**3.49**

Table P Determining weights for site-level aggregation for Surgery Unit II at Time 1, Time 2, and Time 3, compared to unweighted site-level. Workgroups (more than 5 participants) included: (1) = AN nurses, (2) = OR nurses, (3) = Surgeons, (4) = Anesthesiologists.

Appendix 9

Measures and Analyses of Safety Culture

Internal Consistency of SAQ-DK Survey, Cronbach's Alpha Test			
	Time 2	Time 3	All Surveys
Cronbach Alpha values, α	0.92	0.92	0.92

Table A Test for internal consistency, Cronbach's alpha values in SAQ-DK Survey.

Inter-scale Correlation, Pearson´s Correlation Coefficient							
	1. Team climate	2. Safety climate	3. Job satisfaction	4. Stress recognition	5. Perception management	6.Working conditions	7. Without category
1. Team climate	1						
2. Safety climate	0.58**	1					
3. Job satisfaction	0.55**	0.57**	1				
4. Stress recognition	÷ 0.19*	÷ 0.28**	÷ 0.08	1			
5. Perception of management	0.34**	0.52**	0.41**	0.01	1		
6. Working conditions	0.49**	0.59**	0.57**	÷ 0.06	0.43**	1	
7. Without category	0.56**	0.60**	0.48**	÷ 0.10	0.48**	0.49**	1

Table B Inter-scale correlation of SAQ-DK tested by Pearson's correlations. *$p < 0.05$, ** $p < 0.01$.

Mean Scale Score Over Time							
	Time 2			Time 3			Mean
	n	mean	SD	n	mean	SD	diff
Teamwork climate	75	67.7	18.9	48	64.8	21.6	÷ 2.9
Safety climate	75	57.4	19.4	48	54.0	19.0	÷ 3.4
Job satisfaction	75	70.1	18.7	48	66.5	19.4	÷ 3.7
Stress recognition	76	68.7	22.9	47	72.7	27.9	+ 4.0
Perception of management	76	54.8	22.9	48	57.2	24.1	+ 2.4
Working condition	76	71.2	21.0	48	71.4	20.9	+ 0.3

Table C Mean scale scores at Time 2 and Time 3 for all respondents.

Comparisons of Mean Scale Scores in SAQ-DK Between Time 2 and Time 3								
	Time	n	t	df	Sign.	mean	SD	mean diff.
Team climate	2	31	0.69	30	0.4959	67.8	18.9	2.0
	3	31				65.8	21.8	
Safety climate	2	31	1,65	30	0,1091	54.5	19.8	3.6
	3	31				51.0	18.2	
Job satisfaction	2	31	1,97	30	0,0582	66.8	16.9	4.0
	3	31				62.7	20.0	
Stress recognition	2	32	÷1,85	31	0,0742	67.8	26.7	÷ 7.8
	3	32				75.6	25.6	
Perception of management	2	32	÷1,33	31	0,1936	48.3	24.6	÷ 6.0
	3	32				54.2	25.8	
Working conditions	2	32	1,59	31	0,1215	75.4	17.7	4.4
	3	32				69.8	20.1	

Table D Paired t-test comparisons of mean scale scores between Time 2 and Time 3.

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