Sub-acute simulation scenarios from primary care as learning opportunities in interprofessional collaboration for healthcare students

Lene Lunde

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Department of Nursing Science and
Department of General Practice
Institute for Health and Society,
Faculty of Medicine,
University of Oslo

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Abbreviations

IPC: Interprofessional collaboration

WHO: World Health Organization

IPE: Interprofessional education

Sim-IPE: Simulation-based interprofessional education

ICCAS: The Interprofessional Collaborative Competency Attainment Survey

ZPD: The zone of proximal development

UiB: The University of Bergen

UiO: The University of Oslo

SamPraks: Sammen i praksis [Together in practice]

INACSL: The International Nursing Association for Clinical Simulation and Learning

FG: Focus Group

MS: Medical student

AGN: Master's student in Advanced Geriatric Nursing

NS: Bachelor's student in Nursing

IA: Interaction Analysis

Summary

Background: More patients with chronic conditions will need health care from primary care. Interprofessional collaboration is required to meet the patients' complex needs. Interprofessional education in healthcare curricula has been found to prepare students for collaborative practice. Simulation training provides opportunities for interactive and realistic learning experiences in a safe environment and is promoted to support interprofessional education in healthcare education. Most interprofessional simulation-based experiences derive from acute-care situations, although most of healthcare professionals' collaboration will take place in common clinical situations. There are few studies reporting the use of sub-acute scenarios to develop healthcare students' competence in interprofessional collaboration.

Aims: The purpose of this study was to explore the unfolding activities in common, sub-acute simulation scenarios from primary care as learning opportunities for healthcare students to develop competence in interprofessional collaboration. The main aim was investigated through two sub-studies: 1) Translate and validate "The Interprofessional Collaborative Competency Attainment Survey" (ICCAS). 2) Explore interactions and co-creation activities that took place when the students were learning together in and through common, sub-acute primary care simulation scenarios, and to explore the students' experience in participating in Sim-IPE to develop competence in interprofessional collaboration.

Methods: For the instrument validation in sub-study 1, data was collected in a national cross-sectional study. We recruited health and social science students (n=1,440) participating in IPE courses offered at seven educational institutions. The Norwegian version of ICCAS was assessed by content (Delphi experts), response process (cognitive interviews), and internal structure (factor analysis, internal consistency, and paired t-tests). To explore the primary care simulation scenarios in sub-study 2, data was collected with two qualitative methods. We recruited medical students (n=10), master's students in advanced geriatric nursing (n=8) and bachelor's students in nursing (n=9) to participate: a total of 27 participants. Through interaction analysis of video recordings, we explored healthcare students' interactions when they participated in the scenarios. We conducted five focus group interviews with the students directly after the simulation to explore their experiences of participating in the simulation. The transcripts were analyzed using systematic text condensation. To supplement the qualitative data, the healthcare students completed the ICCAS questionnaire.

Results: In sub-study 1, we demonstrated evidence of validity for the Norwegian version of ICCAS concerning content, response process, and internal structure. Similar to prior validation studies, we found a single-factor structure in the material that suggests a strong conceptual overlap between the constructs. This supports that the Norwegian version of ICCAS can be used to measure overall change in interprofessional competence. In sub-study 2, the interaction analysis of the healthcare students' participation in simulation showed variation in how the student groups interacted to develop the shared treatment plan. The groups that actively engaged in productive interaction in a coherent interaction trajectory developed a specific treatment plan for the patient. In the focus group interviews, the themes "realism", "uncertainty", and "reflection" emerged. After participating in the simulation, the students described the scenarios as authentic and recognizable. They explained that the vague, subtle, and unspecific patient symptoms created a situation that gave opportunities for interprofessional collaboration. The students emphasized that participating in the simulation prepared them for future work and increased their confidence in contributing in interprofessional collaborations. The results from the ICCAS questionnaire indicated a self-reported positive change in the students' interprofessional competence after participating in the scenarios.

Conclusions: This study has shown that expanding simulation training to include common, sub-acute scenarios from primary care is promising for healthcare students to develop competence in interprofessional collaboration. Further, the instrument validation of ICCAS ensures that institutions offering IPE courses in Norway have access to a validated tool to assess students' self-reported competence in interprofessional collaboration.

Sammendrag

Bakgrunn: Stadig flere pasienter med kroniske tilstander vil trenge helsehjelp fra primærhelsetjenesten. Tverrfaglig samarbeid er nødvendig for å møte disse pasientenes komplekse behov. Tverrfaglige læringsopplegg i helsefaglig utdanning kan forberede studentene på tverrfaglig samarbeid i praksis. Simuleringstrening gir muligheter for interaktive og realistiske læringsopplevelser i et trygt miljø. De fleste tverrfaglige simuleringsbaserte læringsopplegg omhandler akutte situasjoner, selv om tverrfaglige samarbeid for helsepersonell oftest vil forekomme i vanlige kliniske situasjoner. Det finnes få studier som omhandler sub-akutte scenarier som læringsmuligheter for utvikling av tverrfaglig samarbeidskompetanse for helsefagstudenter.

Hensikt: Målsetningen for denne studien var å utforske vanlige, sub-akutte simuleringsscenarier fra primærhelsetjenesten som læringsmuligheter for å utvikle tverrfaglig samarbeidskompetanse for helsefagstudenter. Studien bestod av to delstudier: 1) Oversette og validere "The Interprofessional Collaborative Competency Attainment Survey" (ICCAS). 2) Utforske interaksjoner og samarbeidsprosesser som fant sted da studentene samarbeidet i vanlige, sub-akutte simuleringsscenarier fra primærhelsetjenesten, samt utforske studentenes erfaring med å delta i scenariene for å utvikle tverrfaglig samarbeidskompetanse.

Metoder: For instrumentvalideringen i delstudie 1 ble data samlet inn i en nasjonal tverrsnittsstudie. Vi rekrutterte helse og sosialfagstudenter (n=1,440) som deltok på tverrfaglige læringsopplegg ved syv utdanningsinstitusjoner. Den norske versjonen av ICCAS ble vurdert etter innhold (Delphi-eksperter), responsprosess (kognitive intervjuer) og intern struktur (faktoranalyse, intern konsistens og parvis t-test). For å utforske de tverrfaglige simuleringsscenariene i delstudie 2 ble data samlet inn med to kvalitative metoder: video-observasjon og fokusgruppeintervju. Vi rekrutterte medisinstudenter (n=10), masterstudenter i avansert geriatrisk sykepleie (n=8) og bachelorstudenter i sykepleie (n=9): totalt 27 deltakere. Gjennom interaksjonsanalyse av videoopptak utforsket vi de tverrfaglige interaksjonene som foregikk når studentene deltok i scenariene. Vi gjennomførte fem fokusgruppeintervjuer rett etter simuleringen for å utforske studentenes opplevelser av å delta i simuleringen. Transkripsjonene ble analysert ved hjelp av systematisk tekstkondensering. For å supplere de kvalitative dataene fylte studentene ut spørreskjemaet ICCAS.

Resultater: I delstudie 1 viste vi oppnådd validitet av den norske versjonen av ICCAS når det gjaldt innhold, responsprosess og intern struktur. I likhet med tidligere valideringsstudier fant vi en enkeltfaktorstruktur i materialet som antyder en sterk konseptuell overlapping mellom konstruksjonene. Dette underbygger at den norske versjonen av ICCAS kan brukes til å måle en samlet endring i tverrfaglig kompetanse. I delstudie 2 viste interaksjonsanalysen forskjeller i hvordan studentgruppene samhandlet for å utvikle en behandlingsplan for pasienten. Gruppene som klarte å skape produktive interaksjoner i et sammenhengende forløp, utviklet en spesifikk behandlingsplan for pasienten. I fokusgruppeintervjuene kom temaene "realisme", "usikkerhet" og "refleksjon" frem. Studentene beskrev scenariene som autentiske og gjenkjennelige. De forklarte at de vage og uspesifikke symptomene til pasienten skapte en situasjon som ga rom for å finne ut av problemet i fellesskap. Studentene fremhevet at deltakelsen i simuleringen forberedte dem på fremtidig arbeid og økte deres tillit til at de selv kunne bidra i tverrfaglig samarbeid. Resultatet fra ICCAS-spørreskjemaet indikerte en selvrapportert positiv endring i studentenes tverrfaglige kompetanse etter å ha deltatt i scenariene.

Konklusjon: Denne studien har vist at simuleringstrening med vanlige, sub-akutte scenarier fra primærhelsetjenesten virker lovende for å utvikle helsefagstudentenes tverrfaglige samarbeidskompetanse. Videre sikrer instrumentvalideringen av ICCAS at institusjoner som tilbyr tverrfaglige læringsopplegg i Norge har tilgang til et validert verktøy for å vurdere studentenes egenrapporterte kompetanse i tverrfaglig samarbeid.

List of publications

The following original papers are included in the dissertation.

I. Lunde L., Bærheim A., Johannessen A., Aase, I., Almendingen K., Andersen I.A., Bengtsson R., Brenna S. J., Hauksdottir N., Steinsbekk A., Rosvold E.O. (2020). Evidence of validity for the Norwegian version of the Interprofessional Collaborative Competency Attainment Survey (ICCAS) across several interprofessional training courses. *Journal of Interprofessional Care*, 35(*4*), 604-611. https://doi.org/10.1080/13561820.2020.1791806

II. Lunde L., Moen A., Jakobsen R.B., Rosvold E.O., Brænd A.M. (2021) Exploring healthcare students' interprofessional teamwork in primary care simulation scenarios: collaboration to create a shared treatment plan. *BMC Medical Education* 21(*1*), 416. https://doi.org/10.1186/s12909-021-02852-z

III. Lunde L., Moen A., Jakobsen R.B., Møller B., Rosvold E.O., Brænd A.M. (2022). "A preliminary simulation-based qualitative study of healthcare students' experiences of interprofessional primary care scenarios". *Advances in Simulation* 7(*1*), 9. https://doi.org/10.1186/s41077-022-00204-5

1 Introduction

This dissertation explores the unfolding activities in common, sub-acute simulation scenarios from primary care as learning opportunities for healthcare students to develop competence in interprofessional collaboration (IPC).

The main motivation driving this PhD-project was an interest in systematic knowledge development for IPC. Particularly, I wanted to study simulation with common clinical situations from primary care as a teaching method and explore its learning potential. Having worked for over a decade in clinical practice as a nurse, I have experienced first-hand both the benefits and the challenges of IPC.

Patients often present with complex health needs that are beyond the expertise of any single profession (1, 2). Health commissions have been recommending a team approach to healthcare for decades (3, 4). Even though reports from the World Health Organization (WHO) established the need for IPC in healthcare in the 80s, little research substantiated these recommendations for healthcare and healthcare education. Therefore, in 2010, the WHO reestablished that to meet new challenges in patient care, healthcare professionals must rely on IPC (5). At the same time, the Lancet Commission for Health Professionals (Lancet Commission) pointed out that healthcare students needed to be prepared for working in interprofessional teams. The report stated that "fragmented, outdated and static curricula" in healthcare education was a significant hindrance to the development of healthcare professionals equipped to meet new challenges in healthcare practice (6, p. 5). The reports from the WHO (5) and the Lancet Commission (6) specified that healthcare professionals must acquire the skills and experiences to work well in interprofessional teams, and that healthcare curricula should prepare students for IPC through interprofessional education (IPE) initiatives. Simulation training as an educational method is promoted to support IPE in healthcare education (7, 8). Simulation-based IPE (Sim-IPE) experiences have shown improved IPC for healthcare students in time-critical, acute-care, and often life-threatening scenarios (9, 10, 11, 12). However, most of healthcare professionals' IPC will take place in common clinical situations. In contrast to most time-critical or algorithm-based scenarios, sub-acute scenarios from primary care can provide more time to solve the problem.

1.1 Aim of the dissertation

The aim of this dissertation is to explore the unfolding activities in common sub-acute simulation scenarios from primary care as learning opportunities for healthcare students to develop IPC competence. The dissertation has two sub-studies, and the empirical data resulted in three scientific articles. Paper I is from sub-study 1 and Papers II and III are from sub-study 2.

Sub-study 1

The aim of sub-study 1 was to translate and validate the Norwegian version of The Interprofessional Collaborative Competency Attainment Survey (ICCAS).

The research aim in Paper I was:

- ✓ To assess the evidence for validity of the Norwegian version of ICCAS across several different educational courses as an instrument for measuring self-reported achieved competence in IPE.

Sub-study 2

The aims of sub-study 2 were to explore interactions and co-creations that take place when the students are learning together in and through sub-acute Sim-IPE scenarios from primary care and to explore the students' experience in participating in Sim-IPE to develop IPC competence.

The research aim in Paper II was:

- ✓ To describe healthcare students' interactions while exploring common, sub-acute patient scenarios in primary care situations and explore how healthcare students' actions influence interprofessional collaboration and treatment plan identification.

The research aim in Paper III was:

- ✓ To explore healthcare students' experiences of participating in sub-acute simulated patient scenarios. Specifically, we aimed to understand how sub-acute simulated patient scenarios from primary care could support the development of interprofessional collaborative competence.

1.2 Outline of the dissertation

The dissertation contains seven chapters. Following this chapter, Chapter 2 summarizes the background for the dissertation, specifically IPE and IPC, and simulation-based training and Sim-IPE in healthcare education and primary care. Chapter 3 elaborates the analytical perspective adopted for the dissertation. In Chapter 4, the design and methods are expanded on to provide an overview of the sub-studies. Furthermore, the main results from the three papers are summarized in Chapter 5 and discussed in Chapter 6. Finally, Chapter 7 concludes with the main contributions and recommendations for further studies.

2 Background

In this chapter, I elaborate on the background for this research as the knowledge base appeared at the start of this study to justify the rationale and clarify the research gaps this study aimed to fill. I present a literature review of perspectives on IPC and IPE in healthcare, followed by simulation-based training and Sim-IPE in healthcare education and primary care. I have chosen to base this discussion mainly on review articles for each of the perspectives, and have added original research papers where relevant review articles were unavailable.

2.1 Interprofessional collaboration and interprofessional education

Collaboration occurs in every level of an organizational structure and can take place between individuals, and between and within organizations and professions (13). The term "collaboration", at its core, constitutes collective action to provide a common goal (14). IPC in healthcare has been defined as a "partnership between a team of health providers and a client in a participatory collaborative and coordinated approach to shared decision-making around health and social issues" (15, p. 11). The term "interprofessional" involves negotiation and interaction between professionals, where their different and often complementary expertise and contributions are brought forward to enhance the quality of care (16). Working "collaboratively" implies mutual respect for one another and one another's professions and willingness to participate in interdependent tasks (17).

According to the WHO, a collaborative practice occurs "when multiple health workers from different professional backgrounds provide comprehensive services by working together with patients, their families, caregivers and communities to deliver the highest quality of care across settings" (5, p. 13). Healthcare education should provide students with the training required to join the collaborative workforce. IPE is the curriculum approach to develop healthcare students' interprofessional collaborative competence for future interprofessional teams (18). IPE in healthcare can be defined as “occasions when members (or students) of two or more professions learn with, from and about each other to improve collaboration and the quality of care” (19, p. 736). The purpose of IPE in healthcare education is for students to understand their roles and responsibilities, the roles of other healthcare professions, and improve communication and teamwork competence to prepare them for future practice (20). The definition of IPE further highlights that this only occurs when students are presented with interactive opportunities to learn in collaboration with each other (19, 20). In this dissertation, the abovementioned definitions support my understanding of IPC and IPE.

2.1.1 IPE research in healthcare education

The research evidence for IPE has evolved significantly and provided more insight in this field of education. Several review articles called attention to enablers and barriers of IPE that could affect the creation or continuation of IPE programs. The early IPE initiatives had often been isolated, short-lived, and initiated by IPE supporters (19, 21). IPE supporters were considered important enablers of IPE because they actively advocate and promote IPE for colleagues, faculty and leaders, which may lead to organizational support and financing to integrate IPE into the curricula (19, 22, 23, 24). Organizational or institutional funding and support could become a barrier if there was internal resistance (23). It was found demanding to arrange for IPE courses across profession-specific teaching and schedules, especially managing to find joint time to add IPE to the curricula. Moreover, actual capacity in the educational facilities and available teacher resources could inhibit opportunities for IPE. Students' willingness to participate emerged as both an enabler and a barrier; notably, reluctance towards IPE was found if it came into conflict with profession-specific learning (19, 22, 23, 25). It seems to be a complex task for educators in different healthcare educations to arrange for joint IPE initiatives. Understanding the barriers and enablers appears to be an important step in IPE implementation.

Reeves and colleagues, renowned experts in the field of IPE and IPC, have prepared Cochrane reviews on the effect of IPE. These reviews compared IPE-based interventions' effectiveness to either profession-specific interventions or no interventions for post-graduate healthcare professionals (26, 27). In their Cochrane review published in 2013, they found 15 effect studies. Positive outcomes after IPE interventions were indicated in seven studies in the areas of diabetes care, emergency care, operating room care, domestic violence care, and mental health care. Four of the studies reported mixed outcomes and four studies reported no impact on either professional practice or patient care after the IPE interventions (26). In the Cochrane review from 2017, they found nine randomized trials (27). Interprofessional activities led by a facilitator and interprofessional meetings were found to slightly enhance healthcare professionals' adherence to recommended practices (27). None of the papers in the reviews presented sufficient evidence to come to conclusions on the effects of IPE interventions, partly due to the small number of studies and the heterogeneity of interventions and outcome measures (26, 27). The results from these Cochrane reviews reflect the challenges of defining and evaluating IPE. Already in 2010, Reeves and colleagues noted in a synthesis of systematic reviews that "in the field of IPE, usual practice does not involve control groups receiving a separate educational intervention" (28, p. 232). By focusing exclusively on randomized trials and similar effect studies, a large proportion of studies were excluded. Using a variety of research methods could further develop the evidence base of IPE (28).

Although the IPE content, duration, and professional participation varied and captured a range of different outcomes, several review articles found changes in attitudes and perceptions of IPE. IPE initiatives were well received by a variety of different health profession learners, albeit mostly from medicine and nursing (22, 28, 29). In addition, student perceptions and the attitudes of other health profession students were positively changed after IPE (27, 30, 31). Improvements were reported in attitudes, knowledge, and skills in collaboration for the healthcare students (22). Moreover, active participation in the IPE activity led to more satisfaction and improvement of the perceptions of other professions (25). Long-term effects of IPE and its effect on changes in attitudes, organizational practices and benefits for patients should be researched further (22, 27, 31).

Some review articles have explicitly highlighted that a major challenge for IPE studies was to identify outcome measures that can document the effect of IPE (16, 26, 27). The IPE interventions were described as complex, multifaceted interventions with elements that are independent but also intertwined (26, 32). For example, the IPE activity could be affected by the backgrounds of learners, the format of the IPE course and the healthcare curriculum, the abilities of the facilitators, and the organizational context in which IPE is delivered (16). This had led to variation in content and focus in the different IPE programs and variability in methodology and the measures/scales used to evaluate the IPE interventions (26, 32, 33). Such variations make comparison difficult across studies. Even though there exists a myriad of different measurement instruments to measure collaboration, many of them are not validated or context-specific (34). Therefore, it remains uncertain how well the measurement instruments examine the different issues of collaborative practice and whether they could be used for different healthcare groups and settings (32).

There is little consensus on how best to measure interprofessional practice that takes into account the interconnectedness of the context, the learners, the curricula and facilitators, and the barriers for implementation (32). Most studies were found to measure attitudes and perceptions with little emphasis on teamwork, skills, and behaviors (31). Greater consistency in reporting IPE activities has been proposed to increase comparability and replicability and provide a stronger theoretical basis for future IPE implementation (33, 35). Conducting qualitative as well as quantitative research was recommended to further understand the comprehensiveness of IPE (28, 29, 34).

2.2 Simulation-based training

Simulation-based training is an interactive teaching and learning method where the students are placed in realistic clinical situations in a safe environment (36). This educational approach can support IPE as it provides an opportunity for groups of learners from different healthcare professions and educational programs to share knowledge and perform activities together (7, 8).

The field of simulation in healthcare has largely derived from non-medical industries such as the military, nuclear power production, and aviation to teach communication and teamwork skills in critical situations (36, 37). Still, simulation-based training has a long history in healthcare disciplines, starting in the early 1900s training nurses to dress, turn and transfer patients, and practice injections (37). In 1960, the development of the first medical simulators, Rescue Annie from Laerdal Medical, provided the opportunity for mouth-to-mouth ventilation and compression training. Continuous development has led to highly realistic and sophisticated patient simulators for education and training in the healthcare system (37). The use of simulation-based learning is recognized as a facilitator for active learning to develop clinical and collaborative skills and competence in a safe environment in healthcare and healthcare education (36, 38, 39).

According to Gaba (36) simulation is a technique intended to substitute and augment real world experiences with interactive experiences replicating carefully selected aspects of a realistic clinical scenario. The simulation setting can comprise a variety of activities and modalities and the choice of modality depends on the purpose and expected outcome of a simulation experience (40). Table 1 describes different simulation modalities (40).

Table 1: Description of simulation modalities and activities

Modality	Activity
Computer-based simulation	Interaction through the screen-based interface of a computer to train for patient encounters and/or procedures.
Procedural and skills training simulation	Training on procedures and specific skills.
Situated clinical immersion	Training in a real (in-situ) or simulated environment (e.g., simulation center) that represents actual clinical cases or work environment.
Hybrid simulation	A combination of several modalities.
Simulated patient	An actor, patient, virtual patient, or a patient simulator plays the role of the patient. Used to replicate encounters with real patients.

The choice of modality depends on the intended learning outcome. For example, if learning outcome is the training of technical skills needed in the specific profession, (37) the modality choice could be "procedural and skills training simulation". If the learning outcome is to transfer the knowledge of skills into realistic practice settings or to train non-technical skills such as teamwork, communication, problem-solving, and decision-making (41), "situated clinical immersion" with or without a "simulated patient" could be the modalities to use.

2.2.1 Simulation-based medical education research

In recent years, the volume of research on simulation-based medical education has grown substantially. Several reviews have focused on clarifying the design features or best practices for the development of simulation that would lead to effective learning (36, 39, 42, 43, 44). These best practices for simulation development included providing immediate feedback, deliberate practice (e.g., defined learning objectives, appropriate level of difficulty, and repetitive practice), integration into the curriculum, providing outcome measurement and testing, and the evaluation of simulation fidelity/realism (e.g., difficulty and/or complexity). In addition, the best practices focused on the development of skill acquisition and maintenance, transfer to practice, team training, and instructor training. Last, defining the proper amount of realism to enhance the relevance for practice should be prioritized (36, 39, 42, 43, 44).

Several systematic reviews have compared the use of simulation to other interventions or no interventions in healthcare and healthcare education. A review demonstrated significant improvements in knowledge, skills, and attitudes when using virtual patient simulation for professionals and students in medicine, nursing, and other healthcare professions (45). Another showed enhanced knowledge, skills, and attitudes for nursing students after participating in technology-enhanced simulation with patient simulators (46). Both reviews compared the participants with groups without intervention or traditional education. Using technology-enhanced simulation compared to other instructional modalities also improved knowledge, skills, and attitudes for practicing and student physicians, nurses, dentists, and other health care professionals (47, 48).

Other review articles have explored different simulation educational approaches. For example, in-situ simulation, that is, training in a real-life environment, showed promise as a method for providing opportunities for systematic skill training (49, 50). Simulation in undergraduate nurse education and medical education led to knowledge acquisition and improved technical and procedural skills (38, 51, 52). Reviews have also found that nursing and medical students and physicians in continuing education increased their confidence and reported higher satisfaction when participating in simulation (50, 51, 52). The simulation experiences led to skills and knowledge acquisition. However, simulation sessions could also lead to enhanced stress levels and anxiety for the healthcare students (51). The level of difficulty was proposed to match with the participants' level of experience to reduce stress and maximize learning opportunities (42, 43). Overall, students and professionals in healthcare seemed to value simulation as a teaching and learning technique (50, 51, 52). In summary, the reviews show that simulation-based learning seems promising to help learners in undergraduate and post-graduate settings to achieve and sustain clinical skills and competences.

As with the reviews on IPE (Chapter 2.1.1), varying methodology, content, and the use of measurement scales in the simulation studies made comparison difficult (46, 51, 52, 53). Although there was an increase in simulation evaluation instruments, most of these instruments focused on cognitive learning and fewer measured how simulation affects patient outcomes (54). Moreover, many studies used non-validated assessment tools (52). The lack of consensus on how to assess or measure learning promoted future studies using validated assessment tools (52). Before applying an evaluation instrument, the user should consider whether the instruments are valid and reliable for the intended population and activity (54).

2.3 Simulation-based IPE

Sim-IPE is where simulation and IPE overlap and provides a collaborative approach for the development of IPC for participants from different professions (55). The use of Sim-IPE is relatively new in healthcare education, but has grown in recent years. Reported enablers and barriers for Sim-IPE were found to be similar to the IPE initiatives without simulation found in Chapter 2.1.1 and best practices for simulation in Chapter 2.2.1. In short, debriefing and repetitive practice in a safe environment enhanced the learning experience, while the coordination of schedules, costs and different learning perspectives were among the barriers towards IPE (56).

Examination of the review articles showed that the settings for Sim-IPE were primarily from specialist and acute-care. Review articles demonstrated an increase in non-technical skills, such as teamwork, communication, and leadership for multi-professional trauma teams after simulation training (57) and improved teamwork in resuscitation teams and the management of acutely unstable patients (58, 59). Sim-IPE supported the development of communication competence in palliative and end-of-life care (60). These review articles supported the importance of training non-technical skills such as teamwork and interpersonal skills. A majority of the Sim-IPE studies found in the review articles were with teams composed of medical and nursing students or professionals, followed by teams that also included physical therapy and pharmacy students/professionals (7, 8, 56, 58, 59, 61).

Healthcare students reported high satisfaction with Sim-IPE and demonstrated improved knowledge and skills in IPC after participation in Sim-IPE (7, 8, 59, 61). Sim-IPE was also found to be a valuable tool for teaching, rehearsing, and analyzing the interprofessional communication, teamwork, and leadership for healthcare professionals (58). The review articles demonstrated a general agreement that Sim-IPE was a beneficial teaching method for healthcare students at the undergraduate and post-graduate level to learn IPC and the non-technical skills necessary for IPC (7, 8, 58, 59, 61). There was no consensus regarding the most appropriate time to introduce Sim-IPE in undergraduate curricula (7, 61).

As with the research regarding IPE and simulation (Chapters 2.1.1 and 2.2.1), the findings from Sim-IPE review articles also demonstrated varying methodology in study design and evaluation methods (8, 59, 60, 62). Studies in Sim-IPE should use published guidelines on reporting items and validated measurement instruments to ensure comparability (8, 59) and increase the use of a theoretical or conceptual framework (8). Most of the measurement scales were developed for acute-care situations and few were found to assess undergraduate teamwork objectively (61). Several of the reviews highlighted that there was a dearth of studies regarding primary care Sim-IPE, demonstrating a knowledge gap (8, 60, 62).

2.3.1 Sim-IPE in primary care

When reviewing the literature of Sim-IPE from primary care, few review articles regarding IPC in primary care were found. Only one review regarding IPE in primary care for healthcare students was found and none regarding Sim-IPE.

The findings from review articles on IPC in primary care showed that organizational support was vital for successful teamwork in primary care practice (63). Setting clear goals, having regular team meetings, and audits appeared to foster effective teamwork. However, these areas could also become barriers towards teamwork if, for example, the communication revealed tension or conflict instead of aiming to enhance collaboration (63). Economic factors played a vital role for IPC in primary care, as found in previous chapters (2.1.1, 2.2.1 and 2.3), especially regarding availability of funding or compensation across professions (1). Other barriers found towards IPC in primary care were lack of staff training and work overload (64, 65). Having clear structures of legal responsibilities and defined regulations promoted IPC. The degree of management support, the availability of different professions, and the presence of guidelines for structuring the collaboration were also described as enablers, depending on whether they were present or not (1). Healthcare professionals experienced the benefits of IPC and teamwork to be, for example, improvement in relationships, the continuity of patient care, and time saved. Successful IPC was found to rely on opportunities for frequent, transparent, and shared communication (65, 66).

One systematic review explored the student learning and patient outcomes associated with IPE in outpatient, primary care clinics (67). Most of the studies included in the review investigated student volunteers from medicine, nursing, and allied health professions working in interprofessional clinics. Improved teamwork, knowledge of roles, and enhanced confidence were found, as well as increased competence in IPC (67).

Although the body of review articles on Sim-IPE was limited, some primary studies reported on simulation training from primary care. Several studies were from different home care settings. After a home visit simulation to a patient with chronic illness and multiple medications, senior nursing students reported enhanced confidence with regard to entering into a patient's home and assessing and determining health problems (68). Likewise, participating in a simulated home visit provided some evidence that nursing students' stress decreased after the simulation experience (69). Further, senior community health nursing students were satisfied with the home care simulation experience and reported increased confidence in providing home care (70). In a study where nursing students were randomly assigned to home care simulation or classroom teaching regarding medication management, both groups reported enhanced knowledge about medication, but only the students participating in the simulation reported a significant increase in self-confidence (71). In simulated patient consultations where master's students in nursing science practiced a systematic approach to patient assessment and planning, the simulation was well received by the students (72). End-of-life simulations in nursing education led to increased familiarity with death and dying (73), enhanced the nursing students' communication skills, and provided greater understanding of the pathophysiology at the end of life (74).

In a Sim-IPE study involving nurse practitioner/midwifery, dental, and medical students, the students participated in a scenario focusing on patients with chronic disease in primary care (75). The students reported improved interprofessional competence after participating in the Sim-IPE (75). In another Sim-IPE discharge planning experience for students in physical therapy, nursing, and social work, most of the students reported improved clinical thinking skills and an improved ability to prioritize the patient’s problems (76). Further, the students also reported enhanced confidence in discharge planning (76).

Implications for this study

The review of reviews and primary studies have revealed that Sim-IPE offer learning opportunities to promote effective collaborative practice. Research has also identified several barriers to IPE and/or Sim-IPE, such as profession-specific teaching, schedules, actual capacity, teacher resources, and economy (19, 22, 23, 24, 25, 56). There is also lack of agreement on how IPC competence should be assessed (77). Using validated assessment tools is one way to assess students’ IPC competence. Most of the available assessment tools are developed for one specific context, predominately acute-care settings (34, 61, 78). The Interprofessional Collaborative Competency Attainment Survey (ICCAS) is a self-reported assessment tool validated for several IPE settings in health and social care (79, 80, 81). The ICCAS was, for example, used as an assessment tool in the two Sim-IPE studies from primary care (75, 76) found in Chapter 2.3.1.

Most of the review articles and studies regarding simulation and Sim-IPE were from acute-care, which supports a need for research related to the use of primary care Sim-IPE to develop healthcare students’ IPC competence (8, 60, 62). Healthcare students need to learn adequate response to severe, acute-care situations as professional practitioners and as team members. However, most of their IPC will take place in everyday clinical situations where the patients have less acute, life-threatening diseases. Common clinical situations could provide students with practice in recognizing problems at an early stage (82). There lies a potential for healthcare students to achieve profession-specific and IPC competence from primary care scenarios, and prepare them for the future work and common clinical situations they would often encounter (83).

3 Analytical approach

In this dissertation, I sought perspectives to better understand IPC and learning within the context of simulation. As described in Chapter 2.1, the definitions of the terms "interprofessional" and "collaboratively" highlight interaction and negotiation between professionals in a mutually respectful atmosphere where the participants are willing to work together to enhance the quality of care (16, 17). Moreover, the definition of IPE emphasizing "about, from and with," as the foundation for learning further points out that learning in this context only occurs in interaction and collaboration with others (20). Thus, I sought approaches to explore the actions and learning of IPE as fundamentally socially constructed where learning and development are mutually dependent on social and individual processes. This is in essence why the socio-cultural perspective comes as a useful analytical approach for this dissertation.

Simulation is considered a pedagogical approach where interactive experiences replicate aspects of the real world in a safe environment (36). Simulation can provide students with learning opportunities and environments that promote active participation and interaction. Thus, simulation activity can be studied as a social practice where learning is constructed in interaction between the participants, the tasks, the context, and the equipment (84, 85, 86). Based on these considerations, the socio-cultural perspective was found to be a suitable perspective to understand IPC and learning within the context of simulation. In this chapter, I present the chosen analytic perspective for how learning and knowledge exchange can be understood in this study.

3.1 A socio-cultural perspective on learning

The socio-cultural perspective of learning is rooted in Vygotsky's developmental psychology work where knowledge is connected to the actual situation in which it is developed, making learning an integrated part of human activities (87). According to the socio-cultural perspective, knowledge is constructed in a social practice where the participants interact with each other, with artefacts such as tools and objects and with the environment (85, 86). Thus, learning is viewed as a result of participation in purposeful activities through productive interactions and collaboration with others in a cultural context (88). This aligns directly with the definitions that guide my conceptualization of IPC and IPE (Chapter 2.1).

Mediation and situated learning

The socio-cultural perspective refers to learning and understanding as situated in a physical, cultural and historical space (85, 86). The physical space typically contains the objects and tools, while the cultural is influenced by, for example, traditions, education, rules and peers. Last, the historical space takes into account that knowledge is contextualized and connected to the individual's experience, knowledge and collective expectations (86).

In a simulation session, the participants are individuals who bring their own way of thinking that have emerged out of their participation in activities in physical, cultural, and historical space (86). The students navigate these spaces by using the tools and resources integrated in their social practices over years. Language, tools, artefacts, and objects are the mediational means from the physical space on which we base our understanding of the world (85, 86). The healthcare curricula contains various meditating artefacts such as activities in the class room (tasks), the professional literature, the teachers' interactions with the students, and through supervisors in practice (89). Mediation is inextricably linked to the students' cultural and historical space and is fundamental to understand how knowledge and values ingrained in education and practice are acquired (86).

The participants in a simulation session represent their own expert cultures where knowledge, experience and responsibility are anchored in the profession, with clear subject-specific ways of sharing knowledge or finding solutions to specific problems (90). Moreover, the health care professions are characterized by autonomy as well as a monopoly on, for example, assessments and evaluations. It is during their education that the students develop their professional integrity that is comprised of the ethical values that encompass the conduct of their professional roles in practice (91). It also consists of autonomy, identity, and integration, which require participants, whether they are students or professionals, to be reflective to integrate their personal norms and values with that of their profession (91, 92).

Each healthcare education conveys its own professional language and its own historical development. Thus, that means that the students are shaped by the culture of the profession within which they are educated. When developing a learning activity such as a simulation session, it is important to take into account that the students' existing professional identity and integrity, and the formation of them, influence the communicative and collaborative interactions within the simulation. Disruption in relation to knowledge monopolies or to the individual's decision-making and ability to work outside the usual professional boundaries can put pressure on their professional identities (93).

The zone of proximal development

In the discussion of mediated learning, Vygotsky (87) described a developmental process taking place in the "zone of proximal development" (ZPD). More specifically, the ZPD is defined as the difference between what one is capable of doing independently, and what one can achieve in interplay with others in a cultural context (87, 94). Within this zone, learning occurs when the learners' capabilities are stretched and leads to new forms of development (94). A common, but narrow, interpretation of the ZPD defines it as interactions where a less competent person becomes more competent in a specific task in collaboration with a more competent person. The ZPD is not solely about the enhancement of skills related to any particular task, but refers to the steps needed to expand to the next developmental stage of their capability (94). Although Vygotsky's (87) ideas were specifically aimed at child development, the concept of ZPD has been applied to educational settings in healthcare such as surgical education and nursing education (95, 96, 97). Figure 1 illustrates the development of ZPD situated within the physical, cultural and historical space.

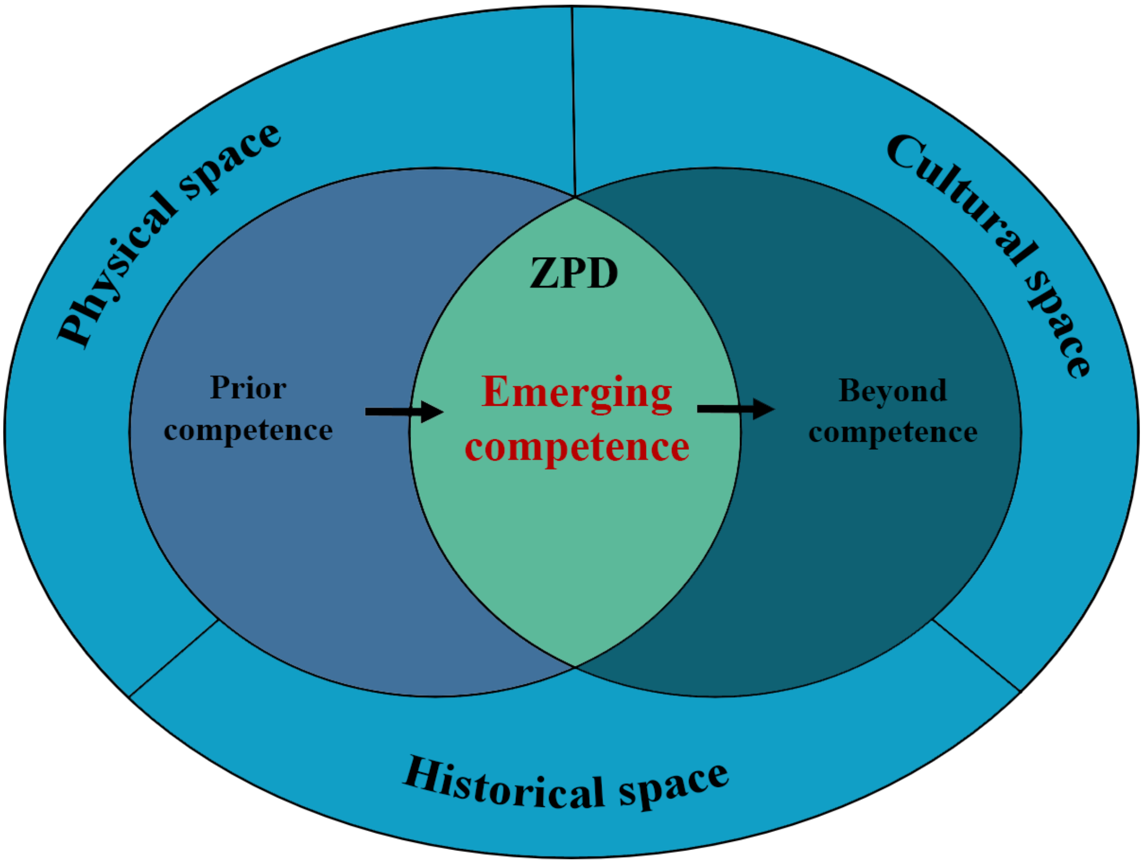

Figure 1: *The zone of proximal development*

The ZPD can be seen as a developmental space for healthcare students when collaborating with other healthcare students through social interaction, such as in Sim-IPE. Within this developmental space learning occurs if the learning situation manages to stretch the students' capabilities towards the edge of their ZPD, without pushing them too far (87). The simulation sessions could provide learning opportunities for the student in IPC where the issue/problem at hand challenge and push them to evolve, develop, and stretch their ZPD.

We complement the concept of ZPD with the following constructs: shared knowledge objects, productive interactions, active participation, and interaction trajectories (88). *The shared knowledge objects* are the materialization and co-creation of knowledge that represented the outcome/goal to be achieved through the activity (88). The development of a treatment plan is a core object in healthcare, and essential for the efficient collaboration of patient care and, thus, an important part of IPC. We viewed the treatment plan as a representation of a shared knowledge object to be co-created in the interactions and the communicative exchanges between the students during the simulation. Thus, the shared treatment plans were the shared outcome of the simulation activity.

To co-construct shared knowledge, represented as the treatment plan in this study, requires productive and goal-oriented interactions. *The productive interactions* are understood as collaborative verbal and non-verbal interactions that lead to co-construction, refinement, and elaboration of the knowledge objects (88, 98). Examples of productive interactions are deliberate activities, such as sharing profession-specific knowledge and contributing with elaboration on each other's statements in an effort to clarify and translate the joint knowledge into specific concepts (88). Further, being attentive towards each other through gaze and body language can contribute to encouraging participation to mobilize mutual knowledge. A joint effort from all the students is required for the interactions to be productive; this highlights that productive interactions are intertwined with active participation.

Active participation is described as a key feature of the co-construction process where the participants contribute to the shared knowledge in a deliberate effort (88). This does not simply refer to individual students providing their profession-specific knowledge and perspectives to the group, but calls for the development of shared knowledge through discussions, negotiations and mutual feedback (88). Parallel to the definition of IPC, which highlights interaction and negotiation between professionals and/or students in a mutual respectful atmosphere (16, 17), active participation can be seen as a core component of IPC. Looking at how actively the students participated in the groups provided the opportunity to explore the students' current and emerging IPC competence.

Interaction trajectories illustrate how interactions unfold over time and whether they are productive for knowledge development (88). The interaction trajectories are based on a timescale perspective and were viewed as sequences of productive interactions that unfolded as moment-to-moment events over time (88, 99). This created possibilities for discovering how the students' interactions were built and evolved over time and how they took advantage of one another's contributions. These constructs underline learning as a goal-oriented, mediated process where knowledge is actively constructed through productive interaction (88).

The socio-cultural approaches highlight that learning and development are mutually dependent on both social and individual processes. Students' prior knowledge and capabilities influence their interactions within their socio-cultural context and are anchored in their profession and the development of their professional integrity. When facing a challenge or potential conflict with their current frame of reference, the students have the opportunity to use each other or the facilitator to problem-solve in collaboration (100). Consequently, ZPD is intertwined with the students' ability to take advantage of resources in their environment (94).

4 Design and methods

In this chapter, I present the study design and methods with the setting, recruitment, characteristics of the participants, data collection methods, and analysis separately for the two sub-studies. Finally, I present ethical considerations in relation to my study.

4.1 Design

We employed an explorative design. The gap in research on primary care Sim-IPE as learning opportunities for healthcare students to develop IPC competence supported the use of an exploratory design (101).

The dissertation is comprised of two sub-studies, and draws on empirical data from two different methodological approaches and samples. Table 2 provides an overview of the sub-studies which comprise this dissertation.

Table 2: Overview of sub-studies

Sub-study	Aim	Design	Participants	Data collection	Analysis
1	Validate the Norwegian version of ICCAS (Paper I)	Quantitative	1,440 health and social science students 7 institutions 18 professions	Self-reported questionnaire	Content, response process, internal structure, and consequence
2	Explore IPC in sub-acute scenarios (Paper II) Explore experiences of participating in Sim-IPE from primary care (Paper III)	Qualitative	27 healthcare students 3 institutions 3 educations	Video recordings of simulation scenarios FG interviews	Interaction analysis Systematic text condensation

In sub-study 1, we used quantitative methods to validate the self-reported ICCAS questionnaire (Paper I). Data was collected in a national cross-sectional study where health and social science students from educational institutions offering IPE courses in Norway were recruited. We used a quantitative framework for assessing validity of the translated version (102, 103). More details are reported in Chapter 4.2.

In sub-study 2, we used qualitative methods. Data was collected from healthcare students recruited to participate in the primary care Sim-IPE. We explored the healthcare students' interprofessional interactions during the Sim-IPE with interaction analysis of video recordings (Paper II). We explored the healthcare students' experiences of participating in these scenarios through systematic text condensation of the focus group (FG) interviews conducted right after the simulation (Paper III). Elaborations are found in Chapter 4.3.

4.2 Sub-study 1: The ICCAS instrument validation

This sub-study (Paper I) consists of the instrument validation of the "Interprofessional Collaborative Competency Attainment Survey" (ICCAS). The goal was to prepare a well-established assessment instrument available for common use in Norway. In this chapter, I present the setting of the sub-study, the ICCAS questionnaire, and the translation procedure. Further, I describe the recruitment process and participants before outlining the data collection methods and data analysis.

4.2.1 Setting, sample, and data collection

Setting

National educational policies in Norway require IPC to be a central part of healthcare education (104, 105, 106). This has led to the development of national learning objectives to increase students' knowledge of and competence in IPC (107, 108). Norwegian institutions must choose educational strategies and assessment methods that ensure that the anticipated, final IPC competence is achieved.

The validation of ICCAS was organized as a national research collaboration between seven academic institutions in Norway responsible for training health and social science students in IPC: The University of Bergen (UiB), the Western Norway University of Applied Sciences (HVL), the University of Stavanger (UiS), Oslo Metropolitan University (OsloMet), the University of Oslo (UiO), the Norwegian University of Science and Technology (NTNU), and the Arctic University of Norway (UiT).

The ICCAS questionnaire

ICCAS is a self-assessment tool validated for use in a variety of IPE settings (79, 80, 81). The development of ICCAS was based on the National Interprofessional Competency Framework from Canada (15). This framework defines six domains that comprise the core competences in IPE: a) role clarification, b) team functioning, c) IPC, d) patient/client/family/community centered care, e) interprofessional conflict resolution, and f) collaborative leadership. ICCAS consists of 20 retrospective pre- and post-questions based on the aforementioned domains. The participants are asked to self-assess their change in level of competence after completing an IPE intervention (79). ICCAS has been used as an assessment instrument in several settings in recent years, including chronic disease scenarios from primary care (75) and discharge planning scenarios (76). See Paper I for more examples.

Translation and Delphi process

The Centre for Interdisciplinary Work-Place Learning (TVEPS) at UiB organized the first translation with independent back-translation using translators with the required language, culture, and professional competence (109). The translation was based on the English ICCAS version by Schmitz et al. (80).

After the initial translation, representatives from all seven institutions offering IPE courses, including myself, participated in a Delphi process (109, 110). As recommended in the literature, we aimed to develop a Norwegian version that was conceptually similar to the original and easy to understand and answer for the students who participated in the IPE courses (109, 111). Therefore, we chose to focus on semantic equality where a similar meaning of each element in the original and translated version is sought, without the versions necessarily being linguistically identical (112).

Over a period of six months, we met regularly through video meetings to discuss, incorporate, and agree upon proposed amendments. For example, we discussed the wording of the responses suggested by Schmitz et al. (80) for the 5-point Likert-type scale compared to the wording of the questions in the Norwegian version. We did not retain the wording from Schmitz et al. (80): 1=poor, 2=fair, 3=good, 4=very good, 5=excellent. The original wording from Archibald et al. (79), 1=strongly disagree, 2=slightly disagree, 3=neutral, 4= slightly agree, 5=strongly agree, was more adequate when translated to Norwegian since we asked the students to rate their agreement.

Next, we organized cognitive interviews with two medical students from UiB where they provided verbal descriptions of their thought processes as they filled out the Norwegian version. The oral feedback was conducted separately for the students and aimed to assess whether the students understood the questionnaire and the response format (102, 103). Lastly, the Delphi panel agreed upon a final version (Appendix 1).

Sample: Recruitment and participants

We recruited students from the IPE courses offered at the seven institutions to obtain a variety of professions and courses. The courses varied in duration and covered several types of applied pedagogy and settings. Each institution recruited participants from their IPE course. I recruited students from the IPE course "Sammen i Praksis [Together in practice]" (SamPraks) at UiO (113).

The total sample of participants consisted of 1,440 health and social science students. Details of age and sex are found in Table 3. Details of location, professional program, and academic year are presented in Paper 1.

Table 3: Characteristics of respondents

Age	Total N= 1,440
Mean (SD)	24.50 (5.32)
Median	23
Min-max	18–50
Sex	Total N (%)
Male	275 (19.1)
Female	1165 (80.9)

Data collection

Data collection took place from September 2018 to January 2019 in a cross-sectional study. The ICCAS questionnaire was developed in SurveyXact® as a web-based survey (114). The educators responsible for the IPE courses provided the students with a link to the web-based survey directly after completing the course. Figure 2 shows an overview of the overall recruitment flow.

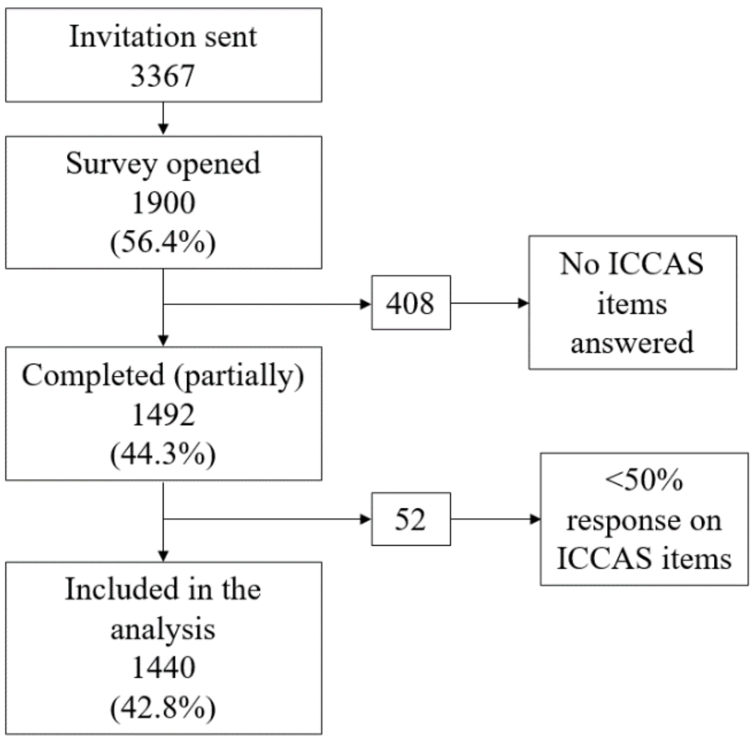

Figure 2: *Flow chart of the recruitment*

4.2.2 Data analysis

Although ICCAS had previously been validated for a variety of settings, there is no guarantee of validity after translation and cultural modification. Thus, the translated Norwegian version of ICCAS had to be validated to examine whether it measured what it was said to measure for the intended purpose (115). Evidence of the validity was assessed through content, response process, internal structure, and consequence; see Table 4 for further description (102, 103).

Table 4: Summary of sources of validity evidence

Sources of validity evidence	**Questions related to source of evidence**	**Assessment method**
Content	Does the content reflect the construct it is intended to measure?	Delphi experts - content experts
Response process	Do the responses align with the intended construct? The relationship between the intended construct and the thought processes of subjects or observers	Cognitive interviews - rater's verbal description of thought process while rating
Internal structure	Is the test score reliable? Acceptable reliability and factor structure?	Exploratory factor analysis - Principal Axis Factoring (PAF) - Parallel Analysis Internal consistency - McDonalds's omega coefficient - Item-total correlation Paired t-test - Standardized effect size with Cohen *d*
Consequence	What is the impact of the Norwegian version– consequence of the assessment score/anticipated impact (positive, negative, neutral) on students	Discussion based on findings

Evidence for the content and response process validity was assessed in the translation process described in Chapter 4.2.1. The evidence for internal structure validity was evaluated by exploratory factor analysis, internal consistency, and paired t-test (102, 103). The SurveyXact® file of student responses was converted for statistical analysis to SPSS (Statistical Package for Social Science) 26 (116) and R (117).

Internal structure

Exploratory Factor Analysis (EFA) using Principal Axis Factoring (PAF) with an oblique oblimin rotation was used to attain the best-fitting structure and number of factors (118). PAF was chosen because it makes no assumption regarding the distribution of the variables (118) and was conducted separately on both pre- and post-scores. Furthermore, oblique rotation could provide a more accurate representation of how the constructs were likely to correlate. Oblique rotation also produced estimates of the correlations among factors, which was useful when interpreting the conceptual nature of the factors (119).

By inspecting the correlation matrix for coefficients of .3 and above, we assessed the suitability of the data for factor analysis (118). The Kaiser-Meyer-Olkin (KMO) test was used to test the sampling adequacy, where values above .7 justified good sampling adequacy (120). To further support the factorability of the correlation matrix, Bartlett's test of sphericity had to reach statistical significance (118). We did a Parallel Analysis to further assess the number of factors to retain. In a Parallel Analysis, only factors where the eigenvalues are larger than the corresponding eigenvalues from a random data set of the same size are suggested for retention (121).

We assessed *internal consistency* by using McDonald's omega coefficient and item-total correlation. We chose McDonald's omega coefficient instead of the more commonly used Cronbach's alpha since McDonald's omega has less risk of overestimating or underestimating reliability (122). The internal consistency should be greater than or equal to .7 if the different items on the scale measure the same concept. Additionally, all items should correlate with the total score ($r \geq .30$) on a reliable scale (118, 123).

We used *paired t-test* on pre-and post-scores for each item to evaluate the Norwegian version's ability to detect changes in perceived IPC competence (118).The differences in pre- and post-scores were assessed to determine the impact of the change in perceived interprofessional competence in terms of standardized effect sizes, based on Cohen *d* calculations and 95% confidence limits. “Large” differences were interpreted as those over .80, “moderate” differences between .79–.50, and “small” differences between .2–.49 (124).

4.3 Sub-study 2: The primary care Sim-IPE

This sub-study was directly related to the primary care Sim-IPE sessions. We explored the healthcare students’ unfolding actions, collaborations, and interactions during the simulation session (Paper II) and elicited their experience in participating in Sim-IPE to develop IPC competence (Paper III).

In this chapter, I first describe the development of the simulation scenarios with the subsequent pilot test. Then, I report on the settings, recruitment process, and participants for this sub-study. Last, I present the data collection methods and data analysis.

4.3.1 The steps in simulation—planning and development

The International Nursing Association for Clinical Simulation and Learning (INACSL) Healthcare Simulation Standards of Best Practices guided our planning, development and execution of the Sim-IPE (Table 5). The Standards of Best Practices contains specific criteria for design, development, and conduction of simulation to achieve the expected outcomes (125) and is in line with the best practices for IPE, simulation, and Sim-IPE (Chapters 2.1.1, 2.2.1, and 2.3). Since the best practices are living, evolving documents, I refer to the latest update from 2021 in this chapter.

Table 5: Summary of best practices in simulation based on INACSL

1. Simulation design (55, 125)
- Design the simulation scenario with content and simulation experts - Examine the need for a simulation-based experience (gaps) - Create broad and specific learning objectives that address identified needs - Choose conceptual theory, select modality, and structure the scenario - Create the required realism/fidelity

- Determine the facilitative approach used prior to, under, and after the simulation - Develop required material, tools, and resources - Determine evaluation process - Pilot test to ensure intended purpose and identify confusing, missing, or underdeveloped elements
2. Pre-briefing (126, 127)
- Set the stage for the simulation-based experience - Describe learning outcomes, roles, responsibilities, time-frame to participants - Introduce the room, equipment, patient simulator, evaluation method - Establish an environment of confidence and trust - Introduce to the scenario
3. Conducting the simulation (127)
- The participants engage in the scenario - Facilitators deliver cues to assist the participants to achieve the outcome
4. Debriefing and evaluation (55, 125, 128)
- Use the planned debriefing method - Use the determined evaluation of the students and/or simulation experience

Planning and development of the sub-acute scenarios

The scenarios were developed following the best practices for *simulation design* presented in Table 5. We held several participatory workshops with the research group and healthcare professionals from primary care to assure that the scenarios reflected the intended context (55, 125). The research group drafted the main outline of the scenarios with pneumonia and urinary tract infection as tentative diagnoses. After prioritizing the content areas, we invited healthcare professionals to provide input to make sure that the scenarios were relevant examples of common, sub-acute situations from primary care (55, 125). During the development, I had several meetings with an advanced geriatric nurse working in primary care to enhance the authenticity of the scenarios. We discussed how older patients communicate, how difficult it can be to assess clinical signs in the elderly, and the importance of subtle physiological changes.

We prepared the medical record in collaboration with healthcare professionals from primary care and specialist health care to ensure authenticity (55, 125). A medical doctor working in a nursing home provided specifications on the patient's background story, the medication list and prepared the patient admission papers to the nursing home. An orthopedist—also part of the research group—working in a large hospital provided a medical discharge summary from the hospital. He collaborated with nurses and physiotherapists at the orthopedic ward to obtain a relevant nursing discharge summary and a physiotherapy discharge summary. To be able to prepare authentic documentation from the nursing staff in a nursing home, I went on a study visit to a nursing home. There, I discussed day-to-day documentation with two nurses. More specifically we discussed who wrote the documentation and what kind of information was usually provided, including the form they used for assessing newly admitted patients. I emailed the nursing documentation to the nurses for confirmation, afterwards. Last, we invited the resource group, consisting of coordinators from education in advanced geriatric nursing, pharmacy, psychology and clinical dentistry, to review and discuss the proposed scenarios. The scenario description is found in its entirety in Appendix 2, and in a shorter version in Paper III.

In the planning and development phase (Table 5), we also chose the facilitation approach to use before, during, and after the simulation (125, 127). We chose a method which focuses on creating a safe environment so that the students could feel comfortable in engaging in the simulation and in discussing successes and failures to understand and learn about their actions in the debriefing (129, 130). The impact of the outcomes can be evaluated by, for example, participant satisfaction, measurement of knowledge, skills or attitudes, measurement of behavioral change, or improved quality and safety (55, 125). We chose the Norwegian version of ICCAS as the evaluation tool (see sub-study 1) to assess the students' self-reported competence in IPC.

We conducted a *pilot test* to explore if we managed to obtain the intended purpose and objectives and to identify any necessary changes and/or amendments (125). The pilot test provided the opportunity to assess the level of realism in the scenarios (see Table 5) to optimize the learning opportunities (55, 125). We recruited five healthcare students to pilot test the two scenarios in December 2018. Two were medical students (MS), one master's student in advanced geriatric nursing (AGN), and two bachelor's students in nursing (NS). We divided the students into two groups. One group consisted of an MS and an AGN, and the other group consisted of one MS and two NSs. The groups participated in both scenarios with pre-briefing, simulation, and debriefing. Following the simulation we conducted a FG interview with the five healthcare students to explore their assessment of the scenarios, potential learning opportunities, and any need for change. The FG interview was audio recorded and transcribed verbatim. The transcript of the interview was reread several times to elicit the students' assessment of the scenarios, the potential learning outcomes, and the suggested changes. Although we did not conduct a formal qualitative analysis of the transcript from the pilot FG, the repeated readings allowed for a good overview of the students' experiences.

The results from the pilot test supported that both scenarios were relevant and useful for the participants. The realistic and recognizable scenarios from primary care particularly enhanced the experience. The students also appreciated making a treatment plan for the patient together, as that was something with which the students had little experience. The students stated that the scenarios provided the potential for learning IPC. The students suggested adding more equipment in the simulation room to make the situation even more realistic. During the pilot test, the only medical equipment available consisted of the patient simulator providing pulse and blood pressure, breathing movements, and heart and lung sounds. The students suggested adding, for example, a urinary test kit, a pulse oximeter device, bandages, and other equipment usually present in a nursing home.

Based on the pilot test, we acquired more medical equipment for greater realism, but kept the scenario description as it was.

4.3.2 Setting, sample, and data collection

Setting

The study took place in UiO:eColab, a research laboratory at the UiO, where we had access to simulation rooms, patient simulators, medical equipment, and other technical resources (125). Thus, the simulation modality we chose was "situated clinical immersion" (see Table 1, Chapter 2.2). In addition to the physical setting UiO:eColab provided, we prepared the objects and tools, or the "mediating artefacts" (see Chapter

3), the students had access to during the simulation session (Table 5, Chapter 4.3.1). The mediating artefacts developed or available were the patient rooms, the technical equipment for data collection such as audio and video equipment, the patient simulators, medical equipment, and resources (scenario description, medical record and assessment forms). These mediating artefacts in combination with the physical setting were important to facilitate the students' perceived realism of the setting (131).

The patient rooms

The simulation rooms were fully equipped healthcare office/consultation rooms separated by a control room. We divided the simulation rooms into two zones, with the patient room on one side and the office on the other side (Figure 3). The patient zone of the room was set up as a nursing home room. To create a context the students would recognize as realistic for a nursing home, we added artefacts such as homely linens and a nightstand with magazines and flowers. The office section contained the available technical equipment, the medical record, and several assessment forms. The computer was not part of the simulation.

Figure 3: *The patient rooms*

The control room, audio, and video equipment

The control room provided opportunities for the direct observation of activities through a one-way window in addition to equipment to administer the video recordings. The cameras and audio equipment were discreetly placed in the ceiling in the simulation rooms, which minimized interference from technical equipment (132).

The rooms have two cameras each, providing the opportunity for video recordings from the office zone and the patient room zone. The audio equipment was placed above the bed and above the desk (Figure 4). We used an audio recording device placed on the desk as audio backup for the video recordings during the simulations.

Figure* 4*: *The control room and camera and audio placement*

Patient simulator, medical equipment, and resources

We used a Laerdal SimMan® patient simulator (133) as the simulated patient (see Table 1, Chapter 2.2). The patient simulator presented clinical signs such as pulse, blood pressure, breathing movements, and heart and lung sounds. Vital signs were configured on the SimPad by the facilitator. Moreover, the facilitators added voice to the patient simulator and provided feedback on questions, responses to physical examination and other spontaneous inputs and statements to mediate for realism in the patient simulator. These actions are important cues to make the patient believable and to promote realism for the participants (134).

After the pilot test (Chapter 4.3.1), we added more medical equipment likely to be found in a nursing home to create a realistic, physical context that compared to the nursing home setting (131). The equipment available in the rooms were a blood pressure device, an ear thermometer, a pulse oximeter device, a blood glucose measuring device, a C-reactive protein (CRP) test kit, a urinary test kit, bandages, wooden tongue depressors, disposable gloves, bladder scan (only in the room with the urinary tract scenario), hand disinfectant, paper-based medical record and several assessment tools (Figure 5).

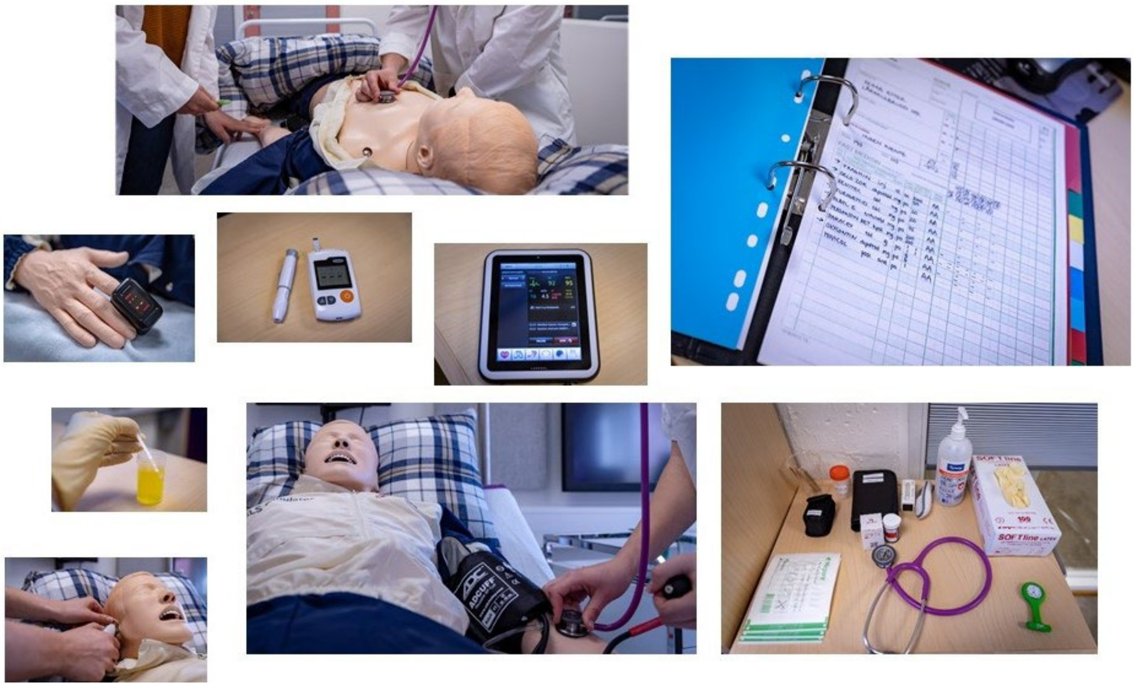

Figure 5: *Selection of medical equipment and resources available*

As described in Chapter 4.3.1, the artifacts were developed and chosen based on what would naturally be present or available in a nursing home. The medical record consisted of the patients medical history, medication list, admission papers to the nursing home, day-to-day nursing documentation at the nursing home, discharge papers from orthopedic doctor at the hospital, discharge papers from nurses at the orthopedic ward, and discharge papers from physiotherapists at the hospital (Appendix 2). The assessment forms available were a Glasgow Coma Scale (GCS), a National Early Warning Score2 (NEWS), an ABCDE assessment score (**A**irway, **B**reathing, **C**irculation, **D**isability, **E**xposure), an ISBAR communication tool (**I**dentification, **S**ituation, **B**ackground, **A**ssessment, **R**ecommendation), a q-SOFA (Quick SOFA) score for sepsis, a Visual Analog Scale (VAS) for pain measurement, and a Rapid clinical test for delirium (4AT).

Sample: Recruitment and participants

We recruited medical students (MS), master's students in advanced geriatric nursing (AGN) and bachelor's students in nursing (NS) to participate in the interprofessional teams as they are some of the healthcare professions that typically collaborate on patient care in nursing homes. We believed that these purposefully sampled student groups could provide us with an in-depth understanding of the Sim-IPE to support our aim (101, 135).

Opportunity to recruit the students was obtained by contacting the educational leaders responsible for the different healthcare educations, after which, we approached teachers and coordinators. We wanted to recruit students in their last or second-to-last year of education, as the students would have completed most of their clinical practice rotation. We planned for the recruitment of 30 healthcare students, with ten students from each education and recruited 27 healthcare students, of which ten were MSs, eight were AGNs, and nine were NSs. I allocated the students into ten groups, with two groups participating in each of the five scheduled days. We wanted as many simulation groups as possible to consist of one student of each education. Table 6 provides participant demographics and group distribution.

Table 6: Participant demographics

Age	N=27
Mean (SD) Min-max	31 (9.4) 21–49
Sex	N (%)
Male Female	6 (22.2) 21 (77.8)
Education	N (%)
MS AGN NS	10 (37.0) 8 (29.6) 9 (33.3)
Prior simulation experience	N (%)
Yes No	22 (81.5) 5 (18.5)
Prior interprofessional simulation experience	N (%)
Yes No	7 (25.9) 20 (74.1)
Groups in the simulation	

1	MS, AGN, NS
2	MS, AGN, NS
3	MS, AGN
4	MS, AGN, NS
5	MS, NS
6	MS, AGN, NS
7	MS, AGN, NS
8	MS, AGN
9	MS, AGN, NS
10	MS, NS, NS

Data collection

Video recordings of the simulation sessions, audio recording of the FG interviews and individual data from the self-reported questionnaire ICCAS were collected over the five days in April 2019. The data from the video recordings is published in Paper II. The data from the FG interviews and the ICCAS questionnaire are used in Paper III.

The *pre-briefing* (see Table 5) consisted of two parts. First, prior to attending the simulation activity, I gave information about the course intent and expected timeframe (126). The exact content of the simulation scenarios was not disclosed, but we emphasized that the scenarios contained sub-acute situations from primary care and that the intent was to study IPC. This provided the students with the possibility to prepare themselves before attending the sub-acute Sim-IPE session and, thus, to become situated within the intended learning context (86, 126, 136).

Second, on the simulation day, I repeated the course intent, with the focus on IPC in sub-acute scenarios to establish familiarity (126). Table 7 presents an overview of the program each day.

Table 7: Program for each simulation day

Time	Activity
09:00-09:30	Introduction to the aim of the study, consent, and facilities
09:30-10:30	Simulation 1 (two groups, two rooms)
10:30-10:45	Short break
10:45-11:45	Simulation 2 (the groups change rooms)
11:45-12:00	Complete the ICCAS questionnaire
12:00-12:30	Lunch
12:30-14:00	FG interview

We were aware that the students did not know each other before the simulation day and offered some time for informal conversations before starting the simulation session to familiarize the students' and promote a safe learning environment (126, 136, 137). In the last part of the pre-briefing, we arranged for detailed explanation and demonstration of the available equipment in the simulation room and instructed the students in how the simulated patient could respond and what procedures could be performed. Last, we conveyed an introduction to the scenario (see Appendix 2), including the learning objectives and expected timeframe to solve the case (126, 136).

The simulation activity provided the basis for the discussion in the debriefing (136). The facilitator enacted predetermined triggers and acted as the patient's voice based on the students' activities as the simulation scenario unfolded (Table 5). Thus, the students were able to see the results of their interventions and the impact on the patient's condition (127, 136). The facilitators took field notes during the simulation session as a preparation for the debriefing (136).

Directly after the simulation session, the students participated in a *debriefing*. The debriefing method was determined in the development phase (see Table 5) and was guided by facilitators with formal training in debriefing techniques (127, 128). The debriefing consisted of three phases. In the first phase, the students described what happened in the scenario, which allowed for initial reactions and feelings. In Phase Two, the students explored the main events and the different aspects of their performance, both what was done well and what needed improvement. Phase Three contained the key learning points and how the participants could integrate and apply what they had learned (136).

Observational data—Video recordings of the simulation sessions

The simulation sessions were video recorded, as we deemed it a suitable method for observing the students and their collaborations in the simulated setting. The video recordings provided us with detailed data of patterns and interactions during the simulation sessions including talk, behavior, use of tools, and artefacts (132, 138), and allowed for collaborative, repetitive viewings of the dialogue and interactions (138).

Experiential data—FG interviews

Following the simulation sessions, we conducted FG interviews with the participants, resulting in five FG interviews. As the aim was to elicit experiences and views from the participants, FG interviews were found to be well-suited. FG interviews are also appropriate to encourage group dialogue after participating in a joint experience such as the Sim-IPE scenarios (139). In the FG interviews, we focused on the students' experiences related to the scenarios, the simulation, and IPC through a semi-structured interview guide (Paper III). Moreover, we encouraged elaboration on the topics the students considered relevant and important.

Supplementary data—The ICCAS questionnaire

After the students had participated in the simulation sessions, they were asked to complete the self-reported ICCAS questionnaire. The ICCAS questionnaire was a replica of the Norwegian version from sub-study 1 (Appendix 1), with the addition of questions on prior simulation and Sim-IPE experience. The questionnaire data supplemented the qualitative data with the students' self-reported interprofessional competence (55).

4.3.3 Data analysis

The main sources of data in sub-study 2 were video recordings and interview data from the FG interviews, with the data from the ICCAS questionnaire as a complimentary source.

Interaction Analysis—for analysis of video recordings

Interaction Analysis (IA) (132, 138) was used to guide our analysis of the video recordings (Paper II). Through IA we had the opportunity to study the unfolding interactions, including talk, non-verbal interactions, and material artefacts that were in play during the social activity (132, 138). This approach to analyzing data aligned well with the adopted socio-cultural perspective, as the analytical task was to explore the interaction and development of knowledge in the simulation setting.

The data from the video recordings consisted of approximately 20 hours of video material. First, I did a preliminary, comprehensive review of the data and created timecode content logs of the key elements for all the videos (138). The content logs comprised summaries mixed with verbatim dialogue and descriptions. Thus, I gained a broad overview of the content and how the groups distributed their time with the patient and in the office.

To further broaden the overview of data, I prepared timelines to visualize interactions and teamwork during the simulations for all the groups (see Figure 6 for example).

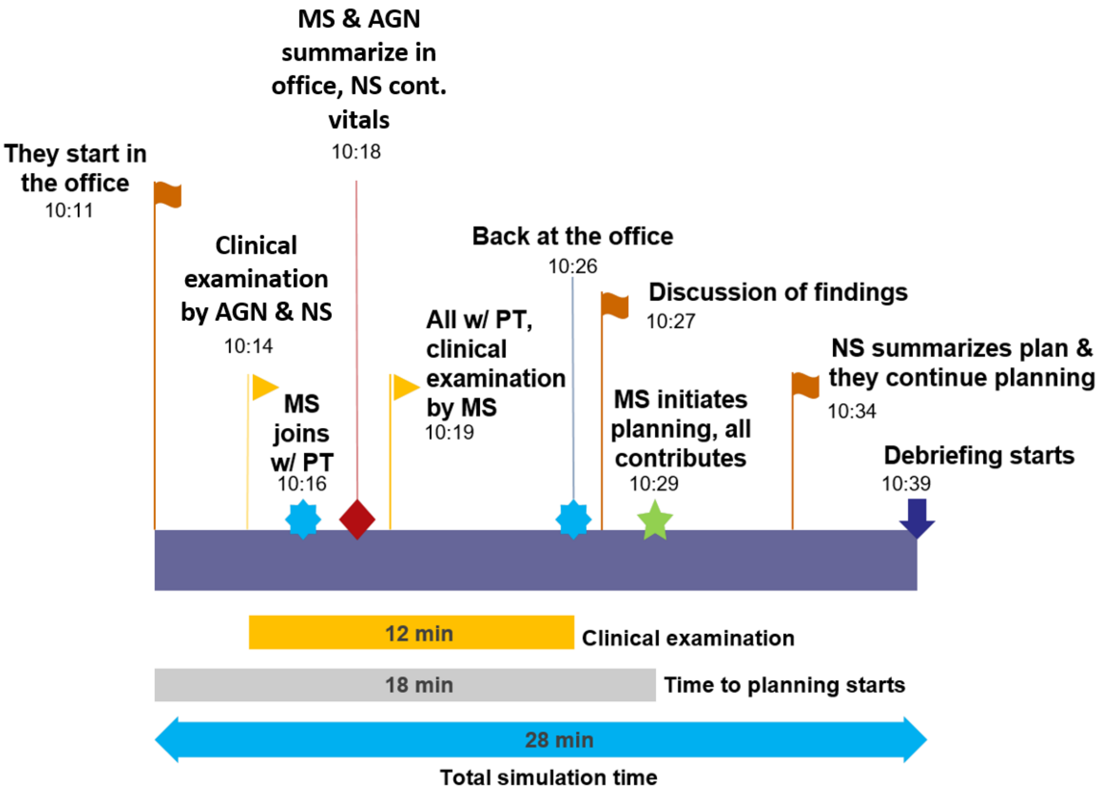

Figure 6: *Example of timeline of the unfolding interactions in the simulation*

I presented the broad overview and the more focused timelines for the research group. We found that several themes emerged in the review of data, such as distribution of time, divisions of tasks and role clarification, development of a treatment plan, and communication and reflection. We discussed the material and agreed to focus further analysis on the students' efforts to develop a treatment plan for the patient as described in Chapter 3.1.

As part of the next analytical step, I extracted the segments from the video recordings containing the development of the treatment plan. Then, I transcribed the verbal and non-verbal behavior in the extracted segments. I used the software NVivo Pro 12® (140) to transcribe the video recordings (Figure 7). The verbal actions, talk, laughter, and other sounds, are in Column 1 (red). The non-verbal actions such as facial expressions, bodily movements, eye contact, tone of voice, and use of resources are in Column 2 (purple). Last, my reflections and comments are in Column 3 (green).

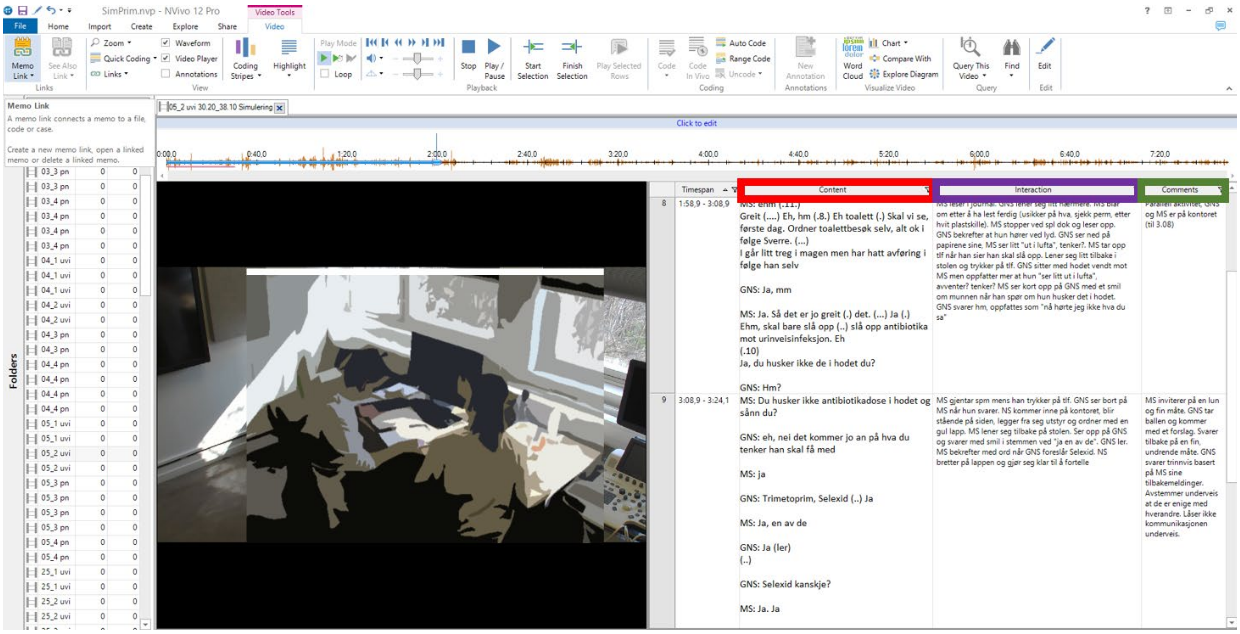

Figure 7: *Example of video transcript*

Then, my main supervisor and I viewed the transcribed videos repeatedly. Here, we also added elaborations of non-verbal actions where necessary. This step provided an overview of the unfolding interactions within the groups and how they developed the treatment plan. After discussing our findings with the whole research group, we divided the material into two groups. The student groups that developed a *specific* treatment plan had plans with relevant, clearly defined clinical problem(s) with defined, related actions and interventions. In the student groups that developed a *non-specific* treatment plan, the treatment plans consisted of either several unspecified clinical problems or lacked defined problems entirely, and the actions and interventions were non-specific or nonexistent.

Next, we analyzed the segments and associated transcripts in depth, focusing on the teams' interactions when they developed the treatment plan. During this phase, we had regularly discussions with the research group as a whole.

The IA analysis enabled us to examine how the students' unfolding actions were produced and co-produced and how prior actions formed the foundation for subsequent actions and activities (132). Further, we examined the resources the students used in the collaboration. The unit of analysis was not the individual or the group, per se, but the joint action (verbal or otherwise) directed at the co-construction and elaboration of the knowledge objects involved (86). The socio-cultural perspective and the constructs of shared knowledge objects, productive interactions, active participation and interaction trajectories guided the analytic approach as described in Chapter 3 (88).

Analysis of FG interviews

The analytical focus was to understand healthcare students' experiences of participating in sub-acute simulated scenarios and how these activities could support the development of interprofessional collaborative competence (Paper III). I transcribed the audiotapes from all of the five FG-interviews verbatim, noting all pauses, laughter, and sounds, as well as the questions and answers, using the software NVivo Pro 12® (140). We used systematic text condensation in four steps: 1) total impression of the material, 2) identifying and sorting meaning units, 3) condensation, and 4) synthesizing to analyze the FG transcripts (141).

Table 8a-d: Examples of analytical steps

1) Total impression of the material: First, my main supervisor and I read the transcripts independently to get an overview and total impression of the material. The material consisted of 138 pages of transcripts from the five FG interviews. Through discussions with the whole research group, we identified the preliminary themes from the material.

Table 8a: Step 1

General impression and identification of preliminary themes
Sub-acute scenarios differ from acute scenarios Room for reflection not present in practice Learning from each other Roles and responsibilities Conducting the simulation twice

2) Identifying and sorting meaning units: Second, we independently identified and sorted the meaning units into code groups. Then, we compared and discussed the meaning units we had identified and found several similar meaning units. We initially used NVivo Pro 12® to organize and structure the data (140). As the analysis progressed, we switched to a word processor program to organize the material into tables for easier visualization. The preliminary themes from Step 1 were used as codes to sort the meaning units. Then, the whole research group discussed the material and further narrowed down and restructured the codes (main themes) and sub-categories in an iterative process. This resulted in the main themes "realism," "doubt and uncertainty," and "reflection," with their associated sub-categories and meaning units. Table 8b exemplifies Step 2.

Table 8b: Step 2

Identification and coding of meaning units (first person)
Main theme: Reflection *Sub-category*: Better prepared for the future
MS5 (FG3): "It's the kind of experience that you can come back to and reflect on. You can call on it in different settings and think, 'Oh, yes, we did this that time.'" NS6 (FG4): "If you could act through it in advance and be trained beforehand, you can handle it better later, in terms of how to talk to each other." MS2 (FG2): "I don't think it's easy to put your finger on exactly what it is. Just the feeling of having experienced the situation before. Recognizing the situation, that's very valuable." AGN3 (FG2): "I did not quite know what to expect, but having been in the situation would be very helpful the next time you experience that kind of situation. And you get to be in the situation in a safe environment, a controlled environment."

3) Condensation: In the third step, we started to prepare condensates for each code group (main theme), which are artificial quotes in the first person, summarizing the meaning units (example in Table 8c). The material was also translated into English. Meetings with the research group ensured agreement within the group and provided valuable input for further analysis.

Table 8c: Step 3

Construction of artificial quotations (condensates) summarizing several meaning units (first person)
Main theme: Reflection *Sub category:* Better prepared for the future
"This is the kind of experience that would keep on giving. I can look back and reflect on this in several settings. Having had the opportunity to act through the scenarios may help me deal with similar situations. Just the feeling of having experienced the situation before in a safe environment, that's valuable. I didn't know what to expect. However, having been in the situation would be very helpful the next time I experience that kind of situation."

4) Synthesizing: Finally, in the last step, we created synthesized descriptions by reconceptualizing the condensates into main themes and sub-categories. To get an overview of all the themes and ensure that the meaning units were sorted correctly, I printed an early version of the themes. Then I reread the meaning units without their previous themes attached and sorted them again, manually this time (Figure 8).

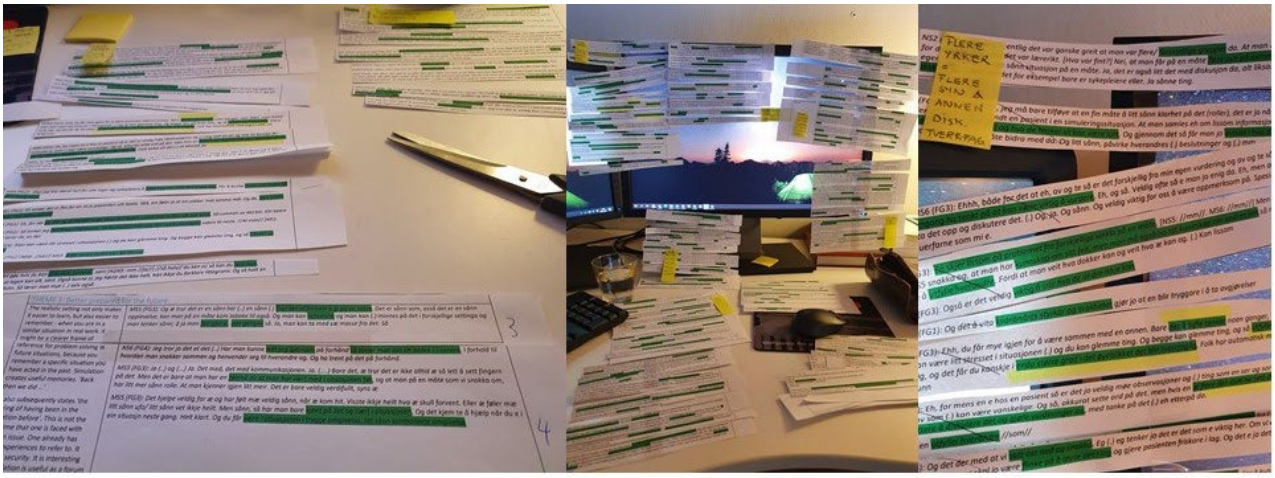

Figure 8: *Manual sorting of meaning units*

The updated version of themes and meaning units was distributed to the research group for review. After discussing the analysis in the research group, the themes and subthemes were restructured. We agreed on "Realism," "Uncertainty," and "Reflection" as the final themes to capture key contributions to understand learning opportunities for IPC through the Sim-IPE. Furthermore, we chose the quotes that would best represent the synthesized description (golden quotes). An example of Step 4 is presented in Table 8d.

Table 8d: Step 4

Syntheses of contents into main themes and sub-categories Choice of golden quotes (third person)
Main theme: Reflection *Sub category:* Better prepared for the future The students talked about the simulation scenarios as an experience that would keep on giving. Having acted through the simulations would help them deal with similar situations in the future, the students elaborated. Thus providing a sense of security for future work, as they had faced such issues in a safe environment during education. *Golden quotes* MS5 (FG3): "It's the kind of experience that you can come back to and reflect on. You can call on it in different settings and think, 'Oh, yes, we did this that time.'" NS6 (FG4): "If you could act through it in advance and be trained beforehand, you can handle it better later, in terms of how to talk to each other."

To supplement the qualitative data, we analyzed the data collected with the ICCAS questionnaire.

Analysis of ICCAS

We analysed the ICCAS questionnaires using paired *t-test* to determine if there were statistically significant differences in self-assessed perceived competence from pre-scores to post-scores, and Cohen *d* standardised effect size to determine the impact of the eventual change (118, 124). We used IBM SPSS Statistics Version 27 for the analyses (116).

4.4 Ethical considerations

This study was conducted in accordance with the ethical principles of medical research written in the Declaration of Helsinki (142). Participation was voluntary and the participants could withdraw their consent at any time without any negative consequences.

Sub-study 1:

We collected informed consent from the participants after giving oral and written information. The consent form was in the web-survey and if the participants chose "no" as an answer, the questionnaire stopped. UiB was responsible for the study and applied for approval. The Norwegian Centre for Research Data approved the study (project number 61063). The collected data was stored at a secure data facility at UiB. The Excel-file of student responses that I obtained from UiB could not be traced back to individuals, which supported anonymous analysis of the results.

Sub-study 2:

We informed the students about voluntary participation, confidentiality, video recording and storage, and that only the project group had access to the recorded material. We obtained informed consent after giving oral and written information. The signed forms were stored in a locked cabinet to which only I have access. The Norwegian Centre for Research Data approved the study, project number 60867. All the collected data was stored at the secure data storage facility, Services for Sensitive Data (TSD) at UiO. Considering that an important part of the data material consisted of video recordings, I found it especially prudent to explain that it would not be possible to delete the video recordings in which they had participated as part of a team. They could withdraw their consent to participate, but the video recordings would not be deleted until the end of the project. I highlighted that all results from the video recordings, FG interviews, and the ICCAS questionnaire would be presented in de-identified form. I also specified that how they performed in these scenarios would not affect their further studies, since this material would not be shared with their teachers.

5 Summary of results

In this section, the main results from the three papers included in the dissertation are summarized. The main findings of each paper are presented in Table 9.

Table 9: Overview of papers with main findings

Paper	Main findings
I. Evidence of validity for the Norwegian version of the Interprofessional Collaborative Competency Attainment Survey (ICCAS) across several interprofessional training courses	Evidence of validity was established for the Norwegian version of ICCAS regarding content, response process, and internal structure. ICCAS could be used and analyzed at an overall level to address change in interprofessional competence.
II. Exploring healthcare students' interprofessional teamwork in primary care simulation scenarios: collaboration to create a shared treatment plan	The groups that managed to actively engage in productive interaction in a coherent interaction trajectory developed a specific treatment plan for the patient. Moreover, participation in solving the scenarios showed potential to expand the students' ZPD.
III. A preliminary simulation-based qualitative study of healthcare students' experiences of interprofessional primary care scenarios	Participating in the simulation increased the students' confidence in IPC and prepared them for future work. The ICCAS showed enhanced self-reported IPC competence after participating in the scenarios.

5.1 Paper I

We established evidence of validity for the Norwegian version of the ICCAS questionnaire regarding content, response process, internal structure and consequence. This validation study further recommend that ICCAS can be used to measure the self-reported change of overall collaborative interprofessional competence. These findings support previous findings from validation studies showing that ICCAS is responsive to measure change in IPC competence at an overall level (80, 81). Institutions in Norway must choose which educational strategies and assessment methods to use to develop and assess IPC competence. This study contributes with a validated questionnaire that educators in Norway can use to assess the students' self-perceived achievement of pre- and post- IPC learning outcomes.

5.2 Paper II

We identified that the groups that managed to develop a specific treatment plan for the patient engaged in productive interactions where the collaborative verbal and non-verbal interactions led to co-construction of knowledge. Active participation from the students seemed to further contribute to productive interactions and enhanced the quality of the treatment plan. Moreover, the groups that managed to create specific treatment plans followed a coherent interaction trajectory where productive interactions unfolded across a passage of time, building on previous statements and actions. The Sim-IPE from primary care seemed to contribute to expanding the students' ZPD, that is, their ability to stretch their IPC competence in collaboration with others. The treatment plan as a shared object to develop is an important activity to promote the development of IPC competence.

5.3 Paper III

Systematic text condensation of the FG interviews revealed the students' perspectives regarding the elements in the Sim-IPE scenarios that contributed to the learning outcomes of IPC competence. Especially, the realism and authenticity of the scenarios was highlighted as an important contribution to enable engagement in the simulation session. Furthermore, the students explained that the vague symptoms the patient presented provided opportunities to collaborate, listen to each other, and use each other's competence to solve the problem. Participating in these Sim-IPE scenarios contributed to developing their confidence and made them more comfortable in expressing their opinions in future IPC. As a complementary result, though there was too small a sample size to evaluate any effect of the Sim-IPE, the students indicated a positive change in self-assessed interprofessional competence through ICCAS after participating in the scenarios.

6 Discussion

This chapter begins with a discussion of the overall findings. Thereafter I discuss methodological considerations, specifically regarding the concept of trustworthiness.

6.1 Discussion of overall findings

The discussion is based on the understanding that learning is a mediated process where knowledge is actively constructed in and through interaction and collaboration (85, 86). This emphasizes that the perspectives of the learner, the task at hand, and the context are important to understanding the interactions and collaboration that occur in the simulation (84, 85, 86).

First, I discuss how the simulation activities can support students' learning and learning outcomes of IPC through interaction and collaboration, that is, how the participants orient to each other, interact, collaborate, and engage in the simulation activity to develop shared knowledge. Then, I discuss how educators can facilitate learning through the primary care Sim-IPE and how these scenarios may provide an arena for learning IPC in healthcare education.

6.1.1 Simulation activities for interprofessional learning

A main contribution of this study is that the primary care Sim-IPE contributed to the transfer of IPC skills for the future, particularly due to the realism in the scenarios and the realistic setting provided (Paper III). Seeing learning as situated in the simulation, the physical context can facilitates for recall in clinical situations later and enhance the transfer of knowledge to clinical practice (84, 131, 134, 137).

Realism and socially constructed understanding

The level of realism and fidelity are concepts used to describe the simulated learning environment (131), yet fidelity is more often used to describe the technological level in the simulation practice (131, 143). The concept of realism provides a broader understanding of how simulation sessions can be tailored for learning, consisting of physical, conceptual and psychological realism (125, 130, 131). Considering realism *within* the tasks and context of the simulation directs attention towards the simulation as a social practice where physical, cultural, and historical space influence the students' perception of realism (86, 143). In this study, the participants explained that the physical setting of a nursing home with its associated resources and equipment created a context they recognized (Paper III). This suggests that physical realism was achieved (131). This is in line with findings from other studies that found that realistic scenarios enhanced the learning experience (144, 145, 146).

Recreating realistic surroundings stimulated several of the groups in this study to generate activity that was productive in the sense that their interactions led to the construction of joint knowledge (Paper II). The joint construction of specific knowledge objects is promoted in collaborative efforts aimed at learning and knowledge development (88, 147). In this study, we saw the joint development of shared treatment plans as a means to improve and develop competence in communication and IPC, which is also supported by earlier studies (148, 149). Opportunities to participate in purposeful activities with the goal of the joint development of knowledge objects is intertwined with how the students understand and perceive the world (86). This relates directly with conceptual and psychological realism, that is, how the students make sense of and emotionally respond to the simulation activities (125, 130, 131). It is also in line with past studies, wherein IPE initiatives had to be perceived as relevant and realistic with structured opportunities for active participation to support the development of IPC competence (144, 150, 151, 152). The students' ability to participate actively depends on how they manage to understand and act on the mediating artefacts, resources, signs, and actions within the simulation activity (86, 153). We found that the participants mediated their actions through the available resources and artefacts such as the medical record, the available assessment forms and equipment, and their written notes (Paper II).

In this study, the simulation scenarios provided the participants with clinical situations where they would naturally collaborate in real-life to attend to conceptual realism. The students' prior knowledge and the capabilities that influence their understanding and interactions are anchored in their profession, the cultural space in which they are educated (86). The educational culture and their socialization into their future profession shape how the students learn and how they make sense of the concepts in the simulation session, which, in turn, affect their perceived conceptual realism (125, 130, 131). IPE initiatives are found to provide a platform where students can learn from, with, and about healthcare professionals with whom they will work in future teams (18, 20). However, an IPE intervention does not in itself guarantee student interaction and active participation (137, 154). As reported in Paper II, we found variation in how the groups interacted and participated in the co-construction of the treatment plan. A mismatch between the realism of the scenario and the students' capacity to make sense of the scenario based on their present competence, could compromise the learning opportunities. This is also described by Chiniara et al. (131, p. 549) as "the zone of learning efficacy," where the level of realism facilitates learning without hampering it. This relates with aiming to develop and stretch the students' ZPD without pushing them too far (87, 94). Therefore, the level of realism needs to be tailored to accommodate the students participating to reduce stress and enhance the learning opportunity (42, 43).

Professional role

This study illustrates that a major learning opportunity for future IPC resulted from the possibility of engaging in collaborative problem-solving and joint knowledge development (Paper II). Further, the realistic setting and expected collaborative partners created associations with clinical practice that prepared the participants for future IPC (Paper III). One study specifically noted that divergence from the students' expectations of traditional practice, for example, regarding who would naturally collaborate with whom, led them to perceive the situation as unrealistic (155). The students are individuals with their own cultural and historical space consisting of contextualized knowledge developed by personal values, beliefs, and experiences (86), and this space affects perceptions of realism. Moreover, it relates to the students' professional integrity, or the fundamental ethical values that encompass the conduct of their professional roles in practice (156). Students could potentially consider the IPE experience unnecessary if the content or format does not accommodate all students involved (154, 157). The participants in this study recognized the scenarios as clinical situation they would often experience in primary care in general and in nursing homes specifically (Paper III). This illustrates that the Sim-IPE provided relevant learning environment for participants from the healthcare educations included in this study.

In our study, the participants expressed that the scenarios offered opportunities to listen to one another, engage in group discussions, and complement each other's perspectives (Paper III). These findings support that students have the potential to reach the learning outcomes of IPC through the sub-acute primary care Sim-IPE, as the scenarios promoted discussions, negotiations and mutual feedback, which relates directly with what IPC entails (16, 17). This is in line with a recent study wherein learning activities with opportunities for shared expertise and decision-making were found to optimize collaborative learning (158). We also found that some of the participants seemed to refrain from participating actively in the collaborative process, leaving the responsibility to the medical student (Paper II). This shows that the mutual knowledge exchange and development might be difficult for some students. The students come with different profession-specific knowledge, including expectations of the division of tasks and autonomy (91, 92), which, in turn, could affect the communication and shared knowledge development. In this study, we asked the participants to assume their future professional roles. That way, they had the potential to mobilize the knowledge they had accumulated through personal experience and during their profession-specific education to expand their ZPD or learning zone (87, 131).

To gradually integrate personal contributions with those of their profession might remain difficult for some students, especially if they are unsure of their own competence or their role in scenarios requiring interprofessional contributions. This is congruent with other studies that found that anxiety arose if the students felt forced to take action in areas in which they did not feel competent (146, 159, 160), that is, participate outside their current ZPD. This uncertainty regarding their own knowledge and competence can be a barrier to the students' participation and initiation of action. Furthermore, preconceptions of presumed power relations and hierarchical structures, with, for example, preset expectations of role distribution can also be barriers to active participation (161, 162). This can ultimately lead to lost opportunities for engagement in productive interactions where they not only limit their own potential for expansion of the ZPD, but also reduce the other students' possibilities to advance in their ZPD. In this study, the participants explained that the Sim-IPE provided opportunities for equal discussions in a safe environment (Paper III). Studies shows that feeling safe in a learning situation fosters willingness to participate in a team (163, 164). Experience of a safe environment can motivate the students to perform at the edge of their expertise and contribute to expansion of their own and others' ZPD.

Activity as socially constructed

Analyzing the participants' interactions within the simulation scenarios has provided insight into the unfolding collaborative activities that they engaged in when working with complex, sub-acute patient scenarios, and how they managed to construct the shared knowledge object. Although the participants expressed that the Sim-IPE led to newfound confidence in their abilities to participate in IPC and voice their opinions (Paper III), we saw differences in how the groups managed to develop the shared treatment plan (Paper II). Our study showed that the groups that developed a specific treatment plan managed to engage in productive interaction where they shared knowledge and elaborated on each other's statements through a coherent interaction trajectory, while the groups that developed a non-specific treatment plan had fewer proposed concepts and limited shared elaborations (Paper II). Other studies have also reported that teams that manage to co-construct knowledge in collaboration through productive interactions yielded a better outcome of the shared knowledge object in question (88, 98).

Development of a knowledge object is found to have potential to mediate and structure the participants' collaborative efforts towards a joint goal (147). The simulation activity in this study, with the specific end goal of developing a treatment plan for the patient, provided the participants with a concrete task that had potential to activate their collaborative skills. We found that the scenarios triggered some of the groups to elaborate concepts and bring multiple perspectives into the discussion to form a coherent trajectory to develop and refine the treatment plan. At the same time, this study identified the emerging problems the participants might encounter in IPE and/or early IPC, such as an insufficient elaboration of concepts or inability to bring concepts to action. From an educational perspective, this study supports that facilitating for learning and productive interaction in the simulation session is an important, but potentially complicated, task to prepare and organize, as the guidance must be tailored to the needs of each group. This is congruent with prior studies (88, 98). The next section focuses on how the educator can facilitate learning in the primary care Sim-IPE.

6.1.2 Primary care Sim-IPE as learning opportunity for IPC

The potential for interprofessional, collaborative learning in this Sim-IPE came from the combination of a realistic scenario and having a designated interprofessional learning environment, a practice space, for IPC (Paper III). Educators must create these spaces for students to develop IPC competence in healthcare education. Otherwise, it is difficult for the students to gain sufficient opportunities to know each other and learn how to complement each other's competence (20, 165). This was also pointed out in a recent study where healthcare students expressed that it was strange to be expected to collaborate after graduation, but not during their education (166). If they met during clinical rotation, the students were busy focusing on their own roles, with very limited time to engage in IPC (166). Our results expand on this, showing that, though the Sim-IPE was similar to practice, it was also different, since structured opportunities for joint reflection and debriefing were less available in clinical practice (Paper III). Still healthcare education is predominated by profession-specific lectures and clinical rotations, with few opportunities for IPC (6, 18, 167). To overcome professional silos in education and healthcare practice and promote the development of IPC competence, the students need interprofessional learning spaces where they can be active participants and interact with other healthcare students (20, 167).

Common, sub-acute situations in primary care

In this study, the participants pointed out that the scenarios containing a set of subtle, often vague, uncertain symptoms made the clinical problem less clear-cut and illustrated a situation where the best course of action was uncertain. The uncertainty was perceived as positive since they had to broadly approach the problem and draw on each other's professional competence to solve the problem (Paper III). This is consistent with another study that found that when the students collaborated to examine complex nursing home patients without predefined problems, they were driven to examine the patient from many professional angles and use one another's competence (168).

In this sub-acute primary care Sim-IPE, the participants expressed that in contrast to time-critical or acute-care scenarios, the collaboration and interaction process could not be approached or operationalized to pre-defined actions through algorithms to solve the problem (Paper III). This observation aligns with a growing body of research on more sub-acute common situations to develop IPC competence, often consisting of geriatric patients and/or patients with chronic disease, similar to this Sim-IPE. For example, in another study, the scenario topic "patient fall" was chosen to ensure that cause and treatment would not be clear from the onset for the participating medical and nursing students (169). Further, another Sim-IPE study found that disclosure of a medication error in a sub-acute setting provided possibilities for reflection upon IPC skills in contrast to a crisis situation with a focus on clinical performance skills (170).

Dieckmann et al. (143) emphasized the potential for learning through successes in common situations. Common situations are not necessarily less complex, but are, rather, non-acute and non-life-threatening. Instead of bringing the learners to the edge of what they can handle to improve their skills and competence to act and react, the facilitators should “bring the learners to the edge of their ability to reflect” (143, p. 287). As such, these common situations from primary care, which are encountered often and by many, might allow for more complex reflections than the typical life-threatening acute-care simulations provide. This is in agreement with other studies that found that more open-ended scenarios where the patient’s condition does not deteriorate rapidly provide the students with more time and opportunity to emphasize IPC (41, 171). Similarly, a study with nursing and respiratory therapy students, found that an increased complexity of patient care challenged the students’ ability to work together. This was due to limited knowledge about and familiarity with each other’s professional roles regarding how to collaborate interprofessionally (144). Further, a study consisting of discharge planning for students in nursing, pharmacy, physical therapy and a medical assistant program, found that the roles and responsibilities could be misunderstood. Disrespect or stereotyping other professions was a barrier to the IPE (146). This is in line with the participants in this study, who commented that if the scenario was too complicated medically it could lead to poor communication where one team member or profession could dominate the discussion (Paper III).

The presumed role expectations and responsibilities within their own profession and that of others, acquired through the participants’ personal, cultural, and historical space, would affect how students view the world (86, 90). As such, navigating between one’s own and others’ expectations without compromising personal expectations, professional norms and ethics, and autonomy can be a challenge (91, 156). Teaching healthcare students about role expectations and responsibilities within their own professions and that of others is promoted as a promising strategy to break down unwanted barriers to collaboration (146). In this study, the participants pointed out that they became familiar with each other’s competence and scope of practice through participating in the Sim-IPE and, thus, were better prepared for future collaboration (Paper III).

Interprofessional problem-solving in a safe environment

In this study, we developed the simulation scenarios in an interprofessional group to minimize barriers to shared problem solving (56, 172) and stretch the students' current level of knowledge and skills in each profession. We did not provide any specific instructions or strategies for how to collaborate in a team in the first pre-briefing. In other words, we asked the participants to do something for which they might not have any or only some of the prerequisite knowledge. This may have contributed to the participants already being on the verge of their ZPD or at the edge of their zone of learning efficacy, and, therefore, being hesitant in their interactions (87, 131). Educators need to be aware of this when planning and conducting Sim-IPE scenarios, especially if the students are expected to *learn* IPC *through* IPC perhaps without IPC experience.

The advantage of simulation is that it provides a safe environment in which to train to achieve competence they have not yet achieved (130). Even though we did not provide instructions on how the collaborative task could be completed, the participants took part in two quite similar scenarios during the simulation session (Appendix 2). Each run of the scenario was preceded by a pre-briefing and followed by a debriefing (125). In the debriefings, the facilitators focused on the collaborative and communicative activities that had occurred during the scenario to enhance the participants' awareness and understanding of the socially generated situation (128, 129). Thus, the participants in this study reflected on the specific experience they had just participated in. They said that being able to talk about how they collaborated and communicated as a team, and worked individually, within the debriefing created awareness and understanding of the situation and enhanced the learning outcome (Paper III). Thereby, the participants developed a frame of reference for how they could conduct the next scenario based on their common immediate experiences.

This study provides insight into the value of performing multiple sessions consecutively, as the reflection in the debriefing can act as a pre-briefing for the next session. Through debriefing, the participants are given the opportunity to become aware of where they are in their own ZPD, and to identify more focused and clarified points of attention for their interprofessional development in the next session to expand their ZPD further. A study found that experienced facilitators seek to encourage and guide the participants to reflect upon the underlying explanations of what happened in the situation to stimulate knowledge development (173). This highlights the facilitators' potential to bring the theory and practice of IPC into play in the debriefing as a tool to nuance and expand reflection, and, thus, enhance the learning potential of IPC. This also relates to the socio-cultural understanding that meaning is constructed in the specific context where the action took place and, thus, creates prerequisites for understanding and acting in similar contexts (86). The participants in this study said that after completion of the first scenario they were better acquainted, which made it easier to draw on each other's competence and find their own role the second time (Paper III). This is in line with another study that also found that the participants improved their collaborative skills from the first to the second iteration (159). Targeted debriefing between the two scenarios, as we had, could better prepare for IPC and situate the students within the collaborative context of healthcare practice. In this way, the opportunities for goal fulfillment and learning become a joint effort with shared visions and strategies.

Facilitating for learning IPC competence through the Sim-IPE

During the Sim-IPE session, the facilitators in this study played the multifaceted role of instruction and facilitation. This was done through engaging the predetermined triggers such as responses to physical examination, answering questions directed to the patient and supporting the participants in achieving the simulation outcome. This is an expected role composition for facilitators (127). Viewing this multifaceted role through the socio-cultural perspective highlights that the facilitators are of great importance in stretching the students' IPC competence through stimulating simulation activities that move the students towards the edge of their ZPD without pushing them beyond their ability to learn and reflect (87, 94).

The facilitators in this study had prior training, with skills and knowledge in simulation and learning. They knew the scenarios first-hand from being involved in their development and pilot testing. Being well prepared and able to improvise is important for a facilitator to be successful in both pushing and supporting the students in their effort to reach the objectives of the simulation (137). This further illustrates the multifaceted role of the educators and facilitators. The level of complexity and realism of the tasks in the scenario should be adapted to the level of experience and knowledge of the participants. Educators and facilitators should also be prepared to provide the students with strategies to solve the task if necessary (131, 134, 137, 144, 159).

This study shows that the student groups that did not manage to mobilize their resources to structure concepts, elaborate on ideas, or identify key concepts for the shared treatment plan developed a non-specific treatment plan (Paper II). The facilitators in this study did not provide any instructions regarding the development of the shared treatment plan or how to advance in their collaboration. One method found to be beneficial to help students in their decision-making process is to consider in-scenario instruction through cues or suggestions from the facilitator (143, 174). For example, advising the participants to confer with the hospital when they kept returning to hospital admission as a probable intervention (Paper II), could have led them to progress in their decision-making process and enhanced the potential for reaching the learning outcome of IPC. However, educators and facilitators must consider whether the students would benefit most from creating their own experiences, including mistakes, without interruption, or if they should intervene if the group is not collaborating productively or moving towards a shared knowledge outcome. This is congruent with prior literature discussing when and how to use in-scenario instruction (143, 174). Being aware of the facilitators' multifaceted role during the simulation session and the necessity for flexibility could prepare the facilitators for this complex task and ensure that they are able to instruct the students and facilitate the fulfilment of their learning goals in IPC.

IPC competence and its measurement

In the discussion on how to measure IPC competences, the ICCAS questionnaire validated in this dissertation (Paper I), is promoted as one of ten current or emerging validated assessment instruments to consider for Sim-IPE measurement (55). The ICCAS was developed based on six domains that account for teamwork, roles and responsibilities, as well as, conflict management and the patient/family perspective (79). As outlined in Chapter 2, IPE activities are found to be shaped by learners, the format of the scenarios and its tasks, the abilities of the facilitators, and the organizational context in which IPE is delivered (16). Furthermore, IPC competence is found to be interconnected and difficult to distinguish into separate competences (32, 77, 80, 81). The instrument validation in this study further established that ICCAS should be used to measure the change of overall IPC competence (Paper I). This is in line with prior validation studies (80, 81) and supports that IPC competence is very interrelated. The instrument validation in this dissertation is also a contribution to the accumulated validation of ICCAS as a tool to measure students' self-reported IPC. Replication studies of existing instruments can help further establish reliability, validity, and practice (54). Moreover, this study contributes to the evidence-base and evaluation of an assessment tool that is validated across several different IPE settings, and not only within acute-care settings (34, 61, 78).

The participants reported through ICCAS significant improvements in self-assessed competence after participating in the IPE courses (Paper I). The findings support that the Norwegian version of ICCAS is responsive in measuring self-reported change in IPC competence. The enhanced self-perceived IPC competence reported through ICCAS in the sub-acute Sim-IPE experience (Paper III) is consistent with several Sim-IPE studies of common, primary care scenarios. For example, one study where nurse practitioner/midwifery, dental, and medical students collaborated in performing a physical examination of a simulated patient demonstrated significant improvement in self-assessed IPC competence (75). Moreover, a Sim-IPE program regarding drug prescriptions and the detection of inconsistence in the medical record, also demonstrated overall improvement in IPC for students from medicine, nursing, dentistry, public health, and informatics (175). Further, Sim-IPE with screening of depression in older patients indicated a significant increase in post-simulation scores for nurse practitioner, pharmacy and medicine students (176).

In another recent study similar to this Sim-IPE experience, pharmacy and nurse practitioner students had to collaboratively obtain the patient health history, perform a physical examination, and provide a comprehensive treatment plan for an older patient with chronic cardiovascular disease (177). The ICCAS results showed significantly improved self-assessed competence after the Sim-IPE experience (177). It is worth noting that not all studies reported positive changes in self-perceived IPC competence. A Sim-IPE with a discharge planning scenario for students in physical therapy, nursing and social work, did not report significant difference in post-scores compared to pre-scores, though the students reported improved confidence in discharge planning (76). The growing body of research, which includes this study, demonstrate that common, sub-acute scenarios from primary care provide learning opportunities to enhance the students' self-perceived IPC competence and thus offer a viable approach to developing IPC competence in healthcare education.

This study illustrates that using the ICCAS questionnaire is one way to assess students' self-reported IPC competence. Using a combination of assessment methods could provide educators with more comprehensive assessment of the students IPC competence. For example, direct observation of collaborative practice has been found to identify additional elements of IPC that might not be noticeable to individuals when asked to self-report (66). Another interesting approach is to use or complement with an assessment instrument that evaluate self-assessed competence development throughout group work courses or collaborative knowledge creation assignments (147, 178). This could provide an angle for understanding IPC that is directly related to the learning activity and the shared knowledge development.

To summarize the discussion of the overall findings, common, sub-acute Sim-IPE scenarios from primary care offers learning opportunities for IPC. These scenarios are typically complex, with subtle patient symptoms, but not time-critical, or guided by checklists or algorithms. The outcome is dependent on the learners' capacity to use their knowledge in practice, collaborate, and expand on their clinical judgment together. IPC competence is found to be complex and interconnected. ICCAS is one way to measure the students' self-reported assessment of their own IPC competence after participating in IPE courses and might indicate if the expected learning outcome is achieved.

6.2 Methodological considerations

In this chapter, I discuss the relevant methodological considerations for this dissertation. First, I discuss the considerations regarding study design and the approach to the research field. Then, I address the data material, analysis, and presentation of findings under the concept of trustworthiness. Last, I reflect on my role as a researcher entering this field of study.

6.2.1 Study design

The design of the study was explorative, since research of primary care Sim-IPE as an opportunity for healthcare students to develop IPC competence is in its infancy (101). The sub-studies in this dissertation draw on empirical data from two different samples and use two different methodological approaches.

The rationale for combining the findings from these sub-studies and methods in this dissertation was the need to capture different perspectives, both subjective and objective, on the sub-acute Sim-IPE to develop IPC competence. This combination made it possible to study how the participants interacted in the situated context to solve the collaborative task of developing a treatment plan (Chapter 4.3; Paper II), and explore the students' own perspectives on and assessment of participating in the Sim-IPE (Chapter 4.3; Paper III). Furthermore, we had a validated instrument to assess how the students rated their own IPC competence after participating in IPE/Sim-IPE (Chapter 4.2 and 4.3; Papers I and III). This combination of data sources and methods is a strength as it provided broad insight regarding opportunities for exploring the sub-acute primary care Sim-IPE as a teaching method to develop IPC competence (179).

Setting the stage

The background section (Chapter 2) in this dissertation is mainly based on review articles reporting prior research on IPE, simulation, and Sim-IPE. Review articles present summarized knowledge and provide for good and comprehensive overview of the knowledge base and the gaps in the understanding of the topic. These review articles were mostly concerned with establishing what works, which is, any effect of IPE, simulation, and Sim-IPE (see Chapters 2.1.1, 2.2.1 and 2.3). As a consequence, there might be a gap in understanding between what the reviews reported and the findings presented in individual studies. Especially regarding exploratory studies, as they are often excluded from review articles (28). The literature review also revealed few primary studies, and, consequently, few reviews, in the field of sub-acute primary care Sim-IPE (8, 60, 62). Therefore, there was less knowledge about the potential for developing IPC competence in sub-acute primary care Sim-IPE scenarios. In recent years, however, there has been a development towards more sub-acute common simulation scenarios to develop IPC competence, often consisting of geriatric patients and/or patients with chronic disease (144, 146, 155, 169, 170, 177, 180), similar to this Sim-IPE.

To understand the many facets of IPE, including the opportunities with Sim-IPE for learning IPC, there is a need to design and conduct studies with complementary methods (28, 29, 34). Despite the limitation of relying on review articles, the background provided a foundation and rationale for why exploratory studies like this dissertation add insights that contribute to filling the knowledge gap.

The intersection between clinical practice and education

The main contribution from this dissertation is in the intersection between clinical practice and education or, more specifically, exposing learners to future practice where tangible knowledge traditions in clinical practice and perspectives on learning and teaching in healthcare educations meet up. To move forward and develop the research base, we needed analytical perspectives and a theoretical approach to understand how the students solved the primary care Sim-IPE in collaboration to explore the potential for learning IPC.

The scenarios models aspects of clinical practice, as we provided the students with realistic tasks to perform in a realistic environment (131, 134). The subtle and vague patient symptoms were introduced as realistic and authentic, as confirmed by the participants in the pilot test (Chapter 4.3.1) and reinforced by the students in the FG interviews (Paper III). Furthermore, this dissertation is connected to the standard approach for developing and conducting simulation, as presented in Chapter 4.3.1. Following these guidelines (see Table 5), such as developing the scenarios in collaboration with experts from the field with firsthand knowledge of common patient situations in the nursing home context, is an added strength. Choosing to view the students' learning and knowledge development through the socio-cultural perspective provided an analytical perspective to interpret the data and understand IPC within the context of the primary care Sim-IPE, especially regarding how the students made sense of the situation, constructed learning and knowledge in interaction with each other, the tasks, and the context (84, 85, 86).

Cultivation one perspective might have provided more in-depth exploration into that tradition or perspective. However, development of profession-specific and interprofessional knowledge for healthcare students' capacity for IPC is inevitably rooted in practice and education. The commitment to prepare for future practice made it logical to combine perspectives from clinical practice, simulation-based education and the socio-cultural perspective to explore the research area.

6.2.2 Trustworthiness

In this section, I will discuss the quality of the dissertation under the concept of trustworthiness (135, 179). The quality criteria for quantitative and qualitative research can play out differently, especially in the terms used, but are ultimately about the extent to which the results can be trusted (179).

Sample and recruitment

In this dissertation the empirical data was collected from two different samples, in an effort to purposefully recruit participants that would provide insights into different experiences (135, 179).

In sub-study 1, we recruited participants from all of the ongoing Norwegian IPE courses to meet the study aim of validating ICCAS for a variety of settings (135, 179). We obtained participants from 18 professional programs ranging from music therapy to medicine (see overview in Paper I). This heterogeneous group was a strength, since the goal was to recruit from all the different IPE courses (181). The questionnaire was a web-survey that included the informed consent and the ICCAS questionnaire itself. It was a strength that the students' participation remained anonymous to the educators responsible for recruitment. However, opportunity for targeted reminders was absent. Since it was a web-survey, the reasons for their choices regarding non-participation remain unknown to us. Although the number of participants from each professional program varied, we obtained a response rate of 42.8% overall. The response rate was deemed appropriate to validate the Norwegian version of ICCAS (Paper I) as web-surveys typically achieve response rates of 50% or below (112).

In sub-study 2, we recruited participants from different healthcare educations and future professions that often collaborate in nursing homes, to participate in the Sim-IPE. Since we recruited students in their last or second-to-last year of education, we got students with clinical experience who, to some extent, were prepared to work in teams. Despite the minor limitation that not all of the simulation groups consisted of participants from all three educations, they were present in each of the FG interviews (Chapter 4.3.2). We may not have obtained the full range of student responses and perspectives, as those participating might already have had positive opinions about the aim of the study. At the same time, it might not have affected the results, since we were interested in exploring the learning opportunities of the Sim-IPE. In this sub-study, the reasons for non-participation were primarily lack of time or not getting time off from work or clinical practice. The use of video recording as a data collection method resulted in some students declining to participate (Papers II and III). These are important issues to consider when planning further studies, as participating in Sim-IPE would require more time from the participants. Overall, the sample of 27 healthcare students divided into ten teams offered enough perspectives for a more in-depth understanding of the Sim-IPE (101, 135, 182).

Participation or non-participation might have been affected, to some degree, by the students' relationships or feelings towards the recruiters, both positive and negative. We explicitly stated that neither participation nor non-participation would affect the evaluation of the students in the IPE courses (sub-study 1) or affect their further studies (sub-study 2). We also tried to avoid conflict with busy study schedules by asking the students to complete the ICCAS directly after the IPE-course (sub-study 1) and by facilitating for one attendance to participate in the Sim-IPE (sub-study 2). These measures might have contributed to enhanced participation.

Overall, we had little specific information about the students' prior experience (Papers I-III). The majority of the students (63.5%) in sub-study 1 were in their third year, which is the final year for most of the professions (Paper I). Thus, we could only assume that the students had some prior experience, though we were unaware of what kind. In sub-study 2, most of the students, independent of education, had limited Sim-IPE experience (Table 6; Papers II and III). Those few with experience, explained that these experiences were from acute-care simulation such as resuscitation and trauma care (Paper III). In future Sim-IPE studies, it would be useful to obtain information about the participants' clinical experience in addition to their prior Sim-IPE experience. Their previous experience or lack thereof could affect how they respond and perform in the scenarios.

Despite some limitations, the recruitment strategy and sample were deemed appropriate, as the participants recruited in this study provided a variety of experiences and insights necessary to achieve the study aim (101, 135).

Data collection and material

The procedures of translation, back-translation, and the Delphi process were important steps to develop the translated version (109, 111) that the subsequent sample of health and social science students completed to provide data for the statistical analysis included in the validation process (Chapter 4.2.2; Paper I). It could be a limitation that we had the dual role of being researchers and participants in the IPE expert group at the same time. However, in this sub-study, all of those providing IPE courses were regarded as IPE experts in Norway. Therefore, this duality was perceived as necessary to ensure that the content aligned with the construct (110). Although I was part of the Delphi process and research collaboration, I was learning about IPE myself at the time. It may have been an advantage to have a novice in the group asking questions and requesting elaborations and explanations.

In sub-study 2, we distributed the tasks of facilitator and interviewers according to competence within the research team (101, 125). We were concerned that the students might find it difficult to speak freely if the facilitator also conducted the FG interview. Therefore, the facilitators did not participate in the interviews. Other perspectives might have emerged if the facilitators had been involved in the interviews, though, it also could have been a limitation for the students. The interviewers observed the simulation sessions from the control room, which was a strength. In that way, the interviewers had an overview of the unfolding actions and interactions within the simulation sessions, without interacting with the students.

We used the same semi-structured interview guide in all the FG interviews (Paper III) to ensure that the data collection covered the same topics, even though the composition of the interviewers varied (101). We also encouraged the students to speak freely and share their experiences (139), both positive and negative, since the aim was to explore opportunities for the development of IPC competence. We anticipated that some of the students might be reluctant, to some degree, to share their experiences and thoughts in the FG interviews, since they did not know each other. Moreover, as the hierarchical structures or power dynamics between healthcare professions can be a barrier to collaboration (101, 179), we were aware that this could be visible within our student groups as well. We observed that the students appeared to share their thoughts freely and elaborate on each other’s statements (Paper III), which suggested that we managed to create a safe environment for them to share their opinions (126, 130). We considered it a strength that we captured the participants' immediate perspectives and experiences by conducting the FG interviews directly after the Sim-IPE sessions. Other, more long-term perspectives might have emerged had we conducted the interviews at a later time, but attendance could have been compromised by busy schedules.

A considerable strength in this study, and, likewise, a minor limitation (see sample and recruitment above), was the use of video recording as a method for data collection. The use of video could have affected how the students interacted and communicated with each other. UiO:eColab offered video and audio equipment discretely placed in the ceiling of the room, which made it possible to change camera angles without disturbing the interactions in the room. We observed that the students quickly became engaged in the simulation sessions (Paper II). As such, any awareness of visible video recording equipment on the on-going activities was minimized (132). Another strength was that, by capturing everything on video, the collected data allowed for repetitive viewings of the interactions and actions, as opposed to an observational or oral account (132, 138).

Analysis, results, and presentation of findings

The validation of ICCAS in sub-study 1 (Paper I) was based on a framework for assessing evidence of validity (102, 103). In sub-study 2 (Papers II and III), we used interaction analysis (132, 138) of the video recordings and systematic text condensation (141) of the FG interviews. The analysis and interpretation of the data material was performed in joint discussions and analytic seminars (Papers I-III) with the research groups in the two sub-studies. This provided the opportunity to bring forth different meanings in the material and agree on the interpretation and presentation of the findings (179). We have provided rich descriptions of the methods of analysis in the Papers (I–III) with additional details in this dissertation (Chapter 4) to provide transparency of the process (179).

The analysis of the video recordings of the simulation sessions provided ample opportunities for exploring the healthcare students' interactions and their production of knowledge in-depth, with the treatment plan as the goal of the knowledge production (Chapter 4.3.3; Paper II). Repeated viewing of the video recordings allowed to explore how the students oriented themselves as the scenario developed over time and how they interacted to solve the problems at hand, produce shared outcomes, and gain insight (153). An added strength was that we obtained the students' own perspectives of participating in the Sim-IPE (Paper III), in addition to the observations on how they interacted in the situated context.

The analysis of the video recordings (Paper II) and the FG interviews (Paper III) were based on the research group's interpretations of the segments and transcripts (138, 141), and were not sent to the participants for confirmation. The students' interpretations or explanations of the segments and transcripts could have differed from ours. We have provided excerpts and quotes in an effort to display the voices of the participants and how our findings were derived from the data to enhance transparency (101, 179). We are also aware that our previous experience from different educational and healthcare settings might produce unconscious preconceptions about the activity in the simulations or in the understanding of the FG interviews. Similarly, our collective experience also facilitated our awareness and understanding of what these situations entailed.

In this dissertation, I have provided descriptions about the context of the study, the settings and participants, the methods for data collection and analysis, and the findings to ensure transparency and to facilitate for transfer to other settings (179).

Reflections on researcher position

I entered this field of study with an interest in knowledge development situated in primary care and simulation as a tool for enhanced learning. As a nurse, I had experience from clinical practice regarding infectious diseases and infection control, IPC, and continuous practice development after working in specialist health care. Although I had little experience from primary care, I had gained competence through a project at UiO, where I was responsible for developing an online course to promote clinical assessment skills in primary care. Through this project, I acquired a network of healthcare professionals from primary care, which was an advantage in the planning and development of the simulation sessions.

I had little experience in planning and developing simulation sessions, beyond attending short mandatory simulation sessions of resuscitation annually during my clinical practice. Therefore, at the start of the PhD-project, I sought to develop my practical and theoretical experience and expertise through attending facilitator courses. To obtain and refine my facilitator skills, as recommended in simulation literature (127), I had the opportunity to be a facilitator at the Student-BEST course developed by UiO and OsloMet on several occasions. I had some experience with the translation and cultural validation of questionnaires (183, 184), which was an advantage in this study. To obtain a theoretical introduction and more knowledge of IPE and IPC, I attended the PhD course, "Research perspectives on interprofessional education learning and collaboration" at Linkoping University. This increased my understanding of the background and development of IPE and the complexity of IPE and IPC. Furthermore, I did a research stay abroad at Copenhagen Academy for Medical Education and Simulation to gain knowledge and insight into different types of research in simulation and IPC.

Overall, my clinical and academic experience, as well as being aware of my own shortcomings, has been helpful when diving into the field of primary care Sim-IPE. It has opened up new perspectives and contributed to knowledge development in areas where I had less experience. Although I have tried to be aware of my pre-understandings and pre-conceptions, my effort to make sense of this research is shaped by my own personal, cultural, and historical experience (86). Consulting and discussing with my supervisors in the research group has enhanced the transparency of the interpretations (101). Moreover, their combined interprofessional experience have provided me with helpful advice and directions in the research process, which was of great value throughout the project and contributed to expanding my understanding of IPC.

Next, I present the conclusions of this dissertation together with recommendations for further research.

7 Conclusions

This dissertation has shown that expanding simulation training to include common, sub-acute primary care Sim-IPE scenarios offers the students learning opportunities from realistic situations where they have time to assess, discuss, and collaborate to solve a clinical problem. The simulation challenged the students to recognize the importance and value of understanding other professionals′ scopes of practice and how professional roles complement each other (Paper III). This is important in IPE and promising for developing the capacity for IPC. In particular, focusing on the development of shared treatment plans may lead to improved interprofessional communication, coordination, and collaboration, and a more coherent plan for the patient (Paper II). Further, the instrument validation of ICCAS ensures that institutions offering IPE courses in Norway have access to a validated tool to assess students' self-reported competence in (Paper I).

Looking at the Sim-IPE activity in this dissertation from a socio-cultural perspective, provided a perspective to develop a deeper understanding of the students' actual conduct in the situated context. Specifically, the socio-cultural perspective was useful for exploring the healthcare students' unfolding actions and interactions during the simulation session, that is, how communication took place, how the students interacted, and how information and knowledge were exchanged and interpreted (Paper II). Further, it provided a deeper understanding of their perceptions, views, and experiences of the situated context in itself and as a means to develop IPC competence (Paper III). To be able to stimulate the students' IPC knowledge and consequently stretch their ZPD or zone of learning efficacy, educators can frame the scenarios for the intended learners' current and emerging knowledge, that is, what the students presently are capable of, what they might be capable of with assistance, and what currently is beyond their ability. Seeing the learning as situated, the simulated context can facilitate for recall in clinical situations later and enhance the transfer of knowledge to clinical practice.

The findings in this dissertation show that Sim-IPE has the potential to promote learning by having students from different health educations learn from, with, and about each other, while providing collaborative patient care in a simulated sub-acute primary care context. This dissertation contributes with evidence-based knowledge and evaluation of Sim-IPE from primary care as a learning opportunity for healthcare students to develop IPC competence. Introducing these kinds of scenarios has the potential to expand healthcare students' collaborative competence and prepare them for future IPC.

Recommendations for education

This dissertation has illustrated that the thoroughly prepared Sim-IPE scenarios come with a lot of promise. However, educators have to understand what kind of tasks and what level of realism and difficulty that is needed to facilitate the intended learning outcome for their participants. Educators, thus, have to know the students' current knowledge and competence to be able to organize and develop simulation scenarios where they can advance in their ZPD. Furthermore, educators are recommended to develop and evolve the scenarios in collaboration with healthcare professionals from the intended real-life context to get the environment, resources and task believable for their setting.

The pre-briefing, especially, is where the educators can lay the foundation for how the students perceive the simulation session. It is imperative that educators manage to create an environment of trust, confidentiality and respect so the participants can feel comfortable in sharing and expressing their thoughts without being afraid of negative consequences. The combination of a safe environment and realism contributes to stimulate the students' imagination so that they can immerse themselves in the scenario.

An added advantage to the Sim-IPE scenarios in this study, is that they are feasible to use on-site in an education facility or in practice with minimal equipment and resources. Although we used a patient simulator in this study, a fellow student, educator or healthcare personnel could play the role of the patient. Moreover, the scenarios do not require high-tech equipment, just ordinary medical equipment found at a regular nursing home. This might contribute to reduce some of the economic barriers toward IPE as the educational facilities do not have to buy expensive equipment or educate highly specialized facilitators.

It is important to note that, although it is possible to implement these sub-acute Sim-IPE scenarios in educations, the scenarios should be streamlined to the participating educations/professions to facilitate for the best outcome. Known barriers to IPE, such as profession-specific schedules, location, and teacher resources can reduce the number of possibilities for IPE. Collaboration across professions and curricula is one important precondition for successful IPE. The most important thing to achieve positive impacts for IPC, is to manage to implement IPE in healthcare curricula. This demands that the existing curricula are open to this learning approach and actively seek to reduce the barriers to this teaching method.

Recommendations for further studies

To further develop IPE strategies, research should expand on the interactions and collaborative efforts when people are learning through interprofessional simulation. This study has provided insight on how the students interacted when they developed a shared treatment plan for the patient. In our findings, the participants subjectively described that repeating the simulation offered possibilities to use what they had just learned. We did not explore whether the students changed the way they interacted from the first simulation to the second. Therefore, we have no objective observations or analysis that support that they used what they had learned from the first simulation session in the next. It would be worth exploring how and if the interaction trajectories expand and develop from one simulation to the next to gain in-depth knowledge of the value of performing multiple sessions consecutively to develop IPC competence. In this dissertation, we explored the participants' immediate experiences and perspectives of the Sim-IPE. Investigating how the participants in this Sim-IPE study perceived the simulation experience after having entered healthcare as healthcare professionals would also be an interesting opportunity for further study.

The participants in this study indicated a positive change in self-assessed interprofessional competence through ICCAS after participating in the Sim-IPE scenarios. The sample size, however, was too small to determine any effect of the primary care Sim-IPE. In further studies, it would be interesting to scale up the primary care Sim-IPE to accommodate real student numbers and assess the effect on self-perceived IPC competence in a larger sample. Seeing that objective observation is found to identify areas of IPC that might not be evident to individuals when asked to self-report, using ICCAS in combination with an objective assessment tool could provide a more comprehensive assessment of the primary care Sim-IPE.

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Original papers

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Evidence of validity for the Norwegian version of the interprofessional collaborative competency attainment survey (ICCAS)

Lene Lunde[a], Anders Bærheim[b], Ane Johannessen[b], Ingunn Aase[c], Kari Almendingen[d], Irene Aasen Andersen[e], Rutt Bengtsson[f], Sissel Johansson Brenna[g], Nanna Hauksdottir[h], Aslak Steinsbekk[i], and Elin Olaug Rosvold[j]

[a]Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway; [b]Department of Global Public Health and Primary Care, Faculty of Medicine, University of Bergen, Bergen, Norway; [c]SHARE- Center for Resilience in Healthcare, Faculty of Health Sciences, University of Stavanger, Stavanger, Norway; [d]Department of Nursing and Health Promotion, Faculty of Health Sciences, Oslo Metropolitan University, Oslo, Norway; [e]Department of Health and Caring Sciences, Western Norway University of Applied Sciences (HVL), Førde, Norway; [f]Department of Social Studies, Faculty of Social Science, University of Stavanger, Stavanger, Norway; [g]Department of Health and Caring Sciences, Western Norway University of Applied Sciences (HVL), Bergen, Norway; [h]Centre for Faculty Development, Faculty of Health Sciences, The Arctic University of Norway, Tromsø, Norway; [i]Department of Public Health and Nursing, Norwegian University of Science and Technology, Trondheim, Norway; [j]Department of General Practice, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway

ABSTRACT

This was a validation study of the Norwegian version of The Interprofessional Collaborative Competency Attainment Survey (ICCAS). ICCAS consists of 20 retrospective pre- and post-questions, where respondents rate their agreement with regard to self-assessed competencies after participating in interprofessional education courses. It has been validated across various settings. The questionnaire was translated using the back-translation technique. We investigated evidence of validity regarding content, response process, and internal structure. Data were obtained from health and social care students (n = 1440, response rate 42.8%) participating in 12 different interprofessional courses in seven education institutions in Norway using a cross-sectional design. Exploratory factor analysis indicated one retracted factor for pre-scores and one retracted factor for post-scores. High McDonald's omega values indicated good internal consistency. Item deletion did not improve the scale's overall consistency on pre- or post-scores. We observed higher mean post-scores than pre-scores with moderate-to-large effect sizes, indicating a positive change in self-assessed interprofessional capabilities after training. Our findings indicate that the Norwegian version of ICCAS is a valid tool that may be implemented across a wide range of interprofessional education courses. Finally, our findings support earlier recommendations that ICCAS should be analyzed at an overall level to address change in interprofessional capabilities.

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Introduction

In 2010, the World Health Organization (WHO) highlighted that, to meet new challenges associated with optimized patient care, health-care professionals must work in interprofessional teams. The Commission on Education of Health Professionals for the 21st Century emphasized that health-care graduates were capable of interprofessional team-based care (Frenk et al., 2010). Increasing complexity in health promotion and public health worldwide has contributed to expanding interprofessional education (IPE) and interprofessional collaboration (IPC) beyond health and social care educations to include professions such as police and teachers (Barr et al., 2005).

Although there is worldwide agreement on the importance of IPE and IPC (Reeves, Palaganas et al., 2017; Reeves, Pelone et al., 2017), there is no clear international or national consensus regarding how such competencies should be assessed. Several tools are available for use in the self-assessment of individual attitudes and skills in IPC. However, most of the available assessment tools are dependent on the users' contexts and situations, and have scarcely been validated (Boet et al., 2019; Nelson et al., 2017; Shoemaker et al., 2016). The use of validated assessment tools that are less context-sensitive can help educators' measure students' self-reported achieved competence in IPE and, consequently, develop the optimal IPE for future professionals.

Background

In Norway, IPC has been highlighted in several white papers as a key factor in improving health and social services, with requirements for graduates' knowledge of IPC and collaborative competencies (The Norwegian Ministry of Education and Research, 2012, 2017b; The Norwegian Ministry of Health and Care Services, 2009). Subsequently, national frameworks, learning outcomes, and recommendations for IPC are being developed (The Norwegian Association of Higher Education Institutions, 2016; The Norwegian Ministry of Education and Research, 2017a). Several IPE courses and initiatives have emerged in recent years at Norwegian Universities and University Colleges. In an effort to synthesize experiences and contribute to expanding the IPE field in Norway,

CONTACT Lene Lunde lene.lunde@medisin.uio.no Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway

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a collaboration between seven educational institutions offering different IPE courses was formed.

One way to assess students' competencies in IPC and consequently evaluate, and compare educational courses is to use a validated self-reported questionnaire that allows comparison across various courses. We chose to translate The Interprofessional Collaborative Competency Attainment Survey (ICCAS) to Norwegian as it has been deemed valid and reliable in a variety of IPE settings (Archibald et al., 2014; Schmitz et al., 2017; Violato & King, 2019). Use of existing questionnaires does not guarantee validity after translation and cultural modification. Thus, a translated version needs to be validated (i.e., the degree to which an instrument measures what it says it should measure for the intended purpose; Cook & Beckman, 2006). Validity can be evaluated through five sources; content, response process, internal structure, relations with other sources, and consequences (Cook & Lineberry, 2016; Cook et al., 2014).

The aim of the present study was to assess the evidence for validity of the Norwegian version of ICCAS across several different educational courses as an instrument for measuring self-reported achieved competence in IPE.

The interprofessional collaborative competency attainment survey

The Interprofessional Collaborative Competency Attainment Survey (ICCAS) was developed in response to the call for validated assessment instruments for IPE evaluation (Archibald et al., 2014). ICCAS was based on the interprofessional care competencies: communication, collaboration, patient-/family-centered approach, roles, and responsibilities, conflict resolution and management, and team functioning (Canadian Interprofessional Health Collaborative, 2010). Participants self-assess changes in their interprofessional competencies' levels after completing an IPE intervention. The questionnaire has 20 retrospective pre- and post-questions. Respondents rate their agreement using a 7-point Likert-type scale, thus adopting a retrospective pre-/posttest measurement format. It also includes a "*not applicable*" option. The initial psychometric study of ICCAS in English and French consisted of 584 participants from 15 different IPE programs with 19 different professions in Canada and New Zealand (Archibald et al., 2014). The authors found good internal consistency and reliability, with two retracted pre-score factors (Cronbach's alpha.96 and .94) and one post-score factor (Cronbach's alpha .98). The authors concluded that ICCAS can be used to measure participants' competencies across several IPE programs (Archibald et al., 2014).

In a replication validation study, 785 students from various health-care professions participated after completing an educational program in Minnesota, USA (Schmitz et al., 2017). The authors made two changes to the questionnaire: the rating scale was changed from a 7-point to a 5-point qualitative Likert-type scale, and an item designed to capture how much the students' overall abilities had changed was included. The retrospective pre-/posttest measurement format was retained for collecting the data. Good internal consistency and reliability were observed with retraction of one factor for post-scores (Cronbach's alpha .96), supporting the use of ICCAS. The use of an overall sum score was recommended due to strong conceptual overlap between constructs (Schmitz et al., 2017).

In a Canadian validation study, 991 students from various health programs participated after completing a mandatory three-hour IPE course during their first weeks of education (Violato & King, 2019). Schmitz et al. (2017) version was used, and retrospective pre-/posttest measurement format was chosen for collection of data. The study provided additional validity evidence for ICCAS, supporting a single-factor structure for pre-scores (Cronbach's alpha .97) and post-scores (Cronbach's alpha .95; Violato & King, 2019). ICCAS has been used as an evaluation tool in multiple different settings in recent years such as interactive case-based IPE sessions for pre-licensure health science students (Langford et al., 2019), academic day devoted to introductory IPE experiences for first-year healthcare students (Singer et al., 2018) and IPE clinical simulations for students from non-clinical disciplines and health-care disciplines (Champagne-Langabeer et al., 2019). However, to date, most of the studies are based on the original English version (Archibald et al., 2014).

Method

This validation study was a national collaboration between seven academic institutions in Norway responsible for training health and social science students in IPC.[1]

Questionnaire and scoring

The Norwegian ICCAS translation was based on the English version developed by Schmitz et al. (2017) with a 5-point Likert-type scale. We retained the wording of the responses from the original study (Archibald et al., 2014), namely: 1 = *strongly disagree*, 2 = *slightly disagree*, 3 = *neutral*, 4 = *slightly agree*, and 5 = *strongly agree*, rather than using the qualitative responses (1 = *poor*, 2 = *fair*, 3 = *good*, 4 = *very good*, 5 = *excellent*) developed by Schmitz et al. (2017). In the Norwegian translation, the students rate their agreement, which is better answered with agree-disagree than poor-excellent. We also retained the response n/a = *not applicable* from the original questionnaire. Higher scores reflect a more positive evaluation of the students' self-assessed interprofessional capabilities (Archibald et al., 2014). An overall sum score is recommended because of strong conceptual overlap among constructs (Schmitz et al., 2017). However, because this is the first validation of the Norwegian version, we found it necessary to replicate pre-post response rate on item level for comparison.

Translation

The Center for Interdisciplinary Work-Place Learning (TVEPS) at the University of Bergen (UiB) translated the first draft of ICCAS into Norwegian, with independent back-translation into English (Beaton et al., 2000). After adjusting some grammatical discrepancies, TVEPS finalized a preliminary Norwegian version. Through a national Delphi process with representatives from all seven institutions, a cultural validation took place. A Delphi process is a means of obtaining structured group opinion and group consensus from experts in a given field (Hsu & Sandford, 2010). We discussed, incorporated, and agreed upon proposed amendments during Skype® meetings and via e-mail over a period of 6 months. Cognitive interviews were conducted with two students. Based on their interpretations of the individual questions as they filled out the form, only small changes were made. Following the students' review, we agreed upon a final version with 20 items.

Data collection

Data collection took place in a cross-sectional study from September 2018 to January 2019. We included students from the IPE courses, a total of 12, currently in effect at our seven institutions, to obtain a variety of professions and courses. The courses varied in duration and spanned a wide range of applied pedagogy, from interprofessional learning in the workplace, through learning in simulated environments, and case-based learning on campus.

A web-based survey, developed in SurveyXact® (Rambøll Management Consulting, 2019) was used. The students were provided with a link to the survey directly after completing an IPE course, thus maintaining the retrospective pre-/posttest measurement format for data collection. In addition to the ICCAS questions, the students stated gender, age, place of study, field of study (IPE course and profession), and academic year.

Data analysis

Sample characteristics of the respondents and basic statistics were calculated to visualize the data material. We treated the response category "*not applicable*" as a missing value in the data analysis. Items missing on item level were not imputed.

The validity of the Norwegian version of ICCAS was assessed by content (Delphi experts), response process (cognitive interviews), and internal structure (factor analysis, internal consistency, and paired *t*-tests). Content validity evidence was evaluated in a Delphi process with IPE experts. Evidence for response process validity was assessed by cognitive interviews with two students (Cook & Lineberry, 2016; Cook et al., 2014).

Evidence for internal structure validity was evaluated by factor analysis, internal consistency, and paired *t*-test (Cook & Lineberry, 2016; Cook et al., 2014). Internal structure was assessed by Exploratory Factor Analysis (EFA) using Principal Axis Factoring (PAF) with an oblique oblimin rotation to attain the best fitting structure and number of factors (Field, 2018). We chose PAF over other extraction procedures because it makes no assumption regarding the variables' distribution, and oblique rotation in view of the distinct possibility that any underlying factors might be correlated (Field, 2018). PAF was conducted separately on both pre- and post-scores. The suitability of the data for factor analysis was assessed by inspecting the correlation matrix for coefficients of .3 and above (Field, 2018) and Kaiser-Meyer-Olkin (KMO) values above .7 to justify good sampling adequacy (Dziuban et al., 1974). Bartlett's test of sphericity must reach statistical significance to further support the factorability of the correlation matrix (Field, 2018). To further assess the number of factors to retain, we did a Parallel Analysis. Only factors with eigenvalues exceeding the corresponding eigenvalues from a random data set of the same size are suggested for retention (O'Connor, 2000).

Internal consistency was assessed using McDonald's omega coefficient and item-total correlation (Dunn et al., 2014). If the different items on the scale measure the same concept, the internal consistency must be greater than or equal to .7. Additionally, on a reliable scale, all items should correlate with the total score ($r \geq .30$) (Field, 2018; Kline, 2000).

Paired *t*-tests on pre-and post-scores for each item were assessed to evaluate the Norwegian versions' ability to detect changes in perceived IPC competencies. We analyzed differences in pre- and post-scores in terms of standardized effect sizes, based on Cohen *d* calculations and 95% confidence limits. We interpreted "*large*" differences as those over .80, "*moderate*" differences between .79-.50, and "*small*" differences between .2-.49 (Cohen, 1988).

The SurveyXact® file was converted via Excel into an SPSS (Statistical Package for Social Science) file for statistical analysis in SPSS 26 (IBM Corp, 2017) and R (R Core Team, 2017).

Ethical considerations

Approval from the Norwegian Center for Research Data was obtained (project number 61063). Participation was voluntary, and we gained informed consent from the participants.

Results

Invitations to participate were sent to 3,367 students. Of 1,900 opened surveys, 1,012 were completed in their entirety, and 428 had most of ICCAS items completed. Consequently, 1,440 surveys were included in the analysis (42.8%). Of the respondents, 1,165 (80.9%) were female and 275 (19.1%) were male. The *median* age was 23 (*range* 18–52, *mean* 24.5, *SD* 5.32). Details of location, professional program, and academic year are listed in Table 1.

Pre-score item means ranged from 3.6 to 4.2 and post-score item mean ranged from 4.2 to 4.6. Missing item responses for pre- and post-scores ranged between 0.6 and 10.5 and 0.4–11.3%, respectively. In a comprehensive manual review of missing items, there were no obvious systematic missing except items 15 and 18. Item 15 concerns the influence of the patient/user/family in decision-making, and item 18 deals with addressing team conflict in a respectful manner. Missing percentages were 8.1% pre and 8.8% post on item 15, and 10.5% pre and 11.3% post on item 18. Item descriptions may be found in Tables 2 and 3.

Content and response process validity

Content validity was deemed adequate in the Delphi process conducted over a 6 month period by IPE experts from the seven institutions. The constructs in the questionnaire were also found to align with the learning outcomes described in the IPE courses offered in Norway. The two students' verbal assessment of the questionnaire indicated that they understood the

Table 1. Characteristics of the respondents (n = 1440). Number of respondents in each institution, program and academic year (n), and percentage of total sample (%).

	n (%)
Location	
UiB	46 (3.2)
HVL Bergen	687 (47.7)
HVL Førde	5 (0.3)
UiS	63 (4.4)
OsloMet	11 (0.8)
UiO	15 (1.0)
NTNU Trondheim	558 (38.8)
UiT	55 (3.8)
Professional Program	
Audiology	29 (2.0)
Biom edical Laboratory	96 (6.7)
Child Welfare	2 (0.1)
Dentistry*	8 (0.6)
Dental Hygiene	26 (1.8)
Geriatric Nursing	5 (0.3)
Kindergarten Teacher	3 (0.3)
Medicine*	123 (8.5)
Music Therapy	2 (0.1)
Nutrition*	8 (0.6)
Nursing	422 (29.3)
Occupational Therapy	136 (9.4)
Pharmacy*	11 (0.8)
Physiotherapy	147 (10.2)
Psychology*	5 (0.3)
Radiography	89 (6.2)
Social Education	179 (12.4)
Social Work	149 (10.3)
Academic year	
1	268 (18.6)
2	205 (14.2)
3	914 (63.5)
4	18 (1.3)
5	22 (1.5)
6	13 (0.9)

UiB = University of Bergen, HVL = Western Norway University of Applied Sciences, UiS = University of Stavanger, OsloMet = Oslo Metropolitan University, UiO = University of Oslo, NTNU = Norwegian University of Science and Technology, UiT = Arctic University of Norway.
*Professional program of more than three years duration

questionnaire and the response format, thus supporting response process validity.

Internal structure

Exploratory factor analysis (EFA)

Evaluation of the correlation matrix-supported retention of all 20 items on ICCAS. The KMO values were .96 and .97 for the pre- and post-scores, indicating that the correlation matrix was appropriate for factor analysis. Bartlett's test of sphericity reached statistical significance ($p < .001$) for pre- and post-scores, further supporting the factorability of the correlation matrix.

In the PAF analysis with oblique rotation (direct oblimin), three factors had eigenvalues over Kaiser's criterion of 1 in the pre-scores and, in combination, accounted for 60.8% of the variance. The scree plot showed inflections that could justify the retention of two factors. The Parallel Analysis showed that only one component had an eigenvalue exceeding eigenvalues from the randomly generated data matrix of the same size. Because previous studies did not support the suggested theoretical five-factor structure, we found it suitable to retain one factor for pre-scores, accounting for 47% of the total variance.

Table 2. Summary of exploratory factor analysis results.

ICCAS item	Pre-scores Factor	Post-scores Factor
1. Promote effective communication among IP members	**.62**	**.71**
2. Actively listen to IP team members' ideas and concerns	**.63**	**.77**
3. Express my ideas and concerns without being judgmental	**.62**	**.71**
4. Provide constructive feedback to IP members	**.63**	**.68**
5. Express my ideas and concerns in a clear, concise manner	**.66**	**.70**
6. Seek out IP team members to address issues	**.69**	**.76**
7. Work effectively with IP team members to enhance care	**.74**	**.80**
8. Learn with, from and about IP team members to enhance care	**.73**	**.80**
9. Identify and describe my abilities and contributions to the IP team	**.69**	**.73**
10. Be accountable for my contributions to the IP team	**.72**	**.77**
11. Understand the abilities and contributions of IP team members	**.72**	**.81**
12. Recognize how others' skills and knowledge complement and overlap with my own	**.70**	**.78**
13. Use an IP team approach with the patient to assess the health situation	**.72**	**.75**
14. Use an IP team approach with the patient to provide whole person care	**.70**	**.76**
15. Include the patient/user/family in decision-making	**.62**	**.67**
16. Actively listen to the perspectives of IP team members	**.72**	**.81**
17. Take into account the ideas of IP team members	**.72**	**.81**
18. Address team conflict in a respectful manner	**.65**	**.72**
19. Develop an effective care plan with IP team members	**.66**	**.68**
20. Negotiate responsibilities within overlapping scopes of practice	**.69**	**.73**

* Factor loadings after rotation. Factor loadings over 0.40 appear in bold

For the post-score analysis, PAF showed eigenvalues of 11.68 and 0.95 for the highest-ranking factors, explaining 58.4% and 4.7% of the variance, respectively. Only one factor had an eigenvalue over Kaiser's criterion of 1, and Parallel Analysis showed one component with eigenvalues exceeding the eigenvalues from the randomly generated data matrix. Considering a theoretical support of one factor for post-scores from previous studies, a single factor was extracted. The factor retained accounted for 56.3% of total variance. Table 2 shows the results of the factor analysis for the pre- and post-scores.

Internal consistency

The internal consistency of the ICCAS using McDonald's omega reliability coefficient was .91 for pre-scores and .92 for post-scores. Item deletion did not improve the overall consistency of the scale on either pre- or post-scores. Table 3 illustrates the item-total correlations for pre- and post-scores.

The internal consistency of factors using McDonald's omega reliability coefficient was .91 for the pre-score factor and .92 for the post-score factor.

Paired t-tests

There was a significant difference ($p < .001$, two-tailed paired sample *t*-test) in mean scores for each pre- and post-item pair. Overall, we observed moderate-to-large effect sizes for 18 of the 20 items indicating responsiveness of the Norwegian version (Table 4).

Table 3. Item total score correlation and omega if item deleted based on students' responses pre- and post-score.

	Pre-scores		Post-scores	
ICCAS item	Item total r	Omega if item deleted	Item total r	Omega if item deleted
1. Promote effective communication among IP members	.63	.90	.74	.92
2. Actively listen to IP team members' ideas and concerns	.65	.90	.79	.92
3. Express my ideas and concerns without being judgmental	.63	.91	.73	.92
4. Provide constructive feedback to IP members	.64	.91	.69	.92
5. Express my ideas and concerns in a clear, concise manner	.67	.91	.74	.92
6. Seek out IP team members to address issues	.69	.91	.78	.92
7. Work effectively with IP team members to enhance care	.73	.91	.82	.92
8. Learn with, from and about IP team members to enhance care	.74	.91	.82	.92
9. Identify and describe my abilities and contributions to the IP team	.70	.91	.76	.92
10. Be accountable for my contributions to the IP team	.72	.91	.79	.92
11. Understand the abilities and contributions of IP team members	.72	.91	.81	.92
12. Recognize how others' skills and knowledge complement and overlap with my own	.71	.91	.79	.92
13. Use an IP team approach with the patient to assess the health situation	.71	.91	.76	.92
14. Use an IP team approach with the patient to provide whole person care	.70	.91	.78	.92
15. Include the patient/user/family in decision-making	.62	.91	.70	.92
16. Actively listen to the perspectives of IP team members	.72	.91	.82	.92
17. Take into account the ideas of IP team members	.73	.91	.82	.92
18. Address team conflict in a respectful manner	.65	.91	.72	.92
19. Develop an effective care plan with IP team members	.67	.91	.70	.92
20. Negotiate responsibilities within overlapping scopes of practice	.70	.91	.76	.92

Discussion

Our study provides validity evidence for the Norwegian version of ICCAS in content, response process, and internal structure in alignment with findings from previous validation studies. The consequence of our study is further recommendation to analyze ICCAS at an overall level to address change in interprofessional capabilities.

A thorough Delphi process involving the IPE experts responsible for conducting the various IPE courses in Norway ensured that the content in the Norwegian version aligned with the construct, thus providing evidence of content validity. Evidence of response process was provided with cognitive interviews of two students indicating that they understood the questionnaire and the response format. In retrospect, we could have expanded the pilot test to involve several students in an effort to further assess clarity of the questionnaire. However, at the time, we deemed the answers from those students to be sufficient.

As with previous studies (Archibald et al., 2014; Schmitz et al., 2017; Violato & King, 2019), the factors emerging in our study did not support the theoretical five-factor construction of communication, collaboration, roles, and responsibility, patient/family-centered care, conflict management/resolution, and team functioning (Canadian Interprofessional Health Collaborative, 2010). We extracted one factor from the pre-scores and one factor for post-scores. High McDonald's omega for the factor from pre-scores and the factor from post-scores in our material further demonstrates good internal consistency, supporting evidence of internal structure validity. However, as with previous studies (Archibald et al., 2014; Schmitz et al., 2017; Violato & King, 2019), a single-factor structure in our material suggests a strong conceptual overlap between constructs.

The internal consistency of the Norwegian version of ICCAS was found to be good, with high McDonald's omega coefficient values, supporting evidence for the internal structure's validity. Item deletion from the Norwegian version of the scale would neither increase nor decrease the McDonald's omega. This is consistent with the results from previous validation studies (Archibald et al., 2014; Schmitz et al., 2017; Violato & King, 2019), further supporting retention of the items. A desirable value for internal consistency is usually between .70 and .90. Very high omega coefficients might be associated with redundancy of elements (Dunn et al., 2014). In our material, the McDonald's omega coefficient is just above the upper value of .90. ICCAS has proved to contain sets of measures that are naturally correlated, and therefore, can be expected to be highly interrelated. Based on that assumption, we argue that our findings suggest a good internal consistency.

We found that mean post-scores were higher than pre-scores, reflecting a positive change in self-assessed interprofessional capabilities. Our study indicates a slightly larger effect size on the different items than Archibald et al. (2014) and Schmitz et al. (2017), with 18 items scoring moderate or large effect size. Violato and King (2019) reported higher effect sizes than our study, with the majority of items scoring large effect size. The authors argued that the large effect sizes may be accounted for by low levels of previous IPE and IPC experience among their participants (Violato & King, 2019). Several factors may explain the differences in our material, including previous IPE experience or the absence thereof. However, we did not ask the students about their prior experience. Another reason could be that the participating educational institutions have an above-average involvement and focus on interprofessional collaborative learning, which might in turn affect the students' learning favorably, regardless of previous experience. Nevertheless, we report a positive change in self-assessed IPC competencies, adding to the evidence that the ICCAS is responsive and sensitive in measuring change.

Limitations

A retrospective pre-/post-measurement format offers a means of limiting recall bias in self-reported questionnaires (Skeff et al., 1992). Recall bias can occur when participants do not remember their pre-ratings and/or have changed their understanding of the concepts being measured. When the pretest is completed at the same time as the posttest, directly after the intervention, it is possible to reduce this response-shift bias, because the students have better perspectives on their improvement in IPC when they complete the questionnaire (Skeff et al., 1992). With this measurement format, however, some students may wish to

Table 4. Paired-samples *t*-tests between pre- and post-scores on each item.

Construct	Items[1]	Mean (SD) Retrospective Pre-score	Mean (SD) Post- score	Mean difference [95% CI] Post-pre	Effect size[2]	Difference[3]
Communication	1	3.55 (0.85)	4.30(0.75)	0.75 [0.71, 0.80]	.89	Large
	2	4.23 (0.85)	4.60 (0.73)	0.37 [0.33, 0.41]	.50	Moderate
	3	4.09 (0.90)	4.42 (0.80)	0.33 [0.29, 0.37]	.44	Small
	4	3.78 (0.95)	4.18 (0.85)	0.40 [0.36, 0.44]	.53	Moderate
	5	3.75 (0.89)	4.18 (0.84)	0.43 [0.39, 0.46]	.57	Moderate
Collaboration	6	3.78 (0.97)	4.36 (0.80)	0.58 [0.53, 0.62]	.67	Moderate
	7	3.84 (0.90)	4.44 (0.75)	0.60 [0.56, 0.65]	.74	Moderate
	8	3.74 (0.90)	4.47 (0.76)	0.73 [0.69, 0.77]	.84	Large
Roles and responsibilities	9	3.68 (0.92)	4.28 (0.80)	0.60 [0.55, 0.64]	.73	Moderate
	10	3.92 (0.94)	4.38 (0.78)	0.46 [0.42, 0.50]	.62	Moderate
	11	4.08 (0.92)	4.58 (0.74)	0.50 [0.46, 0.54]	.63	Moderate
	12	3.85 (0.93)	4.49 (0.76)	0.64 [0.60, 0.69]	.76	Moderate
Patient-centered care	13	3.58 (0.95)	4.29 (0.83)	0.71 [0.67, 0.76]	.82	Large
	14	3.64 (0.93)	4.29 (0.83)	0.65 [0.60, 0.69]	.77	Moderate
	15	3.85 (0.98)	4.28 (0.88)	0.43 [0.39, 0.47]	.56	Moderate
Conflict management, team functioning	16	4.20 (0.86)	4.58 (0.73)	0.38 [0.34, 0.42]	.54	Moderate
	17	4.19 (0.87)	4.54 (0.75)	0.35 [0.31, 0.38]	.52	Moderate
	18	4.00 (0.96)	4.31 (0.88)	0.31 [0.27, 0.34]	.46	Small
	19	3.62 (1.01)	4.18 (0.93)	0.56 [0.51, 0.61]	.67	Moderate
	20	3.67 (0.94)	4.20 (0.88)	0.53 [0.49, 0.57]	.64	Moderate

[1]Item description is found in table 2 & 3. [2]Cohen *d*, [3]Qualitative differences: "*Large*" = values of ≥0.8, "*Moderate*" = values between 0.79-0.50 and "*Small*" values between 0.2-0.49 (Cohen, 1988)

Items on ICCAS were scored on a five-point Likert-type scale; 1= *strongly disagree*, 2= *slightly disagree*, 3= *neutral*, 4= *slightly agree*, 5= *strongly agree*, n/a= *not applicable* (registered as missing)

maximize the pre- and post-difference. Results from our material show that the students indicate the IPE programs had a moderate-to-large effect. However, the description of each variable supports the finding that the students did not maximize their differences, with pre-score item mean ranging from 3.6 to 4.2 and post-score item mean ranged from 4.2 to 4.6. Therefore, ICCAS has provided us with positive evidence for student learning of interprofessional competencies. We are also aware that the item effect sizes could reflect some differences in sample as well as random coincidences. In future studies, it could be interesting to see if actual repeat-measurement of the questionnaire replicates the change-score evidence found in the pre-post format.

When assessing results from the self-reported questionnaire, we must be mindful that the responding students might be the most receptive and positive to the IPE course they attended. Our sample might not consist of the students that were dissatisfied with the courses, thus enhancing the positive results. Nothing is known of the study's non-responders, and we acknowledge that their responses could have altered our results. The opportunity to compare our results with three other thorough validation studies strengthened our study. The use of a self-reported instrument without any objective measures of how the students' abilities changed is also an important limitation. However, until we obtain a validated scoring tool for objective evaluation of IPC, use of self-report instruments is one way to assess competencies across settings.

The educational courses involved in our study varied in length and format. Not all courses contained elements of patient/family involvement, which might explain why items about the involvement of patient/family had the highest missing values. Furthermore, relatively short courses, such as many of the courses in our study, might not represent an arena for the emergence of conflicts. Thus, management of interpersonal conflicts might not arise, resulting in high missing values. Another limitation is that the mean score we refer to is based on courses that vary in duration, content, and participants. We have not compared results based on institutions, courses, or professions to explore possible differences or similarities. However, in an effort to validate the Norwegian version of ICCAS across several different IPE courses, we deemed it necessary to analyze the material as a whole.

Although there are limitations to our study, we found sound evidence for validity of the Norwegian version of ICCAS across settings. We will continue to use ICCAS for evaluation of our educational programs, and to compare results across courses, educations, and sites.

Practical and theoretical implications

One of the strengths of this study is that it contributes further evidence for the validity of ICCAS across several courses. We have also shown support for regarding ICCAS as a questionnaire that is responsive and sensitive in measuring change in students' competencies.

Our results do not support the theoretical five-factor construct the ICCAS is based on, but rather a single-factor solution for pre- and post-scores. Thus, we question the validity of constructing sub-competencies and learning outcomes to interprofessional capabilities. Use of social learning theories can be one way of understanding interprofessional competence, whereby the students learn through participation in social activities (Lingard, 2012). From a socio-cultural perspective, for example, learning is regarded as a process whereby people reconfigure their relationships in practice. Knowledge and skills that define experts are based on knowledge and values that matter in practice, and are made up of shared experiences or shared understandings (Edwards, 2012). Their competence, therefore, is developed in the context of teamwork, through which multifaceted interactions and actions accumulate into interprofessional competence. Thus, we support Schmitz et al. (2017) in that ICCAS must be analyzed at an overall level, rather than divided into different competencies or items. To our understanding, this does not mean that ICCAS is inappropriate for measuring interprofessional capabilities. On the contrary, our results support the complexity and interconnectedness of interprofessional competencies and indicate that ICCAS can be used to measure the change of overall collaborative interprofessional abilities.

The national requirement for learning outcome descriptions for IPC in Norway can help reduce disparities in education and facilitate IPE (The Norwegian Ministry of Education and Research, 2017a). Institutions are free to choose educational and assessment methods to ensure that the defined final competence is achieved. Therefore, our combined efforts to translate and validate the Norwegian version of ICCAS ensures that institutions offering IPE courses have access to a validated tool with which to assess students' self-reported competencies in IPC when the requirements for IPC learning outcomes are in effect. A shared, validated measurement tool could prove valuable for measuring students' self-reported acquired competencies, but also to evaluate and compare educational courses across institutions.

Conclusion

Knowledge and expertise in interprofessional collaboration is a desired outcome highlighted by national white papers and international frameworks to prepare students for an increasingly complex health and social services. Using validated, less context-specific assessment tools that are easy to use and implement helps educators to obtain students' self-reported achieved competence in IPE. Those results can be useful in evaluating IPE courses, and consequently, be used to develop the best possible IPE for future professionals.

Our study provides validation evidence for the Norwegian version of ICCAS regarding content, response process, internal structure, and consequences. Although validation is an ongoing process and further evidence is needed, especially concerning comparison to objective measures, our study contributes to the accumulated validation of ICCAS to measure students' acquired, self-reported IPE competencies across several different IPE courses. As with earlier validation studies, we recommend that ICCAS be analyzed at an overall level, supporting the use of ICCAS to measure changes in overall collaborative interprofessional ability.

Note

1. University of Bergen (UiB), Western Norway University of Applied Sciences (HVL), University of Stavanger (UiS), Oslo Metropolitan University (OsloMet), University of Oslo (UiO), Norwegian University of Science and Technology (NTNU) and the Arctic University of Norway (UiT)

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Declaration of interest

We report no conflict of interest and are responsible for the content and writing of this article.

Notes on contributors

Lene Lunde, RN, MSc, PhD Candidate, Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Norway.

Anders Bærheim, MD, Professor Emeritus, Department of Global Public Health and Primary Care, Faculty of Medicine, University of Bergen, Bergen, Norway.

Ane Johannessen, Associate Professor, Department of Global Public Health and Primary Care, Faculty of Medicine, University of Bergen, Bergen, Norway.

Ingunn Aase, RN, Associate Professor, SHARE - Centre for Resilience in Healthcare, Faculty of Health Sciences, University of Stavanger, Stavanger, Norway.

Kari Almendingen, CD, Professor, Department of Nursing and Health Promotion, Faculty of Health Sciences, Oslo Metropolitan University, Oslo, Norway.

Irene Aasen Andersen, RN, Associate Professor, Department of Health and Caring Sciences, Western Norway University of Applied Sciences, Førde, Norway.

Rutt Bengtsson, SW, Associate Professor, Department of Social Studies, Faculty of Social Science, University of Stavanger, Stavanger, Norway.

Sissel Johansson Brenna, RN, Assistant Professor, Department of Health and Caring Sciences, Western Norway University of Applied Sciences, Bergen, Norway.

Nanna Hauksdottir, PT, Assistant Professor, Centre for Faculty Development, Faculty of Health Sciences, The Arctic University of Norway, Tromsø, Norway.

Aslak Steinsbekk, Professor, Department of Public Health and Nursing, Norwegian University of Science and Technology, Trondheim, Norway.

Elin Olaug Rosvold, MD, Professor, Department of General Practice, Institute of Health and Society, Faculty of Medicine, University of Oslo, Norway.

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Paper 2

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RESEARCH ARTICLE Open Access

Exploring healthcare students' interprofessional teamwork in primary care simulation scenarios: collaboration to create a shared treatment plan

Lene Lunde[1*], Anne Moen[1], Rune B. Jakobsen[2], Elin O. Rosvold[3] and Anja M. Brænd[3]

Abstract

Background: Primary care providers assume responsibility for patients with increasingly complex problems requiring interprofessional collaboration. Introducing interprofessional education in healthcare curricula prepares healthcare students for this reality. Solving simulation scenarios as an educational strategy is promoted to support interprofessional education in health care, and is mostly used in acute clinical situations. This paper aims to explore how healthcare students' actions influence interprofessional collaboration and treatment plan identification when they solve common, sub-acute patient scenarios in primary care situations.

Methods: Interaction analysis of video recordings from the simulation scenarios was performed with a focus on the students' joint actions; specifically how these actions unfold and how productive the students were in terms of developing treatment plans.

Results: We found variation in the groups' interactions, the paths they followed, and the quality of their knowledge output in their shared treatment plan. The groups with the capacity to collaborate and engage in sharing information, and explain and elaborate on concepts, were more successful in developing comprehensive treatment plans. Furthermore, these groups managed the duality of defining and solving the immediate problem and collaboratively preparing for future care.

Conclusions: Analysis of the activities in our scenarios showed the students' potential to practice interprofessional collaboration. Our study illustrates that simulation of sub-acute scenarios in primary care is an underexplored but suitable arena to train communication and teamwork in complex situations. The simulation scenarios are also feasible for use on-site in an educational facility or in practice with minimal equipment and resources.

Keywords: Primary care, Interprofessional education, Simulation, Interaction, Healthcare students

Background

Primary care professionals assume responsibility for patients with increasingly complex problems. Shorter hospital stays and increased emphasis on home care and aging in place suggest that more people will require primary health care [1]. To meet such new challenges and offer optimized quality patient care, working in interprofessional teams will be the preferred practice [2, 3]. Introducing interprofessional education (IPE) into healthcare curricula prepares healthcare students for interprofessional collaboration [3].

* Correspondence: lene.lunde@medisin.uio.no
[1]Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway
Full list of author information is available at the end of the article

IPE implies that students from two or more professions engage in interactions to learn about, from, and with one another to improve collaboration and quality of care [1, 4]. Research has showed that students in healthcare IPE programs gained confidence, improved communication skills, adopted more positive attitudes towards interprofessional learning and team care, and enhanced their understanding of the roles of other professionals after participating in IPE [5, 6]. Despite broad consensus on the importance of IPE, there is no consensus on how to integrate IPE into healthcare education, or go beyond profession-specific teaching and overcome practical constrains such as schedules, actual space capacity, teacher resources, and economics [7, 8].

Healthcare education programs may have different perspectives on learning and teaching, adding to the barriers of implementing IPE. Based on the definition of IPE, where learning "about, from and with" one another is the cornerstone, we adopted a socio-cultural perspective to understand interprofessional learning. Facilitating IPE requires effective teaching methods, and the use of simulation as an educational strategy is promoted to support IPE in healthcare education [9, 10].

The use of simulation scenarios is recognized as a facilitator for active learning to develop clinical and collaborative skills in a safe environment in health care and healthcare education [11]. Simulation offers realistic learning activities based on clinical scenarios with a focus on developing skills, combining knowledge and skills, and transferring knowledge to practice [12]. The simulations may consist of several modalities, such as case studies, role-playing games, and simulation with technology [13], or utilizing technical equipment, simulated patients, professional patients, virtual environments, or a combination of these [12]. Simulation training typically exposes the learners to the problem-solving of severe, time-critical, and potentially fatal scenarios, such as resuscitation [14], trauma care [15], and surgery [16], as well as strategies for improved interprofessional collaboration in acute situations [5].

Shift of care and treatment from hospitals to primary care, increased prevalence of long-term conditions, and complex care requirements depend on collaboration between healthcare professionals in primary care who are more accustomed to collaborate within their profession, organization and sector [17]. Thus, primary care professionals, and healthcare students, do not necessarily have the skills, knowledge, and values needed to collaborate with the range of professionals they will meet during their professional work [18]. Previously reported primary care education studies include simulation scenarios for home visit preparation [19], home care and safety assessments [20], medication management [21], patient consultations [22], and end-of-life care [23].

Expanding simulation training to include common, sub-acute primary care scenarios offers the learners complex situations where they have time to assess, discuss, and collaborate to solve the problem. In particular, the development of shared treatment plans can work as a means to improve communication, coordination, and collaboration, consequently resulting in a more coherent plan for the patient [24]. These scenarios are typically not as time-critical and dependent on detailed algorithms or checklists as many acute-care scenarios. The outcome is dependent on the learners' capacity to use their knowledge in practice, and to collaborate and expand on their clinical judgment together. Thus, such simulation may prepare the students for realistic and common clinical situations. Introducing simulation-based IPE with a focus on primary care scenarios can supplement traditional simulation approaches for developing the collaborative competence required to work in healthcare teams.

This paper describes the analysis of healthcare students' interactions while exploring common, sub-acute patient scenarios in primary care situations, and aims to explore how healthcare students' actions influence interprofessional collaboration and treatment plan identification.

Theoretical perspective

This study adopts a socio-cultural perspective where knowledge and learning are constructed and co-created in interactions between participants, environments and artefacts (tools and objects) in a social practice [25, 26], herein "simulation" is the social context. Thus, learning is viewed as a result of participating in social activities and collaborating with others in a cultural context to solve mutual problems, produce outcomes, and gain insight. Learning is further defined as a developmental process outlined as the zone of proximal development (ZPD). ZPD refers to a development space for students' collaborating with others through social interaction [26]. This view of learning is also in line with the aforementioned definition of IPE as learning "about, from and with" one another emphasize learning through interactions in a social context [1]. These premises are complemented by the following constructs: shared knowledge objects, productive interactions, active participation, and interaction trajectories [27]. The *shared knowledge objects* are viewed as the materialization and co-creation of knowledge that represents the goal to be pursued (e.g. learning outcome) and the material outcome to be achieved through the activity (e.g. simulation) [27];. We understand *productive interactions* as verbal and non-verbal communicative exchanges between the participants leading to the co-construction of the shared knowledge objects [28]. *Active participation* is understood as deliberate, joint, knowledge driven activities contributing to the shared goal [27]. The *interaction trajectories* are viewed as coherent sequences of productive interactions, which unfolds as moment-to-moment events over time [27].

Methods

Research design

We conducted an explorative, qualitative study with video recordings of healthcare students participating in primary care simulation scenarios. The unit of analysis in this study is the collaborative actions (verbal and non-verbal) in which the shared knowledge is produced. Such actions comprise speech, bodily behavior, artefacts, and environmental structures.

Participants and setting

We recruited 27 healthcare students close to graduation, 10 of which were medical students (MS), eight were master's students in advanced geriatric nursing (AGN), and nine were bachelor's students in nursing (NS). The students were allocated into 10 groups, and two groups participated in the simulation each day. Table 1 presents details regarding the participants.

The simulation took place at UiO:eColab, a research laboratory with two fully equipped healthcare offices/ consultation rooms separated by a control room. We used a Laerdal SimMan® patient simulator [29]. The patient simulator presented clinical signs such as pulse, blood pressure, breath movements, and heart and lung sounds. The facilitators were present in the simulation room, and acted as the patient's voice and supplemented responses not available through the simulator.

Table 1 Participant description

	Total *N* = 27	MS *N* = 10	AGN *N* = 8	NS *N* = 9
Age				
Mean (SD)	31 (9.4)	28 (3.4)	42 (7.8)	25 (6.7)
Min-Max	21-49	24-34	28-49	21-42
	N (%)	N (%)	N (%)	N (%)
Male	6 (22.2)	3 (30)	1 (12.5)	2 (22.2)
Female	21 (77.8)	7 (70)	7 (87.5)	7 (77.8)
Prior simulation experience				
Yes	22 (82)	8 (80)	6 (75)	8 (88.9)
No	5 (18)	2 (20)	2 (25	1 (11.1)
Prior interprofessional simulation experience				
Yes	7 (26)	2 (20)	2 (25)	3 (33.3)
No	20 (74)	8 (80)	6 (75)	6 (66.7)

Simulation scenarios

We developed two simulations with common, sub-acute patient scenarios from primary care situations. The scenarios were developed based on the assumption that caring for patients with complex problems is often beyond the expertise of any single profession [30]. The two scenarios had a shared introduction with an older patient staying at a nursing home following surgery for a hip fracture. Then, the patient developed symptoms of either a urinary tract infection or pneumonia. The simulation session started with a briefing about the room, available (technical) equipment, a reminder about confidentiality, and an introduction to the scenario. During the briefing, we also emphasized to the students that collaboration was important. The students were assigned to perform a clinical assessment, agree on a reasonable clinical problem or diagnosis, and develop a shared treatment plan during the simulation. Each simulation scenario lasted for 25 to 35 min (mean 31 min). The facilitator conducted a debriefing directly after the simulation. The students were asked not to reveal the content of the simulation until all the groups had participated in both scenarios.

Data collection, analysis, and transcription methods

We collected data during 5 days in April 2019. Video recording was chosen to enable repetitive viewings of the dialogue and interactions by the project group [31]. Discrete placement of cameras and audio recorders in the ceiling, which were operated from the control room, minimized interference from technical equipment. The recordings were directly imported to a secure data storage facility at the University of Oslo (TSD), where only the project group had access. The facilitators took field notes during the simulation.

We used interaction analysis to guide our analysis of the data. Interaction analysis is a useful method to study the unfolding interactions in play during a social activity, including talk, non-verbal interactions, and material artefacts [31, 32]. Initially, the first author undertook a preliminary, comprehensive review to obtain an overview of the data and then created a timecoded content log of key events for all the videos, a total of 20 h. Secondly, after a substantive review of the data, we selected the students' efforts to develop a treatment plan for the patient for further analysis. The treatment plan was viewed as a representation of the shared knowledge object co-created in the interactions and the communicative exchanges between the students. Furthermore, shared treatment plans are essential for efficient coordination of care and, thus, are an important part of interprofessional collaboration. In a third analytical step, relevant segments from the video recordings containing the development of the treatment plan were extracted for final analysis. Verbatim transcription of verbal and non-verbal behavior in the extracted segments was performed. Then the segments and associated transcripts were analyzed in depth, focusing on the teams' interactions when they developed the treatment plan. The first author translated the transcripts to English. In the transcripts, shorter pauses are marked by brackets with punctuation representing seconds, concurrent talk is marked by double slashes at the start and end of an excerpt, and half sentences are marked with single slash.

Ethical considerations

We informed the students about voluntary participation, confidentiality, video recording and data storage, and that only the project group had access to the recorded material. We obtained informed consent after giving oral and written information. The Norwegian Centre for Research Data approved the study (project number 60867).

Strategies to enhance rigor and trustworthiness in the analysis

The video recordings facilitated repeated review of the material, individually and in group work, by coauthors with different backgrounds, helping to ensure the legitimacy of our interpretations [33]. The first and last author were present for all of the simulations, while the remaining coauthors were present for one to 3 days, enabling familiarity with the material. The authors are nurses (LL, AM) and medical doctors (RBJ, EOR, AMB) working in research and education (e.g. teaching, curriculum planning, and simulation training). The authors also have experience from different healthcare settings, including primary care. This might produce unconscious preconceptions about the activity in the simulations; however, the authors' experience may also facilitate awareness and understanding of what these situations entail. In the following transcribed extracts, extensive details are provided to make it possible to follow the talk and interactions, ensuring a high level of transparency [33].

Results

The analysis revealed that the content and structure of the treatment plans varied between the groups and was influenced by the interactions and communication between the students. This led us to divide the material into two groups: *specific treatment plans* and *non-specific treatment plans*. A specific treatment plan had relevant, clearly defined clinical problem(s) with defined, related actions and interventions. A non-specific treatment plan either had several unspecified clinical problems or lacked defined problems entirely, and the actions and interventions were non-specific or nonexistent. Table 2 shows overall performance in creating a treatment plan during their first simulation.

In the groups that engaged in productive interactions, and created a specific treatment plan, we observed a deliberate, collective strategy bringing multiple perspectives into the discussions. The interactions unfolded as coherent sequences where the students actively built on each other's input in a joint effort. The students shared information and discussed, and their collaborative actions led to the emergence of new knowledge and progress of the shared treatment plan. In the groups that created non-specific treatment plans we observed circular discussions, with repetition of prior statements without clarifying the concepts. There were limited contributions and less active participation in the groups, which led to less development of shared knowledge, and ended with a non-specific treatment plan. We have selected unfolding interactions as examples from two groups that prepared a specific and non-specific treatment plan to illustrate the most typical interactions and co-creation activities observed in the simulations. In the following section, we present examples from Group 1 and Group 2 to help explain and visualize these interactions.

Table 2 Overall performance in the 10 groups

Group	Participants	Overall performance in creating a treatment plan
1	MS, AGN, NS	Specific treatment plan
2	MS, AGN, NS	Non-specific treatment plan
3	MS, AGN	Non-specific treatment plan
4	MS, AGN, NS	Non-specific treatment plan
5	MS, NS	Non-specific treatment plan
6	MS, AGN, NS	Specific treatment plan
7	MS, AGN, NS	Non-specific treatment plan
8	MS, AGN	Specific treatment plan
9	MS, AGN, NS	Non-specific treatment plan
10	MS, NS, NS	Non-specific treatment plan

Interactions and collaborative co-creation activities leading to a specific treatment plan

Group 1 consists of an MS, AGN, and NS and they are simulating a scenario with pneumonia. At the beginning of the simulation, they are sitting by the table in the office, with the AGN in the middle. The medical record lies open in front of the MS and AGN. There is a notepad with notes on the table in front of the NS. Everybody is looking at the medical record.

Establishing shared understanding

In the following excerpt, we meet Group 1 at the starting point of the planning phase (Table 3). Before this excerpt, they agreed on pneumonia and dehydration as tentative clinical problems for the patient.

In the excerpt, we see that the MS starts with an open question about fluid intake (Section 1.1), inviting the other participants to contribute. The invitation is accepted, with both the NS and AGN contributing. The NS writes on the notepad and suggests writing their plan down (Section 1.8). The AGN reads the medication list and explains that the patient is on diuretics.

The first notable finding in this excerpt is that this group's interactions were aimed at creating a shared understanding from the start. By looking at the AGN and NS, talking in an open, questioning tone, the MS addresses both directly to assess their interpretation of the situation. The conversation between the participants is characterized by equal contribution, albeit in half sentences. Nevertheless, they elaborate spontaneously on one another's input. The NS suggests writing down a plan in an attempt to structure the group's knowledge. They continue to elaborate on one another's suggestions, contributing to further clarification and specification of diagnostic tests and treatment.

Mobilizing mutual knowledge

Leading up to the following excerpt, the group had been discussing pain medication, which led the NS to suggest monitoring the patient's pain. Both the MS and AGN agreed to this suggestion, with the MS exclaiming that it was a very good idea. The discussion continues in Table 4.

As illustrated in this excerpt, MS actively addresses the AGN and invites the AGN to contribute in a friendly tone (Section 1.11). The AGN hesitates slightly and reaches for the forms. The AGN flips through the pile of forms and explains that registering delirium should be considered (Section 1.12). Then NS spots the form and points towards it (Section 1.16). The AGN confirms that the NS is correct in a cheerful tone (Section 1.17).

The excerpt presented in Table 2 illustrates that the MS actively seeks to obtain the AGN's specific knowledge in an effort to elaborate on the treatment plan. The AGN gives an impression of familiarity with the use of different forms to assess delirium and takes initiative to look for a suitable form. This is picked up on by the others, with both the NS and MS leaning towards the forms as the AGN goes through them. The NS spots the form first, draws attention to it and gets confirmation from the AGN. In doing this, they utilize the tools and

Table 3 Excerpt 1 from Group 1

	Participant[a]	Verbal	Non-verbal
1.1	MS	Ehm (..) It (.) / I think that we at least can ehm, consider giving him some fluid. He had drunk a little, but //he//	Starts hesitantly, but continues to talk in a normal, clear tone. MS turns toward AGN at "I think". MS alternates between looking at AGN and NS. Both look at MS. Uses questioning tone at "drunk a little."
1.2	NS	//a coffee// was what he //said//	Confirms in an agreeable tone. NS nods.
1.3	MS	//yes//	Positive, confirmative tone. MS points to NS.
1.4	AGN	//mm//	Confirmatory sound. AGN reaches towards the medical record with right arm.
1.5	MS	He appeared a little dry (*dehydrated*)	Questioning, open tone
1.6	NS	mm	Light, confirmative tone
1.7	AGN	Yes, eh //he is on//	Clear, agreeable tone at first, then explanatory. AGN flips the medical record to the medication list. MS leans forward to look at the medication list.
1.8	NS	//let's//see, shall we write down the plan? (..)	Questioning tone. NS takes the notepad and picks up a pen. Writes something in the notepad.
1.9	AGN	ehh (..) He is on diuretics, on Furosemide	Hesitant tone, while reading the medication list; turns it slightly towards themselves. Scratches face with right hand. Explanatory, friendly tone.
1.10	MS	Right	Confirmative, friendly tone

[a]*MS* medical student, *NS* Nursing student, *AGN* Advanced geriatric nursing student

Table 4 Excerpt 2 from Group 1

	Participant[a]	Verbal	Non-verbal
1.11	MS	Do you have any other thoughts?	Friendly, questioning tone. Looks at AGN and then back at the medical record. NS writes.
1.12	AGN	(...) Ehh, let's see what kind of forms there are here. I just thought about registering, in relation to (..) eh such (.) delirium and such //things//	AGN straightens and hesitates somewhat. Talks in a mild, explanatory tone and reaches for the box with forms. AGN lifts them up and goes through the pile of forms. MS and NS watch, leaning towards AGN. AGN continues to talk in an explanatory tone.
1.13	MS	Yes	Clear, agreeable tone
1.14	NS	mm	Light, agreeable tone
1.15	AGN	Ehm (...)	Hesitant sound uttered while AGN reads.
1.16	NS	Yes, the one there (..)	Quiet, suggestive tone. NS points to the form.
1.17	AGN	Yes, the one there (..) 4AT[b]	Cheerful, friendly tone. AGN shrugs a little at "4AT", then smiles and laughs.
1.18	NS	Yes, right	Cheerful, friendly tone. NS smiles and brushes hair away from face with right hand.

[a]*MS* Medical student, *AGN* Advanced geriatric nursing student, *NS* Nursing student. [b]4AT = refers to the rapid clinical test for delirium

resources available in the room to expand on the joint knowledge development.

So far, these short excerpts show Group 1's attempts to gain knowledge by using artifacts, and that they continue to build on one another's statements and suggestions in order to co-create a coherent treatment plan.

Elaborating on and reframing the shared knowledge

Continuing the planning phase, the group has discussed the 4AT (a tool for delirium assessment) and National Early Warning Score (NEWS) forms. The MS expressed unfamiliarity with the 4AT and NEWS forms, and the AGN and NS both contributed in explaining the forms' aims and usages. In the following excerpt (Table 5) Group 1 starts to conclude their treatment plan.

This excerpt shows that the NS initiates the summarization of the treatment plan (Section 1.19). The NS summarizes in a clear, friendly tone, while actively pointing to the notes on the notepad (Section 1.21). The MS and AGN look attentive towards the NS and contribute with clear, confirmative sounds (Section 1.22). The NS appears unsure about the possibility of monitoring pain with the suggested form, hesitating and talking in a questioning tone while looking at the AGN (Section 1.26), prompting the AGN to explain (Section 1.27). After this excerpt, they continue to discuss different pain scales and then the NS continues to summarize the plan.

Table 5 Excerpt 3 from Group 1

	Participant[a]	Verbal	Non-verbal
1.19	NS	So, to conclude	Clear, friendly tone. NS points to the notepad when mentioning concluding.
1.20	MS	mm	Confirmative sound
1.21	NS	We administer 1 l of Ringer Acetate slowly now	NS continues to summarize in a clear, friendly tone and actively points to the notes, tracks the notes, and looks down at the notepad.
1.22	MS/AGN	mm	Confirmative sound. MS and AGN nod, both hold their attention towards NS.
1.23	NS	Intravenously. We send a urine sample for cultivation. Eh (.) see if we can get a nasopharynx test	Still clear, friendly tone. Hesitates slightly and looks from MS to AGN when mentioning nasopharynx. Seems open for input and/ or questions.
1.24	AGN	mm	Confirmative sound. AGN nods.
1.25	MS	Yes	Confirmative tone. MS nods.
1.26	NS	Eh, and then we try to monitor the pain with VAS scale[b] if we can manage. Then we can see (…)	NS hesitates a little again, continue to track the notes and talks in a slightly questioning tone. Looks at AGN when mentioning VAS. NS shrugs at "if we can manage" as if unsure if it will work. NS gestures with right arm at "can see."
1.27	AGN	There are different types //of pain scales yes//	AGN looks at NS. Confirmative, explanatory tone. Nods. NS and MS hold their attention towards AGN.

[a]*NS* Nursing student, *MS* Medical student, *AGN* Advanced geriatric nursing student. [b]VAS scale refers to visual analog scale

The MS and AGN contribute with input to make the plan more specific.

Here, the students attempt to construct an overview by summarizing their existing knowledge, initiated by the NS. Through the structuring and reframing of the proposed treatment plan, the group members collectively arrive at a better understanding of how to treat the patient. The way in which the students continuously dealt with uncertainty by explaining and elaborating upon the concepts in question during the planning shows that they are attentive towards one another and actively seeking joint knowledge. This example is illustrative of interactions that lead to a concrete and specific treatment plan.

Interactions and collaborative co-creation activities leading to an unspecific treatment plan

Group 2 has the same composition as Group 1, with an MS, AGN, and NS, and they are also simulating the scenario with pneumonia. At the beginning of the simulation, they are sitting by the table in the office, with the MS in the middle. The medical record lies open in front of the MS. A notepad with notes is on the table in front of the AGN. The AGN and NS look at the MS.

Identifying collective uncertainty

In the excerpt presented below, we meet Group 2 approximately 1.5 min into the planning phase. Prior to this excerpt, the MS expressed an intention to admit the patient to hospital due to confusion. The MS also suggested administering intravenous fluids and bladder scan at the nursing home. The AGN contributed with agreement and repeated the MS's statements. The NS said nothing except in a response to the MS about the amount of urine output. The planning continues in Table 6.

In this excerpt, the MS starts speaking hesitantly and suggests conferring with the hospital, since they are unsure of why the patient is disoriented (Sections 2.1 and 2.3). The AGN confirms the MS's statements and agrees with the MS (Sections 2.4 and 2.6). Then, the AGN indicates the lack of information by waving a hand over the notes. The NS does not contribute with any relevant content.

The excerpt above illustrates how the MS acknowledges their collective lack of knowledge as to why the patient is disoriented. At once, the AGN contributes with agreement and repetition of the MS's statement. Thus, they have agreed on their mutual knowledge about the patient's condition: the fact that they do not understand it. Voicing this collective uncertainty has the potential to strengthen the collaborative effort to explore the problem at hand. The excerpt also shows that they have the opportunity to utilize other resources to solve the problem by conferring with the hospital. However, when we observe the students' subsequent actions, it is obvious that they do not act on their prior statements.

Insufficient elaboration of concepts

Before the next excerpt, the MS talked about the operation wound and contacting the patient's relatives. The AGN mostly replied in a confirming tone without further contribution. The NS went to the patient to perform a practical assignment (bladder scan). Then, the MS mentioned frequent monitoring at the nursing home in case admitting the patient to the hospital takes time, if they accept to admit him at all, still without any

Table 6 Excerpt 1 from Group 2

	Participant[a]	Verbal	Non-verbal
2.1	MS	I also want to call (.) / Call to confer about him at least	Light, hesitant tone. Looks down at the medical record.
2.2	AGN	mm	Confirms in a quiet tone. AGN looks at MS and nods. NS says nothing, but puts left elbow on the table and lays chin in hand.
2.3	MS	At ehm (..) at the hospital. Since we have no information as to why he should suddenly become deli / become disoriented	MS starts to speak in a slightly hesitant tone. MS turns head and makes eye contact with AGN at "information." Stronger, more confident tone, with a little hesitation at the end. Shakes head.
2.4	AGN	No, we do not have any	Light, agreeable tone. AGN waves left hand over notes while speaking.
2.5	NS	Mm	NS nods and utters a non-committal sound.
2.6	AGN	Completely clear	AGN looks down at the notepad, moves it a little and speaks in a light, friendly tone.
2.7	MS	No	Clear, agreeable tone.
2.8	AGN	Clear reasons for //what it could be//	MS and AGN talk at the same time, look at each other. Both speak in friendly tone.
2.9	MS	//Right//	

[a] *MS* Medical student, *AGN* Advanced geriatric nursing student, *NS* Nursing student

Table 7 Excerpt 2 from Group 2

	Participant[a]	Verbal	Non-verbal
2.10	MS	Ehm, mm (...) Let us see, is there anything we have not thought of? I think if I can admit him to hospital then there is no reason to make a long plan, but it	Hesitant sound at first, then use a questioning, open tone. MS straightens, puts hand to face. Explanatory, friendly tone. MS flips through the medical record, gestures with left hand at "long plan." AGN looks up from the notes and puts hand to face. NS still leaning with chin in right hand.
2.11	AGN	No	Light, confirmative sound. AGN looks at the medical record.
2.12	MS	but we might need to have a plan if they do not want to accept him (..) Even though they cannot really refuse. But eh	Questioning, open tone at first, then a light, cheerful tone when saying that they cannot refuse. MS smiles and flips the medical record.
2.13	AGN	Should we wait until (…) if the time comes and they won't accept him, then make a plan	Questioning, light tone. Looks at MS questioningly and hesitates a little at "if the time". MS puts right hand to chin and turns towards AGN. NS straightens up, then resumes the same position as before (leaning chin on hand).
2.14	MS	Yes. We could have a tentative treatment plan in case this suddenly	Clear, confirmative tone at "yes," then explanatory. MS nods, looks at the medical record.
2.15	AGN	mm	Light tone. AGN nods, then leans on the table with both hands. Looks towards MS.
2.16	MS	improves spontaneously, eh	Explanatory, light tone. MS gestures briefly with right arm at "improves."
2.17	AGN	Yes	Light, confirmatory tone. AGN nods.
2.18	MS	with fluids and (.) better pain relief	Explanatory, light tone. Looks at the medical record.

[a] *MS* Medical student, *AGN* Advanced geriatric nursing student, *NS* Nursing student

elaboration or contribution from the AGN or NS. Table 7 shows the excerpt from the continuing simulation.

This excerpt shows that the MS initially aims for a discussion with the AGN and NS by asking if there is anything they have not thought of. However, the MS quickly returns to the concept of admitting the patient to hospital yet again (Section 2.10). Then the MS changes direction towards making a plan if the patient is not admitted (Section 2.12). The AGN picks up this statement and hesitantly suggests waiting to make a plan until they know if the patient will be admitted (Section 2.13). Initially, the MS agrees, but then explains that they should have a tentative treatment plan prepared if fluids and pain relief improves the situation (Sections 2.14, 2.16 and 2.18). The NS says nothing.

In this excerpt, we see that the group seems inclined to return to possible hospital admittance as the main intervention for the patient. Although this concept repeatedly occurs in the simulation, they continue to add other potential interventions sporadically. The discussion, however, often stops at the point of mentioning an intervention, such as administering fluids, without further elaboration of why or how. In turn, they do not arrive at a mutual understanding of the concepts and the conversation circles back to the hospital. The talk is mostly driven by the MS, who appears unsure of what to do. They have not stated any tentative clinical problems for the patient, which consequently seems to make it difficult to refine, elaborate on, or conceptualize a treatment plan.

Inability to bring concepts to action

Leading up to the following excerpt, the MS has talked about intravenous fluid, possible constipation, and optimizing pain medication. The AGN mentioned coughing, but the MS dismissed it because of clear lungs when auscultating. The MS commented on fluids again and monitoring fluid intake and output to optimize the patient, if not admitted. The MS then asked if anything had been forgotten, and the AGN mentioned nutrition. The discussion continues in Table 8.

This excerpt shows that the MS acknowledges the suggestion from the AGN regarding nutrition (Section 2.19). However, in the same section, the MS explains why it is important to clarify the patient's condition first, because wound revision in the hospital requires fasting (Section 2.21). Thus, the MS rejects the contribution from the AGN due to the possible necessity for surgery. At this point, the MS starts to admit that hospitalization is uncertain (still Section 2.21), and is interrupted by the AGN who adds that everything depends on admittance or not (Section 2.22). The facilitator ends the simulation.

The excerpt above illustrates that the group did not progress in their development of the treatment plan. They were not able to generate concrete ideas or further elaborate on the concepts they shared. Any attempt to start a joint discussion about the treatment plan and materialize these ideas is stopped by their inability to define the patient's clinical problems. The planning phase goes around in circle, with wanting to confer with the hospital about the patient's confusion, then admitting

Table 8 Excerpt 3 from Group 2

	Participant[a]	Verbal	Non-verbal
2.19	MS	I completely agree with that. So if it calms down now then we (..) / we must try to get him to eat. Right now when he is / want to clarify his condition a little more first	Clear, agreeable tone at first, then explanatory, friendly tone from "So if." Hesitates a bit, but continues in explanatory, friendly tone. MS gestures slightly in front of chest at "get him to," and looks down at the medical record.
2.20	AGN	Mm	Light, agreeable sound. AGN looks at MS.
2.21	MS	eh (..) If he is going to go in for a revision of the wound then it is/ foolish / a little foolish if he is not fasting. So it all really depends on //on what//	Hesitant start, then explanatory, friendly tone. All three look at the medical record. Friendly, cheerful tone. MS smiles and chuckles.
2.22	AGN	//depends on whether he// is admitted or not	Friendly, cheerful tone. AGN also smiles and chuckles.
2.23	MS	Yes	Cheerful and confirmative tone from both, both continue to smile
2.24	AGN	Yes	

[a]*MS* Medical student, *AGN* Advanced geriatric nursing student

him without any clear indication as to why, then suggesting to make a tentative treatment plan in case he is not admitted, and then talking about admittance due to wound revision. The group seems to have knowledge of the situation in practice, but appears to have difficulties conceptualizing, elaborating on and refining a treatment plan.

Summary of findings

The interaction and co-creation process ranged from discussions, efforts to structure knowledge, and use of tools in Group 1, to repetition of prior statements without further elaboration in Group 2, as illustrated in Fig. 1.

In summary, we found variation in how the groups engaged in interactions, the paths they followed and the quality of their shared knowledge object, the treatment plan.

Discussion

The analysis showed that the development, content, and structure of the shared treatment plans were influenced by the interactions within the group. The groups that managed to engage in productive interactions in a coherent interaction trajectory developed a more comprehensive and specific treatment plan than the groups where the interactions were less productive.

Productive interactions

We identified that several productive interactions occurred during the collaborative work, exemplified by Group 1, such as joint discussion and elaboration of concepts. The students in Group 1 mediated their actions by utilizing the artefacts and tools available to them [25]. Through speech, the students verbally invited each other to participate using friendly, open tones. By looking directly at one another and being attentive towards the ones speaking, they encouraged each other to

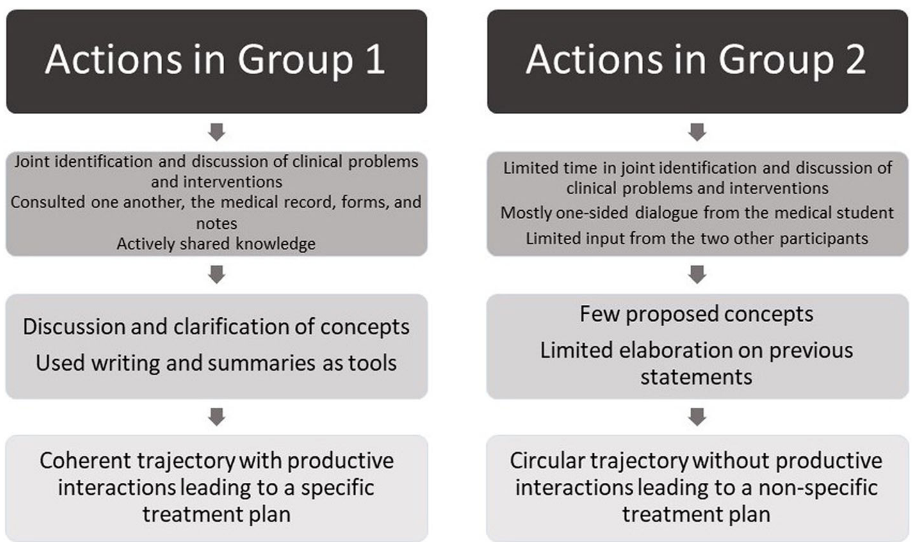

Fig. 1 Integration of findings

participate through gaze and body language. This exemplifies some of the productive interactions mediating their actions in an effort to understand their task, and to construct and refine the shared understanding of the patient's problem.

In contrast, Group 2 spent limited time in joint identification and discussion of concepts and were less productive in mediating the artefacts and tools available to them. Although talking in friendly tones, the verbal contributions were mainly confirming sounds or repetition of statements, instead of suggestions or elaborations. They had sporadic eye contact, but most of their gaze faced their notes or the medical chart. Consequently, they did not manage to utilize available productive resources to advance in their conceptualization of the treatment plan.

Our results illustrates that the groups where the students participated actively in sharing knowledge, practice and experiences managed to engage in productive interactions and refine the treatment plan in a collaborative effort. ZPD can be seen as a process where the student's performance is co-constructed in interaction and collaboration with others [26]. The goal is to provide a developmental space for the students where the learning situations stretch the students' capabilities towards the edge of their ZPD, without pushing them too far. Interprofessional learning activities should equip students with the necessary competencies to participate actively and share knowledge to stretch their expansion in the ZPD [26]. Thus, educators have a vital role in developing collaborative learning activities that stimulate and support the students reaching toward higher levels in their ZPD [34]. For the students to be able to actively participate and engage in productive interactions and create expansion in their ZPD, however, they have to be able to make sense of the actions played out in the simulation. Making sense of a situation relates to understanding and acting on signs and actions in the activities, but also being able to draw on available resources [35]. As such, being able to develop a specific treatment plan can be seen as a result of the productive interactions between the participants in the simulation, intertwined with the capacity to make sense of the scenario at play. Consequently, when developing IPE scenarios with the aim to expand the students' activities within the ZPD, educators need to consider the level of realism - often referred to as fidelity - and difficulty needed to optimize learning opportunities [36, 37]. Enhancing simulation fidelity is described by Dieckmann and Ringsted [36] as optimizing the educational value of the simulation, and is not solely about maximizing difficulty or use of simulation equipment. They highlight that slowing down the physiological deterioration of the patient in a simulation might be a solution to give the learners more time to react. If the learning activity is perceived as too demanding, it might be impossible for the students to make sense of the situation, compromising advancement in their ZPD. Consequently, leading to missed learning opportunities and a negative experience for the students. In contrast to healthcare professionals, students attend simulation to develop skills they not yet have fully acquired in a more or less unfamiliar practice situation [38]. The students' ability to make sense of the situation seems to be connected to how far they have progressed in their education, but also what clinical practice they have had. As such, it is a delicate balance for educators designing interprofessional collaborative simulations, to clarify what technical skills and which level of clinical deterioration is necessary to expand the students' ZPD.

Our scenarios presented the students with sub-acute situations from a nursing home, and were not dependent on the students having advanced technical skills. However, we acknowledge that they might have perceived the scenarios as complex due to an atypical presentation of symptoms and lack of algorithms to follow. Still, since the simulation scenarios comprised common primary care situations and a slow pace, the students had time to assess, plan, and talk together to solve the problem. The scenarios seemed to facilitate the development of the students' collaborative competencies, and expand their ZPD, as long as the student managed to make sense of the activities. Our study highlights the feasibility of sub-acute primary care simulation scenarios to teach communication and teamwork in situations where an accurate diagnosis and decisions about treatment may be difficult to make. After completing the simulation together, the students may be better prepared to participate and contribute in this type of scenario in the future. Through that process, the students ZPD will have been expanded. The next time the students participate in simulation, they should manage a higher level of difficulty, and further develop their ZPD.

Interaction trajectories

Our results revealed two distinct trajectories when developing a shared treatment plan. By contrasting two groups, we have illustrated how the co-construction process of shared knowledge can take different routes and lead to different results. Ideally, the groups should follow a coherent interaction trajectory, as seen illustrated in Group 1, where the elaboration on previous statements, use of available resources, and interactions created possibilities for the development of the shared knowledge object [39]. However, as exemplified by Group 2, some of the groups remained in a circular trajectory with few proposed concepts and limited elaboration on previous statements, which affected the development of a treatment plan. For educators, zooming in on why some of the groups had difficulties establishing a functional way of interacting, is important to enhance future IPE. One way of addressing the *why* is to look at the IPE definition where learning "about, with and from", is a cornerstone. Still, healthcare students are educated in professional silos [2] and there are common assumptions that students are exposed to interprofessional collaboration during clinical practice [1]. The students may not have had the opportunity to be involved in interprofessional collaboration and thus need more knowledge *about* other professions and *about* their own role in the collaboration. We exposed the students to collaborative activities where they had to develop a shared treatment plan for the patient without providing instructions on how the task could be completed. Expansion of the students' ZPD requires active participation and some students might not feel comfortable with active participation if they are insecure of *how* to participate. In our study, only seven of the 27 students had prior interprofessional simulation experience and we do not know which groups these students were allocated to. Neither do we know anything about their experience from clinical practice. Limited previous experience might have affected their ability and willingness to take an active part in the scenarios. In addition, the students had not met prior to the simulation activity. They did spent some time in informal conversation in the groups to get to know each other before the simulation started. Nevertheless, a failure in creating a specific treatment plan could be explained by the fact that the students had just met, and thus were a bit hesitant in their interactions.

In our results, exemplified by Group 2, we saw that some students seemed to entrust identifying and generating knowledge to the medical student. It can be a complex task for students to know how to engage in interactions that lead to concrete ideas and to further elaborate on those ideas to develop a shared knowledge object [28]. The students have to draw on experience and knowledge from their education and clinical training during the simulated scenarios. Thus, healthcare students have different profession-specific knowledge, in addition to personal values and beliefs, which in turn could affect the communication and shared knowledge development. Participating in these learning activities might remain complex for some students, especially if they are unsure of their own competence or their role in the scenario. In addition, presumed power relations and hierarchical structures, where the medical doctor is seen as the expected leader, may also be a barrier to participate [40]. As such, some of the students might decide to listen and learn *from* the other students, rather than contribute actively in learning in interaction *with*. This would limit their own contributions, but also the other students' possibility to advance in their ZPD. Making the students feel safe and confident in the learning situation can foster confidence in the students own role and willingness to participate in a team [6], and consequently contribute to co-construction of knowledge. Offering learning activities with a non-hierarchical structure may create a safe environment for teaching interprofessional collaboration for students in primary care settings, where the team is greater than the sum of its parts [41]. We believe that our scenarios have potential to be a safe way to develop collaborative competence as everyone's knowledge is essential in solving the problem and different perspectives are valued and necessary to create the treatment plan.

Implications for conducting IPE

As we have sought to understand how to organize student activities supporting interprofessional learning, we found that productive interactions and coherent interaction trajectories are important aspects for training interprofessional collaboration. We have contrasted and compared two groups to visualize these interactions and trajectories. Our results indicate that the groups with coherent interaction trajectories managed the duality of defining and solving the immediate problem and preparing for future care in collaboration. Those groups with circular trajectories may miss important opportunities for interprofessional learning.

When planning and implementing IPE, educators should have strategies available to prevent or detect the problems that the students encounter to help them move beyond circular trajectories during the simulation. Understanding the students' current knowledge and capabilities, and discovering emerging problems, can help educators determine how to organize or change the simulation so that the students advance in their ZPD. Thus, educators, and especially the facilitators directly involved when the simulation is in progress, need to be flexible in their roles and adapt to the students' needs [42]. In retrospect, we acknowledge that we in a way contributed to the assumption of students being able to collaborate without instruction or tools since we did not provide any instructions on how to collaborate. This lack of instruction or pre-briefing could explain some of the reasons why there was a difference in trajectories. We had a facilitator present in the room with the students to provide the patient's voice and supplement responses the simulator could not, presenting ample opportunity for in-scenario instruction. In-scenario instruction is seen as essential for bridging the gap between a patient simulator and a real patient, but can also be used to give information as a response to the participants' questions or actions [37]. On that account, we believe it prudent to consider using in-scenario instruction when groups are stuck in a circular trajectory. Those instructions could be aimed at helping students to structure concepts, elaborate on ideas, or identify key concepts for further discussion. This will enhance the potential for teaching interprofessional collaboration and contributing to the management of IPE in healthcare education.

Another possibility is to present strategies for collaboration, interaction trajectories and shared knowledge development in the preparation and briefing sequences before the simulation scenarios or add an introductory IPE course before the simulations. This might better prepare the students for interprofessional collaboration as they are presented with strategies on how to collaborate.

Reflecting on the simulation experience is seen as a cornerstone for students to reconstruct their experience into learning [42]. As such, the debriefing sessions provide ample opportunities for reflection on how the students collaborated. Students are often more concerned with their individual actions and if they managed to identify the solution to the medical problem [38]. The facilitator's role in the debriefing process is to challenge the team to reflect on how they collaborated, how the different team members contributed and to evaluate each other's contributions. The simulation setting, including debriefing, allows students to share their profession-specific knowledge and skills with one another, with the potential to expand the learning opportunities for each student and build trust in the clinical competence of other professions.

Despite IPE literature listing interprofessional collaboration and communication as competencies to achieve through IPE [43], it is less clear how the students can develop these competencies. Similarly, most healthcare education programs are profession-specific, and constrains such as schedules, actual space capacity, teacher resources, and economy may affect the educators' possibilities to facilitate for IPE [7, 8]. How to overcome these barriers is a constant struggle for educators. Our scenarios do not require high-tech equipment in the educational facility or practice, nor specialized technical competencies from the facilitators. We used a patient simulator in this study, but this is not necessary, as a fellow student, educator, or healthcare personnel could easily play the role of the patient. Thus, our simulation scenarios are feasible to use on-site in an education facility or in practice with minimal equipment and resources. This might contribute to reduce some of the economic barriers toward IPE as the educational facilities do not have to buy expensive equipment or educate highly specialised facilitators.

Limitations

There are several limitations to our study. We acknowledge that the students agreeing to participate might be the most receptive to IPE and simulation. Reasons given for not participating were lack of time, not granted leave of absence from clinical practice or work, or feeling uncomfortable with video recordings. We tried to avoid non-participation by emphasizing that the interactions between the participants were of interest and not their technical skills, and that only the project group would view the actual recordings. We also provided letters to deliver to leaders and educators to help the students get approved absence. The simulation was completed in 1 day, which also minimized absence from work or practice. Our study has a small sample size, as is typical of a qualitative study [33]; thus, our findings are based on a small number of recorded simulations. However, these recordings comprise a large amount of data, enabling detailed study of the interactions and activities within the groups. We have also chosen to present and contrast representative sequences from two groups relevant to the aim of the study. When using interaction analysis, the analysis is based on the researchers' interpretations of the collaborative actions. The students themselves were not invited to comment on their own achievements or our interpretations, and we acknowledge that they might interpret or explain the situations differently from us.

There are also limitations when using video recordings, as the participants might change their behaviour due to the camera. However, in the research facilities where we conducted the simulations, the cameras and audio equipment were discretely placed in the ceiling, minimizing the interference. We used a patient simulator as the patient, which might induce lack of realism, as the simulator does not have facial expressions or the ability to respond. To enhance realism, the facilitators were present in the simulation room, acting as the patient's voice and offering responses not available through the simulator. This in itself could also be a limitation to the realism of the situation. However, informal student feedback suggests that the facilitator added to the realism by acting as an older patient when communicating with them as the scenario played out. The students were not given any concrete tools on how to achieve interprofessional collaboration before the simulation, which might have limited their ability to maximize collaboration. We have suggested adding these strategies to the briefing or implementing an introductory IPE course.

Conclusions

The present study of simulation in common, sub-acute patient scenarios in primary care situations illustrates that what seemed to characterize the groups engaging in productive interactions was a deliberate, collective strategy bringing multiple perspectives into the discussions in a coherent trajectory. For the students to actively participate and engage in productive interactions, and advance in their ZPD, they have to be able to make sense of the simulation. Use of in-scenario instructions might be a prudent way to help students to move out of non-productive trajectories and promote collaboration. Overall, the student activities in our scenarios show the potential for practicing interprofessional collaboration and adding simulations of sub-acute primary care scenarios as an area of importance in teaching communication and teamwork in complex situations. Therefore, we suggest that educators planning and developing interprofessional simulated scenarios should include common, sub-acute primary care situations. To further develop IPE strategies, research should expand on the interactions and collaborative efforts when people are learning through interprofessional simulation.

Abbreviations
IPE: Interprofessional education; MS: Medical student; AGN: Master's student in advanced geriatric nursing; NS: Bachelor's student in nursing; ZPD: Zone of proximal development

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Authors' contributions
LL, AMB, AM, RBJ, EOR contributed to the study conception, design, material preparation and data collection. Analyses were performed by LL, AMB and AM. The first draft of the manuscript was written by LL and AMB, AM, RBJ and EOR commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets generated during and/or analyzed during the current study are not publicly available due to data corpus still being subject to analysis but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The Norwegian Centre for Research Data approved the study, project number 60867. We obtained written, informed consent after giving oral and written information.

Consent for publication
Not applicable.

Competing interests
The authors declare that we have no competing interest.

Author details
[1]Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway. [2]Department of Health Management and Health Economics, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway. [3]Department of General Practice, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway.

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Paper 3

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Advances in Simulation

RESEARCH Open Access

A preliminary simulation-based qualitative study of healthcare students' experiences of interprofessional primary care scenarios

Lene Lunde[1*], Anne Moen[1], Rune B. Jakobsen[2], Britta Møller[3], Elin O. Rosvold[4] and Anja M. Brænd[4]

Abstract

Background: Introducing interprofessional education (IPE) in healthcare curricula can prepare students for healthcare practices that have become increasingly complex. The use of simulation is promoted to support IPE. This study explores healthcare students' experiences of participating in common, sub-acute patient scenarios that routinely occur in clinical practice in primary care. More specifically, it looks at how sub-acute patient scenarios from primary care can help develop interprofessional collaborative competence.

Methods: Medical students ($N = 10$), master's students in advanced geriatric nursing ($N = 8$) and bachelor's students in nursing ($N = 9$) participated in the simulations. The students were in their last or second-to-last year of education. We conducted five semi-structured focus group interviews with the participants' directly after the simulation training to elicit experiences related to the scenarios, the simulation and interprofessional collaboration. The transcripts were analysed using systematic text condensation. To supplement the focus group interviews, the students also completed the interprofessional collaborative competency attainment survey (ICCAS), which measures the students' self-assessed interprofessional competence.

Results: Three main themes emerged from the analysis of the focus group interviews: *realism*, *uncertainty* and *reflection*. The students emphasised the importance of authentic and recognisable scenarios. They said the vague and unspecific patient symptoms created uncertainty in the situation, making it difficult to understand the patient's diagnosis. Despite that uncertainty, they described the experience as positive. Further, the students expressed that the simulation increased their confidence in interprofessional collaboration and prepared them for future work. The results from the ICCAS questionnaire showed that the students reported a subjective positive change in their interprofessional competence after participating in the scenarios.

Conclusions: This study showed that simulation-based IPE with sub-acute primary care scenarios contributes to develop interprofessional collaborative competence in healthcare education. Sub-acute scenarios can supplement the more common approaches with acute care scenarios and aid in developing the collaborative competence required to work in healthcare teams.

Keywords: Simulation, Interprofessional, Primary care, Healthcare students, Sub-acute scenarios, Focus group

Background

Interprofessional education (IPE) is a critical component in healthcare curricula and can help prepare students for healthcare practices that have become increasingly complex [1, 2]. However, there is no widespread educational consensus on how to conduct IPE so that it better

*Correspondence: lene.lunde@medisin.uio.no
[1] Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway
Full list of author information is available at the end of the article

prepares students to collaborate across healthcare disciplines. Traditionally, healthcare students are educated in professional silos [3, 4]. As such, traditional teaching does not promote students' interactions with other healthcare professions. It is a common assumption that students' exposure to, and involvement in, teamwork occurs naturally in clinical practice and, consequently, prepares the students for working in interprofessional teams. However, there is no guarantee that without purposeful organisation, students will experience exemplary teamwork or even collaborate with other healthcare professionals or students during clinical practice [5]. As a result, healthcare education needs to find approaches that expose students to interprofessional collaboration (IPC).

The use of simulation provides learning experiences where the students are placed in realistic and safe clinical situations [6]. A growing body of research promotes simulation as an educational strategy to support IPE in healthcare education [7–10]. Most simulation-based IPE experiences have focused on life-threatening, time-critical acute-care scenarios [11–14]. While it is important for healthcare students to learn and practice how to respond to severe, acute care scenarios, everyday clinical situations are rife with IPC. Shorter hospital stays and an increased emphasis on home care and ageing in place suggest that more patients with increasingly complex needs will require treatment in a primary care setting [15]. In contrast to most acute care algorithm-based scenarios, sub-acute patient scenarios in primary care provide the students with more time to solve a problem, but the actual clinical situation may be more complex. Introducing simulation training of scenarios typical of primary care can therefore contribute to the students' learning experiences of IPC.

With this in mind, we developed simulation-based IPE with sub-acute patient scenarios that would commonly occur in clinical practice. The main aim of this article is to explore healthcare students' experiences of participating in the sub-acute patient scenarios. Specifically, we aimed to understand how the use of sub-acute patient scenarios from primary care could support the development of interprofessional collaborative competence.

Methods

Research design and setting

We conducted a qualitative study, using focus group (FG) interviews to capture experiences from students participating in IPE simulation sessions. This is part of an exploratory study exploring different aspects of simulation as a strategy for training healthcare students in IPC in future curricula development. We developed scenarios comprised of sub-acute situations from primary care. The IPE simulation we developed is not yet implemented in our healthcare curricula. FG interviews were considered well suited to elicit experiences and views from the participants and encourage group dialogue after participating in a joint experience such as simulation-based IPE [16]. A series of questions addressing experiences related to the scenarios, the simulation and IPC acted as a guide for the semi-structured interviews. The participants were encouraged to elaborate on topics they considered relevant and important (Additional file 1). In addition, to supplement the FG interviews, the students completed the Norwegian version of the interprofessional collaborative competency attainment survey (ICCAS). ICCAS captures the students' self-assessment of their interprofessional competence and is validated across various settings and countries, including Norway [17–19].

The simulations took place in a research laboratory at the University of Oslo. The simulation units were set up like rooms in nursing homes. The scenarios were created in collaboration with primary care health professionals and comprised common medical conditions from primary care: an older patient convalescing at a nursing home following surgery for a hip fracture. The patient then developed symptoms of either a urinary tract infection or pneumonia.

The students participated in both scenarios described in Additional file 2 during the simulation-based training. Two scenarios were conducted during each simulation-based training activity each preceded by a briefing and immediately followed by a debriefing [20]. The briefing provided an introduction to the simulation room, the available (technical) equipment and the patient simulator SimMan® by Laerdal Medical [21], as well as a reminder about confidentiality and an introduction to the scenario [22]. During the simulation, facilitators acted as the patient's voice and answered the questions directed towards the patient. We instructed the students to act according to their distinct professional roles and future responsibilities. Each scenario lasted approximately 30 min. The debriefing took place directly after each scenario and lasted on average 25 min [23].

Participants

We recruited medical students, master's students in advanced geriatric nursing and bachelor's students in nursing through purposeful sampling. Educational leaders in universities in central Eastern Norway facilitated the recruitment. The inclusion criteria were healthcare students in the final semester of their last or second-to-last year of education because they had completed most of their clinical practice rotation and thus presumably would have skills competence sufficient to be capable of participating in IPC. Potential participants that met our inclusion criteria received information about the study from contact persons at the different universities. The lead author LL was also invited to several lectures to talk about the project to recruit participants. A total of 27 healthcare students agreed to participate, ranging from 21 to 49 years of age (mean 31), and 21 were female and six were male. All participants in the simulation training took part in the FG interviews. Table 1 presents the details regarding the participants.

To maintain the anonymity of the participants, gender and name were excluded from the transcripts, and abbreviations were used, as can be seen in Table 1. The participants were numbered in the order they appeared in the interviews (e.g. NS1). The FG interviews were numbered in the order they were conducted (e.g. FG1).

Data collection

We conducted the FG interviews in April 2019, just after the students had finished the simulations and completed the ICCAS questionnaire, to avoid conflicts with study schedules. Each student was a member of one of 10 interprofessional teams during the simulations. Two teams participated in the simulation each day, and they joined the same FG, resulting in five FG interviews. The lead interviewers were members of the research group with experience in qualitative research and with doctoral degrees in nursing (AM) and medicine (AMB, EOR). Each FG interview lasted between 60 and 90 min and had five or six participants.

The interviewers observed the simulations from behind a one-way mirror in the control room and did not interact with the students during the simulation. The FG interviews were audio-recorded and were exported to a secure data storage facility at the University of Oslo, then transcribed verbatim by LL.

Data analysis

The transcripts from the FG interviews were analysed by systematic text condensation, in a four-step process [24]. First, we read the transcripts independently to get an overview and total impression and to identify preliminary themes. Secondly, we collaboratively identified and sorted the meaning units into code groups. In the third step, we abstracted condensates from each code group. Finally, we created synthesised descriptions by reconceptualising the condensates and chose the quotes that would best represent the synthesised description (golden quotes). The initial steps were conducted by LL and AMB independently (step 1) and in collaboration (step 2). Then, LL drafted the first versions of condensates (step 3) and synthetisation (step 4) and translated the quotes into English. For each step of the analysis, the research group read the material independently, collaboratively discussed, modified themes, reviewed abstractions and syntheses until reaching a consensus.

We used the software NVivo12 to organise and structure the data. As the analysis progressed, we organised the material into tables. Table 2 shows an example of the analysis.

The ICCAS questionnaires were analysed using IBM SPSS Statistics Version 27. ICCAS comprised the interprofessional competency communication, collaboration, patient- and family-centred care, roles and responsibilities and conflict management. Since prior validation studies recommend analysing ICCAS at an overall level to address change in interprofessional competence [17, 18], we used paired *t*-test to determine the difference in perceived abilities in the mean overall pre- and post-score (range 1–5). We analysed the differences in terms of Cohen *d* standardised effect size (“large” = values of ≥ 0.8, “moderate” = values between 0.79 and 0.50 and “small” values between 0.2 and 0.49) and 95% confidence limits [25].

Strategies to enhance trustworthiness in the analysis

The authors are nurses (LL, AM), medical doctors (RBJ, EOR, AMB) and an educator (BM). Collectively, our experience combines primary care and medical educations, as well as research, teaching, curriculum planning, workplace learning and simulation-based training. Our backgrounds might have influenced our preunderstanding of the simulation setting, the scenarios and the students’ experiences. However, having co-authors with different, yet complementary backgrounds might also help in ensuring the legitimacy of our interpretations [26]. By reporting the process of analysis and providing examples of codes, construction of condensates, syntheses and themes in Table 2, we have brought a certain transparency to the process. Through the research group’s collective reading and analysis, we have worked to enhance the trustworthiness of the results [26].

Results

Three main themes emerged from the analysis of the FG interviews: *realism*, *uncertainty* and *reflection*. Within *uncertainty*, the sub-themes “unspecific situations”, “time to collaborate” and “room for communication” became apparent. In *reflection*, the sub-themes “opportunities not present in practice”, “developing confidence” and “better prepared for the future” emerged.

Realism of the scenario

The students recognised the scenarios as realistic, authentic and likely to be encountered in healthcare and, specifically, in primary care.

MS9 (FG5): I especially think about the fact that it *was so relevant. The topics were important, and the situations ones that you would often experience.*

Furthermore, the students described the nursing home setting as recognisable and representative. They noted that to make the simulations authentic, you needed to have such surroundings. The students seemed to manage to conceptualise the scenario in a clearer way based on the information provided and the environmental set-up.

AGN6 (FG4): And I also think that it was very good that we were told immediately that this is a nursing home and this is the available equipment in the nursing home, and the doctor is present one day a week. This made it realistic.

As such, the students emphasised that it was important to have authentic, recognisable scenarios and that having the setting and equipment described beforehand allowed them to better envision the scenario. Together, these statements illustrated that including information about setting, surroundings and available equipment as well as scenario description in the pre-briefing was important to prepare the students for the simulation.

Uncertainty

Unspecific situation

The students expressed that in prior simulation experiences, they were usually provided with predefined ways of solving the problem, either through algorithms or checklists. In these scenarios, however, they experienced an ambiguous situation, where the right solution did not clearly stand out. They described it as they knew something was going on, but the unspecific clinical signs made the situation difficult to grasp and therefore difficult to analyse.

AGN3 (FG2): Very often it starts with the fact that you realise that there is something going on. Without having anything specific, everything is a bit vague. That's what it's often like.

The realisation that the patient's situation was changing encouraged the students to pay careful attention to the vague and undefinable signs that were found in the clinical examination. The students explained that especially with elderly patients, the clinical signs might not be as apparent or lead to textbook solutions. The presentation of vague and unspecific symptoms made the students think more broadly in their clinical assessments, as a symptom could be interpreted in several ways. Consequently, they were less certain of the patient's diagnosis.

MS6 (FG3): Because there were vague symptoms, you had to think a bit more broadly. You think there can always be something more to it. And, that this kind of assessment feels a little unfamiliar.

The students expressed that they were unaccustomed to these assessments, especially because there was no quick fix or easy solution. However, the students perceived this experience as positive because, in nursing homes, and primary care in general, they would often experience vague clinical situations. As such, it seemed that the scenarios were recognised as important learning activities to prepare for real-life situations. The use of sub-acute scenarios shifted their focus to the inherently complex health services that are provided in primary care on a daily basis and appeared to renew the students' understanding of the many different challenges that can occur.

Time to collaborate

The students emphasised that having an adequate time to practice scenarios together in a calm setting offered the opportunity to ask additional questions, listen to one another and engage in group discussions to solve problems.

MS4 (FG2): When you have so much time and it is quite calm, you have the opportunity to listen, and to ask, "What do you think? Is there anything we have not thought of?"

Although there was enough time to work on it, the clinical problem itself was less clear-cut. The students reported that they could not take any shortcuts because the symptoms were so vague. They had to discuss what they were unsure of and do a full clinical examination.

AGN3 (FG2): If it is a cardiac arrest, pretty much everyone knows what to do, and you cooperate. But when it is so vague, you get a discussion of everyone's knowledge, and it's completely different. You get to use each other's competence in a completely different way than if it was a very specific and dramatic situation.

In contrast, the students found that a simulation solving an acute care situation such as a cardiac arrest where they follow a predefined algorithm was more rehearsed and explicit as they would know what to do and how to react. Sub-acute scenarios provided the students with an opportunity to use each other's competences in new ways. The vagueness, the students said, consequently led to another kind of insight of what the other students knew and how they could contribute, as they had to share their knowledge to expand on the problem. The simulation seemed to contribute to increased understanding of the competence the different educations provided, and how they could complement each other. Thus, when they combined their different perspectives, it helped reduce the uncertainty. This indicated that adding different professional perspectives enhanced the joint discussion and thus increased their learning outcome.

Room for communication

Based on their prior experience with simulation, the students said they expected an extraordinary situation even though they were prepared for sub-acute scenarios. The fact that the clinical condition in the scenario did not overwhelm them was highlighted as positive. Thus, it was possible to focus on the team's interactions and communication, which they deemed important.

> *MS5 (FG3): When it's not medically precarious and acute, you get a little more time to actually communicate. And that's what's most important.*

The students appreciated that the clinical condition did not decline rapidly, as it gave them more time to react and collaborate. They pointed out that in a medically complicated scenario, you could just as well end up with a situation where one team member dominates.

> *NS10 (FG5): If it gets too complicated and there's a dispute between the professions, and the one who speaks loudest overrides the rest of the group. Some just cave in and heed to the one who has the strongest opinions.*

As the students pointed out, complicated cases could negatively affect the communication and collaboration.

Reflection

Opportunities not present in practice

Several students talked about the simulation as being similar to practice and yet not so, especially regarding time to reflect during the simulation and in the debriefing. They highlighted that in these scenarios, they had time to talk through the clinical picture of the patient together and really listen to each other. In real-life practice settings, they said it might be busy and chaotic, and opportunities for reflecting together and share profession-specific knowledge about the patient were less available.

> *AGN3 (FG2): I learned a lot from seeing what the others reflected on. Here you do the reflection together. You see what the different students see; there is not always room for that when you work.*

The students also emphasised that having the opportunity to sit down together in the debriefing and reflect on what they did enhanced the learning outcome. In the debriefing, the students appreciated the possibility to talk about how they communicated and collaborated in the simulation sessions individually and as a team. They particularly pointed out that they valued the focus on raising awareness and understanding of the situation together without merely pointing out what went wrong.

> *MS10 (FG5): I absolutely believe that training in controlled settings where you get time to reflect afterwards has great value that is difficult to include in practice. Because in practice, you are dependent on a supervisor taking time to include reflection and a department with suitable conditions for reflection with others*

The students explained that it was not always possible to take an active part in collaboration in clinical practice, and the possibility to interact with other students or healthcare personnel could be limited or non-existent. In clinical practice, they experienced that there was little time given over to reflect together with others. This appeared to illustrate that profession-specific learning goals in clinical practice are still the most common and that interprofessional activities where the students have time to reflect with others are scarce.

> *NS9 (FG5): We know that, in practice, we can call the priest, social worker, or nutritionist and get them up there and then talk to them. But you may not know how you would collaborate with them in that meeting. You are doing that in here. What we do here is very important in shedding light on how we should collaborate.*

By sharing experiences and reflecting together, the students indicated that they got to know the competences of the other healthcare professions first hand. This was perceived as important for managing collaboration. The students described the simulation setting as a good way to become more aware of the roles and responsibility they would assume in their future work life. It also gave room to reflect on how to collaboratively solve problems, not just on the idea that collaboration was necessary. Experiencing the benefits of IPC may also lead to enhanced respect for each other's profession. As such, the students voiced the importance of participating in training that enhances the quality of IPC.

Developing confidence

The students said that participating in the simulation made them more aware of themselves for better or worse, in terms of how they behaved and dealt with situations. They described the experience as discovering themselves in a new way. Consequently, the experience appeared to develop their confidence to engage more actively in IPC.

> *AGN4 (FG3): With simulation, I see that if I can talk to the medical student, then maybe I can talk to a real doctor. You see proof that it's actually possible to*

talk to other professional groups.

The students found that as the simulation progressed, they got more comfortable with expressing their opinion with the team, which made it possible to have a clinical conversation across professions. Solving the scenario, they explained, provided an opportunity for participating in discussions in a safe environment as equals. The creation of a safe environment allowed the students to dare to present their perspectives and express their opinions.

NS5 (FG3): I learned today that I don't have to be afraid. If I have some knowledge or something that I think of, with the patient in mind, I will just say it.

The students explained that when they discussed together, they realised that they had an important role to play. Thus, the joint problem-solving activities the scenarios provided seemed to increase their experience of themselves as important contributors to the interprofessional discussion. Consequently, the simulation experience led to newfound confidence in the students' abilities to participate and voice their opinions. This confidence appeared to reassure the students in their own role as healthcare professionals. When reassured in their own role, they managed to benefit from the others' competence and mutually create joint knowledge.

Better prepared for the future

The students indicated that the experiences from the scenarios would be long lasting because the simulation created practical memories they could recall later.

MS5 (FG3): It's the kind of experience that you can come back to and reflect on. You can call on it in different settings and think, "Oh, yes, we did this that time."

The students said that taking part in the simulations would help them deal with similar situations in the future. Facing such issues in a safe environment during education gave the students a sense of assurance for future work.

NS6 (FG4): If you could act through it in advance and be trained beforehand, you can handle it better later, in terms of how to talk to each other.

Thus, the students reported that interprofessional collaboration could become something familiar and manageable because of prior training. Participating in the scenarios seemed to provide the students with a clearer frame of reference for problem-solving in future situations. Having useful experiences to refer could provide security since they had faced such issues during education. Consequently, this type of scenarios could prepare the students for future IPC.

Self-reported interprofessional competence

In addition to the material from the FG interviews, all 27 participants completed the ICCAS questionnaire. The results from the ICCAS questionnaire showed that after participating in the scenarios, the students reported a positive change in self-assessed interprofessional competence. There was a statistically significant increase in the mean sum score from pre-scores (mean = 3.64, SD = 0.65) to post-scores (mean = 4.4, SD = 0.3), $t\ (26) = 6.67$, $p < .001$ (two-tailed). The mean difference, 0.76, 95% CI [0.53, 0.99], represented a large effect of $d = 1.29$.

Discussion

In the findings reported here, the students emphasised the importance of authentic and recognisable scenarios. They described that the vague and unspecific symptoms in the scenarios created an uncertain situation where it was difficult to find a clear direction. The students repeatedly emphasised, however, that this experience was positive. They acknowledged, with some surprise, the complexity the sub-acute scenarios presented and the opportunity that arose for them to focus on collaboration and communication. Further, the students reported increased confidence and preparedness for future work. Our results from ICCAS also supported that participating in the scenarios led to a positive change in self-assessed interprofessional competence. Furthermore, we discuss the potential for the sub-acute scenarios to promote interprofessional collaborative learning opportunities for healthcare students.

Collaborative problem solving in a realistic setting

An important finding from this study was the students' positive response to the sub-acute scenarios, especially their seeing scenarios as authentic and realistic learning situations. The recognisable scenarios, together with information about the setting and available equipment, were important factors in getting students to engage in the simulation. Considering the simulation activity as a social practice where learning is constructed in interaction between the participants, environment and equipment, it highlights the importance of pre-briefing to create a safe and recognisable environment for the students to interact in [22, 27, 28]. Thus, they seemed to manage to utilise the resources available in the room and frame the simulated situations into something manageable.

This supports the findings showing that IPE has to be meaningful and relevant, with authentic activities, to be able to support interprofessional learning [4, 29]. Further, for a learning experience to be of value and to prepare the students for future teamwork, structured opportunities for active engagement need to be made available [11, 30]. Thus, IPC experiences involving engagement and opportunities to interact, rather than passive observation of teamwork, are found to have more impact on interprofessional learning and competence development [31–33].

The unspecific symptoms presented in the scenarios created an uncertain situation for the students, where the patient's problem or diagnosis was unclear. As such, the sub-acute scenarios exposed the students to the complexity often presented by this patient group, where accurate diagnosis can be difficult due to atypical symptoms [34]. Since there was no detailed algorithm to follow, the outcome depended on the students' capacity to discuss, identify signs and symptoms and use relevant knowledge to solve the patients' main concerns. Students who actively share information, discuss and draw on one another's resources and competencies seem to manage defining the patients' concerns and prepare for future care in collaboration [35]. In our study, the students highlighted that the relaxed pace of the scenarios, combined with a reasonable amount of time to complete them, made it possible to focus on the interactions and communication within the team, to ask each other questions and discuss and reflect together without being overwhelmed. When students recognise the simulation-based activity as a safe environment, it can motivate them to perform at the edge of their expertise [22], which might enable them to expand on the learning activity and enhance their knowledge. In our scenarios, the students recognised the setting as a safe environment, which made them willing to ask questions, listen to reflections from others and contemplate on the best way forward together, although it might highlight skills deficiencies.

When developing scenarios for simulation-based training, careful consideration of the level of difficulty and complexity is necessary to optimise the learning opportunities [27, 28, 36]. It is important to take into account that the students participating in the scenarios are there to train on competence they have not yet fully acquired [37]. Thus, a mismatch between the difficulty and complexity of the scenario and the students' capacity to make sense of the scenario could compromise the learning opportunities. As the students explained, complicated cases can breed poor communication, as one team member may dominate. As such, scenarios where the patient's condition is stable seem to provide students with more time and opportunity to emphasise team collaboration [38, 39].

The students' experiences of a collaborative learning potential in simulation seemed to come from the combination of a *realistic* scenario and a *practice space* for IPC in the simulations. For students to be prepared for the expected collaboration, educators have to create spaces to train for IPC in healthcare education [15]. The foundation for fruitful learning spaces have to be laid in the prebriefing to get the students to engage in the simulation and interact with the participants, scenario and environment [22]. Without these spaces, it is difficult for healthcare students to get to know one another and find ways of working together [40]. The practice space for IPC in the sub-acute scenarios seems to provide the opportunity for healthcare students to explore one another's perspectives and use one another's competencies interprofessionally.

Learning opportunities

Through IPE-based simulation training of sub-acute situations, this study shows that the following learning potentials can be realised: establishing greater confidence in handling uncertain, sub-acute situations through IPC, understanding their own and others' perspectives and competencies and strengthened confidence in their own IPC competencies and contributions for future work. These practice spaces for IPC emerge during the joint examination of the clinical situation and is strengthened through reflection.

Reflecting on the simulation experience, especially the debriefing, is seen as a cornerstone in simulation-based training for students to reconstruct their experience into learning [27]. There are several ways of facilitating scenario debriefing [41, 42], making it important for educators to make well-considered choice of debriefing strategy beforehand. In this study, the facilitators were instructed to follow the debriefing framework proposed by Rudolph et al. [23] where the focus is enhancing awareness and understanding of the situation. The framework highlights creating a safe learning environment where the students feel comfortable discussing successes and failures to understand and learn of their actions. The students in our study appreciated that the facilitators did not solely focus on what went wrong, but prompted questions, thoughts and opinions that engaged the students to contribute actively with their own reflections and perspectives on collaboration and communication.

In our study, the realistic but vague and unspecific signs and symptoms in the scenarios without a clear conclusion created uncertainty that challenged the students' competence, their role understanding and task sharing. However, the uncertainty also mobilised their resources as they resolved the uncertainty by communication and joint reflection in the simulation and during the debriefing. As such, the development of IPC competence took place both during the scenario and in the debriefing. The quality of the debriefing seems as important for the development of IPC competence as the quality of the scenario since the debriefing is where the participants shift their perspective from the action to the reflection on actions and common experiences from the scenario [23]. This study suggests that the scenarios allowed for discussion and joint reflection and that the simulation training may lead to enhanced understanding of one another's sense of competence and scope of practice. Most especially, the simulation provided an opportunity for equal discussions in a safe environment. This supports the findings suggesting that feeling safe in a learning situation fosters confidence in one's role and willingness to participate in a team [8, 9, 12, 14]. Moreover, our results may indicate that the scenarios provided safe ways of developing interprofessional collaborative competence where different perspectives are valued. Unequal power relations and hierarchical structures are seen as barriers for learning [43, 44]. We highlighted that everyone's knowledge and perspective were necessary to solve the problem which seemed to promote a non-hierarchical learning environment and strengthen the students' confidence in their interprofessional competence.

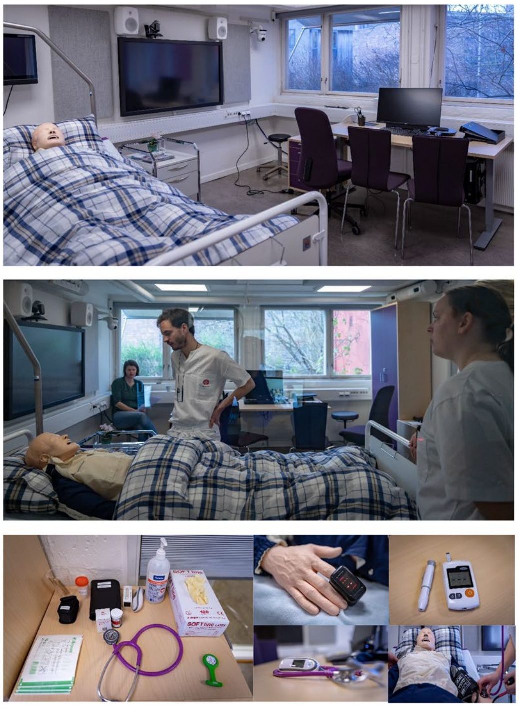
The students said that though similar to clinical practice, the simulated setting was also different. The joint discussions and reflections about the patients' clinical picture they experienced during the simulation session were not usually encountered in clinical practice or work, neither was the structured debriefing. This might be seen as an educational paradox, in which students participate in IPE to prepare for future interprofessional practice that rarely takes place. Thus, it can be challenging to prepare students with IPC competencies if they do not find opportunities to practice in clinical work. Consequently, those students might not consider IPC as important in real-life clinical work [5]. At the same time, education institutions have a responsibility to include high-quality IPE, and thereby contribute to the quality of IPC in the future. Otherwise, newly graduated students risk entering their professions without the interprofessional collaborative competence needed to work efficiently in future healthcare teams [2].

The simulation-based experience offered a frame of reference for future problem solving. Thus, it seems that the realistic setting not only enhances learning, but also makes it more transferable for future situations, confirming existing research which suggests that authentic, interactive and competence-building IPE experiences create lasting impressions [29, 30]. However, it is important to highlight that realism—or fidelity—does not mean that everything must be as found in practice, without exception. Simulation fidelity relates to the educational value of the simulation which means that the necessary level of realism should be evaluated to create the required learning environment [28]. In our study, we have shown that the students valued the authentic and realistic scenarios. Although the simulation was conducted in a simulation centre with a SimMan as the older nursing home patient, the student perceived the situation as realistic due to the authentic scenario description, convincing access to equipment, presentation of vague clinical signs and credible information provided in the medical record. This highlights that to create a realistic simulation experience—or the right amount of fidelity—it has to contain physical elements but also situations the students manage to make sense of and experience as relevant [28, 39]. In our study, albeit the fact that not everything was identical to practice, the abovementioned factors contributed to create a context where the students experienced a sense of recognisability and, thus, engaged in the scenarios.

Systematic IPE could be an advantage for future teamwork, as the students explained that having experienced IPC, they felt prepared to contribute in future IPC situations. The positive change in the students' self-reported competence score supported that participating in the scenarios prepared the students for collaborative practice. Other studies have also found that IPC training develops competence and enhances the ability to engage in future interprofessional teamwork in clinical practice [33]. Exposing healthcare students to IPE during education can result in more graduates with IPC competence, which in turn can promote a positive change towards further interprofessional collaborative healthcare practice. Thus, the IPC learning outcomes the students achieved in these scenarios could be transferable to other settings and situations.

Strengths and limitations

A strength of this study is that it expands simulation-based IPE as a strategy to prepare healthcare students for future IPC and shows the potential of adding simulations of sub-acute primary care scenarios to IPE. We acknowledge that the participating students might be more positive about simulation and IPC than other students might. Reasons for non-participation were, however, mainly the lack of time and not getting time off from work or clinical practice. The simulations and FG interviews were conducted in 1 day to facilitate participation and avoid study schedule conflicts. We do not know if the students would have shared the same viewpoints in the FG interview had they had time to process the experience over a longer period. However, FG interviews provided us with detailed and rich descriptions of the students' immediate experiences.



The simulation rooms were divided into two zones: the patient room and the office. The patient zone was set up as a nursing home room with bed and nightstand. The office section contained the available equipment, medical record and various mapping forms

An example of healthcare students in conversation with the patient, with the facilitator observing in the background.

Equipment such as disposable gloves, hand disinfectant, bandages, ear thermometer, pulse oximeter, paper-based medical record, manual blood pressure device and blood glucose measuring device were in the rooms

Fig. 1 Simulation set-up and available equipment

An interesting follow-up study could be to investigate how the students experienced the simulation after having entered healthcare as healthcare professionals. Although ICCAS added the students' individual and anonymous assessment of their own competence, we have too small a sample size to evaluate the effect of the sub-acute scenarios. We performed the FG interviews with the whole interprofessional group and not divided by professions. This might have inhibited some participants to speak freely, since they might be influenced by how they think they are expected to act in their future professional roles. However, since the students were in these groups for 1 day only, we consider it unlikely that this was a major problem. The analysis was based on the researchers' interpretations of the transcripts. The students have not had the opportunity to comment on our interpretations, and we acknowledge that their interpretations or explanations of the transcripts may differ from ours. Although research promotes the use of simulation to support IPE, there are few studies with sub-acute scenarios from primary care. Thus, our study contributes to a new perspective on how to facilitate for IPE in healthcare education. These scenarios seem to be feasible for implementation in healthcare education. Adding observers with specific tasks related to observation of the simulation activity could be one way to scale up to accommodate real student numbers and consequently avoid inactive participants in the scenarios. Then, the students could take turn in taking part in a scenario and observing their peers taking part in

Table 1 Description of the participants

	N (%)	Prior participation in simulation		Prior participation in interprofessional simulation	
		Yes, *N* (%)	No, *N* (%)	Yes, *N* (%)	No, *N* (%)
Total	27 (100)	22 (82)	5 (18)	7 (26)	20 (74)
Medical students (MS)	10 (37)	8 (80)	2 (20)	2 (20)	8 (80)
Master's students in adv. geriatric nursing (AGN)[a]	8 (30)	6 (75)	2 (25)	2 (25)	6 (75)
Bachelor's students in nursing (NS)	9 (33)	8 (88.9)	1 (11.1)	3 (33.3)	6 (66.7)

[a] The AGN students have a minimum of 2 years of clinical experience as staff nurses before entering into the master's programme

Table 2 Example of analysis

Step 1	Step 2	Step 3	Step 4
General impression and identification of preliminary themes	Identification and coding of meaning units (first person)	Construction of artificial quotations (condensates) summarising several meaning units (first person)	Syntheses of contents into main themes and sub-categories Choice of golden quotes (third person)
Very realistic and similar to practice	MS1 (FG1): "I am in nursing home practice now and had my first day yesterday. This could have been yesterday! And it could be tomorrow." NS2 (FG2): "I think they were really good cases. Because it's the type of patient you would actually meet." MS9 (FG5): "I especially think about the fact that it was so relevant. The topics were important, and the situations ones that you would often experience." AGN6 (FG4): "And I also think that it was very good that we were told immediately that this is a nursing home and this is the available equipment in the nursing home, and that the doctor is present one day a week. This made it realistic." MS7 (FG4): "You need those surroundings to make it is as believable as possible."	I am in practice at a nursing home and this could have been yesterday, or tomorrow. It felt very realistic and relevant for primary care. This is also the kind of patient you would typically meet in healthcare. We were told immediately that this is a nursing home and what equipment we had access to. Having been in a nursing home, the resources and their availability felt realistic. You need to have surroundings that feel realistic to make the simulation believable.	**Main theme:** realism **Sub category:** recognition of realistic scenario and setting The students recognised the scenarios as realistic, the situations as authentic situations and ones that they would likely encounter in healthcare, and specifically in primary care. The students also described the setting in a nursing home as recognisable and realistic. They highlighted the necessity to have realistic surroundings that would make the simulation authentic. Golden quotes: MS9 (FG5): "I especially think about the fact that it was so relevant. The topics were important, and the situations ones that you would often experience." AGN6 (FG4): "And I also think that it was very good that we were told immediately that this is a nursing home and this is the available equipment in the nursing home, and that the doctor is present one day a week. This made it realistic."

another scenario. The scenarios also have potential to be expanded to include other healthcare professions, which would have been an interesting opportunity for further study.

Conclusions

The present study shows that simulation-based IPE with sub-acute primary care scenarios in healthcare education contributes to the development of the collaborative competence. The students valued the authentic scenarios and expressed that solving the scenarios increased their competence in IPC and prepared them for future work. The sub-acute scenarios, although complex in relation to the unspecific and vague symptoms, promoted collaborative learning opportunities for the students due to the authenticity and sufficient time to discuss and reflect. Introducing simulation-based IPE with a focus on primary care scenarios can supplement more common acute care simulation approaches for developing the collaborative competence required to work in healthcare teams.

Abbreviations

IPE: Interprofessional education; IPC: Interprofessional collaboration; MS: Medical student; AGN: Master's students in advanced geriatric nursing; NS: Bachelor's students in nursing; FG: Focus group.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41077-022-00204-5.

Additional file 1.

Additional file 2.

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Authors' contributions

LL, AMB, AM, EOR and RBJ contributed to the study conception, design, material preparation and data collection. All authors contributed to the analysis. LL wrote the first draft of the manuscript, and all authors contributed to the subsequent versions and the final manuscript. The authors read and approved the final manuscript.

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Availability of data and materials
The datasets generated and/or analysed during the current study are not publicly available due to the data corpus still being subject to analysis but are available from the corresponding author on reasonable request. Additional file 1: Interview guide; Additional file 2: Scenario description.

Declarations

Ethics approval and consent to participate
The Norwegian Centre for Research Data approved the study (project number 60867). We obtained written, informed consent from the participants after providing oral and written information.

Consent for publication
The students and facilitator in Fig. 1 have consented to the use of the picture in this article.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of Nursing Science, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway. [2]Department of Health Management and Health Economics, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway. [3]Department of Communication and Psychology, Humanistic Faculty, Aalborg University, Aalborg, Denmark. [4]Department of General Practice, Institute of Health and Society, Faculty of Medicine, University of Oslo, Oslo, Norway.

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Guide for focus group with medical students, advanced geriatric nursing students and nursing students

Presenting the aim of the focus group interview:

The aim of a focus group interview is to gain insights, thoughts, experiences and beliefs of a situation, in this case the simulation scenarios. It is not an aim to gain consensus on the themes under discussion, but we would like to hear about your experiences. Feel free to elaborate on one another's statements.

Opening questions (asking each student):

- We would like you to introduce yourself and tell a little about your previous experiences with simulation in general and interprofessional simulation specifically
- If participated in any kind of simulation, if it was at school or in practice

Key themes and probing questions

Theme 1: The scenarios

What are your thoughts on these scenarios?

- Probing questions:
  - How was it to go through a scenario in a normal nursing home setting?
  - Was something missing?
  - Was there anything that was particularly good?
  - What was your role in the scenario?
  - How did you clarify tasks and roles in the team?
  - What could you bring with you from the first scenario to the second? Do you have examples?
  - Did it make sense to carry out the simulation twice? Should the two scenarios have been more different?

Theme 2: Interprofessional collaboration and simulation

What are your thoughts about having interprofessional simulation training during education?

- Probing questions:
  - Can you describe what interprofessional collaboration means to you?
  - How do you view your own role in interprofessional collaboration?
  - What kind of experience do you have with what other professions or healthcare students learn during their education?
  - If you were to create scenarios focusing on collaboration between students, what would you have focused on?
  - What does it take to create credible and realistic scenarios for training of collaboration?
  - What should the scenarios focus on to be especially relevant for primary care?
  - What are the advantages or disadvantages of conducting sub-acute interprofessional simulation scenarios?
  - What do you think about having this as a compulsory part of the education?

Summary and ending questions

The moderator sums up

Is there anything else you would like to say, elaborate on, clarify etc.? Anything you have forgotten to say or want to emphasize.

Description of the scenarios

Scenario briefing:

You will shortly be presented with a patient case where a patient is staying at a nursing home. You are all at work at the nursing home today.

Firstly, we will go through the tasks in the simulation. You should perform a clinical assessment, agree on a reasonable clinical problem or diagnosis, and develop a shared treatment plan together during the simulation. We expect you to act according to your future professional role in the scenario. You have 30 minutes to perform the tasks.

A week earlier, an old man fell at home and broke his right hip. He went to hospital for surgery. On the fourth post-operative day, he was transferred to the rehabilitation ward at the nursing home. A bladder catheter was removed before the patient left the hospital.

In the nursing home, training is in progress, but he is tired and in pain. The patient trains with a physiotherapist daily, otherwise spends most of his time in bed. He is not sleeping well.

The medical doctor is present in the nursing home once a week.

Medical history found in the medical record:

- Male, 80 years old
- Pensioned accountant living alone in a house with two floors
- Wife died a year ago with moderate Alzheimer. One son.
- No cognitive decline
- Heart failure and hypertension, both stable with medication
- Transient ischemic attack (TIA) in 2015, followed by secondary prophylactic treatment

Additional resources in the medical record

- List of medications
- Admission papers to the nursing home
- Day to day nursing documentation at the nursing home
- Discharge papers from orthopaedic doctor, nurses and physiotherapists at the hospital
- A copy of the medication list from the hospital

The urinary tract scenario:

The patient had an accident with urine on his way to the bathroom, and needed help with his trousers. You are asked to go to the patient to assess the situation.

Main clinical signs:

- No airway obstruction
- Normal respiratory rate and normal breath sounds
- Normal heart sounds
- Blood pressure 118/80, pulse 92
- Temperature 37,7 Celsius
- Frequent urination, cloudy and dark.
- Urinary dipstick: Positive for leukocytes, blood and nitrites
- Bladder scan: 375 ml before urination, 175 ml after urination
- No upper back and side (flank) pain
- No sign of infection in the operation wound on the right hip
- CRP (C-reactive protein): 45

The pneumonia scenario:

The patient had trouble finding his room after dinner. He appeared slightly agitated during dinner. You are asked to go to the patient to assess the situation.

Main clinical signs:

- No airway obstruction
- Normal heart sounds
- Elevated respiratory rate of 18
- Late inspiratory crackles on the right lung, normal left lung
- Dry cough at night, slight dyspnoea when talking
- Blood pressure 122/80, pulse 90
- Temperature 37,9 Celsius
- Normal urination
- No sign of infection in the operation wound on the right hip
- CRP (C-reactive protein): 50

Appendices

I. The Norwegian version of ICCAS (sub-study 1)

II. The scenarios (sub-study 2)

Appendix I

Appendix 1: The Norwegian version of ICCAS (sub-study 1)

En spørreundersøkelse om din tverrprofesjonelle kompetanse

Takk for at du vil delta i denne undersøkelsen om din tverrprofesjonelle kompetanse. Dette spørreskjemaet går til alle studenter i Norge som nylig / nettopp har deltatt i tverrprofesjonell læring. Det er viktig for ditt lærested at du er med på undersøkelsen. Skjemaet har 47 spørsmål til avkryssing. Vi vil etter at du har fylt ut skjemaet ikke kunne spore dine svar tilbake til deg.

Vi spør ikke etter personsensitive eller personidentifiserende opplysninger. Svarene dine brukes til å validere skjemaet statistisk slik at det kan benyttes til å gjøre tverrprofesjonell læring enda bedre. Vi vil også se på effekten av de ulike undervisningsformene for tverrfaglig læring i Norge, slik at alle undervisningsinstitusjonene kan lære av hverandre og bedre egen undervisning.

Du kommer i gang ved å trykke på "neste" nede i høyre hjørne. Du kan bevege deg frem og tilbake i spørreskjemaet uten at svarene forsvinner. Hvis du blir avbrutt i løpet av besvarelsen, kan du fortsette senere der du slapp.
Tusen takk for at du deltar.

Med vennlig hilsen
Universitetet i Bergen
Høgskulen på Vestlandet
Stavanger Universitetssykehus
Universitetet i Stavanger
Universitetet i Oslo
OsloMet
NTNU
Universitetet i Tromsø

Jeg samtykker til å delta ved å fylle ut spørreskjemaet. Svarer du 'Nei' stopper undersøkelsen her

(1) ❑ Ja
(2) ❑ Nei

Du er nå med i undersøkelsen

Jeg er

(1) ❑ Mann
(2) ❑ Kvinne

Min alder i år

______

Studiested

(1) ❑ UiB
(2) ❑ HVL Bergen
(3) ❑ HVL Førde
(4) ❑ SUS
(11) ❑ UiS
(5) ❑ OsloMet
(6) ❑ UiO
(7) ❑ NTNU Trondheim
(8) ❑ UiT
(9) ❑ NTNU Ålesund
(10) ❑ NTNU Gjøvik

Jeg studerer

(1) ❑ Audiograf
(28) ❑ Barnehagelærer
(31) ❑ Barnevern
(25) ❑ Bioingeniør
(30) ❑ Ergoterapi
(27) ❑ Ernæring
(29) ❑ Farmasi
(32) ❑ Fysioterapi
(33) ❑ Geriatrisk sykepleie

(34) ❑ Grunnskolelærer
(35) ❑ Helsesøster
(36) ❑ Jus
(37) ❑ Logoped
(41) ❑ Medisin
(42) ❑ Musikkterapi
(49) ❑ Odontologi
(43) ❑ Psykologi
(44) ❑ Radiograf
(47) ❑ Sosialt arbeid
(48) ❑ Sosionom
(26) ❑ Sykepleie
(6) ❑ Tannpleie
(7) ❑ Vernepleie
(9) ❑ Andre

Jeg deltok ved

(1) ❑ Fellesukene 1(HVL Bergen)
(16) ❑ Fellesukene 2 (HVL Bergen)
(17) ❑ Fellesuke 3 ordinær (HVL Bergen)
(18) ❑ Fellesuke 3 SimArena (HVL Bergen)
(19) ❑ HEL 0700 (UiT)
(20) ❑ Intersim (UiT)
(2) ❑ INTERACT (OsloMet)
(21) ❑ Sammen i praksis (UiO)
(22) ❑ TPS (HVL Førde)
(23) ❑ TPS praksis (UiT)
(3) ❑ TVERRSAM (NTNU)
(4) ❑ TverrPraks (NTNU)
(5) ❑ TVEPS (HVL og UiB)
(24) ❑ TVEPS 'verdighetsprosjektet'
(6) ❑ Tverrfaglig simuleringsdag (SUS, UiS, UiB)
(12) ❑ Tverrprofesjonelt samarbeid (UiS)

Jeg studerer på årskull

(1) ❑ 1. studieår

(2) ❑ 2. studieår

(3) ❑ 3. studieår

(4) ❑ 4. studieår

(5) ❑ 5. studieår

(6) ❑ 6. studieår

ICCAS (Interprofessional Collaborative Competencies Attainment Survey)
Norsk versjon

Vennligst svar på spørsmålene under ved å velge det svaret som best reflekterer din mening om de følgende utsagnene om tverrprofesjonelt samarbeid:
1 = Helt uenig, 2 =Noe uenig, 3 = Nøytral, 4 = Noe enig , 5 = Helt enig, I/r = Ikke relevant

	FØR jeg deltok i denne tverrprofesjonelle treningen var jeg i stand til å:						ETTER jeg har deltatt i denne tverrprofesjonelle treningen er jeg i stand til å:					
	1	**2**	**3**	**4**	**5**	**I/R**	**1**	**2**	**3**	**4**	**5**	**I/r**
1. Fremme effektiv kommunikasjon mellom deltakerne i en tverrprofesjonell gruppe	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
2. Lytte aktivt til ideer og innvendinger fra medlemmene i den tverrprofesjonelle gruppen	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
3. Utrykke mine ideer og innvendinger uten å kritisere	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
4. Gi konstruktiv tilbakemelding til de andre i den tverrprofesjonelle gruppen	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

	FØR jeg deltok i denne tverrprofesjonelle treningen var jeg i stand til å:						ETTER jeg har deltatt i denne tverrprofesjonelle treningen er jeg i stand til å:					
	1	**2**	**3**	**4**	**5**	**I/R**	**1**	**2**	**3**	**4**	**5**	**I/r**
5. Uttrykke mine ideer og innvendinger på en klar og presis måte	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
6. Henvende meg til de andre i den tverrprofesjonelle gruppen for å ta opp saker	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
7. Samarbeide effektivt med andre i den tverrprofesjonelle gruppen for å bedre omsorg og behandling	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
8. Lære med, av og om de andre i den tverrprofesjonelle gruppen for å bedre omsorg og behandling	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
9. Identifisere og beskrive mine kompetanser og bidrag til den tverrprofesjonelle gruppen	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
10. Ta ansvar for mine bidrag til den tverrprofesjonelle gruppen	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
11. Vise forståelse for de andres kompetanser og bidrag til den tverrprofesjonelle gruppen	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

	FØR jeg deltok i denne tverrprofesjonelle treningen var jeg i stand til å:						ETTER jeg har deltatt i denne tverrprofesjonelle treningen er jeg i stand til å:					
	1	**2**	**3**	**4**	**5**	**I/R**	**1**	**2**	**3**	**4**	**5**	**I/r**
12. Anerkjenne hvordan andres kunnskaper og ferdigheter utfyller og overlapper mine	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
13. Bruke en tverrprofesjonell tilnærming sammen med pasient/bruker for å vurdere hans/hennes situasjon	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
14. Bruke en tverrprofesjonell tilnærming sammen med pasient/bruker for å gi helhetlig omsorg / behandling	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
15. Involvere pasient/bruker og pårørende i avgjørelser	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
16. Lytte aktivt til de andre i den tverrprofesjonelle gruppen sine perspektiver	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
17. Ta hensyn til de andre i den tverrprofesjonelle gruppen i mine innspill	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
18. Ta opp konflikter i gruppen på en respektfull måte	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
19. Utvikle en effektiv tiltaksplan sammen med de andre i den tverrprofesjonelle	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

	FØR jeg deltok i denne tverrprofesjonelle treningen var jeg i stand til å:						ETTER jeg har deltatt i denne tverrprofesjonelle treningen er jeg i stand til å:					
	1	**2**	**3**	**4**	**5**	**I/R**	**1**	**2**	**3**	**4**	**5**	**I/r**
gruppen												
20. Avklare ansvar der gruppemedlemmene har overlappende kompetanser	(2) ❑	(4) ❑	(3) ❑	(5) ❑	(6) ❑	(7) ❑	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

21. Sammenliknet med tiden før denne tverrprofesjonelle læringsaktiviteten, vil du anslå din evne til å samarbeide tverrprofesjonelt er (kryss av for et av alternativene):
1 = Mye bedre før, 2 = Noe bedre før, 3 = Omtrent det samme, 4 = Noe bedre nå, 5 = Mye bedre nå

1	2	3	4	5
(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

Takk for at du svarte på dette spørreskjemaet!

Appendix II

Appendix 2: The scenarios (sub-study 2)

Joint introduction:

A week prior, an older patient fell at home and broke his right hip. The patient was admitted to hospital and underwent surgery. A bladder catheter was inserted on admission. The catheter was removed on the second post-operative day without complications. On the fourth post-operative day, he was transferred to a rehabilitation ward at the nursing home.

In the nursing home, training is in progress. The patient trains with physiotherapist daily, otherwise spends most of his time in bed. He is not sleeping well, and is tired and in pain.

The medical doctor is present in the nursing home once a week.

Medical history found in the medical record:

- Male, 80 years old
- Lives alone in a house with two floors, bedroom in second floor
- Wife died a year ago with moderate Alzheimer. One son.
- Pensioned accountant
- No cognitive decline
- Heart failure, stable with medication
- Hypertension, stable with medication
- Transient ischemic attack (TIA) in 2015, followed by secondary prophylactic treatment

Medication list:

- Selo Zok (Metoprolol succinate) 50 mg once a day in the morning
- Renitec (Enalaprilmaleat) 20 mg once a day in the morning
- Furix (Furosemide) 20 mg once a day in the morning

- Albyl-E (Acetylsalicylic Acid) 75 mg once a day in the morning
- Persantin (Dipyridamole) 200 mg morning and evening
- Fragmin (Dalteparin) 5000 IE, one injection daily in the evening for 10 days after hospital discharge
- Paracetamol (Paracetamol) 1 g four times a day as long as severe pain
- OxyContin (Oxycodone hydrochloride) 5 mg morning and evening for 3-5 days after hospital discharge
- Tramadol (Tramadol hydrochloride) 50 mg, 1-2 tablets up to four times a day as long as severe pain

Clinical assessment at admission to nursing home:

Status: 80-year-old male who until the acute injury was mobilized without aids. Appearance corresponding to age. He is oriented for person, time, place and situation

Height	190 cm
Weight	110 kg
Blood pressure	135/76
Pulse	82 regular
Oxygen concentration (SpO2)	98%
Respiratory rate	12
Temperature	36,9 Celsius
Pupils	Round and equal with symmetrical light reaction
Ears	Abundant cerumen in both ears. No access to eardrum. Reduced hearing.
Oral cavity	Clean, pale but slightly dry mucous membranes.
Auscultation lungs	Normal heart sounds
Auscultation heart	Normal lung sounds, mild crackles when forced inspiration

Abdomen	Soft and not tender in sitting position
Extremities	Dry and warm. Slight swelling in right leg. Scar after hip surgery, no signs of infection.
Neurology	Good and even force in upper extremities

Specific information regarding the scenario with urinary tract infection:

It is the day shift and a health worker assistant has reported to you that the patient had an accident with urine on his way to the bathroom. He also needed help with putting on his trouser. You are asked to go to the patient to assess the situation.

Clinical findings:

Airways	No airway obstruction, speaks freely but somewhat reluctant to give information
Breathing	*Respiratory rate*: 14 *Oxygen concentration (SpO2)*: 95 % *Auscultation lungs:* Normal breathing sounds *Auscultation heart*: Normal heart sounds
Circulation	*Pulse:* 92, regular *Blood pressure:* 118/80
Disability	*Wound:* No sign of infection in the operation wound on the right hip *Movement:* Pain in right hip in exertion/ when moving *Urination:* - No upper back and side (flank) pain - Frequent urination, cloudy and dark - Urinary dipstick: Positive for leukocytes (+2), blood (+1) and nitrites (+1) - Bladder scan: 375 ml before urination, 175 ml after urination. *Abdomen*: Soft, not tender in sitting position *Extremities:* Dry and warm. Slight swelling in right leg.

	Neurology: Good and equal force in upper extremities
Exposure	*Temperature:* 37,7 Celsius *CRP (C-reactive protein):* 45 *Blood sugar*: 5,2 *Hemoglobin:* 10,5

Specific information regarding the scenario with pneumonia:

It is nearing the end of the day shift, and a health worker assistant has reported to you that the patient had trouble finding his room after dinner. He appeared slightly agitated during dinner. You are asked to go to the patient to assess the situation.

Clinical findings:

Airways	No airway obstruction, speaks freely but somewhat confused
Breathing	*Respiratory rate:* 18 *Oxygen concentration (SpO2)*: 94 % *Auscultation lungs:* Late inspiratory crackles on the right side, normal left side *Auscultation heart:* Normal heart sounds
Circulation	*Pulse:* 90, regular *Blood pressure:* 122/80
Disability	*Chest:* Slight inspiratory pain, dry cough especially in the night, slight dyspnea when talking *Wound:* No sign of infection in the operation wound on the right hip *Movement:* Pain in right hip in exertion/ when moving *Urination:* No problem. - If urinary dipstick is taken: Positive for leukocytes (+1) and protein (+1), negative for nitrites - Bladder scan: No urinary retention *Abdomen*: Soft, not tender in sitting position

	Extremities: Dry and warm. Slight swelling in right leg. *Neurology:* Good and even force in upper extremities
Exposure	*Temperature:* 37,9 Celsius *CRP (C-reactive protein):* 50 *Blood sugar:* 5,2 *Hemoglobin:* 10,5

Student tasks:

1. Perform a systematic clinical assessment
2. Agree on a reasonable clinical problem or diagnosis
3. Develop a shared treatment plan for the patient

Additional resources in the medical record (in Norwegian)

- Admission papers to the nursing home (Innkomstjournal)
- Day to day nursing documentation at the nursing home (Sykepleiedokumentasjon)
- Discharge papers from orthopedic doctor at the hospital (Epikrise)
- Discharge papers from nurses at the orthopedic ward (Sykepleiesammenfatning)
- Discharge papers from physiotherapists at the hospital (Epikrise fra fysioterapeut)

INNKOMSTJOURNAL

Familie/sosialt
Enkemann, 1 sønn. Pleiet kone med moderat Alzheimer fram til hennes død for 1 år siden. Pensjonert regnskapsfører. Bor i enebolig over 2 plan. Røyker to sigarer og drikker 3-4 glass vin per uke.

Tidligere sykdommer
Hypertensjon
2007 Hjertesvikt påvist., Stabil med bruk av Selo-Zok, Renitec og Furosemid.
2015 TIA. Sekundærprofylakse med Persantin Retard og Albyl E.

Aktuelt
Beboer kommer til rehabiliteringsopphold etter sykehusinnleggelse fom 19.4.19 tom 23.4.19 grunnet fall i hjemmet. Dislokert lårhalsbrudd hø side operert den 20.4.19 med sementert hemiprotese. Mobilisert med prekestol. Kan delbelaste.

Status presens
80 år gammel mann som inntil akutt skade var mobilisert uten hjelpemidler. Nå mobilisert med delbelastning i prekestol med følge. Utseende svarende til alder. Undersøkes sittende i stol.
Beboer er orientert for tid og sted. Han er orientert for egne medisiner, og kjenner egen sykdomshistorie. Fremstår i godt humør og angir ingen smerter for øyeblikket. Samarbeider greit ved US.
BT: 135/76
Puls: 82rgm
SpO2: 98%
RR: 12
Tp: 36,9
Pupiller: Runde og egale med symmetrisk lysreaksjon
Otoskopi: Rikelig cerumen begge ører. Ikke innsyn til trommehinne. Nedsatt hørsel.
Cavum Oris: Rene, bleke men litt tørre slimhinner. Protese oppe, egne tenner nede. Ingen tegn til belegg.
Cor: Rgm aksjon, rene toner, svak syst bilyd over aortaostiet
Pulm: Resp ubesværet, sonor perkusjonslyd, vesikulær respirasjonslyd, lette knatrelyder basalt ved forsert inspirasjon
Abdomen: Palperes bløt og uøm i sittende stilling
Ekstremiteter: Tørrre og varme. Lett hevelse distalt hø ben. Arr etter hofteoperasjon. Ingen tegn til infeksjon/rødhet eller puss
Nevrologi: God og sidelik kraft begge overekstremiteter med sidelikt tempo.

Mental vurdering
Beboer er klar og orientert

Behandlingsavklaring/HLR
Beboer ønsker ikke HLR ved akutt hjertestans. Ser på dette som evt naturlig død. Har ikke noe imot sykehusinnleggelse dersom dette er aktuelt og skal innlegges i sykehus dersom god indikasjon for dette. For øvrig ingen annen begrensning i behandling av beboer.

Faste medisiner ved innkomst

Selo-Zok 50 mg, 1x1	I: Hjertesvikt
Renitec 20 mg, 1x1	I: Hjertesvikt
Furosemid 20 mg, 1x1	I: Hjertesvikt/Deklive ødemer
Albyl E 75 mg, 1x1	I: Sekundærprofylakse etter TIA I 2015
Persantin Retard 200 mg, 1x2	I: Sekundærprofylakse etter TIA i 2015
Paracet 1gx4	I: Smerter etter lårhalsbruddoperasjon. Reduseres når smertene tillater det
Oxycontin 5mg x 2	I: Smerter etter lårhalsoperasjon. Seponeres så fort smertene tillater det (3-5 dager)

Fragmin 5000 ie, en sprøyte daglig i 10 dager etter utskrivelsen.

Ved behov:
Tramadol 50 mg 1-2 x inntil 4 så lenge sterke smerter

Cave
Ingen kjente

Legemiddelgjennomgang
Tramadol seponeres fra ved behov. Setter heller opp Oxynorm 5mg inntil x 3 pr dag ved sterke smerter
Setter opp Movicol 1 pose daglig for å forebygge obstipasjon så lenge han står på Oxycontin. Kan også få inntil 3 poser ekstra pr dag ved obstipasjon

Rehabiliteringsbehov
Protesen er fullt øvelses- og belastningsstabil. Vurdering og opptreningsprogram ved fysioterapeut.

Risikovurderinger
Økt fallfare. Viktig med ganghjelpemidler og hyppig tilsyn
Sårinfeksjon

Videre tiltak
Dryppe og skylle ører
Invitere til pårørendesamtale/Evt ringe pårørende
Sting fjernes om 14 dager
Ingen rutinekontroller ved ortopedisk avdeling, men rekontakt ved tegn til infeksjon i protesen.

SYKEPLEIEDOKUMENTASJON - PNEUMONI

Innkomst – Sykepleier
Sverre Jensen ble overflyttet fra ortopedisk avdeling etter hoftebrudd på høyre side. Han har fått innvilget 2 uker korttidsopphold for opptrening.
Planlagt hjemreise etter oppholdet.
Vurderingsnotat er påbegynt. Se også dokumenter fra sykehuset

Kommunikasjon	Klar og orientert
Respirasjon/sirkulasjon	RF 12, SpO2 98%, ubesværet respirasjon BT 135/76, puls 92, afebril
Ernæring	Spiser selv, ingen allergi
Eliminasjon	Kontinent
Hud/vev – sår	Operasjonssår hø hofte. Ikke gjennomsiv i bandasje, lar ligge til i morgen
Aktivitet	Oppegående med prekestol. Har fått dette tildelt. Mulig å forsøke med rullator?
Søvn/velvære	Ua
Smerter/ sanseintrykk	Ikke smertepreget ved ankomst
Psykosos./relasjoner	Sønn orientert om ankomst Hageby.

Kveldsvakt – Hjelpepleier

Aktivitet	Han går med prekestol og følge til matsalen. Han sier han er sliten etter reisen fra sykehuset og holder stort sett sengen. Pusset tenner selv på badet
Søvn/velvære	Sverre har funnet seg til rette på rommet. Hadde behov for ekstra smertestillende i forkant av gåturen til spiserommet. Tilsynelatende god effekt.

Nattevakt – Sykepleier

Søvn/velvære	Tilsynelatende sovet ved tilsyn

Dagvakt dag 1 - Hjelpepleier

Kommunikasjon	Oppfattes som klar og orientert
Ernæring	Normalkost. Trenger ingen tilrettelegging. Må oppfordres til å drikke
Eliminasjon	Ordner toalettbesøk selv. Alt ok ifølge Sverre selv
Hud/vev – sår	Byttet bandasje på hø hofte. Ingen tegn til infeksjon.
Aktivitet	Fikk hjelp til dusj. Ønsket tilsyn da han føler seg ustø. Greier det meste selv, men trengte hjelp med sokkene ved påkledning. Har gått et par runder med prekestol. Fysio ordnet med rullator som kommer i morgen. Fysio har gjennomgått en del øvelser med Sverre og laget plan for opptrening. Målet er opp å gå minst x2 per vakt. Helst sitte i stol og ikke ligge i seng. Gjøre øvelser x 2 per dag.
Søvn/velvære	Trøtt etter aktivitet. Døser i stolen
Smerter/ sanseintrykk	Ønsket smertestillende før dusj og før han skulle gå til matsalen til middag. God effekt

Kveldsvakt dag 1 - Ufaglært

Kommunikasjon	Blid og fornøyd
Ernæring	Spist godt. Litt dårlig til å hente seg drikke, men drikker godt når det er drikke tilgjengelig.
Aktivitet	Holder stort sett senga eller sitter i stolen. Måtte overtales til å gå til matsal. Utført øvelser fra fysio
Søvn/velvære	Trøtt
Smerter/ sanseintrykk	Fikk smertestillende av spl før kveldsmat
Psykosos./relasjoner	Besøk av sønn

Nattevakt dag 1 - Sykepleier

Søvn/velvære	Sovet ved tilsyn

Dagvakt dag 2 - Hjelpepleier

Ernæring	God appetitt. Forsøker å drikke nok. Liker godt juice og melk.
Eliminasjon	Litt treg i magen, men har hatt avføring ifølge han selv.
Hud/vev – sår	Byttet bandasje på hofte - ua
Aktivitet	Trengte litt hjelp til å ta på sokker, ellers kun tilsyn ved stell.
Søvn/velvære	Føler seg trøtt og sliten. Tror selv det er pga smertestillende
Smerter/ sanseintrykk	Trenger fortsatt ekstra smertestillende i forkant av trening.

Kveldsvakt dag 2 - Ufaglært

Ernæring	Ua
Eliminasjon	Har endelig fått i gang magen sier han selv.
Aktivitet	Holder seg stort sett på rommet. Ville ikke gå en ekstra runde i kveld. Sier han er sliten.
Søvn/velvære	La seg tidlig
Psykosos./relasjoner	Besøk av sønn. Sønn påpeker at far virker mer sliten i kveld.

Nattevakt dag 2 - Sykepleier

Respirasjon/sirkulasjon	Sverre sier han har hostet i natt. Ikke observert noe ved tilsyn
Søvn/velvære	Sovet dårlig ifølge han selv.

Dagvakt dag 3 – Helsefagarbeider (Påbegynt)

Kommunikasjon	Opplevdes som irritabel/misfornøyd under middag.
Kunnskap/utvikling	
Respirasjon/sirkulasjon	
Ernæring	Småspist til frokost.
Eliminasjon	Ua
Hud/vev – sår	Ikke tilsett såret, sykepleier skal ta det senere
Aktivitet	Har gått til matsal med følge til begge måltider. Ville gå tilbake alene etter middag, men gikk inn på feil rom.
Søvn/velvære	Tiltaksløs og sliten
Smerter/ sanseintrykk	
Seksualitet/reproduksjon	
Psykosos./relasjoner	
Åndelig/ kulturelt	

SYKEPLEIEDOKUMENTASJON – URINVEISINFEKSJON

Innkomst – Sykepleier
Sverre Jensen ble overflyttet fra ortopedisk avdeling etter hoftebrudd på høyre side. Han har fått innvilget 2 uker korttidsopphold for opptrening.
Planlagt hjemreise etter oppholdet.
Vurderingsnotat er påbegynt. Se også dokumenter fra sykehuset

Kommunikasjon	Klar og orientert
Respirasjon/sirkulasjon	RF 12, SpO2 98%, ubesværet respirasjon BT 135/76, puls 92, afebril
Ernæring	Spiser selv, ingen allergi
Eliminasjon	Kontinent
Hud/vev – sår	Operasjonssår hø hofte. Ikke gjennomsiv i bandasje, lar ligge til i morgen
Aktivitet	Oppegående med prekestol. Har fått dette tildelt. Mulig å forsøke med rullator?
Søvn/velvære	Ua
Smerter/ sanseintrykk	Ikke smertepreget ved ankomst
Psykosos./relasjoner	Sønn orientert om ankomst Hageby.

Kveldsvakt – Hjelpepleier

Aktivitet	Han går med prekestol og følge til matsalen. Han sier han er sliten etter reisen fra sykehuset og holder stort sett sengen. Pusset tenner selv på badet
Søvn/velvære	Sverre har funnet seg til rette på rommet. Hadde behov for ekstra smertestillende i forkant av gåturen til spiserommet. Tilsynelatende god effekt.

Nattevakt – Sykepleier

Søvn/velvære	Tilsynelatende sovet ved tilsyn

Dagvakt dag 1 - Hjelpepleier

Kommunikasjon	Oppfattes som klar og orientert
Ernæring	Normalkost. Trenger ingen tilrettelegging. Må oppfordres til å drikke
Eliminasjon	Ordner toalettbesøk selv. Alt ok ifølge Sverre selv
Hud/vev – sår	Byttet bandasje på hø hofte. Ingen tegn til infeksjon.
Aktivitet	Fikk hjelp til dusj. Ønsket tilsyn da han føler seg ustø. Greier det meste selv, men trengte hjelp med sokkene ved påkledning. Har gått et par runder med prekestol. Fysio ordnet med rullator som kommer i morgen. Fysio har gjennomgått en del øvelser med Sverre og laget plan for opptrening. Målet er opp å gå minst x2 per vakt. Helst sitte i stol og ikke ligge i seng. Gjøre øvelser x 2 per dag.
Søvn/velvære	Trøtt etter aktivitet. Døser i stolen

Smerter/ sanseintrykk	Ønsket smertestillende før dusj og før han skulle gå til matsalen til middag. God effekt

Kveldsvakt dag 1 - Ufaglært

Kommunikasjon	Blid og fornøyd
Ernæring	Spist godt. Drikker dårlig og må oppfordres
Aktivitet	Holder stort sett senga eller sitter i stolen. Måtte overtales til å gå til matsal. Utført øvelser fra fysio.
Søvn/velvære	Trøtt
Smerter/ sanseintrykk	Fikk smertestillende av spl før kveldsmat
Psykosos./relasjoner	Besøk av sønn

Nattevakt dag 1 - Sykepleier

Søvn/velvære	Sovet ved tilsyn

Dagvakt dag 2 - Hjelpepleier

Ernæring	God appetitt. Obs drikke. Liker godt appelsinjuice, kaffe med melk og gul saft
Eliminasjon	Litt treg i magen, men har hatt avføring ifølge han selv.
Hud/vev – sår	Byttet bandasje på hofte - ua
Aktivitet	Trengte litt hjelp til å ta på sokker, ellers kun tilsyn ved stell. Trent med fysio – fikk smertestillende i forkant
Søvn/velvære	Føler seg trøtt og sliten. Tror selv det er pga smertestillende
Smerter/ sanseintrykk	Trenger fortsatt ekstra smertestillende i forkant av trening.

Kveldsvakt dag 2 - Ufaglært

Ernæring	Ua.
Eliminasjon	Sverre sier han går ofte på toalettet. Ikke observert noe uvanlig, men han ordner dette selv
Aktivitet	Holder seg stort sett på rommet. Ville ikke gå en ekstra runde i kveld. Sier han er sliten.
Søvn/velvære	La seg tidlig
Psykosos./relasjoner	Besøk av sønn. Sønn påpeker at far er litt irritabel i kveld.

Nattevakt dag 2 - Sykepleier

Eliminasjon	Fant Sverre på wc kl 02. Han sier han er treg i magen og ikke får gått på do. Bør få ekstra Movicol i morgen

Dagvakt dag 3 – Helsefagarbeider (Påbegynt)

Kommunikasjon	
Kunnskap/utvikling	
Respirasjon/sirkulasjon	
Ernæring	Småspist til frokost. Måtte minnes på å drikke
Eliminasjon	Hadde hatt et uhell med urin på vei til wc i morges. Fikk litt assistanse i morgenstell og bytte av bukse
Hud/vev – sår	Ikke tilsett såret
Aktivitet	Ville helst ikke gå til matsalen til frokost.
Søvn/velvære	Tiltaksløs og sliten
Smerter/ sanseintrykk	

EPIKRISE

Diagnose: S72.0 Lårhalsbrudd.
Behandlingskoder: NFB12 Innsetning av distal primær delprotese i hofteledd med sement

Supplerende undersøkelse
Rtg bekken og høyre hofte ved innkomst: Dislokert lårhalsfraktur
Rtg thorax ved innkomst: Mulig lett forstørret hjerteskygge, frie sinus, ingen tegn til infiltrater
Rtg høyre hofte postop: Hemiprotese i god stilling
Blodprøver ved innkomst: Hb. 14.1, hvite 10.1, crp 30, Na 139, K 4,1, Krea 70
Blodprøver ved utskrivelse: Hb. 10.1, hvite 8,5, crp 150, Na 138, K 4,3, Krea 75

Tidligere sykdommer fra innkomstjournal
Hjertesvikt 2007. Hypertensjon. TIA 2015.

Forløp og behandling:
Pasienten falt hjemme fra egen høyde 4 dager før utskrivelsen. Ved innleggelsen ble det påvist et dislokert lårhalsbrudd på høyre side. Pasienten ble operert dagen etter innleggelsen med en sementert hemiprotese ukomplisert. Han ble mobilisert i avdelingen med hjelp fra fysio og utskrivelsesdagen går han med prekestol med delbelastning på den opererte siden. Postop røntgen viste god stilling og blodprøver har vist hemoglobinfall forhøyet CRP som forventet etter operativt inngrep.
Han utskrives nå til videre rehabilitering på korttidsopphold på sykehjem med følgende plan.

Plan etter utskrivelse
1. Protesen er fullt øvelses- og belastningsstabil. Videre mobilisering med hjelp fra fysioterapeut.
2. Sting fjernes hos egen lege eller på sykehjem 2,5 til 3 uker etter operasjonsdato.
3. Tromboseprofylakse etter rutine med Fragmin 5000 ie, 1 sprøyte daglig tom. 10 dager etter utskrivelsen.
4. Smertelindring med Paracet 1g, 1 x inntil 4 så lenge behov. Ved behov for sterkere smertestillende foreslås enten lavdose Oxycontin (5 mg, 1x2 i noen dager) eller Tramadol (50 mg 1-2 x inntil 4).
5. Ingen rutinekontroller ved ortopedisk avdeling.
6. Rekontakt ved tegn til infeksjon i protesen.

Medisiner ved utskrivelse
Selo-Zok 50 mg, 1x1
Renitec 20 mg, 1x1
Furosemid 20 mg, 1x1
Albyl E – 75 mg, 1x1
Persantin Retard – 200 mg, 1x2
KUR Fragmin 5000 ie, en sprøyte daglig i 10 dager etter utskrivelsen
KUR Paracet 1g, 1x inntil 4 så lenge smerter
KUR Oxycontin 5 mg 1x2 i 3-5 dager etter utskrivelsen
KUR Tramadol 50 mg 1-2 x inntil 4 så lenge sterke smerter

SYKEPLEIESAMMENFATNING

Årsak til innleggelse
Fallskade mot hoften

Kommunikasjon/sanser:
Kommuniserer godt, lett tunghørt.

Kognitiv funksjon:
Har vært klar og orientert og uten kognitiv svekkelse under innleggelsen.

Ernæring/væske:
Spist selv, ikke hatt behov spesialkost.

Eliminasjon:
Fikk urinveiskateter ved innkomst, fjernet andre postoperative dag. Kontinent og selvhjulpen på do etter det.

Aktivitet/funksjonsstatus:
Mobilisert til gange med prekestol. Forsøkt seg med krykker men noe ustø og hatt behov for støtte.

Smerte/søvn/hvile/velvære:
Har behov for litt tilrettelegging til stell, men vasker seg selv på overkroppen.

Sosialt/planlegning av utskrivelse:
Sønnen er informert om at pasienten utskrives til sykehjem.

Åndelig/kulturelt/livsstil:
Ingen bemerkninger.

Medisinsk oppfølging/legedelegerte oppgaver:
Ingen bemerkninger. Se kopi av kurve

EPIKRISE FRA FYSIOTERAPEUT

Diagnose: S72.0 Brudd i lårhals

Familie/sosialt (fra legens innkomstjournal).
Enkemann, 1 sønn. Pleiet kone med moderat Alzheimer fram til hennes død for 1 år siden. Pensjonert regnskapsfører. Bor i enebolig over 2 plan. Røyker to sigarer og drikker 3-4 glass vin per uke.

Tidligere sykdommer (fra legens innkomstjournal)
Hjertesvikt 2007. Hypertensjon. TIA 2015.

Indikasjon (fra operasjonsbeskrivelsen)
Pasienten faller hjemme og skadet høyre hofte. Rtg viser dislokert fraktur i collum femoris. Det foreligger klar opr. indikasjon. Han informeres om inngrepets art, mulige komplikasjoner og forventet resultat.

Postoperativ oppfølgning: Belaste fullt, men justere etter smerter.

Forløp:
Pasienten har fått muntlig og skriftlig informasjon om det postoperative forløp. Ved utreise er pasienten ved god allmenntilstand med lite smerter, kvalme og svimmelhet.

Pasienten bor i egen bolig med trapp inn og boareal over 2 etasjer. Han gikk uten hjelpemidler før det aktuelle.

Han setter seg selvstendig opp på sengekanten og reiser seg med støtte i sengekanten. Oppegående med prekestol over kortere distanser med tilsyn. Går med forkortet standfase på opr. side og økt skrittlengde på ikke-operert side. Fremstår som noe ustødig og ikke klart krykkegange selvstendig.

Han er instruert i egenøvelser for bevegelighet og muskelkontakt. Pasienten viser god kontakt med muskulatur og beveger over alle ledd i kne og hofte men redusert aktiv bevegelse og kraft som forventet. Informert om anbefalte hjelpemidler.

Forslag til videre oppfølgning:
- Det er tillatt med full belastning på operert bein, bør bruke nødvendig hjelpemiddel til trygg forflytning og ingen halting.
- Trening av bevegelighet samt styrke, stabilitet og nevromuskulær kontroll rundt operert hofte etter prinsipper for progressiv styrketrening, innenfor rammer som smerter og hevelse gir.
- Bør ha fallforebyggende tiltak.