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Institutionen för kliniska vetenskaper, Danderyds sjukhus (KI DS)  
Karolinska Institutet

**STUDENT OUTCOMES, LEARNING ENVIRONMENT,  
QUALITY OF CARE AND PATIENT SAFETY  
AT AN INTERPROFESSIONAL TRAINING WARD**

Karin Hallin



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**Karolinska  
Institutet**

## **Student outcomes, learning environment, quality of care and patient safety at an interprofessional training ward**

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som för avläggande av medicine doktorsexamen vid Karolinska Institutet  
offentligen försvaras i Aulan, Danderyds Sjukhus

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# ABSTRACT

The overall aim was to enhance knowledge on students' collaborative learning and patient safety of interprofessional education (IPE) at an interprofessional training ward (IPTW). Medical, nurse, physiotherapy and occupational therapy students and patients at the IPTW were studied.

## 1.1 STUDENTS

*Study I:* A prospective quantitative questionnaire study on 616 IPTW students evaluated whether students perceived they had achieved interprofessional competence. Anonymous pre and post course questionnaires were used. The response rate was 96 %. All four student groups perceived improved knowledge of the other three professions ( $p=0.000000$ ). They assessed the course had contributed to the understanding of the importance of communication and teamwork to patient care (effect size 1.0;  $p=0.00002$ ), where medical students had the greatest gain ( $p=0.00093$ ). All student groups perceived an increased clarity of their own professional role ( $p=0.00003$ ), where occupational therapy students had the greatest gain ( $p=0.000014$ ).

*Study II:* A qualitative content analysis on free text answers of 333 questionnaires explored IPTW students' perspectives on learning environment and on own development. Two themes emerged. *An enriching learning environment – a safe place with space* included authentic and relevant patients, well composed and functioning student teams, competent and supportive supervisors and adjusted ward structure to support learning. *Awareness of own development with faith in the future – from chaos to clarity* included personal, professional and interprofessional development towards a comprehensive view of practice.

## 1.2 PATIENTS

*Study III:* A quantitative questionnaire study on 102 patients treated by student teams at the IPTW compared to 85 patients treated at a regular ward. Patients' perceptions of collaborative and communicative aspects of care were assessed. The response rate was 82 % and 73 %. IPTW patients felt more involved in the decisions regarding their treatment as compared to controls ( $p=0.006$ ). They were also more satisfied that their home situation had been taken into account when preparing for discharge ( $p=0.0002$ ) as well as with given information regarding need of help at home ( $p=0.003$ ). Finally, IPTW patients felt better informed ( $p=0.02$ ).

*Study IV:* A retrospective registry study on operated orthopaedic patients' safety, by comparing readmission rates and mortality between patients treated by student teams at the IPTW compared to patients treated in usual care. Included cohort consisted of 5766 patients with 6274 admissions. No significant differences in either 30 or 90-day readmission rates or in one-year mortality were found. Patients with student team exposure every day of their hospital stay had an estimate of 0.89 for readmission within 90 days and of 0.68 for one-year mortality, i.e. a tendency to a lower risk.

## 1.3 CONCLUSIONS

Active patient based learning by working together in a real ward context is effective to increase interprofessional competence. When the community of practice at an IPTW provides a safe, supportive and permissive learning environment it enables students to develop fully. With embodied understanding of practice, students obtain faith in one self as future healthcare professionals interacting with others. If the learning environment is impaired, however, students' development could be halted.

Patients treated at an IPTW perceive a greater quality of care in aspects of communication and collaboration as compared to usual care. A more structured interprofessional team-based care may be beneficial even in usual care. We found no increased risk for orthopaedic patients - as concerns readmissions and mortality – when exposed to student teams at an IPTW compared to usual care. The results should reassure further implementation of IPE in authentic patient based contexts.

## LIST OF SCIENTIFIC PAPERS

- I. Hallin, K., Henriksson, P., Dalen, N., & Kiessling, A. (2011). Effects of interprofessional education on patient perceived quality of care. *Med Teach*, 33(1), e22-26. doi: 10.3109/0142159X.2011.530314.
- II. Hallin, K., Kiessling, A. A safe place with space for learning enables students to go from chaos to clarity – experiences from an interprofessional training. (Submitted).
- III. Hallin, K., Kiessling, A., Waldner, A., & Henriksson, P. (2009). Active interprofessional education in a patient based setting increases perceived collaborative and professional competence. *Med Teach*, 31(2), 151-157. doi: 10.1080/01421590802216258.
- IV. Hallin, K., Gordon, M., Sköldenberg, O., Henriksson, P., Kiessling, A. Readmissions and mortality in patients treated by interprofessional student teams at a training ward as compared to usual care. (Manuscript).

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## LIST OF ABBREVIATIONS

CAIPE	Centre for the Advancement of Interprofessional Education
CEW	Clinical Education Ward (identical with IPTW and KUA)
CoP	Community of Practice
CP	Collaborative Practice
IPE	Interprofessional Education
IP	Interprofessional
IPTW	Interprofessional Training Ward (identical with CEW and KUA)
KUA	Kliniska utbildningsavdelning (identical with CEW and IPTW)
M	Medical student
N	Nurse student
O	Occupational therapy student
P	Physiotherapy student
SOLO	Structure of the Observed Learning Outcomes
VAS	Visual Analogous Scale
RW	Regular Ward implies usual care
WHO	World Health Organisation



# 1 SVENSK SAMMANFATTNING

## BAKGRUND

Modern sjukvård blir allt mindre hierarkisk och genomförs allt mer av team bestående av olika professioner. Denna utveckling medför förändrade krav på yrkesutövare och en förändrad syn på olika yrkesroller. Färdigheter såsom samverkan, effektiv kommunikation och att ta tillvara teammedlemmars olika kompetens blir allt viktigare för en god och säker patientvård.

Klinisk utbildning inom hälso- och sjukvård syftar bland annat till att utveckla professionell kompetens och mognad inför den kommande kliniska verksamheten. I och med att sjukvården förändras, ökar kravet på hälso- och sjukvårds utbildningar att studenter, utöver specifik professionsträningen, även får öva kliniskt teamsamarbete redan under grundutbildningen.

I interprofessionell utbildning får studenter från olika professionsutbildningar möjlighet att träna sin yrkesroll tillsammans med andra. Centre for the Advancement of Interprofessional Education (CAIPE) definierade år 2002 interprofessionell utbildning som *"tillfällen då två eller flera professioner lär med, av och om varandra för att förbättra samarbete och kvalitet i vården"*.

På s.k. kliniska utbildningsavdelningar (KUA) bedrivs patientbaserad interprofessionell utbildning. Den första avdelningen av detta slag startades 1996 på ortopedkliniken på Linköpings universitetssjukhus och följdes 1998 av ortopedkliniker på universitetssjukhusen i Stockholm. Utbildningsavdelningar har numer etablerats inom fler specialiteter och i andra länder. Syftet med en KUA är att studenter från olika grundutbildningar lär tillsammans genom att aktivt delta i det kliniska arbetet. Studenternas mål är att tillgodose patienternas behov av medicinsk vård, omvårdad och rehabilitering genom att utveckla sin egen yrkesroll, öka förståelsen av andras roller samt att öka förståelsen av god kommunikation och samverkan för patientens bästa.

Pedagogiken i denna form av verksamhetsintegrerat lärande bygger på upplevelsebaserat lärande där teori och praktik integreras och omsätts i professionell mognad.

KUA på Danderyds sjukhus tar emot ca 200 studenter årligen. Den 2 veckor långa kursen är obligatorisk. Studenter från utbildningsprogrammen för läkare, sjuksköterskor, arbetsterapeuter och fysioterapeuter samverkar i 2 team kring vården av patienterna. Studenterna uppmuntras till att arbeta så självständigt som möjligt och de handleds av ett team där samtliga professioner är representerade. Avdelningen har 8 vårdplatser med både akut och planerat inlagda patienter med en bredd av ortopediska diagnoser. Många av patienterna är äldre och lider även av andra sjukliga tillstånd som t ex hjärt-kärl sjukdom, diabetes och undernäring. Mycket svårt sjuka patienter vårdas inte på KUA. Inte heller patienter med demens, drogmissbruk eller komplicerande psykisk sjukdom eftersom kommunikation är en av hörnstenarna i utbildningen.

Avhandlingens övergripande syfte är att få ökad kunskap om lärandet och att studera utfall av interprofessionell utbildning på KUA både ur ett student- och ett patientperspektiv.

### **STUDIE I: ACTIVE INTERPROFESSIONAL EDUCATION IN A PATIENT BASED SETTING INCREASES PERCEIVED COLLABORATIVE AND PROFESSIONAL COMPETENCE**

Syfte: Att utvärdera om studenter på KUA upplevde att de hade uppnått lärandemålen. Fanns det skillnader mellan utbildningsprogrammen?

Metod: Kvantitativ prospektiv enkätstudie på 616 studenter under åren 2002 - 2005. En jämförelse gjordes mellan enkätsvar före- och efter KUA där enkät nr 1 fylldes i på placeringens första dag och enkät nr 2 fylldes i på placeringens sista dag. Studenter hade inte tillgång till enkät nr 1 vid ifyllandet av enkät nr 2. Enkäterna besvarades anonymt, men studenterna angav sitt studieprogram och eget valt "bomärke" som användes för att kunna jämföra varje enskild students svar före och efter KUA. Svarsfrekvensen var 96 %.

Resultat: Alla fyra studentgrupper upplevde ökad kunskap om andras professioner, ökad tydlighet i egen profession och att kursen hade poängterat vikten av hur viktig god kommunikation och lagarbete är för patientens bästa. De ansåg även att patienternas behov av medicinsk vård, omvårdnad och rehabilitering i hög grad hade uppfyllts. Alla fyra studentgrupper skattade således en ökad interprofessionell kompetens. De största vinsterna sågs hos läkar- och arbetsterapeutstudenter.

### **STUDIE II: A SAFE PLACE WITH SPACE FOR LEARNING ENABLES STUDENTS TO GO FROM CHAOS TO CLARITY – EXPERIENCES FROM AN INTERPROFESSIONAL TRAINING WARD**

Syfte: Att utforska studenters syn på lärandemiljön på KUA och på sin egen utveckling.

Metod: Kvalitativ innehållsanalys av fritextsvar från 333 studenters enkäter under åren 2004 - 2011. Analysprocessen utgick från ett socialkonstruktivistiskt förhållningssätt till lärande. Teorier såsom "community of practice", "embodied understanding of practice" och "peer learning" användes i tolkning och diskussion av resultaten.

Resultat: Två teman identifierades. 1) An enriching learning environment – a safe place with space (En gynnsam lärandemiljö - en säker plats med frihet) illustrerade studenters perspektiv på lärandemiljön på KUA. Temat baserades på fyra subteman; verkliga och relevanta patienter, väl sammansatta och välfungerande studentteam, kompetenta och stödjande handledare och, slutligen, en anpassad struktur för att stödja lärandet. 2) Awareness of own development with faith in the future – from chaos to clarity (Medvetenhet om egen utveckling med framtidstro - från kaos till klarhet) illustrerade studenters perspektiv på den egna utvecklingen. Temat baserades på två subteman; att utvecklas personligt och professionellt samt att utvecklas interprofessionellt mot ett helhetsperspektiv på patientvård. Det andra temat var beroende av det första temat - för att kunna gå från kaos till klarhet krävdes interaktion i en säker och samtidigt tillåtande miljö. Resultaten antydde också att studenters utveckling avstannade om lärandemiljön var otillräcklig.

### **STUDIE III: EFFECTS OF INTERPROFESSIONAL EDUCATION ON PATIENT PERCEIVED QUALITY OF CARE**

Syfte: Att utvärdera patienters upplevelse av vårdkvalitet på KUA jämfört med patienter på en traditionell ortopedavdelning med fokus på kommunikation, information och delaktighet.

Metod: Kvantitativ enkätstudie av skattningar från patienter under åren 2004-2005. Patienter som uppfyllde kriterier för vård på KUA och som skrevs ut direkt till eget boende inkluderades. Patienter som skrevs ut under en helg (då utskrivningen inte utfördes av studenter) och patienter med återinläggning inom 4 veckor exkluderades. 102 patienter på KUA och 85 patienter på kontrollavdelning inkluderades. Svarsfrekvensen var 82 resp. 73 %.

Resultat: Patienter vårdade på KUA upplevde större delaktighet i besluten om sin vård och de kände sig bättre informerade om sin behandling jämfört med patienter vårdade på kontrollavdelning. De ansåg även att personalen i högre grad hade tagit hänsyn till deras hemsituation i samband med utskrivning och att de hade blivit bättre informerade om möjlig hjälp i hemmet.

### **STUDIE IV: READMISSIONS AND MORTALITY IN PATIENTS TREATED BY INTERPROFESSIONAL STUDENT TEAMS AT A TRAINING WARD AS COMPARED TO USUAL CARE**

Syfte: Att utvärdera patientsäkerheten på KUA genom att jämföra frekvensen av återinläggning och död mellan patienter vårdade på KUA och patienter vårdade på traditionell ortopedavdelning.

Metod: Retrospektiv registerstudie på 8054 opererade patienter som vårdats på någon av Danderyd sjukhus ortopedavdelningar inklusive KUA under åren 2006 - 2011. Data hämtades från Socialstyrelsens patientregister, Dödsorsaksregistret samt ortopedklinikens register på vårdade patienter. Patienter med betydande samsjuklighet och diagnoser som inte var lämpliga för vård på KUA exkluderades. Patienter som vårdats < 2 dygn och eller > 2 veckor och patienter vårdade under semesterperioder (jul och sommar) exkluderades också. Studerade utfallsmått var återinläggningsfrekvens inom 30 och 90 dagar respektive död inom 1 år från utskrivningsdatum.

Resultat: Inkluderad kohort bestod av 5766 patienter med 6274 inläggningar. 58 % av patienterna var kvinnor med en medianålder på 63 år och en medianvårdtid på 4 dagar. Vi fann ingen skillnad i 30 och 90 dagars återinläggningsfrekvens eller död inom 1 år mellan patienter som vårdats av interprofessionella studentteam på KUA jämfört med patienter som vårdats på någon av de övriga ortopedavdelningarna. Slutsatsen kvarstod efter regressions- och känslighetsanalys och efter justering för förvillande data (confounders).

## SLUTSATSER

- Att lära genom att arbeta tillsammans i vården av patienter är ett effektivt sätt att lära sig att samverka över professionsgränserna och att öka sin professionella och interprofessionella kompetens.
- Om lärandemiljön är säker, stödjande och tillåtande, görs det möjligt för studenter att mogna personligt, professionellt och interprofessionellt.
- I en gynnsam lärandemiljö får studenter tilltro till sig själva, sitt framtida yrke och till sitt framtida samarbete inom vården. I en otillräcklig lärandemiljö kan studenters utveckling bromsas.
- Patienter som vårdas av interprofessionella studentteam upplever en hög vårdkvalitet gällande samarbets- och kommunikationsaspekter. Traditionell patientvård bör gynnas av att vården i större utsträckning bedrivs av strukturerade interprofessionella team.
- Det finns ingen ökad medicinsk risk vad beträffar återinläggning inom 30- och 90 dagar samt död inom 1 år efter utskrivning mellan patienter vårdade av handledda interprofessionella studentteam på en utbildningsavdelning jämfört med patienter vårdade av utbildad hälso- och sjukvårdspersonal på traditionell avdelning.
- En fortsatt utveckling av interprofessionell undervisning i autentiska patientbaserade utbildningsmiljöer bör uppmuntras både ur student- och patientsynpunkt.

## 2 INTRODUCTION

This thesis focuses on students' learning and outcome of interprofessional education and on patients' quality of care and safety at an interprofessional training ward compared to usual care. The introductory chapter aims to present some useful terminology and to highlight important aspects of this rapidly and worldwide expanding area of knowledge.

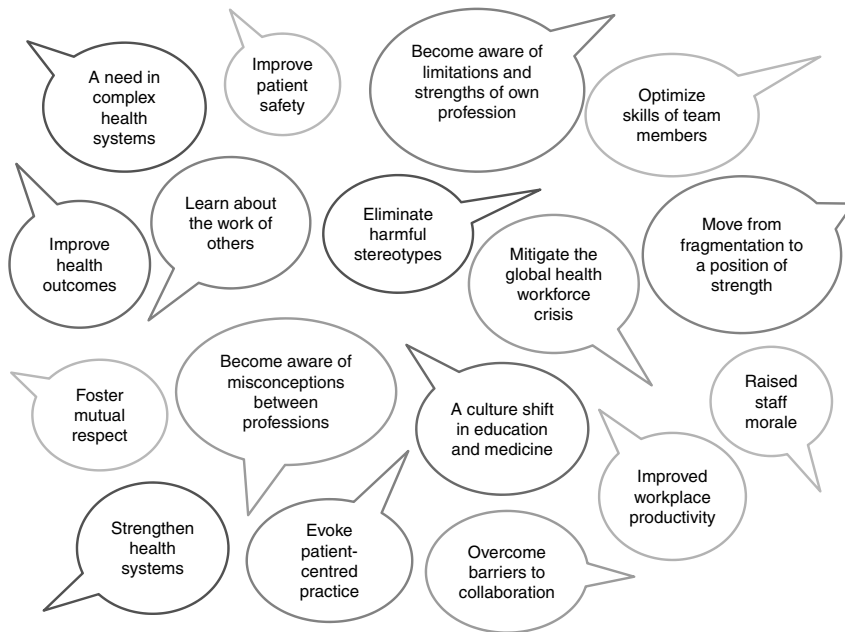
### ***INTERPROFESSIONAL EDUCATION (IPE)***

Centre for the Advancement of Interprofessional Education (CAIPE), an independent charity, founded in 1987, has defined IPE as: *when two or more professions learn with, from and about each other in order to improve collaboration and the quality of practice* (CAIPE, 2002).

The ideas of interprofessional education dates back to the 1960s and has since then been reinforced through several World Health Organization (WHO) reports, for instants; *Learning together to work together for health* (WHO 1988) and *Framework for Action on Interprofessional Education and Collaborative Practice* (WHO, 2010).

The terminology has varied over the years and may still give rise to confusion – e.g. multiprofessional-, interprofessional-, interdisciplinary education, etc. Many times the meaning of the terms is the same but sometimes it is not. A situation where several professions are present at the same time and context but their learning occurs in parallel to each other – then it is not interprofessional education. The CAIPE definition is a precise and complete description of IPE and should be used when one means an educational process where students or practitioners from various health professions learn together - with, from and about each other – with the goal of collaborating in providing health care. In some reports, the goals of the IPE initiatives seem to go beyond communication and role understanding, and suggest changing the culture of health professional interaction, referred to as flattening hierarchies (Herbert, 2005).

Several international organisations have over the years formulated statements on the relation between IPE and collaborative practice. Some of these are stated in Figure 1 below.



**Figure 1. Frequently used statements on interprofessional education - collaborative practice formulated by different influential organisations**

AIPPEN Australasian Interprofessional Practice and Education Network  
 AMEE The Association for Medical Education in Europe,  
 CAIPE Centre for the Advancement of Interprofessional Education  
 CIHC Canadian Interprofessional Health Collaborative  
 EMSA European Medical Students' Association  
 EIPEN European Interprofessional Education Network  
 HPGN Health Professionals Global Network (WHO)  
 IAMSE International Association of Medical Science Educators  
 IFMSA International Federation of Medical Students' Associations  
 NaHSSA National Health Sciences Students' Association in Canada  
 NIPNet Nordic Interprofessional Network  
 The Network: TUFH The Network: Towards Unity For Health  
 WFME World Federation for Medical Education  
 WHO World Health Organization

## **COLLABORATIVE PRACTICE**

Working in teams crossing professional boundaries is a matter of increasing importance in the delivery of healthcare. For patients it is, more or less, taken for granted that their care is run by smoothly operating teams, in which team members, despite professional affiliation, agree upon a conjoined strategy concerning their care. Health care institutions of today agree upon the importance of collaborative competence to secure patient safety in analogy with the landmark report of the Institute of Medicine (USA) (Institute of Medicine, 2001). However, deficiencies in collaboration is still an important contributing factor to adverse events in healthcare (Agency for Healthcare Research and Quality, 2013), and verbal communication

errors between staff members cause or contribute to a substantial amount of severe patient safety incidents (Rabol et al., 2011).

In accordance with the World Health Organization, interprofessional education is a necessary step in preparing a “*collaborative practice-ready*” health workforce that is better prepared to respond to local health needs (WHO, 2010). A collaborative practice-ready health worker is someone who has learned how to work in an interprofessional team and is competent to do so. Despite that many health workers already practice in teams and actively communicate, in collaborative practice, cooperation has taken one step further. These health workers know how to collaborate with colleagues from other professions with complementary skills and they do so with respect of one another. They interact to create a shared understanding that they would not have come to on their own. According to the WHO, it is important to introduce interprofessional education and collaborative practice as strategies that can transform the health system. It is no longer enough for health workers to be professional.

Figure 2 is inspired by the WHO (WHO, 2010) and illustrates the pathway between interprofessional education and collaborative practice.



**Figure 2. The relation between IPE and collaborative practice. Inspired by the WHO (WHO, 2010).**

## ***INTERPROFESSIONAL TRAINING WARD (IPTW)***

An IPTW is a student-adapted arena for interprofessional workplace learning. There is no golden standard terminology and the phenomenon is also named e.g. clinical education ward (CEW), student training ward, training unit etc. If the context is an authentic clinical environment and the student training is based on the definitions of interprofessional education, the different terms probably have a substantially equal meaning.

IPTWs were launched in Sweden 1996 and have since then been introduced in several countries. It has been showed that IPTW is an effective means for students to practice collaborative skills and to develop professional and interprofessional competences. (Brewer & Stewart-Wynne, 2013), (Hallin, Kiessling, Waldner, & Henriksson, 2009), (Jacobsen, Fink, Marcussen, Larsen, & Hansen, 2009), (Wilhelmsson et al., 2009), (Ponzer et al., 2004), (Reeves & Freeth, 2002), (Hilton & Morris, 2001), (Wahlstrom, Sanden, & Hammar, 1997),

## ***IPTW AT DANDERYD HOSPITAL***

### **Course and setting**

The IPTW course is a two-week mandatory IPE course at the Karolinska Institutet, Stockholm, Sweden. The IPTW at Danderyd University Hospital, Stockholm, is one out of four wards at the Department of Orthopaedics. The ward has run since 1998 and hosts two hundred undergraduate students yearly. It has 8 patient beds, 1 office for e.g. computer work, hospital records and documentation and 1 conference room for e.g. rounds and reflections. The ward is the setting of all studies included in this thesis.

### **Students**

The IPTW course is designed for medical students in their surgical semester (eighth out of eleven) and for nursing, occupational and physiotherapy students in their last semester before graduation (sixth). Before the course, students have passed a substantial amount of theoretical studies and a varied amount of uniprofessional workplace clerkships. Students are divided into two teams, each consisting of 1–2 medical students, 3–4 nursing students, 1 occupational therapy student and 1 physiotherapy student. If a student team is short of a profession, the supervisor of the missing profession acts as a role model within the team.

### **Supervisors and faculty**

During the two-week course, the interprofessional team of supervisors consists of five to six nurses, one orthopaedic surgeon, one occupational therapist and one physiotherapist. At least one professional nurse is always present at the ward, where the other three professions also hold part time duties out of the ward but are available when needed. Moreover, one auxiliary nurse is available to help and guide the students with the basic patient care.

An interprofessional faculty team representing the four professions is responsible for course evaluation and development and for staff support. They also participate in the course introductory and closing seminars.



## **Patients**

Patients are both acute and elective and are randomly admitted to the IPTW or to one of the other wards within the department depending on available patient beds and on the different profiles of the wards. Patients have the option to not be treated at the IPTW, but very few choose not to. A majority of the patients are elderly and suffer from a wide range of orthopaedic diagnoses. Many patients also present complicating comorbidities e.g. cardiovascular diseases, diabetes and malnutrition. Patients with dementia, psychosis, drug- or alcohol abuse or patients with medically very demanding conditions (multi-trauma, contagious disease or moribund) are not eligible to be treated at the IPTW.

## **Intended learning outcomes**

Students' intended learning outcomes are both interprofessional (shared by all student groups) and profession specific. The interprofessional intended learning outcomes are:

- Provide the patient independently, under supervision, with good medical care, nursing and rehabilitation
- Increase knowledge and understanding of own professional role
- Increase knowledge and understanding of other professions' competences
- Develop comprehension of communication and teamwork
- Increase understanding of ethical awareness.

Examples of profession specific goals are:

- Examine patients, set diagnoses, suggest investigations and treatments, write referrals, manage medication, organize and lead rounds (medical students)
- Lead, prioritize, distribute and carry out care tasks, give and document medication, surgery wound care (nurse students)
- Investigate and carry out patients' need for occupational therapy in the care, at home, at work and at recreational time (occupational therapy student)
- Investigate and carry out patients' need for physiotherapy in the care, at home, at work and at recreational time (physiotherapy student)

## **Schedule**

The course starts with an introduction, followed by eight days of practice. Students are divided into two teams who alternate daytime and evening shifts. A day shift starts with handover from regular night staff to the student team. A structured team conference is held where patient issues and goals are discussed and planned and followed up by a patient round. Hereinafter follows different tasks to secure patients' medical care and rehabilitation executed by the whole student team, parts of the team or by singular students depending on the task. Both teams are present during mid-day with enough handover time from day shift to evening shift. Most day shifts end with a scheduled reflective session. To facilitate patient continuity, the student team present at the evening shift return on the following day shift. All actions by students are supervised.

During daytime shifts all students have access to a supervisor of their own profession, while one or two nurses supervise the entire student team during evening shifts. In need of further medical help during evenings, the orthopaedic surgeon on call is available. During shifts without students (i.e. nights, weekends and student holidays) the regular orthopaedic staff manages the ward.

The course ends with a closing seminar where the students, supervisors and course faculty are present. Students have beforehand prepared written and oral reflections of their learning and achieved goals as a base for the discussion at the seminar. The students also fill out an evaluating questionnaire.

### **Educational methods**

The workplace learning at the IPTW is based on the pedagogy of *experiential learning* (Kolb 1984), and on *experience-based learning* (Dornan, Boshuizen, King, & Scherpbier, 2007), where theory and practice are integrated. Students learn by observing, doing, evaluating and reflecting. The overall educational strategy has a *collaborative student-activating* approach. It is based on the CAIPE definition of IPE (CAIPE, 2002); when students of two or more professions *learn about, from and with each other* to enable effective collaboration and improve health outcomes. At the IPTW, the student teams collaborate to treat, care for and rehabilitate the patients.

In the beginning of the course, students need more guidance and support and the supervisors act as role models in the team. Gradually, supervisors step back ‘with their hands on the back’ to support students’ independent problem-solving skills, to let them take more active part in the care and to give them a realistic impression of the responsibilities of qualified professionals. Consequently and eventually, it is mainly the students who communicate with the patients, with patients’ relatives and with professionals engaged in the care of patients. Likewise, it is mainly the students who provide the direct patient care at the IPTW.

*Peer learning* (Topping & Ehly, 1998), (Ladyshevsky, 2006) is consistently used in the collaborative teamwork.

Scheduled reflective sessions and the closing seminar support students’ reflective skills and their deep learning.

### **Course evaluation**

Recurrent meetings with supervisors and faculty, oral evaluations with students at the closing seminar and recurrent student questionnaires support a continuous evaluation and development of the course.

## **THEORETICAL FRAMEWORKS**

Several frameworks build the theoretical base of this thesis. They are often intertwined and partly overlapping. The frames of most significance for learning at an IPTW are presented here.

**Kolbs experiential learning theory** of 1984 offered at that time a new way of looking at learning compared to traditional educational methods, which were mostly based on rational idealist epistemology. The theory describes a holistic integrative perspective on learning that combines experience, perception, cognition and behaviour. Learners, if they are to be effective, need four different kinds of abilities: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). Learning requires abilities that are polar opposites, and a learner must continually choose which set of learning abilities is best fitted to a specific situation. In the process of learning, one moves in varying degrees from actor to observer, and from specific involvement to general analytic detachment. The theory is often illustrated as an experiential learning cycle (Kolb 1984).

According to Bleakley, the most commonly used learning theories in medical education still focus on the individual student rather than on the socio-cultural context (Bleakley, Bligh, & Browne, 2011). In IPE literature there is a common request for frameworks applicable to students' participatory learning in the context of a collaborative health care practice (Barr, 2013), (D'Amour, Ferrada-Videla, San Martin Rodriguez, & Beaulieu, 2005), (Thistlethwaite, 2012).

The **social constructivism** perspective implies that knowledge is constructed through interaction and reality is based on multiple, imperceptible mental constructions, socially grounded and context specific, and also dependent on individuals or groups holding the construction (Guba & Lincoln, 1994). In this thesis a perspective of social constructivism is chosen as students perform professionally relevant actions, interact with others and reflect both in and about. The perspective matches well with the ideas of IPE in the socio-cultural context of an IPTW.

A prerequisite of all IPE in contrast to uniprofessional education is that there are always several students learning together i.e. peers are always present to interact with. **Peer learning** is defined as a method whereby individuals with equal status actively help and support each other in learning tasks (Topping & Ehly, 1998). Learning is a social process that can be enhanced by involving peers. Sharing of a patient is one good way to ensure that students have a successful collaborative peer learning experience (Ladyshevsky, 2006). Peer learning is consistently used at the ITPW in the collaborative teamwork.

A key issue in IPTW learning is to support professional competence development. Several theories and concept have been stated to understand this complex process. In 1986 Dreyfus and Dreyfus presented **the novice to expert development**, a five-staged model of adult professional skill acquisition as a critique of the view on human skill development as a

cognitive learning process with explicit rules to follow in order to perform a task (Dreyfus, Dreyfus, & Athanasiou, 1986). In the model the learner moves from reliance on abstract rules to use concrete experience, shifts from reliance on rule-based thinking to intuition, changes in perception of the situation viewed as compilation of equally relevant bits to an increasingly complex whole and the learner passes from detached observer to involvement. The five stages for the learner to pass are: novice, advanced beginner, competence, proficiency and expertise. The stage model has e.g. been applied to describe the development of nurse competence going from beginners to experts (Benner, Tanner, & Chesla, 1992).

Dall'Alba and Sandberg developed the concept from a one-dimensional adult skill acquisition into a two-dimensional model of professional development. A horizontal dimension that represents skill development with increasing professional experience and a vertical dimension that represents development of an **embodied understanding of practice** in a given context. Embodied understanding integrates knowing, acting and being, i. e. learning knowledge and skills become integrated into a "professional way-of-being" (e.g. "being a doctor"). (Dall'Alba & Sandberg, 2006).

Learning that takes place in authentic clinical contexts is called **workplace-, experience-based- or situated learning**. This learning is of great importance to health care students as the workplace is where competence is eventually applied. The learning at the IPTW uses the pedagogy of workplace learning where theory and practice are integrated.

According to Dornan, the experience-based learning at a workplace is a process of absorbing and being absorbed into the culture of the workplace. The core process of clinical workplace learning involves 'participation in practice', which evolves along a spectrum from passive observation to performance. Students quickly become bored if they remain as passive observers, contrasting to the more actively and closer they are involved to care for patients, the more highly they value it. The core condition for clinical workplace learning is 'supported participation', where outcome is dependent on supervisors' attitudes, support and challenge (Dornan et al., 2007). When a workplace allows students to be active participants in clinical work instead of a passive listeners or readers, students' learning is effective (O'Brien et al. 2001).

Workplace learning may be challenging to students, as they have to identify and attach relevant theoretical knowledge into practice, and at the same time try to be accepted and get a sense of belonging at the workplace. Different workplaces have different cultures – meaning professionals' attitudes and values, how they mutually tackle and resolve tasks, how professionals interact and communicate and how they understand and learn from each other. This culture is often named a community of practice.

Lave and Wenger defined **community of practice (CoP)** in 1991 as a group of people who share a common interest and a desire to deepen their knowledge by interacting (Lave & Wenger, 1991). They stated that most of the learning occurs in social relationships at the workplace rather than in a classroom setting, a concept known as 'situated learning'. To

participate in the day-to-day activities of a CoP is an important part of learning. The concept was developed 1998 and described as an entity bounded by three interrelated dimensions; *mutual engagement, joint enterprise and shared repertoire* (Wenger, 1998). In 2002, Wenger et al revised the three characteristics of CoP and named them *domain, community, and practice* (Wenger, McDermott, & Snyder, 2002). CoP is still an evolving concept and there is no consensus on what a true CoP is. Li et al recommend to focus on optimizing three specific characteristics of the concept; *support for members to interact with each other, emphasize on learning and sharing knowledge and building a sense of belonging within groups* (Li et al., 2009).

## **RATIONALES FOR THIS THESIS**

It is a big commitment to initiate and manage an interprofessional patient based workplace course as an IPTW course – both to the responsible university programmes and faculty as well as to supervisors and hospitals implementing the training. As their efforts involve a dual great responsibility towards both students and patients, it is important to study the effects of an IPTW course from both perspectives.

When investigating the effect on students, a primary focus is to study whether students reach their intended learning outcomes in this specific context and to what degree their knowledge and understanding changes over time. It is also important to study whether there are any differences between students belonging to different educational programmes.

In IPE research there is a request to focus on the socio-cultural context (Bleakley et al., 2011), (Barr, 2013), (D'Amour et al., 2005), (Thistlethwaite, 2012). To further explore and better understand how and why students reach, or fail to reach, intended learning outcomes this thesis focuses on important characteristics in the learning environment and in students' development.

The final aim of interprofessional education is to improve the care of patients. Studies on patients' outcome on IPE are scarce and it is an important field of research (Barr, Freeth, Hammick, Koppel, & Reeves, 2006), (Reeves et al., 2008), (WHO, 2010). This thesis focuses on communicative and collaborative aspects of care - areas where students are highly involved in the patient care and therefore might have a great impact.

As an increased number of patients are treated at a rising number of IPTWs, it is of great importance to also study aspects of patient safety. To our knowledge, this has not been done before, using objective and robust outcome measurements.

### **3 AIMS**

The overall aim was to enhance knowledge on students' collaborative learning and patients' quality of care and safety related to interprofessional education (IPE) at an interprofessional training ward (IPTW).

- To evaluate whether students perceived they had achieved interprofessional competence after participating in patient-based teamwork training during an IPTW course
- To explore how environmental characteristics impact students learning at an IPTW, and the characteristics of students' development in this context
- To assess the patients' perceptions of collaborative and communicative aspects of care when treated at an IPTW as compared to usual care
- To assess patient safety of an IPTW by comparing readmission rates and mortality between patients treated by student teams at the ITPW and patients treated in usual care

## **4 METHODS AND RESULTS**

### ***ETHICAL CONSIDERATIONS***

In both study I and II, all participating students voluntarily answered the regular course questionnaire used to evaluate the course. The questions were answered anonymously and students were informed that the answers were to be analysed at group level with no possibility to identify the answers of a particular individual.

In study III participating patients answered voluntarily a sample of questions from a validated survey routinely used at the hospital to evaluate patients' satisfaction with care. Patient data such as age, length of hospital stay, diagnosis etc were retrieved from patient records by the first author. These data was kept in secured files by the first author. Patients were informed that the answers were to be analysed at group level with no possibility to identify the answers of a particular individual

In study IV the register data was achieved from the National Board of Health and Welfare. Ward information for each patient was retrieved through the hospital information system. All personal identification numbers was replaced by serial numbers and it was not possible to track data to a specific patient. The data was kept in secured files and only accessible to three of the authors. No journal records were studied and there was no need for informed consent from patients.

All investigations conforms to the principles outlined in the 'Declaration of Helsinki; 1964'. The Regional Ethical Review Board in Stockholm, Sweden, approved all included studies.

## OVERVIEW OF THE THESIS

A summary of the four studies included in this thesis is shown in table 1.

**Table 1: Overview of included studies**

	<b>Study 1</b>	<b>Study 2</b>	<b>Study 3</b>	<b>Study 4</b>
<b>Focus</b>	Student objectives	Learning environment and student development	Patient quality of care	Patient safety
<b>Main aim</b>	Do students perceive they achieve interprofessional competence?	What characterizes the learning environment and students' perceived development?	What are patients' perceptions of collaborative and communicative aspects of care at IPTW compared to usual care?	Are there any differences in readmission rates and mortality in IPTW patients compared to usual care?
<b>Design</b>	Prospective comparative before and after	Prospective descriptive	Prospective comparative by group design.	Retrospective registry cohort comparative
<b>Data collection</b>	Quantitative Questionnaire data	Qualitative Free text questionnaire data	Quantitative Questionnaire data	Quantitative Registry data
<b>Study period</b>	2002 - 2005	2004 - 2011	2004 - 2005	2006 – 2011



	<b>Study 1</b>	<b>Study 2</b>	<b>Study 3</b>	<b>Study 4</b>
<b>Participants</b>	Medical, nurse, physiotherapy and occupational therapy students	Medical, nurse, physiotherapy and occupational therapy students	Patients at the IPTW and at a comparable ward without student teams	Patients at the IPTW and 3 other wards at the department of orthopaedics
<b>Number of participants</b>	616	333	102 IPTW 85 controls	8054 population 5766 cohort
<b>Response rate</b>	96% before 97% after	-	82% (n 84) IPTW 73% (n 62) controls	-
<b>Studied individuals in total</b>	949 students		5912 patients in total 1192 IPTW patients	
<b>Data analysis</b>	Analyses of variance (ANOVA) with up to two within-subject factors and contrasts. Descriptive statistics	Explorative content analysis	Descriptive comparative statistics. Nonparametric and Chi-square analyses.  Cronbach alpha for internal consistency.	Observational. Poisson regression.  Cox proportional hazards regression.

# **STUDY I**

## **Methods**

The study was based on data from student questionnaires during the period 2002 - 2005. The "post IPTW" questionnaire was, during the time of the study, in use by all four university hospitals in Stockholm to evaluate IPE. It was considered to have high face validity and students perceived it was easy to understand and to fill out. Selection of items and validity has been described elsewhere (Ponzer et al., 2004). We introduced a "pre IPTW" questionnaire in order to assess achieved competence as change over time. The "pre IPTW" questionnaire was answered at the introduction on the first day at the IPTW. The "post IPTW" questionnaire was answered at the closing seminar on the last day. The questions were answered anonymously and marked with an individual code, chosen by the student, in order to match pre and post IPTW questionnaires. The educational program, academic semester and sex were noted. An unnumbered visual analogous scale (VAS) (Bowling 1997) was used. Students answered each item by placing an X on a 10-centimeter scale with verbal 'anchors' expressing the extremes. The score for each item was obtained by measuring from the left anchor to the X mark with an accuracy of 0.1 cm.

## **Statistical analysis**

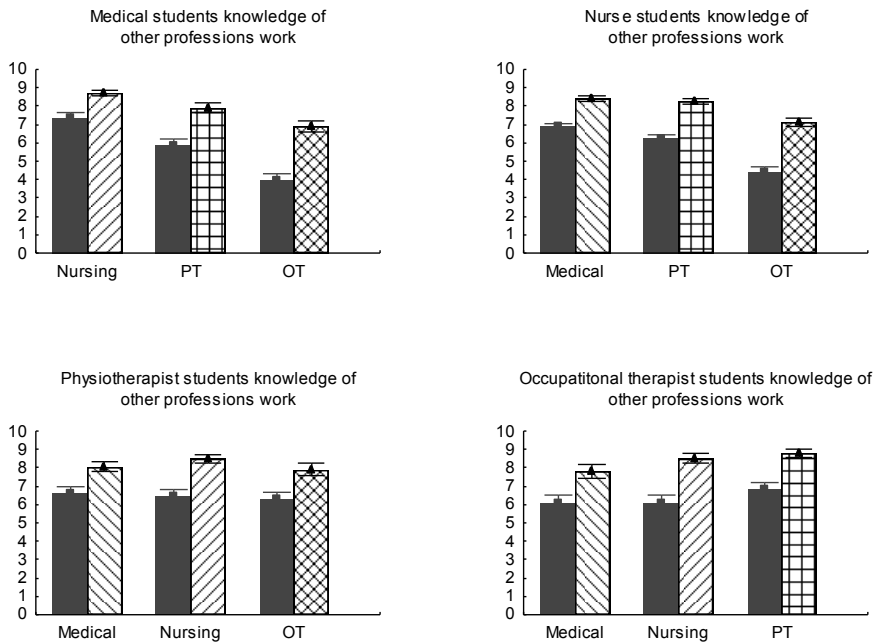
Pre IPTW results were compared to post IPTW. Analyses of variance (ANOVA) with up to two within-subject factors and contrasts were used. The power analysis showed that with 590 students in each group, we had more than 90 % power to detect a 10 % change between pre and post IPTW evaluations at a two sided alpha of 0.05. The descriptive data for the VAS measurements are given as means and 95 % confidence intervals. The results were considered significant at  $p < 0.05$ . All analyses were performed with the STATISTICA Stat Soft, Inc 7.0 package.

## **Results**

616 students participated in the course at the IPTW during the evaluation period 2002 – 2005. 175 were medical students, 290 nurse students, 83 physiotherapy students and 66 occupational therapy students. 34 % of the medical students were male, in the other three groups a majority were female (87 - 95 %). The response rates of the pre and post IPTW questionnaires were 96 % and 97 % respectively.

### Knowledge of other professions' work

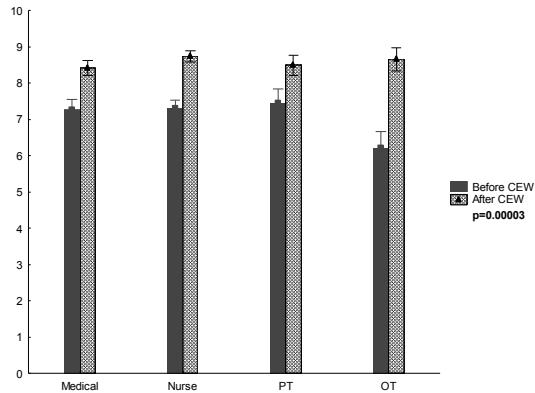
As shown in figure 3, all student groups perceived a significant gain in knowledge of all other professions ( $p = 0.000000$ ). For nursing and medical students the most prominent gain was of physiotherapy and occupational therapy. For physiotherapy students the significant increase in perceived knowledge showed no difference between the three professions. The occupational therapy students' gain in perceived knowledge of the medical and nursing professions were significantly higher than that of the physiotherapy profession.



**Figure 3. Knowledge of the other three professions' work before and after interprofessional education at the IPTW.** Medical denotes the medical profession. Nursing denotes the nurse profession. PT denotes the physiotherapy profession. OT denotes the occupational therapy profession. 0 denotes superficial knowledge and 10 denotes deep knowledge. Black bars represent results before IPTW. Means and 95% confidence intervals are indicated.

## Perspective of own professional role

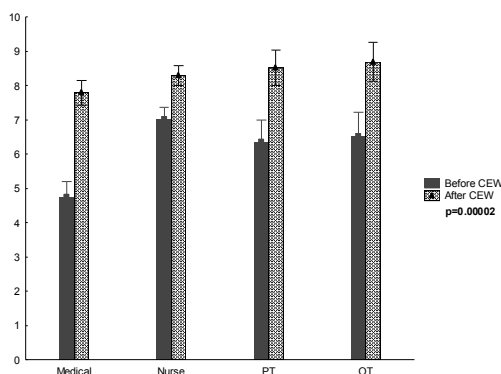
Students' perception of clarity of their own professional role increased significantly among all student groups ( $p = 0.00003$ ). Occupational therapy students had the greatest gain in clarity ( $p = 0.000014$ ) and had a significantly lower clarity in the pre IPTW questionnaire compared to the others. This difference disappeared after the IPTW. Figure 4 illustrates the perspectives on own role before and after IPTW.



**Figure 4. Perspective of own professional role before and after interprofessional education at the IPTW.** PT denotes physiotherapy students. OT denotes occupational therapy students. 0 denotes Unclear and 10 denotes Clear. Means and 95% confidence intervals are indicated

## Practice and comprehension of communication and teamwork

All student groups assessed that the IPTW course had contributed considerably to their understanding of the importance of communication and teamwork in patient care (1.00;  $p = 0.00002$ ). Before IPTW, the medical students had significantly lower ratings of how their clinical education, so far, had contributed to this understanding, compared to the other student groups. This difference diminished after IPTW and the medical students had the greatest gain compared to the other student groups ( $p = 0.00093$ ). Figure 5 illustrates IPTW contribution in communication and teamwork.



**Figure 5. Practice and comprehension of communication and teamwork for good patient care.** Students rated to what extent their clinical education before and during the IPTW course had contributed to this knowledge. PT denotes physiotherapy students. OT denotes occupational therapy students. 0 denotes Small extent and 10 denotes Large extent. Over all effect size was 1.00. Means and 95% confidence intervals are marked.

## Other aspects of IPE

All students had high ratings on the importance of communication and teamwork for good patient care both before [9.32 (9.22–9.43)] and after IPTW [9.41(9.32–9.50) ns]. As expected all student groups had high ratings on the importance of professional competence to good patient care already before IPTW [9.04 (8.83–9.25)]. A small increase was found after IPTW [9.32 (9.16–9.50);  $p = 0.0044$ ]. All student groups perceived that the patients' need of medical care, nursing and rehabilitation were met at the ward. The physiotherapy students had a slightly lower rating with a mean of 7.9 ( $p = 0.0017$ ) compared to the other student groups who varied between 8.3–8.6. Furthermore, all student groups perceived that the teamwork at the IPTW had met patient needs [8.65 (8.47–8.83)].

## Conclusion

Active patient based learning by working together in a real ward context seemed to be an effective means to increase collaborative and professional competence.

## **STUDY II**

### **Methods**

This qualitative study was based on interpretation of students' free text answers to the broad question: *"What is your general opinion of your learning experiences on the clinical training at the IPTW?"* The study was guided by a constructivist theory of learning. The questionnaire was answered at the closing seminar on the last day at the IPTW. The questions were answered anonymously with a notation of educational program, course date and sex. The study period was between the years 2004 to 2011. Due to the great amount of answers, the sample size was limited by including answers from a random sample of student semesters until saturation was reached. Finally, free-text answers from 333 students, representing all four professions from four semesters (fall 2004, spring 2006, fall 2006 and spring 2011), were included. Medical students were equally males and females. The other student categories were almost all female.

The free text answers were analysed by qualitative content analysis inspired by Graneheim and Lundman (Graneheim & Lundman, 2004). Data was grouped by their content. Meaning units were identified that focused on student's learning. Each meaning unit was given a code that described the content. Meaning units and codes were grouped into themes (expressions of latent content; interpretation of the text).

### **Rigour**

Students answered the questionnaires on the last day of the course and, therefore, at a time when the subject was of current interest to them, contributing to trustworthiness. The role of the first author during the data collection period was to supervise the medical students and to be medically responsible for the patients at the IPTW. The second author's role was more external with expertise in medical education research with special focus on IPE. Both authors are therefore, knowledgeable on IPE in general and on the studied IPTW in particular. As the first author has been practically involved with the students at the ward, there might be a risk to consider own assumptions while interpreting the text. On the other hand, time has past between being a supervisor and performing the data analysis, making it easier to look at the written text more objectively. Moreover, the second author contributed with an overview perspective during the process. Both authors conducted all steps in the process. The codes, categories and themes were discussed from different perspectives until consensus was reached. Representative quotes were selected to illustrate the results and to gain credibility. Care was taken to ensure accurate translation from Swedish to English by using a professional translator.

### **Results**

Two themes conceptualised students' perspectives on their learning environment an enriching interprofessional learning environment – a safe place with space, and on their own development awareness of own development with faith in the future – from chaos to clarity.

The second theme was dependent on the first theme. Themes, subthemes and categories are presented in Table 2.

### *An enriching interprofessional learning environment – a safe place with space:*

#### **Authentic and relevant patients**

Students described the inspiration and the positive challenge of finally taking care of authentic patients. They were eager to use their knowledge and skills in practice and through patient interaction gather clinical experience. The number of patients was important as well as patients' disease severity and level of basic care was appropriate to the student team.

#### **Well composed and functioning student teams**

Students described it was fun, safe and instructive to belong to a team with other students. They felt safe to communicate and collaborate being among peers. The opinion and knowledge of everyone was equally valued. Consequently, students' learning was inspired.

It was important that the student team was complete. A team missing a student profession felt incomplete even though a supervisor covered up professionally. Likewise, a team with too many nurse students was criticized as valuable opportunity for each nurse student to practice their role was decreased and, in addition, nurse related issues was at risk to take precedence at the expense of the interests of others.

#### **Competent and supportive supervisors**

'To be allowed' was greatly appreciated. Supervisors' supportive and permissive attitude enabled students to take responsibility and to act independently. Learning was facilitated as students got enough time and patience from supervisors to develop their skills, to seek knowledge and to interact with patients and team members. Other valued supervising qualities were to instruct when needed, encourage and give feedback. Students appraised the safe culture, created by pedagogically and clinically experienced supervisors who were either present or readily available. The whole student team appreciated the always present nurse supervisors but nurse students could express uncertainty, when they perceived a shortage of supervising nurses at evenings. There were comments on insufficient presence of the physician supervisor. Physician attendance during morning rounds and when needed during the day, as well as being easily available at all times, was important. Criticism was also expressed towards substituting supervisor as students sensed a lack of enthusiasm to work at the ward or a lack of IPTW experience.

#### **Adjusted ward structure to support learning**

A thorough introduction to the course and to the ward was important, in order to lessen the initial feelings of uncertainty. Nurse students also expressed a need for an update on orthopaedics. Moreover, students appreciated scheduled opportunities to collaborate.

Structured morning rounds and afternoon shift handovers were considered excellent learning opportunities where interprofessional collaboration was emphasized and enough time was allocated. Joined reflective sessions were also important. Periods of less patient activity could be labelled 'boring' or 'inactive'. Evenings tended to be less productive according to medical-, physiotherapy- and occupational therapy students. The invested time, organisation and educational value of basic patient care was criticised. In order to offer enough space for learning, students of all four professions called for an adjusted workload of basic patient care. More help from auxiliary nurses was desired. Suggested was also the inclusion of an auxiliary nurse student to the student team to further balance up towards authentic practice.

### *Awareness of own development with faith in the future – from chaos to clarity:*

#### **Develop personally and professionally**

Students increased own awareness and self-confidence as they took own responsibility in patient care. Students from all professions embraced the opportunity to practice and feel safe in future professional roles and to get the feeling of being like a real physician, physiotherapist, occupational therapist or nurse. They valued to practise profession-specific clinical skills and to independently apply their theoretical knowledge in practice. They got faith as to their professional future and for many it was the first time they were allowed, and expected, to take own clinical responsibility. Taking the steps 'from chaos to clarity' could be frightening and tough but the outcome was gratifying. Students described this as 'learning to fly'.

#### **Develop interprofessionally towards a comprehensive view of practice**

Students described the joy to work together in a team towards a shared goal – the patients' recovery and rehabilitation. They perceived an increased knowledge and understanding of other professions and got faith in others' competence and support. To communicate and collaborate, also promoted students to mirror themselves in others and thereby, become clearer in own profession. As students experienced that the bits and pieces of teamwork came together as a unity, they went 'from chaos to clarity'. Joint difficult medical decisions enhanced students' awareness of ethical dilemmas. To achieve a comprehensive view of patient care was gratifying and they labelled this as 'the big picture' or the 'wholeness' appeared. They became aware of the value of collaborative patient care and they got faith in future interprofessional healthcare.



**Table 2. Identified themes, subthemes and categories.**

Theme	Subtheme	Category
<b>An enriching interprofessional learning environment – a safe place with space</b>	Authentic and relevant patients	Authentic care
		Sufficient number of patients
		Adjusted severity of diagnosis and level of basic care
	Well composed and functioning student teams	Fun and instructive
Safe to be among peers		
Complete teams – all professions included		
Adjusted number of students		
Competent and supportive supervisors	Allowing students to take responsibility	
	Instructive and experienced	
	Providing encouragement and feedback	
	Creating a safe environment	
	Being present or readily available	
Adjusted ward structure to support learning	Informative introduction	
	Scheduled time for interprofessional collaboration and uniprofessional interaction	
	Adjusted student schedules to avoid periods of inactivity	
	Adjusted work load of basic patient care	
<b>Awareness of own development with faith in the future – from chaos to clarity</b>	Develop personally and professionally	Increased self-confidence
		Visualised own personal and professional development
		Practice clinical skills
		Apply theoretical knowledge in practice
		Practice independency in own professional role
		Faith in own professional future
	Develop interprofessionally towards a comprehensive view of practice	Increase knowledge and understanding of other professions
		Trust others' competencies
		Practice communication and collaboration
		Mirror oneself in others and become clearer
		Overall picture of patient care
	Ethical awareness	
	Faith in future interprofessional healthcare	

## **Conclusion**

When the community of practice at an IPTW provides a safe, supportive and permissive learning environment it enables students to mature personally, professionally and interprofessionally. With embodied understanding of practice, students obtain motivation and faith in one self as future healthcare professionals interacting with others. To go from chaos to clarity requires possibilities to interact in a safe place with space. If the learning environment is impaired, however, students' development could be halted and limited to only personal and or professional development and lack development of interprofessional competence and a comprehensive view.

## **STUDY III**

### **Methods**

The study was based on questionnaire data. Patients treated by student teams at an IPTW were compared with patients treated in usual care. During the study period from 2004 to 2005, the IPTW was incorporated as a part of a regular orthopaedic ward. The setting at the IPTW was identical to the description "IPTW at Danderyd Hospital" in the Introduction chapter. The occupational therapy supervisor was placed at IPTW solely and the regular part of the ward had another occupational therapist at their service. The rest of the staff had rotating schedules at the entire ward. Due to pedagogic skills and interest, some of the staff had their main placement at the IPTW. During weekends and other periods without students' presence, the regular staff treated all patients. Accordingly, the ward context with its facilities and personnel was nearly equivalent in the two parts of the ward and the main difference was the collaborative student participation at the IPTW.

Patients prepared for discharge to their homes were included. Patients discharged to another clinic or to inpatient aftercare were excluded, as well as, patients discharged during weekends and holidays when students were not present. In addition, patients readmitted to the hospital within 4 weeks after discharge were excluded. Thus the IPTW group consisted of patients treated and prepared for discharge by supervised IPE student teams. The control group consisted of patients treated by ordinary staff without participation of students. Only patients with diagnosis and conditions eligible to treat at the IPTW were included in the control group.

Patients were asked to fill out a questionnaire after they had been prepared for discharge, i.e. after all information had been given to the patients by students at the IPTW or by ordinary staff at the regular part of the ward. The patients had the option to fill it out and put it in a sealed envelope at the ward or they could fill it out at home and use regular mail service. Patients who did not get a questionnaire at the ward had one sent to their homes within a week after discharge. In case of a missing answer, one reminder was mailed within 4 weeks after discharge. In order to diminish bias, only a few persons and no students handed out the questionnaires to the patients. Patients were given oral and written information on the study and informed that the answers were to be analysed at group level with no possibility to identify the answers of a particular individual. The questionnaire consisted of seven questions chosen from a validated patient satisfaction questionnaire (Jenkinson, Coulter, Bruster, Richards, & Chandola, 2002) regularly used by the hospital for quality assurance purposes. The questions concerned collaborative and communicative aspects of care – areas with great student involvement.

### **Statistical analysis**

Patients at the IPTW were compared to patients treated in usual care. Nonparametric and Chi-square analyses were performed. The patient characteristics are given as  $n$  (%) or  $n \pm SD$ . The

results were considered significant at  $p < 0.05$ . All analyses were performed with the STATISTICA Stat Soft, Inc 8.0 package.

## **Results**

The study population consisted of 102 patients in the IPTW group and 85 patients in the control group. A total of 35 reminders were mailed to patients in the IPTW group and 26 to the controls. A total of 84 patients filled out the questionnaire in the IPTW group and 62 patients in the control group. The response rates were 82 % and 73 %, respectively. There were no significant differences between the groups of responding patients regarding gender, age, length of the hospital stay or type of care (elective or acute). Furthermore, there was no significant difference between the groups as regards the distribution of the patients' diagnoses.

As shown in Table 3, the patients treated and prepared for discharge by student teams at the IPTW felt more well-informed as regards the results of their treatment than the controls ( $p = 0.02$ ). They also rated a higher involvement in the decisions regarding their care as compared to controls ( $p = 0.006$ ). Furthermore, they rated a higher grade of satisfaction with information regarding possible home assistance as compared to controls ( $p = 0.003$ ). In addition, they stated in a higher grade that their family and home situation were taken into account when they were prepared for discharge as compared to controls ( $p = 0.0002$ ). No unfavourable effects were noted in the IPTW patients. The reliability of the questionnaire was good with a high internal consistency. The Cronbach alpha-coefficient of total satisfaction with the collaborative and communicative aspects of care (items 1–7) was 0.73.

**Table 3: Questions and results.**

Question	IPTW				Usual care				p-value
	Yes	Partly	No	N A	Yes	Partly	No	N A	
1/ Did you understand the information given to you regarding the results of your treatment?	61(73)	19(23)	3(4)	1	36(60)	14(23)	10(17)	1	<b>0.02</b>
2/ Where you involved in the decisions regarding your care?	63(76)	17(20)	3(4)		39(65)	9(15)	12(20)		<b>0.006</b>
3/ Did you get enough information regarding as to how your disease will influence your daily living?	34(44)	28(36)	15(20)	6	22(37)	23(38)	15(25)	2	0.6
4/ Did you receive information regarding possible home assistance?	49(72)	17(25)	2(3)	15	20(49)	12(29)	9(22)	19	<b>0.003</b>
5/ At discharge - were you informed on whom to contact if you had questions?	58(77)		17(23)	7	44(76)		14(24)	3	0.8
6/ Were you bothered, at discharge, on how to cope at home?	45(54)	33(39)	6(7)		38(64)	14(24)	7(12)		0.12
7/ Did the staff take your family and home situation into account when preparing for discharge?	62(75)	19(23)	2(2)		34(59)	10(17)	14(24)		<b>0.0002</b>

All values are given as count and percentage; n (%)

P-values are calculated according to Chi-square statistics

Answers could be given as Yes; Partly; No or Not applicable (N A)

## **Conclusion**

Patients perceived an improved quality of care as concerns collaborative and communicative aspects of care when their care was given by supervised student teams at the IPTW as compared to patients treated in usual care. A more structured interprofessional team-based care may be beneficial even in usual care. Our findings should be reassuring and supportive in future development of IPTWs.

## **STUDY IV**

### **Methods**

The study is a retrospective cohort study based on registry data from the National Board of Health and Welfare. Patients operated and treated at the Department of Orthopaedics at Danderyd University Hospital were selected during academic periods between 2006 and 2011. Ward information for each patient was retrieved through the hospital information system. These data was merged with information from the national cause of death register and the in-patient registry using the personal identification number. From the year of 2006, the IPTW is one out of four wards at Department of Orthopaedics – as opposed to the period of study III where the IPTW was incorporated as a part of a regular orthopaedic ward. The setting at the IPTW was identical to the description "IPTW at Danderyd hospital" in the Introduction chapter. Out of the three other wards at the department, one had a focus on planned hip- and knee replacements, one had a trauma/fracture profile and finally, one ward cared for a mix of orthopaedic diagnoses.

We identified 8,054 consecutively operated patients. 7,311 patients remained after excluding 743 patients with diagnoses not eligible for care at the IPTW ward. Exclusion criteria used in the registers were: 1) At index hospital stay - Patients with registered diagnoses of severe infectious disease, severe multiple trauma or other severe conditions that according to the department's practice were incompatible with care at the IPTW. 2) At index hospital stay or during the previous two years - Patients with diagnoses reflecting drug or alcohol abuse, psychosis, dementia, paralysis, metastatic disease or AIDS/HIV, according to the corresponding Elixhauser's and Charlson's comorbidity groups (Quan et al., 2011), (Sundararajan et al., 2007), (Quan et al., 2005), (Charlson, Pompei, Ales, & MacKenzie, 1987). Further 1,545 patients with less or equal to 2 days or more than 2 weeks length of stay and patients treated by ordinary staff during vacation periods were excluded.

Primary outcome measure was readmission rate within 90 days. Secondary outcome measures were readmission rate within 30 days and one-year survival. Exposure was defined as the proportion of hospital stay in days, during which student teams treated the patients. The proportion was categorized into three groups; "Full exposure" (100 % student exposure of hospital stay), "Mixed exposure" (more than 0 % but less than 100 % student exposure) and "No exposure" (0% student exposure). At the IPTW there were no student teams present

during weekends and student holidays, which affected the proportion of student exposure to the patients at the ward. For instance, a patient admitted to the IPTW on a Monday and discharged three days later on a Thursday, were exposed to students 100 % of hospital stay and therefore belonged to the “Full exposure” group. Consequently, a patient admitted on a Wednesday and discharged three days later on a Saturday, were exposed to students 75 % of hospital stay and belonged to the “Mixed exposure” group. A patient hospitalised at one of the other three wards within the department had 0 % exposure to student teams and therefore belonged to the “No exposure” group. Confounders adjusted for were age, sex, type of care (acute or elective), length of stay, and comorbidities.

## Statistical analysis

We used Poisson regression for readmissions with offset term for person time (in days) with one model for readmissions within 30 days and one model for readmissions within 90 days. Overdispersion in the Poisson regressions was investigated using Cameron and Trivedi’s test. To compare proportions we used Fisher’s exact test. For survival analysis Cox proportional hazards regression was used. The proportional hazards assumption was tested using Grambsch and Therneau’s test. All analyses were performed using R 3.1.1, using the rms-package (v. 4.2-1) for survival modelling, AER for investigating overdispersion (v. 1.2-2), knitr (v. 1.7) for reproducible research, Gmisc (v. 1.0.0) with Greg (v. 1.0.0) for table output.

## Results

Our final cohort consisted of 5,766 patients with 6,274 admissions. Out of these 58.4 % were women, and mean age at first occurrence in the study was 63.0 years. The median length of stay was 4 days. Readmission rates within 90 days did not differ between patients at the IPTW (full and mixed student exposure groups) and controls (14% vs. 13.5%,  $p=0.66$ ). Neither did readmission rates within 30 days differ (7.4% vs. 7.5%,  $p=0.95$ ). Likewise, there was no difference in one-year mortality between patients at the IPTW (full and mixed student exposure groups) as compared to usual care. (5.3% vs. 5.2%;  $p=0.82$ ). Patient characteristics and outcomes are presented in Table 4. Poisson regression of readmission rates showed no significant differences between the groups. Adjusting for confounders showed no marked risk increase. The estimates for 90 days readmission in student exposed patients at the IPTW (in the mixed and full exposure groups) varied between 0.89 and 1.03 with an upper confidence interval (representing a worst case scenario) of 1.26. Readmission rates are presented in Table 5. Sensitivity analysis with Cox proportional hazards regression of one year mortality did neither identify any significant difference between the groups. Here the estimates of effect size (hazard ratio; HR) for student exposed patients at the IPTW varied between 0.68 and 0.98 with an upper confidence interval of 1.39. All mortality rates are presented in Table 6. A forest plot comparing the three different outcomes in relation to student exposure, type of care, comorbidity, age, sex and length of stay is shown in Figure 6.

**Table 4: Study population characteristics and outcomes. Continuous variables are presented as mean and standard deviation.**

	Control wards	Interprofessional Training Ward (IPTW)	
	No (0%)	Full (100%)	Mixed (>0 but<100%)
<b>Patients No</b>	4658	418	690
<b>Age</b>	63.5 (±20.0)	54.9 (±20.3)	64.7 (±21.7)
<b>Sex</b>			
Male	1,932 (41.5%)	201 (48.1%)	267 (38.7%)
Female	2,726 (58.5%)	217 (51.9%)	423 (61.3%)
<b>Type of care</b>			
Acute	3,046 (65.4%)	239 (57.3%)	620 (89.9%)
Elective	1,610 (34.6%)	178 (42.7%)	70 (10.1%)
<b>Length of stay (days)</b>	4.5 (±2.5)	2.5 (±0.8)	5.6 (±2.8)
<b>Charlson's index ‡</b>	0.2 (±0.7)	0.2 (±0.5)	0.3 (±0.8)
<b>Deceased during stay</b>	6 (0.1%)	0 (0.0%)	1 (0.1%)



	<b>Control wards</b>	<b>Interprofessional Training Ward (IPTW)</b>	
<b>Student exposure†</b>	<b>No (0%)</b>	<b>Full (100%)</b>	<b>Mixed (&gt;0 but&lt;100%)</b>
<b>Readmissions 30 days</b>			
No	4,309 (92.5%)	395 (94.5%)	631 (91.4%)
Yes	349 (7.5%)	23 (5.5%)	59 (8.6%)
<b>Readmissions 90 days</b>			
No	4,029 (86.5%)	380 (90.9%)	573 (83.0%)
Yes	629 (13.5%)	38 (9.1%)	117 (17.0%)
<b>One-year survival</b>			
Alive	4,418 (94.8%)	410 (98.1%)	639 (92.6%)
Dead	240 (5.2%)	8 (1.9%)	51 (7.4%)

† Student exposure denotes the proportion of hospital stay in which patients were exposed to students. No (exposure) denotes patients treated at a usual care ward with no student exposure. Full (exposure) denotes patients treated at the IPTW with 100 % student exposure during hospital stay. Mixed (exposure) denotes patients treated at the IPTW with >0 % but <100% of student exposure during hospital stay. Comorbidity measured according to the Charlson's index (Quan et al., 2011).

**Table 5: Readmission rates.**

	Crude		Adjusted*	
	Coef	2.5 % to 97.5 %	Coef	2.5 % to 97.5 %
<b>Readmission within 30 days</b>				
<b>Incidence rate</b>	0.08	0.07 to 0.09	0.08	0.06 to 0.09
<b>Student exposure†</b>				
No (0 %)	1.00	ref	1.00	ref
Full (100%)	0.72	0.46 to 1.08	0.90	0.57 to 1.35
Mixed (>0% but<100%)	1.15	0.86 to 1.50	0.97	0.72 to 1.27
<b>Type of care</b>				
Acute	1.00	ref	1.00	ref
Elective	0.55	0.44 to 0.69	0.61	0.48 to 0.77
<b>Charlson's index‡</b>	1.62	1.49 to 1.74	1.45	1.33 to 1.58
<b>Age</b>	1.03	1.02 to 1.03	1.02	1.01 to 1.03
<b>Sex</b>				
Male	1.00	ref	1.00	ref
Female	1.20	0.99 to 1.46	0.95	0.77 to 1.16
<b>Length of stay</b>	1.08	1.04 to 1.11	0.98	0.94 to 1.02

	<b>Crude</b>		<b>Adjusted*</b>	
	<b>Coef</b>	<b>2.5 % to 97.5 %</b>	<b>Coef</b>	<b>2.5 % to 97.5 %</b>
<b>Readmission within 90 days</b>				
<b>Incidence rate</b>	0.15	0.14 to 0.16	0.15	0.13 to 0.17
<b>Student exposure†</b>				
No (0 %)	1.00	ref	1.00	ref
Full (100%)	0.65	0.46 to 0.89	0.89	0.63 to 1.23
Mixed (>0% but<100%)	1.29	1.05 to 1.56	1.03	0.84 to 1.26
<b>Type of care</b>				
Acute	1.00	ref	1.00	ref
Elective	0.53	0.44 to 0.63	0.61	0.51 to 0.73
<b>Charlson's index‡</b>	1.65	1.55 to 1.74	1.43	1.34 to 1.52
<b>Age</b>	1.03	1.03 to 1.03	1.02	1.02 to 1.03
<b>Sex</b>				
Male	1.00	ref	1.00	ref
Female	1.29	1.12 to 1.49	0.97	0.83 to 1.13
<b>Length of stay</b>	1.12	1.10 to 1.15	1.02	0.99 to 1.05

\* Confounders adjusted for are type of care, comorbidity, median age, sex, and median length of stay.

† Student exposure denotes the proportion of hospital stay in which patients were exposed to students. No (exposure) denotes patients treated at a usual ward with no student team exposure. Full (exposure) denotes patients treated at the interprofessional training ward (IPTW) with 100 % student exposure during hospital stay. Mixed (exposure) denotes patients treated at IPTW with >0 % but <100% of student exposure during hospital stay

‡Comorbidity measured according to the Charlson's index (Quan et al., 2011).

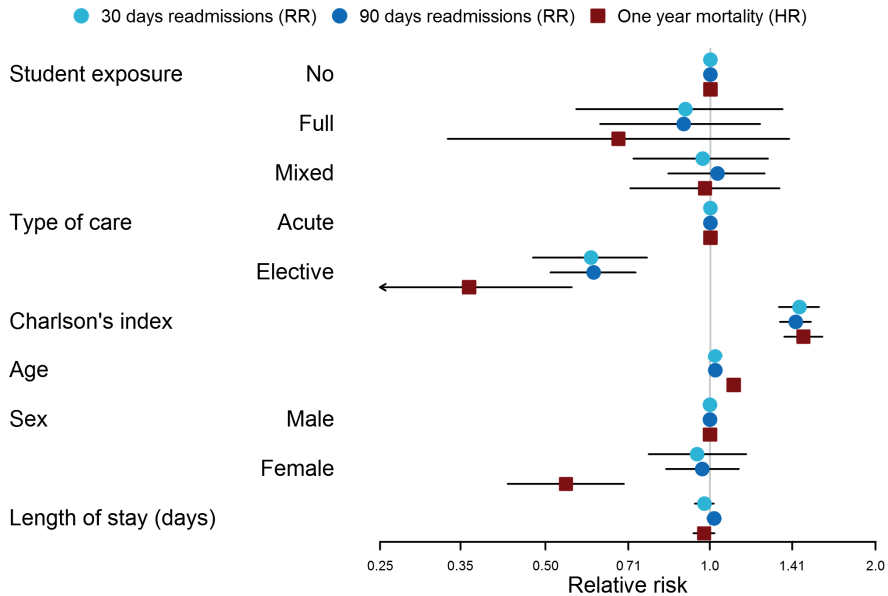
**Table 6: Hazard ratios for one-year mortality after admission.**

	Crude		Adjusted*	
	HR	2.5 % to 97.5 %	HR	2.5 % to 97.5 %
<b>Student exposure†</b>				
No (0 %)	1.00	ref	1.00	ref
Full (100%)	0.37	0.18 to 0.75	0.68	0.33 to 1.39
Mixed (>0% but<100%)	1.47	1.08 to 1.99	0.98	0.71 to 1.34
<b>Type of care</b>				
Acute	1.00	ref	1.00	ref
Elective	0.19	0.13 to 0.29	0.36	0.24 to 0.56
<b>Charlson's index‡</b>	1.97	1.82 to 2.12	1.48	1.36 to 1.60
<b>Age</b>	1.11	1.10 to 1.13	1.10	1.09 to 1.12
<b>Sex</b>				
Male	1.00	ref	1.00	ref
Female	1.11	0.88 to 1.41	0.54	0.43 to 0.69
<b>Length of stay (days)</b>	1.19	1.15 to 1.23	0.98	0.93 to 1.02

\* Confounders adjusted for are type of care, comorbidity, age, sex, and length of stay. For continuous variables the reference values are set to 0.

† Student exposure denotes the proportion of hospital stay in which patients were exposed to students. No (exposure) denotes patients treated at a usual ward with no student exposure. Full (exposure) denotes patients treated at the interprofessional training ward (IPTW) with 100 % student exposure during hospital stay. Mixed (exposure) denotes patients treated at the IPTW with >0 % but <100% student exposure during hospital stay.

‡Comorbidities measured according to the Charlson's index (Quan et al., 2011).



**Figure 6: A forest plot comparing the relative risk of readmission in 30 and 90 days respectively of mortality within one year - in relation to student exposure, type of care, comorbidity, age, sex and length of stay.** Student exposure denotes the proportion of hospital stay in which patients were exposed to students. No denotes patients at a control ward with no student exposure. Full denotes patients at the interprofessional training ward (IPTW) with 100 % of student exposure during hospital stay. Mixed denotes patients at the IPTW with >0 % but <100% of student exposure during hospital stay. Comorbidities were measured according to the Charlson's index (Quan et al., 2011). For continuous variables the reference values were set to 0.

## Conclusion

Our analysis showed no indication of an increased risk for readmission and mortality in patients treated by supervised student teams at an interprofessional training ward as compared to usual care. The results should reassure further implementation of interprofessional education in authentic patient based contexts.

## 5 DISCUSSION

This thesis shows that interprofessional active patient based learning at an IPTW effectively meets students' intended learning outcomes. If the learning environment is safe, supportive, permissive and structured, students are able to develop professionally and interprofessionally towards a comprehensive view of practice. According to students, patients are provided with good medical care, nursing and rehabilitation. According to patients at the IPTW, their care is of high quality as to communicative and collaborative aspect of care. In addition, objective data on readmissions and mortality did not show any differences as compared to usual care.

As described earlier there are several interprofessional intended learning outcomes for students to achieve during their experiencebased learning at the IPTW. Kolb states that learning is the process whereby knowledge is created through the transformation of experience (Kolb 1984). First, the emphasis is on the process of adaptation and learning as opposed to content or outcomes. Second, knowledge is a transformation process, being continuously created and recreated, not an independent entity to be acquired or transmitted. Third, learning transforms experience in both its objective and subjective forms and finally, to understand learning, we must understand the nature of knowledge (epistemology). The interprofessional learning objectives at IPTW can be related to Kolbs 'experiential learning cycle' and covers all four stages.

Taking care of patients together in an interprofessional team is per definition a complex task. That implies that the learning objectives per se are grounded at the two highest levels of the Structure of Observed Learning Outcomes (SOLO) taxonomy (Biggs & Tang, 2007). The taxonomy is a general and systematic framework to describe how a learner's performance grows in complexity and can be used to define or evaluate learning outcomes. As students learn, they pass different stages of increasing complexity. First a quantitative change, as the amount of details increase. Then a qualitative change, as the details become integrated into a structural pattern. The different levels are: prestructural, unistructural, multistructural, relational and extended abstract.

### ***TO DEVELOP OWN PROFESSIONAL ROLE IN AN INTERPROFESSIONAL CONTEXT***

Study I shows that the four student groups (medical, nurse, physiotherapy and occupational therapy students) perceived an increased clarity of their own professional role. This is worth considering since all students – except medical students – were in their last term of pre-qualifying education. In accordance with Bleakley (Bleakley et al., 2011) we state that students apparently perceived a value of a clear role in a specific and authentic sociocultural context with space and place for their learning. Occupational therapy students had the lowest clarity of their own professional role before the IPTW course. Fortunately, they also had the greatest gain during the course and did not differ in clarity of own role from other students

after the course. For a majority, IPTW was their first opportunity to practice interprofessional teamwork and also the first chance to expose their professional role to others.

Becoming a professional is a complex and only partly described process (Lindquist, Engardt, Garnham, Poland, & Richardson, 2006). The skill acquisition model of Dreyfus (Dreyfus et al., 1986) describes a one-dimension model of skill development with increasing professional experience. Dall'Alba & Sandberg (Dall'Alba & Sandberg, 2006) developed the model by adding a dimension of understanding of, and in, practice i.e. 'embodied understanding' in a given context. In embodied understanding, knowledge becomes integrated into a 'professional way-of-being'. In study II we found that students sensed a joyful and inspiring embodied understanding of practice when acting and being like a 'real' doctor, nurse, physiotherapist or an occupational therapist. Supervisors' and peers' support and feedback enhanced the development of embodied understanding. A study by Silén et al has explored the supervisors' perspective on supervision at the workplace and enhances the importance of feedback and of being a role model not only of professional skills but also in a 'professional way-of-being' in the context (Silén 2011).

According to Dornan et al, medical students must develop two qualities in order to reach their ultimate goal of helping patients. One is practical competence; the other is a state of mind that includes confidence, motivation and a sense of professional identity. The two qualities reinforce one another. When 'experience-based learning' at a workplace offers a relatively high level of participation, it rewards the students, particularly when students adopt the role of a doctor being involved in the care of the patients. On the other hand, students quickly become bored if they remain as passive observers. An effective workplace teacher is therefore, someone who simultaneously can support and challenge students (Dornan et al., 2007). Applied to the experience-based learning at IPTW (study II), we find that the four student groups developed a sense of professional identity as they were supported and challenged by supervisors to independently care for authentic patients. They increased their self-confidence and visualized own professional development as they applied theoretical knowledge into practice. On the other hand, periods with a lack of patients or with less profession-specific clinical activity, were considered boring to students.

### ***TO INCREASE KNOWLEDGE AND UNDERSTANDING OF OTHER PROFESSIONS' COMPETENCES***

Study I shows that the four student groups perceived a significant increased understanding and knowledge of the other professions. Medical and nursing students perceived the greatest gain in their knowledge of occupational therapy. Occupational therapy students' greatest gain concerned medicine and nursing. For physiotherapy students the significant increase in perceived knowledge of others was similar for the three other professions. The results are probably explained by the fact that both medical and nurse students have some interaction with doctors and nurses, less with physiotherapists and very limited interaction with occupational therapists and vice versa during uniprofessional clerkships prior to the IPTW (Hallin et al., 2009).

Students at the IPTW are not learning alone. They are constantly interacting and learning together with peers. Learning is a social process that can both be enhanced and reduced by involving peers. A cooperative reward structure emerges when learners realise that the only way to achieve their personal goal is to ensure that the group achieves its goal. A competitive reward structure, in contrast, exists when learners perceive that they can only achieve their personal goal at the expense of the group achieving its goal. Supervisors have a great impact on which reward system is in use (Ladyshevsky, 2006). At the IPTW, the student team's sharing of a patient supports a cooperative peer learning experience. Students learn to use the team's different skills and trust its different competences for the patient's best (study II).

IPE implies learning with a greater level of interactivity between professions where both differences as well as similarities are discussed (Barr, 1996). When students look at a task from both own, as well as from the perspective of others, they acquire knowledge, skills and attitudes not possible in uniprofessional education (Funnell 1995). A prerequisite at the IPTW course, in contrast to uniprofessional education, is the participation in a student team, that implies interaction with peers. This peer learning is consistently and implicitly used in the IPTW course. In study II, students described the joy of being among peers from different professions. To be at the same level facilitated their learning, as it felt safe to ask questions and to discuss any matter. Being among peers also helped students to mirror themselves in others and become clearer in own role. Students reported a positive change in their knowledge of, trust in and attitude towards each other. Despite this fact, this is not a thesis that focuses on attitudes per se. Jacobsen & Lindqvist found an attitude shift during teamtraining at an interprofessional training unit (ITU) in Denmark. Students began to see members of other professions as more like members of their own in respect of the studied core concepts of caring and subservience. The greatest change of students' attitudes before and after their stay in the ITU was observed for their views of doctors, which were improved. They argued that it was likely to be a result of students arriving with certain stereotypes of doctors that simply did not fit with what they observed during their time at the ITU (Jacobsen & Lindqvist 2009).

### ***TO DEVELOP COMMUNICATION, TEAMWORK AND A COMPREHENSIVE VIEW OF PRACTICE***

In study I, the four student groups acknowledged the importance to practice and comprehend communication and teamwork for good patient care. When comparing the IPTW course to previous clinical courses, the four student groups found IPTW's contribution significantly higher. Medical students accounted for the highest ratings. A probable explanation is that most of medical student's clinical practice in Sweden is uniprofessional and disciplinary. They seldom interact with students of other professions and their interaction with other health professionals is also limited.



Students described the joy of working together in a team towards a shared goal – the patients' recovery and rehabilitation (study II). This is inline with a study using Contextual Activity Sampling (CASS) - a method using mobile phones to study learning experiences during on-going clinical activities. This study also showed that students at an IPTW in Sweden reported 'a sense of flow' when working together in close involvement with patients (Lachmann, Ponzer, Johansson, Benson, & Karlgren, 2013).

Interprofessional collaboration is assumed to be beneficial because it allows a more holistic approach to patient care than what is possible in uniprofessional care (Funnell 1995). This is in tune with findings in study II. When students experienced that the bits and pieces of teamwork came together as a unity – they went from 'chaos to clarity'. They described a joyful achievement of a comprehensive view of patient care - 'the big picture' or 'wholeness' appeared. According to Dall'Alba and Sandberg (Dall'Alba & Sandberg, 2006) a preunderstanding impacts further development of embodied understanding. However, student statements indicate that even students without a concrete pre-understanding of practice were, during the short period at the IPTW, yet able to pass the whole way from chaos to clarity and to get faith in future collaborative patient care.

### **THE LEARNING ENVIRONMENT AT AN IPTW**

When investigating what, according to students, characterizes an enriching learning environment (study II) we found it consists of authentic and relevant patients, well composed and functioning student teams, competent and supportive supervisors and an adjusted ward structure to support learning. In short we named it 'a safe place with space'. 'Safe' due to supervisors' support, competence and presence as well as the safety being among student peers. 'Place' denotes the ward area at the IPTW. 'Space' is the adjusted course structure and schedule to release time to support learning and also the supervisors' encouragement of student independency.

The learning environment of the IPTW can be applied to three interrelated dimensions of a community of practice (CoP) described by Wenger (Wenger, 1998). Students practiced *Mutual engagement* through communication with each other and the supervisors when discussing the day-to-day patient care. Students increased their understanding of the *joint enterprise* by working together in realistic learning activities when caring for patients. Finally, supervisors upheld the community and its *shared repertoire* when they introduced and engaged students to the culture.

Li et al recommend focusing on optimizing three specific characteristics of the CoP concept (Li et al., 2009). In accordance, we can mirror findings of the learning environment in relation to these characteristics: *Support for members to interact with each other*; Being among peers supported interaction. Inequality is a barrier to interaction and this might explain why students experienced a lack of interaction with a profession, if missing in their student team - even when a supervisor covered up for the deficit. Allocating time to informal interaction supported further interaction. The basic patient care could be too taxing and time

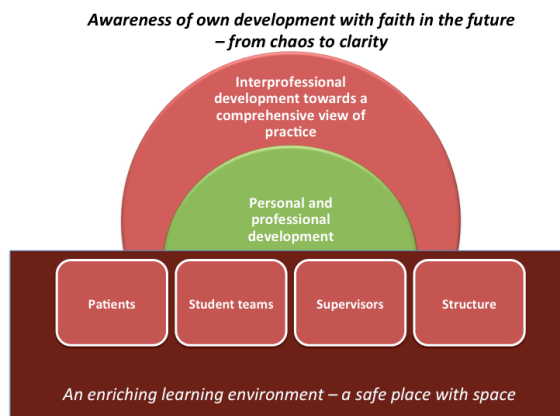
consuming, thus interfering with time to interact. Here, help by auxiliary nurses was essential. Also, students valued scheduled opportunities to interact such as structured morning rounds, shift handovers, etc. *Emphasize on learning and sharing knowledge*; A learning environment with authentic care stimulated students to take responsibility, learn and share knowledge. The presence and support by the supervisors were crucial. The scheduled gatherings also stimulated students' learning and sharing of knowledge. On the contrary, low activity times or not enough patients, had the opposite effect. Again, we can point out students' frustration having to perform too much auxiliary nurse tasks. The students perceived a loss of learning focus when this occurred. For clinical situations to emphasize learning and sharing of knowledge all students need to act in their own profession and in realistic collaborative work. *Building a sense of belonging within groups*; The supervisors' attitude, support and competence in combination with a shared repertoire created a strong CoP where interactions were based on mutual respect and trust. As the presence of students is a corner stone in the IPTW concept, they easily develop a sense of belonging, in contrast to more traditional placements where students may experience "being in the way" (Hagg-Martinell, Hult, Henriksson, & Kiessling, 2014). Students criticized substituting supervisors' lack of enthusiasm or lack of IPTW experience. As these supervisors were new members to the community, they disrupted the sense of belonging that the CoP had developed. The same disturbance can be applied to supervisors not being sufficiently involved. It is important to realize that an IPTW represents a special CoP and therefore, vital to provide newcomers – both students and supervisors – with a thorough introduction and allow them time to adjust.

Dornan also points out the importance of being absorbed into the culture of a CoP. When students enter a new workplace they may lose confidence in knowledge they have spent years acquiring. Likewise, stress levels peak when students start learning at new workplaces because they become acutely aware of their own incompetence and unimportance (Dornan et al., 2007). The importance of being accepted and included in the community has also been pointed out by Hägg-Martinell et al who shows that students experience a professional growth when the community of practice accepts them, and competent and enthusiastic supervisors give them opportunities to interact with patients and to develop their own responsibilities (Hagg-Martinell et al., 2014).

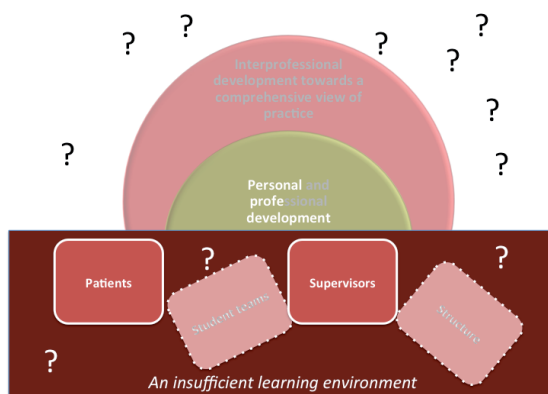
Concerning patients' basic care and students' difficulties in dealing with it, having the time for it or understanding that it may offer opportunities for interprofessional learning, have been found by others (Hylin, Nyholm, Mattiasson, & Ponzer, 2007), (Lidskog, Lofmark, & Ahlstrom, 2009), (Reeves & Freeth, 2002).

## **THE RELATION BETWEEN THE LEARNING ENVIRONMENT AT IPTW AND STUDENTS' DEVELOPMENT**

In study II, we found four important elements that characterizes an enriching learning environment – a safe place with space; authentic and relevant patients, well composed and functioning student teams, competent and supportive supervisors and an adjusted ward structure to support learning. In such a learning environment, students develop awareness of own development with faith in the future – from chaos to clarity characterized by personal and professional development on to interprofessional development towards a comprehensive view of practice. This relation is illustrated in figure 7. On the other hand, if important elements in the learning environment is missing or incomplete – as a lack of patients, lack of a profession representation in the student team, not a fully introduced substituting supervisor or too much time spent on patients' basic care – students' development may be halted at the level of personal and some professional development but insufficient or lacking in interprofessional development as well as comprehensive view of practice and faith in the future. This relation is illustrated in figure 8.



**Figure 7.** The characteristics of an enriching learning environment and of students' development.



**Figure 8.** An insufficient learning environment deficient of important elements and how it relates to students' development being stalled.

## ***PATIENT OUTCOME OF CARE AT AN IPTW***

All four student groups perceived that the patients were provided with good medical care, nursing and rehabilitation (study I).

When looking from patients' view (study III), we found that patients treated by students at the IPTW perceived a higher quality of care compared to patients at a comparable orthopaedic ward. Aspects on communication and collaboration were studied. Patients treated at the IPTW perceived increased own participation in decisions on their treatment, felt better prepared at discharge and they felt better informed. These results are probably explained by the collaborative approach at the IPTW.

The supervisors' role and an adjusted ward structure was important to the collaborative care of the patients. Each day shift at the IPTW started with a team conference with students and supervisors. Students discussed the patients' relevant goals of the day and appointed goals of the hospital stay. They specified profession-specific goals related to the patients and, subsequently, the whole student team agreed upon a conjoined strategy best suited to the patients' needs. Supervisors helped students in the planning, when needed. The overall strategy was patient-centered and to emphasize collaboration. Accordingly, the students were well prepared both professionally and interprofessionally when they started a day's work. A follow-up of patients' goals was made at handover to the evening shift student team. Most day shifts ended with a reflective session where the student team together with one supervisor discussed and reflected on the work of the day.

Objective patient data were analysed in study IV. No significant differences in 30- or 90- day readmission rates or in one-year mortality were found in patients treated by supervised interprofessional student teams at an IPTW as compared to usual care.

Studies on patient outcome on undergraduate health education are scarce and it is difficult to compare results as the contexts of learning differ between hospitals, countries and between specialities. With this in mind, it is worth mentioning a recent meta-analysis on peer-reviewed English-language studies. The aim was to identify objective patient outcomes in teaching versus nonteaching general internal medicine settings. No convincing differences were found in inpatient mortality, 30-day readmission or length of stay (Au, Padwal, Majumdar & McAlister, 2014). The results are in line with our study but students' level of education, number of attending students and the contexts differ, as the reviewed studies did not concern undergraduate interprofessional student teams at an orthopaedic ward.

When looking at research on orthopaedic patients in traditional care, our results are comparable. A readmission rate at 7,5 % within 30 days, 14 % within 90 days and one-year mortality at 5 % in student treated patients at the IPTW, is below or in line with orthopaedic literature. A readmission rate at 19 % within 90 days was found in hip fracture patients in the UK (Hahnel, Burdekin & Anand, 2009). Our cohort consisted of patients eligible for care at an IPTW and therefore healthier as compared to orthopaedic fracture patients in general.

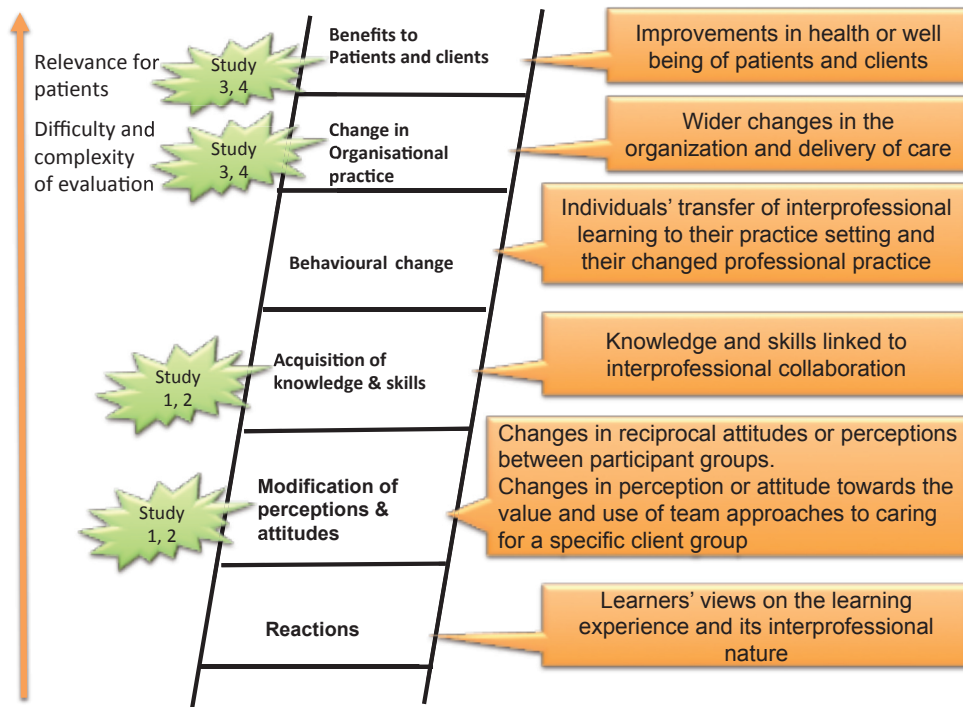
There is an increasing interest in research evaluating patient outcome and quality of care performed by teams consisting of qualified professionals. A report from a nurse-coordinated, multidisciplinary, ambulatory programme demonstrated that healthier lifestyles and improvement in risk factors were achieved among patients with coronary heart disease as compared to standard care, indicating the usefulness of interprofessional work. (Wood et al., 2008).

IPE research has generally focused on its effects on students, but its effect on patients needs further studies. Patient outcome and quality of practice is an important but intricate field of IPE research (Barr et al., 2006). Existing studies on direct patient effects of patient based IPE are mainly based on patients' subjective perceived outcomes (Brewer & Stewart-Wynne, 2013), (Hallin, Henriksson, Dalen, & Kiessling, 2011), (Hansen & Jacobsen, 2009). To our knowledge there are no previous studies on patient safety at an IPTW based on objective patient outcome variables.

In a Cochrane review of IPE research on patient outcomes, Reeves et al requested future IPE studies to comprise of randomised controlled studies with rigorous randomisation or allocation procedures, larger sample sizes, more appropriate control groups and more explicit focuses, in order to improve the evidence base of IPE (Reeves et al., 2008). We believe we have fulfilled some of these requests.

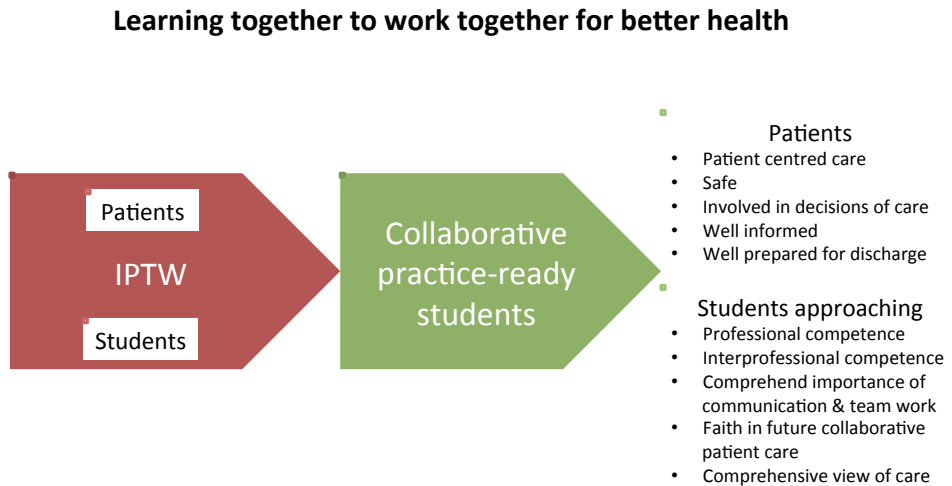
## TO EVALUATE OUTCOME OF IPTW LEARNING AT DIFFERENT LEVELS

Kirkpatrick’s classification of educational outcomes have four levels where the relevance to patients and also the complexity of the evaluation increases by each level (Kirkpatrick 1967). Hammick et al, revised Kirkpatrick’s levels as regards to IPE outcomes by adding two levels (Hammick, Freeth, Koppel, Reeves, & Barr, 2007). Figure 9 illustrates the study levels of this thesis.



**Figure 9: Classification of IPE outcome at six levels.** The relevance to patients and the complexity of the evaluation increases by each level of the ladder. Adopted from Kirkpatrick (1967) and (Hammick et al., 2007). The levels of evaluation used in the four studies is shown.

To sum up, learning together at the IPTW leads to collaborative positive effects on both students and patients. The results are well in line with the WHO report on IPE intents (WHO, 2010). Figure 10 illustrates the pathway between IPTW and collaborative practice-ready students and the outcomes in patients and students.



**Figur 10. The pathway of learning together at an IPTW and collaborative practice-ready students and the effect on patients and students.**

### **METHODOLOGICAL CONSIDERATIONS**

A mixed method approach was used to obtain a more in depth understanding of the multidimensional issues of interprofessional learning. Students' learning and outcomes were studied from both a student and a patient perspective, with both quantitative and qualitative methods and both objectively measurable and individually perceived outcome measures.

This thesis covers a long study period of 11 years. The two studies on students overlap partly, meaning the same students could be included in both studies. On the other hand, no data between the studies was shared. The two studies on patients are separated in time. A total of 949 students and 5912 patients have contributed with data.

One strength of study I is the focus on each individual's progress over time. This means that we included prospective ratings. Another strength is a response rate exceeding 95 %. The response rate, the large number of students and the long study period makes the results robust. The questionnaire in use had high face validity. One weakness is the lack in gender

specific results. However, except for medical students, almost all students were women.

In study II, the use of a large amount of data contributes to trustworthiness. Saturation was amply reached after including 333 students during eight years. The findings were consistent over time as well as between student groups. Given the design of the study it was not possible to assess the effects of learning in the ITPW context but mere to explore prominent themes associated to learning. To enrich the findings, the use of focus group interviews could have been added.

A strength in study III is the mere fact that it evaluates the effects of IPE on patient outcome. Another strength is the use of a control group. One weakness is that it was not possible to randomize the patients.

Study IV has many strengths. To our knowledge it is the first study to evaluate patient safety at an IPTW based on objective data. A large sample size and from one centre, a long study period and an appropriate control group make the findings robust. An observational study, as ours, cannot fully guarantee equal patient groups. Both acute and planned patients were admitted and no randomization of patients to the different wards was feasible. However, our inclusion and exclusion criteria aimed to make the groups as comparable as possible and the data is adjusted for confounders.



## 6 GENERAL CONCLUSIONS

We have shown that interprofessional learning at a training ward increased students' understanding and knowledge of professional and interprofessional competency. Students found the IPTW experience to be worthwhile, instructive, permissive and fun. In an enriching learning environment, adapted to student participation, a transition into an embodied understanding of being a professional was possible in only two weeks. In the beginning of the course, students might have experienced anxiety and chaos, but towards the end, a sense of flow and clarity. Just in time to relish this feeling of flow, clarity of own and others roles and a comprehensive view on patient care, it was time to end the course. Students suggested longer IPTW alike periods, more of the same at other workplace rotations as well as earlier in their clinical education.

We have also shown positive effects of interprofessional learning on patients' quality of care. As regards aspects of communication and collaboration it was beneficial to include students in the close care of patients. In addition, we did not find any difference in patient safety as regards to readmissions or deaths between patients treated by student teams at the IPTW as compared to traditional care. A prerequisite to secure patient safety is, of course, guidance of skilled supervisors who allow students to take own responsibility with preserved patient safety.

## **7 IMPLICATIONS FOR PRACTICE AND FURTHER RESEARCH**

### ***IMPLICATION FOR PRACTICE***

This thesis has important clinical education implications. Interprofessional learning in authentic care, as an IPTW, is an effective educational concept where students learn to collaborate over professional boundaries when taking care of patients. Questions have been raised about patients' safety. However, we found that patients treated by supervised interprofessional student teams perceived a greater quality of care in aspects of communication and collaboration as compared to usual care. A more structured interprofessional team-based care may be beneficial even in usual care. In addition, we found no indications of an increased risk, as regards readmissions and mortality, between patients at the IPTW compared to usual care and we conclude this training can be performed with preserved patient safety. A prerequisite to secure a safe and high quality care is of course guidance of skilled supervisors as well as ward routines well adapted to student participation.

Our results should reassure to further implement and disseminate the IPTW concept to other areas and education periods, where students from several programmes can perform workplace learning.

### ***IMPLICATIONS FOR FURTHER RESEARCH***

In order to get a deeper understanding on how students' actually learn and interact when they participate in IPE, more studies with other methods are needed, e.g. ethnographic methods.

One interesting field of research would be to study aspects on IPE supervisors. Focus group interviews could help to create hypothesis on characteristics, and later be followed up by quantitative and perhaps comparative studies on other professionals.

As to patients' safety, more studies are needed to confirm, reject or reproduce our results and advantageously, studies in other contexts and on other patient populations.

## 8 QUESTIONNAIRES

### Skattning inför klinisk utbildning på avdelning 56, KUA

Studieprogram ..... Kön ..... Din symbol

1. Hur uppfattar Du **Din profession/yrkesroll** idag?

otydlig \_\_\_\_\_ tydlig

2. **Kommunikation och lagarbete** anses viktigt för att tillgodose patientens behov av medicinsk vård, omvårdnad och rehabilitering. I hur hög grad anser Du att den kliniska utbildningen **före KUA** har bidragit till att öka förståelsen för detta påstående?

I låg grad \_\_\_\_\_ i hög grad

3. Hur stor kunskap har Du om **andra yrkesgruppers arbete** idag? (uteslut Din egen profession)

Din kunskap gällande **arbetsterapeuter**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **läkare**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **sjukgymnaster**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **sjuusköterskor**:

Liten kunskap \_\_\_\_\_ stor kunskap

## Utvärdering av klinisk utbildning på avdelning 56, KUA

Studieprogram..... Kön ..... Din symbol

1. Hur uppfattar Du **Din profession/yrkesroll** idag (efter KUA)?

otydlig \_\_\_\_\_ tydlig

2. **Kommunikation och lagarbete** anses viktigt för att tillgodose patientens behov av medicinsk vård, omvårdnad och rehabilitering. I hur hög grad anser Du att den **kliniska utbildningen på KUA** har bidragit till att öka förståelsen för detta påstående?

I låg grad \_\_\_\_\_ i hög grad

3. Hur stor kunskap har Du idag (efter KUA) om **andra yrkesgruppers arbete**? (uteslut Din egen)

Din kunskap gällande **arbetsterapeuter**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **läkare**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **sjukgymnaster**:

liten kunskap \_\_\_\_\_ stor kunskap

Din kunskap gällande **sjuksköterskor**:

liten kunskap \_\_\_\_\_ stor kunskap

4. Vad anser du **allmänt om** utbildningsmomentet på KUA? Vid behov, skriv på baksidan!

---

Tack för dina synpunkter!

## PATIENTENKÄT

Frågor gällande Din senaste vistelse på avdelning 56 eller KUA

Ortopedkliniken, Danderyds sjukhus.

DITT FÖDELSEÅR: \_\_\_\_\_

DITT KÖN: KVINNA

MAN

**Kryssa i det svar som stämmer bäst överens med din uppfattning.**

**1. Fick Du veta resultaten av behandlingen på ett sådant sätt att Du förstod?**

Ja, helt och hållet.....

Ja, delvis.....

Nej.....

Jag fick inte veta några resultat...

Jag väntar på svar.....

**2. Kände Du Dig delaktig i beslut om Din vård?**

Ja, ofta.....

Ja, ibland.....

Nej.....

**3. Fick Du tillräcklig information om hur Din sjukdom eller Dina besvär kommer att inverka på Ditt dagliga liv, t ex när Du kan börja arbeta, motionera, återuppta Dina vardagliga aktiviteter och intressen?**

Ja, helt och hållet.....

Ja, delvis.....

Nej.....

Ej aktuellt.....

**4. Fick Du information om vilken hjälp Du kan få hemma, t ex  
hemsjukvård, hemtjänst, hjälpmedel eller bostadsanpassning?**

Ja, helt och hållet.....

Ja, delvis.....

Nej.....

Ej aktuellt.....

**5. Fick Du i samband med utskrivningen veta vart Du kan vända  
Dig om Du har frågor om Din sjukdom eller behandling?**

Ja.....

Nej.....

Ej aktuellt.....

**6. Kände Du Dig orolig i samband med utskrivningen för hur Du  
skulle klara Dig hemma?**

Ja, till stor del.....

Ja, lite grann.....

Nej.....

**7. Tog personalen hänsyn till Dina hem- och familjeförhållanden  
när Din utskrivning planerades?**

Ja, helt och hållet.....

Ja, delvis.....

Nej.....

Eventuella kommentarer:

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**Ett varmt tack för din medverkan !**

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## 10 REFERENCES

- Agency for Healthcare Research and Quality. (2013). Making Health Care Safer II. An Updated Critical Analysis of the Evidence for Patient Safety Practices. *Evidence Reports/Technology Assessments, No 211. Report No: 13-E001-EF*(march), 472-479.
- Au, A., Padwal, R., Majumdar, S. R., McAlister, F. A. (2014). Patient outcomes in teaching versus nonteaching general internal medicine services: a systematic review and meta-analysis. (1938-808X (Electronic)).
- Barr, H. (1996). Ends and Means in Interprofessional Education: Towards a Typology. *Education for health, 9*(3), 341-353.
- Barr, H. (2013). Toward a theoretical framework for interprofessional education. *J Interprof Care, 27*(1), 4-9. doi: 10.3109/13561820.2012.698328
- Barr, H., Freeth, D., Hammick, M., Koppel, I., & Reeves, S. (2006). The evidence base and recommendations for interprofessional education in health and social care. *J Interprof Care, 20*(1), 75-78. doi: 10.1080/13561820600556182
- Benner, P., Tanner, C., & Chesla, C. (1992). From beginner to expert: gaining a differentiated clinical world in critical care nursing. *ANS Adv Nurs Sci, 14*(3), 13-28.
- Biggs, J., & Tang, C. (2007). *Teaching for Quality Learning at University (Society for Research Into Higher Education)*: Open University Press.
- Bleakley, A., Bligh, J., & Browne, J. (2011). *Medical Education for the Future [Elektronisk resurs] : Identity, Power and Location*. Dordrecht: Springer Netherlands.
- Bowling, A. (1997). Social research on health: Sociological and psychological concepts and approaches. In: Bowling A, editor. *Research Methods in Health: Investigating Health and Health Services*. Buckingham, Philadelphia: Open University Press. (page 17–45).
- Brewer, M. L., & Stewart-Wynne, E. G. (2013). An Australian hospital-based student training ward delivering safe, client-centred care while developing students' interprofessional practice capabilities. *J Interprof Care, 27*(6), 482-488. doi: 10.3109/13561820.2013.811639
- CAIPE. (2002). The definition and principles of interprofessional education. <http://www.caipe.org.uk/aboutus/the-definition-and-principles-of->
- Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis, 40*(5), 373-383.
- D'Amour, D., Ferrada-Videla, M., San Martin Rodriguez, L., & Beaulieu, M. D. (2005). The conceptual basis for interprofessional collaboration: core concepts and theoretical frameworks. *J Interprof Care, 19 Suppl 1*, 116-131. doi: 10.1080/13561820500082529
- Dall'Alba, G., & Sandberg, J. (2006). Unveiling Professional Development: A Critical Review of Stage Models. *Review of Educational Research, 76*(3), 383-412.
- Dornan, T., Boshuizen, H., King, N., & Scherpbier, A. (2007). Experience-based learning: a model linking the processes and outcomes of medical students' workplace learning. *Med Educ, 41*(1), 84-91. doi: 10.1111/j.1365-2929.2006.02652.x
- Dreyfus, H. L., Dreyfus, S. E., & Athanasiou, T. (1986). *Mind over machine : the power of human intuition and expertise in the era of the computer*. New York: Free Press.
- Funnell, P. (1995). Exploring the value of interprofessional learning. In: Sothill KW, editor.

Interprofessional Relations in Health Care. CL, London: Edward Arnold. (Page 163–1719.

- Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), 105-112. doi: <http://dx.doi.org/10.1016/j.nedt.2003.10.001>
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in Qualitative Research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, Calif.: Sage.
- Hagg-Martinell, A., Hult, H., Henriksson, P., & Kiessling, A. (2014). Students perceive healthcare as a valuable learning environment when accepted as a part of the workplace community. *Educ Health (Abingdon)*, 27(1), 15-23. doi: 10.4103/1357-6283.134296
- Hahnel, J., Burdekin H Fau - Anand, S., & Anand, S. (2009). Re-admissions following hip fracture surgery. (1478-7083 (Electronic)). doi: D - NLM: PMC2966164 EDAT-2009/06/30 09:00 MHDA- 2009/12/16 06:00 CRDT- 2009/06/30 09:00 PHST-2009/06/25 [aheadofprint] AID - 10619 [pii] AID - 10.1308/003588409X432374 [doi] PST - ppublish
- Hallin, K., Henriksson, P., Dalen, N., & Kiessling, A. (2011). Effects of interprofessional education on patient perceived quality of care. *Med Teach*, 33(1), e22-26. doi: 10.3109/0142159X.2011.530314
- Hallin, K., Kiessling, A., Waldner, A., & Henriksson, P. (2009). Active interprofessional education in a patient based setting increases perceived collaborative and professional competence. *Med Teach*, 31(2), 151-157. doi: 10.1080/01421590802216258
- Hammick, M., Freeth, D., Koppel, I., Reeves, S., & Barr, H. (2007). A best evidence systematic review of interprofessional education: BEME Guide no. 9. *Med Teach*, 29(8), 735-751. doi: 10.1080/01421590701682576
- Hansen, T. B., & Jacobsen, F. (2009). Cost effective interprofessional training an evaluation of a training unit in Denmark. *J Interprof Care*, May;23(3), 234-241. doi: 10.1080/13561820802602420
- Herbert, C. P. (2005). Changing the culture: interprofessional education for collaborative patient-centred practice in Canada. *J Interprof Care*, 19 Suppl 1, 1-4. doi: 10.1080/13561820500081539
- Hilton, R., & Morris, J. (2001). Student placements--is there evidence supporting team skill development in clinical practice settings? *J Interprof Care*, 15(2), 171-183.
- Hylin, U., Nyholm, H., Mattiasson, A. C., & Ponzer, S. (2007). Interprofessional training in clinical practice on a training ward for healthcare students: a two-year follow-up. *J Interprof Care*, 21(3), 277-288. doi: 10.1080/13561820601095800.
- Institute of Medicine. (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington (DC): The National Academic Press.
- Jacobsen, F., Fink, A. M., Marcussen, V., Larsen, K., & Hansen, T. B. (2009). Interprofessional undergraduate clinical learning: results from a three year project in a Danish Interprofessional Training Unit. *J Interprof Care*, 23(1), 30-40. doi: 10.1080/13561820802490909
- Jacobsen, F., Lindqvist, S. (2009). A two-week stay in an Interprofessional Training Unit changes students' attitudes to health professionals. *J Interprof Care*, May;23(3), 242-250. doi: 10.1080/13561820902739858.
- Jenkinson, C., Coulter, A., Bruster, S., Richards, N., & Chandola, T. (2002). Patients' experiences and satisfaction with health care: results of a questionnaire study of specific aspects of care. *Qual Saf Health Care*, 11(4), 335-339.
- Kirkpatrick, DL. (1967). Evaluation of training. In: Craig R, Bittel I, editors. Training and

Development Handbook. New York: McGraw-Hill.

- Kolb, D.A. (1984). Experiential learning: experience as the source of learning and development. *Englewood Cliffs, NJ: Prentice Hall*. The chapter: The process of experiential learning. Page 20-38.
- Lachmann, H., Ponzer, S., Johansson, U. B., Benson, L., & Karlgren, K. (2013). Capturing students' learning experiences and academic emotions at an interprofessional training ward. *J Interprof Care, 27*(2), 137-145. doi: 10.3109/13561820.2012.724124
- Ladyshevsky, R. K. (2006). Building cooperation in peer coaching relationships: understanding the relationships between reward structure, learner preparedness, coaching skill and learner engagement. *Physiotherapy, 92*(1), 4-10. doi: <http://dx.doi.org/10.1016/j.physio.2005.11.005>
- Lave, J., & Wenger, E. (1991). *Situated learning : legitimate peripheral participation*. Cambridge: Cambridge Univ. Press.
- Li, L. C., Grimshaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). Evolution of Wenger's concept of community of practice. *Implement Sci, 4*, 11. doi: 10.1186/1748-5908-4-11
- Lidskog, M., Lofmark, A., & Ahlstrom, G. (2009). Learning through participating on an interprofessional training ward. *J Interprof Care, 23*(5), 486-497. doi: 10.1080/13561820902921878
- Lindquist, I., Engardt, M., Garnham, L., Poland, F., & Richardson, B. (2006). Development pathways in learning to be a physiotherapist. *Physiother Res Int, 11*(3), 129-139.
- O'Brien, T., Freemantle, N., Oxman, A.D., Wolf, F., Davis, D.A., Herrin. (2001). Continuing education meetings and workshops: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*(2): CD003030.
- Ponzer, S., Hylin, U., Kusoffsky, A., Lauffs, M., Lonka, K., Mattiasson, A. C., & Nordstrom, G. (2004). Interprofessional training in the context of clinical practice: goals and students' perceptions on clinical education wards. *Med Educ, 38*(7), 727-736. doi: 10.1111/j.1365-2929.2004.01848.x
- Quan, H., Couris, C. M., Fushimi, K., Graham, P., Hider, P., Januel, J.-M., .Sundararajan, V. (2011). Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. (1476-6256 (Electronic)).
- Quan, H., Sundararajan, V., Halfon, P., Fong, A., Burnand, B., Luthi, J. C., . . . Ghali, W. A. (2005). Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care, 43*(11), 1130-1139.
- Rabol, L. I., Andersen, M., Ostergaard, D., Bjorn, B., Lilja, B., Mogensen, T. (2011). Descriptions of verbal communication errors between staff. An analysis of 84 root cause analysis-reports from Danish hospitals. (2044-5423 (Electronic)).
- Reeves, S., & Freeth, D. (2002). The London training ward: an innovative interprofessional learning initiative. *J Interprof Care, 16*(1), 41-52.
- Reeves, S., Zwarenstein, M., Goldman, J., Barr, H., Freeth, D., Hammick, M., & Koppel, I. (2008). Interprofessional education: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*(1), CD002213. doi: 10.1002/14651858.CD002213.pub2
- Silén, C., Kiessling, A., Spaak, J., Henriksson, P. (2011). The experience of physician supervisors with clerkship students: a qualitative study. *International Journal of Medical Education. 2011*; 2:56-63; DOI: 10.5116/ijme.4e0c.23de

- Sundararajan, V., Quan, H., Halfon, P., Fushimi, K., Luthi, J. C., Burnand, B., . . . International Methodology Consortium for Coded Health, I. (2007). Cross-national comparative performance of three versions of the ICD-10 Charlson index. *Med Care*, 45(12), 1210-1215. doi: 10.1097/MLR.0b013e3181484347
- Thistlethwaite, J. (2012). Interprofessional education: a review of context, learning and the research agenda. *Med Educ*, 46(1), 58-70. doi: 10.1111/j.1365-2923.2011.04143.x
- Topping, K. J., & Ehly, S. W. (1998). Introduction to peer assisted learning *Peer-assisted learning* (pp. 1-24). London: Erlbaum.
- Wahlstrom, O., Sanden, I., & Hammar, M. (1997). Multiprofessional education in the medical curriculum. *Med Educ*, 31(6), 425-429.
- Wenger, E. (1998). *Communities of practice : learning, meaning, and identity*. Cambridge: Cambridge University Press.
- Wenger, E., McDermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice : a guide to managing knowledge*. Boston: Harvard Business School Press.
- WHO. (2010). Framework for Action on Interprofessional Education & Collaborative Practice. from [http://www.who.int/hrh/resources/framework\\_action/en/](http://www.who.int/hrh/resources/framework_action/en/).
- WHO. (1988). Learning together to work together for health. Report of a WHO Study Group on Multiprofessional Education of Health Personnel: the Team Approach. (1988). *World Health Organ Tech Rep Ser*, 769(0512-3054 (Print)), 1-72.
- Wilhelmsson, M., Pelling, S., Ludvigsson, J., Hammar, M., Dahlgren, L. O., & Faresjo, T. (2009). Twenty years experiences of interprofessional education in Linkoping--ground-breaking and sustainable. *J Interprof Care*, 23(2), 121-133. doi: 10.1080/13561820902728984
- Wood, D. A., Kotseva, K., Connolly, S., Jennings, C., Mead, A., Jones, J., . . . Group, E. S. (2008). Nurse-coordinated multidisciplinary, family-based cardiovascular disease prevention programme (EUROACTION) for patients with coronary heart disease and asymptomatic individuals at high risk of cardiovascular disease: a paired, cluster-randomised controlled trial. *Lancet*, 371(9629), 1999-2012. doi: 10.1016/S0140-6736(08)60868-5