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Medical Students' Knowledge, Skills and Attitudes Towards interprofessional Education

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Artigo 48º, Parágrafo 3º. A Faculdade não responde pelas doutrinas expendidas na dissertação (Regulamento da Faculdade de Medicina do Porto. Lei nº 19337, de 29 de Janeiro de 1931).

Article 48, Paragraph 3. The Faculty does not necessarily agree with the doctrines expounded in the dissertation (Rules and Regulations of the Faculty of Medicine of Porto. Law 19337, January 29th, 1931).

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To my family, for their unconditional and true support.

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List of publications

1. List of publications

This PhD thesis is based in the following publications:

Table 1: List of publications

Citation	Q	IF
Berger-Estilita J, Fuchs A, Hahn M, Chiang H, Greif R. Attitudes towards Interprofessional education in the medical curriculum: a systematic review of the literature. BMC Med Educ. **2020** Aug 6;20(1):254. doi: 10.1186/s12909-020-02176-4.	Q1 (Education) Q2 (Medicine, miscellaneous)	2.46
Pedersen TH, Cignacco E, Meuli J, Habermann F, **Berger-Estilita J,** Greif R. The German interprofessional attitudes scale: translation, cultural adaptation, and validation. GMS J Med Educ. 2020 Apr 15;37(3):Doc32. doi: 10.3205/zma001325.	Q3 (Education) Q3 (Medicine, miscellaneous)	1.14
Berger-Estilita J, Chiang H, Stricker D, Fuchs A, Greif R, McAleer S. Attitudes of medical students towards interprofessional education: A mixed-methods study. PLoS One. **2020** Oct 21;15(10):e0240835. doi: 10.1371/journal.pone.0240835.	Q1 (Multidisciplinary)	3.24
Pedersen TH*, Berger-Estilita J*, Signer S, Bonsen DEZ, Cignacco E, Greif R. Attitudes towards interprofessionalism among midwife students after hybrid-simulation: A prospective cohort study. Nurse Educ Today. **2021** May;100:104872. doi: 10.1016/j.nedt.2021.104872 *(*shared first authorship)*	Q1 (Education) Q1 (Nursing, miscellaneous)	3.44
Joana Berger-Estilita, Sofia Merlo, Sissel Guttormsen, Alexander Fuchs, Robert Greif, Hsin Chiang, Pre-licensure medical students' knowledge and views on interprofessional learning: a qualitative microconcept analysis framework based on real-world data, Front Educ - Higher Education (accepted for publication)	Q2 (Education)	2.32

2. List of abbreviations

ANOVA: Analysis of Variance test

BeSiC: Bernese Simulation and CPR Centre

IPAS: Interprofessional Attitudes Score

G-IPAS: German Interprofessional Attitudes Score

HCP: Healthcare Professional

IPE : Interprofessional Education

IPEC: Interprofessional Education Committee

NSW: New South Wales

OECD: Organisation for Economic Cooperation and Development

RIPLS: Readiness for Interprofessional Learning Score

SAMW: Swiss Academy for Medical Sciences

UK: United Kingdom

UniBe: University of Bern

UoD: University of Dundee

USA: United States of America

WFME: World Federation for Medical Education

WHO: World Health Organization

Abstract

3. Abstract

3.1. Abstract in English

Undergraduate Interprofessional Education aims to improve students' attitudes toward collaboration, teamwork, and lead to improved patient care upon graduation. There is evidence that interprofessional healthcare interventions improve patient outcomes, such as higher medication safety or reduced length of hospital stay.

However, several questions regarding interprofessional education remain unanswered. These include the determination of the optimal time to introduce IPE in the medical curriculum, the correct understanding of the definition of Interprofessional Learning by medical students and the adequate tool to measure attitudes towards interprofessional learning.

To answer the question regarding the ideal time in the medical curriculum to introduce IPE interventions we initially performed the systematic literature review according to the PRISMA guidelines. We identified and screened 3995 articles. After elimination of duplicates or non-relevant topics, 278 articles remained as potentially relevant for full text assessment. We used a data extraction form including study designs, training methods, participant data, assessment measures, results, and medical year of participants for each study. As the results of the systematic review were inconclusive, we performed a mixed-methods study. In the qualitative aspect of the study, 683 medical students from all six years of medical studies at the University of Bern, Switzerland replied to an online survey about attitudes towards interprofessional learning using an interprofessional attitudes scale. For the scale validation, we used a five-step approach including translation into German, use of cognitive interviews, determination of validity by the Content Validity Index, exploratory factor analysis and calculation of the Cronbach's alpha to assess internal consistency.

On the quantitative aspect, 31 medical students took part in nine semi-structured one-hour interviews which focussed on their experience in interprofessional learning and the possible impact such learning might have on their own professional development. For the concept analysis, we created a deductive three-level code system followed by an inductive code system. We extracted the main entities of the concept of IPE according to both code systems to create a framework.

Finally, we performed prospective two-centre cohort study, with midwife students from two midwife schools in German-speaking Switzerland. One cohort was exposed to hybrid simulation and the other served as control. The simulation group filled in the German Interprofessional Attitude Scale (G-IPAS) before and after simulation, and three months later. The control group filled two sets of GIPAS questionnaires, three months apart. This was the first time the GIPAS was used in a selected population.

Our systematic review showed no clear trends on when IPE interventions should be introduced. In the mixed-methods study, there was a high degree of positive attitudes towards IPE in medical students in all study years, with statistically significant more positive attitudes in pre-clinical years. These findings were validated in the semi-structured interviews. Students were aware of the relevance of IPE for their future professional performance. Although students are aware that interprofessional learning is fundamental to high-quality patient care, there were still obstacles and stereotypes to overcome. We could also determine that the German Interprofessional Attitudes Scale was a reliable instrument, representative of the item dimension of the original scale. With our qualitative concept analysis, we deepened the understanding of previously identified definitions of IPE, and we identified new attributes of the definition. Finally, we could demonstrate that a single short simulation exposure to interprofessional learning could increase the awareness and importance of interprofessionalism in healthcare. Our findings support the early introduction of IPE in a medical curriculum. By adding "wellbeing" as a component of interprofessionality, curriculum planners are supported to offer more objective and authentic interprofessional experiences. Such significant learning interactions might impact how medical students internalise and approach patient-centeredness and experience professional wellbeing. With the validation of the German Interprofessional Attitudes Scale we added original and relevant content to the limited number of available tools to measure interprofessional attitudes in German-speaking countries. As a conclusion, our findings aid in future implementation of IPE activities in the medical curricula as well as in guidance of IPE policies and research. They also serve as guidance documents for educators wanting to revise IPE interventions.

3.2. Sumário em Português

A Educação Interprofissional (EIP) pré-graduada visa melhorar as atitudes dos alunos em relação ao trabalho em equipa e levar a uma melhor abordagem do paciente durante a vida profissional. Há evidência de que as intervenções de saúde interprofissionais melhoram os *outcomes* dos pacientes, incluindo maior segurança na administração de fármacos ou redução do tempo de internamento hospitalar.

No entanto, várias questões sobre a educação interprofissional permanecem sem resposta. Entre elas estão a determinação do momento ideal para introduzir a EIP no currículo médico, a correta compreensão da definição de Educação Interprofissional pelos estudantes de medicina e a ferramenta adequada para medir as atitudes em relação à educação interprofissional.

Para responder à pergunta sobre o momento ideal para introdução da educação interprofissional no currículo médico, inicialmente realizamos a revisão sistemática da literatura de acordo com as diretrizes PRISMA. Identificamos e selecionamos 3.995 artigos. Após a eliminação de duplicados ou tópicos não relevantes, 278 artigos permaneceram como potencialmente relevantes para avaliação de texto completo. Para cada estudo, usamos um formulário de extração de dados incluindo desenhos de estudo, métodos de treino, dados dos participantes, medidas de avaliação, resultados e ano médico dos participantes. Como os resultados da revisão sistemática foram inconclusivos, realizamos um estudo de métodos mistos. Na parte qualitativa do estudo, 683 estudantes de medicina de todos os seis anos da Faculdade de Medicina da Universidade de Berna, Suíça, responderam a um questionário *online* sobre atitudes em relação à educação interprofissional usando uma escala de atitudes interprofissionais. Para a validação da escala, utilizou-se uma abordagem de cinco etapas incluindo tradução para o alemão, uso de entrevistas cognitivas, determinação da validade pelo Índice de Validade de Conteúdo, análise fatorial exploratória e cálculo do alfa de Cronbach para avaliação da consistência interna. Na parte quantitativa do estudo, 31 estudantes de medicina participaram de nove entrevistas semiestruturadas de uma hora de duração que focaram na sua experiência com a educação interprofissional e o possível impacto que tal aprendizagem poderia ter no seu desempenho profissional.

Finalmente, realizamos um estudo de coorte prospetivo em dois centros, com parteiras estudantes de duas escolas na Suíça. Uma coorte foi exposta à simulação híbrida e a outra serviu como controlo. O grupo de simulação preencheu a Escala de Atitude Interprofissional Alemã (G-IPAS) antes e depois da simulação, e três meses depois. O grupo de controlo preencheu dois conjuntos de questionários GIPAS com três meses de intervalo. Esta foi a primeira vez que o GIPAS foi utilizado numa população selecionada.

A nossa revisão sistemática não mostrou tendências claras sobre quando as intervenções de EIP devem ser introduzidas. No estudo de métodos mistos, houve um alto grau de atitudes positivas em relação à EIP em todos os anos de estudo, com atitudes mais positivas estatisticamente significativas nos anos pré-clínicos. Esses achados foram validados nas entrevistas semiestruturadas. Os alunos estavam cientes da relevância da EIP para sua futura atuação profissional. Embora os alunos tivessem consciência de que a aprendizagem interprofissional é fundamental para serviços de saúde de alta qualidade, ainda se verificaram obstáculos e estereótipos a serem superados. Também pudemos determinar que a Escala de Atitudes Interprofissionais Alemã foi um instrumento confiável, representativo da dimensão da escala original. Com nossa análise qualitativa de conceito, aprofundamos o entendimento das definições de EIP previamente identificadas e identificamos novos atributos da definição. Por fim, pudemos demonstrar que uma única exposição curta de simulação ao aprendizado interprofissional pode aumentar a conscientização e a importância do interprofissionalismo na área da saúde. Os nossos achados apoiam a introdução precoce da EIP em um currículo médico. Os educacionistas curriculares são suportados na oferta de experiências interprofissionais mais objetivas e autênticas pela adição do "bem-estar" como componente da interprofissionalidade. Essas interações significativas de aprendizagem podem afetar a forma como os estudantes de medicina internalizam e abordam o foco no paciente e experimentam o bem-estar profissional. Com a validação da *German Interprofessinal Attitudes Scale*, adicionamos uma ferramenta original e relevante ao número limitado de instrumentos disponíveis para medir atitudes interprofissionais em países de língua alemã.

Como conclusão, nossas descobertas auxiliam na implementação futura de atividades de EIP nos currículos médicos, bem como na orientação de políticas e pesquisas de EIP. Eles também servem como documentos de orientação para educadores que desejam rever as intervenções de EIP nas suas Universidades.

Introduction

4. Introduction

In the last two decades, patient care has moved its focus away from acute diseases – usually managed in a hospital setting – to long-term conditions and health-related quality of life issues (Pfaff & Markaki, 2017), mostly handled within the community (Hustoft et al., 2019; Reeves et al., 2013). This shift made patients more dependent on complex systems involving different healthcare professionals (HCP)(Reeves et al., 2013).

Consequently, both caregivers and patients now face more distressing situations due to poor communication and lack of collaboration between all the HCPs providing treatment. Such incoordination may result in disruptions in the continuity of care (Olson & Bialocerkowski, 2014).

In order to tackle these undesirable effects of complex healthcare systems, interprofessional education (IPE) has now been introduced as part of undergraduate medical education. As per definition of the World Health Organization (WHO), IPE occurs when "*students from two or more professions learn about, from, and with each other to enable effective collaboration and improve the quality of care*"(WHO, 2010, p.13). Conversely, interprofessional learning designates the practice – preferably originating from IPE – of "*promoting effective communication, collaboration and teamwork within healthcare settings to improve patient care and student clinical learning outcomes*"(Henderson et al., 2010). However distinct, the terms have been used interchangeably.

For an interprofessional team to collaborate synergistically, each member must have a clear understanding of each team member´s roles and responsibilities. Additionally, there is value and respect of the unique contribution of each individual within the team structure to the enhancement of patient care (CIHC, 2010). In this framework of practice "*each profession is empowered to assume leadership on patient care issues appropriate to their expertise*" and there is appreciation for joint decision-making (WHO, 2010). There is evidence that interprofessional healthcare interventions improve patient outcomes, such as higher medication safety or reduced length of hospital stay (Zwarenstein et al., 2009). The process by which this occurs is not entirely known, but include an enhancement of HCP´s communication and interpersonal skills, as well as collaboration and teamwork (Reeves et al., 2013).

Therefore, high-quality, accessible and safe patient-centred care needs a continuous professional development of such interprofessional competencies (IPEC, 2011). Its introduction in HCP training curricula has been called for so that HCP students can enter the healthcare system as effective team members (Frenk et al., 2010; IOM, 2015; Reeves et al., 2016). The interprofessional collaborative practice has become the cornerstone to approach such complex healthcare circumstances.

4.1. Investigator's Perspective

Interprofessional collaboration and team-based practice are fundamental to the good functioning of healthcare systems and supporting such collaboration have been shown to lead to improved patient outcomes (Reeves et al., 2016). There is the belief that IPE during medical training will enhance attitudes toward teamwork and collaboration, improving patient care upon graduation.

In Bern, the degree in Medicine has a duration of six years and is subject to admission restrictions (*numerus clausus*). The Medical Faculty is one of the largest in Switzerland with about 1500 students. It consists of university clinics and institutes from 3 organizations (University of Bern, University Psychiatric Services and Inselspital, Bern University Hospital). The study of Medicine starts with a 3-year bachelors programme focusing on basic science (e.g., physics, chemistry, biology, physiology, biochemistry and anatomy) followed by a 3-year master's programme with a strong practical focus, composed mostly of small group interactions (problem-based learning) and clinical clerkships [14]. Since 2010 the medical faculty and nursing schools have been offering optional two half-day interprofessional internships for their students in the first and third semesters. Further interprofessional activities include a compulsory seminar on confidentiality in cooperation with the Bern University of Applied Sciences and the Institute for Medical Education of the University of Bern (UniBe) as well as the compulsory Intravenous Cannulation course, both taught in the first academic year, during which the learning groups and the team of peer tutors are interprofessionally allocated.

I am a Portuguese Anaesthesiologist working in Switzerland. My primary career interest is teaching and research on teaching strategies. I have started the Doctoral Programme in Clinical Investigation and Health Services Research at the University of Porto in 2013, as I was still working in Portugal. My head of department at the time was Prof. Cristina Granja, so she also became my supervisor.

I left the country for personal reasons in 2014 and interrupted the doctoral programme. My interest in research remained and I started working as a researcher at the Medical Education Research group of the Department of Anaesthesiology and Pain Therapy of the Bern University Hospital, under the supervision of Prof. Robert Greif. I became closely involved in teaching undergraduate and postgraduate students, both bedside and in the simulation suite and I am also currently a researcher of the Institute for Medical Education at the University of Bern. After having published, I was advised to complete the Doctoral Programme in Clinical Investigation and Health Services Research as a self-proposed candidate.

With this thesis, we set to apply the validated G-IPAS to determine the best time to introduce IPE in the Bernese medical population. These findings were complemented with extensive qualitative research using semi-structured interviews using the same students as sample population. This thesis is the result of the several medical education projects that were developed in the University of Bern.

Background

5. Background

This section reviews the literature on interprofessional education (IPE). Four main themes are presented: (1) History and definition of IPE according to different institutions, (2) theoretical perspectives on IPE, (3) evidence on educational practices of IPE in the undergraduate setting.

5.1. History and definition of IPE

Several organisations have expressed their support of IPE through various initiatives and statements. In 1988, the WHO issued the *Learning Together to Work Together for Health* Report (WHO, 1988), which established interprofessional education as a method to build up teamwork and collaboration. More recently, they released another cornerstone report entitled Framework for Action in Interprofessional Education and Collaborative Practice(WHO, 2010), that led to an overall growing interest in IP collaboration and education.

In 2009, six USA associations of schools of the health professions (osteopathic and allopathic medicine, nursing, pharmacy dentistry and public health) created a collaborative to promote IPE learning interventions. They established, for the first time, a document disclosing the core competencies for collaborative practice. This document, known as the IPEC report (IPEC, 2011) aims to prepare future healthcare workforce for enhanced team-based patient care. The IPEC report has gone through several updates and has gained worldwide acceptance as a core document to guide curriculum design within healthcare teaching(IPEC, 2016).

The IPEC report sets four different dimensions (Ethics & Values, Roles & Responsibilities, IP Communication and Teamwork)(IPEC, 2011, 2016) of expert panel recommendations on IP core competencies. They provide a framework for high-quality, integrated patient care within each country´s healthcare system. The IPEC dimensions are aligned with the WHO statements.

Some other international entities like the World Federation of Medical Education (WFME) and the Organization for Economic Cooperation and Development (OECD) have also recommended policies to facilitate IPE.

Both the United Kingdom (UK) and in Canada released clear recommendations and facilitated government funding to support the incorporation of IPE into healthcare education.

The Canadian Health Council recommends that each health sciences university offer at least one IPE intervention (Bandali et al., 2011). In the UK, a Bristol Royal Infirmary Inquiry (DoH, 2001) showed that poor IP collaboration was in the origin of a significant percentage of preventable errors, which introduced the urgent need to address IPE. As of 2006, IPE is a mandatory requirement for undergraduate health and social care students.

In other English-speaking countries there are also recommendations for IPE. The US Institute of Medicine published a report called Crossing the Quality Chasm: A New Health System for the 21st Century, which recommends that *"health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team"*(IOM, 2001). In Australia, the Special Commission of Inquiry into Acute Care Services in New South Wales Public Hospitals also released thorough recommendations supporting IPE approaches (Garling, 2008). However, the degree of this policy enforcement in both these countries seems to be highly variable.

In Switzerland, efforts to include IPE in healthcare curricula started over a decade ago. In 2007, the Swiss Academy of Medical Sciences (SAMW), proposed a document to promote collaboration between healthcare professionals. The charter was published a few years later (SAMW, 2014) and includes clear instructions on the development of common teaching, the adaptation of work organization, and tasks or responsibilities of active partners. More recently, the Swiss Federal Office of Public Health has released a support program for all activities aimed at improving IP cooperation in the healthcare system (BAG, 2018).

5.2. Theoretical perspectives on IPE

In IPE, knowledge, skills and attitudes are formed and modulated through social exchange and interactions of different HCPs. Elements of IPE as building awareness and respect for different roles and developing skills for effective collaboration led to significant differences in the theories behind IPE, when compared to traditional "uniprofessional" or "siloed" learning. An abundance of learning and related theories has contributed to the better understanding and successful implementation of IPE in several contexts (Hean et al., 2012; Sargeant, 2009).

Consequently, this provided an array of theories, in which each author used a favoured process to articulate his or her understanding.

We found that social psychology and complexity theory were especially useful to inform my work because they recognise both the experimental and the social components of IPE as well as the complex healthcare system in which IP takes place. In the next lines we will briefly summarise the two learning theories that align with interprofessional learning:

a) ***Social psychology*** explores the influence of context in the interaction between individuals (Ross & Nisbett, 1991). Sargeant (2009) describes three important contributions of this theory to inform IPE: (1) that situational factors influence social behaviour, (2) that subjective individual interpretations influence social behaviour and (3) that individual cognitive processes are dynamic and unpredictable. Such premises imply that IPE is influenced by external and internal factors and one cannot predict what and how each individual will learn from the interaction.

b) ***Complexity theory*** highlights interactions and the accompanying feedback loops that continually modulate complex systems, such as the healthcare system (Greenhalgh et al., 2004; Grol et al., 2007; Plsek & Greenhalgh, 2001; Sweeney & Griffiths, 2002). It focuses away from a linear view of care, which overlooks the interaction of different elements of practice and education. To help understand IPE as a complex activity, a conceptual model was developed that linked IPE and practice (D'Amour & Oandasan, 2005). This framework (Figure 1, below) illustrates the array of interactions between cultures, organisations, teams and the individual, which all play a role on what is learned.

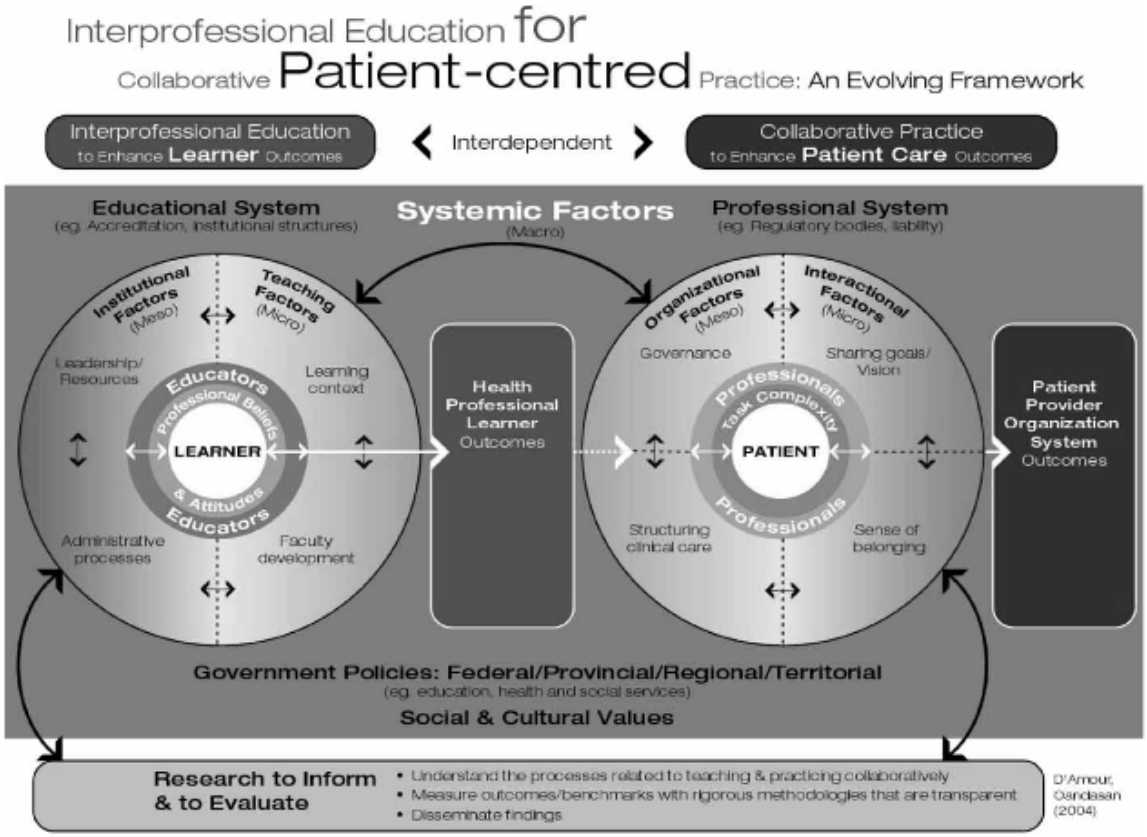

Figure 1: Framework of IPE for collaborative patient-centred practice, retrieved from D'Amour & Oandasan, 2005.

The framework is made of two circles: the left circle represents education and the right circle represents clinical practice. The left circle depicts items that affect a HCP student´s ability to become a collaborative practitioner. It includes macro (systemic), meso (institutional) and micro (teaching) items. The learner stands at the core of this circle and receives influences from the external factors. The right circle includes items that modify patient outcomes. The same macro-meso-micro hierarchy is used. At the core of the second circle stands now the patient, being influenced by HCPs collaborative practice.

Mostly between 2004 and 2011, several authors reviewed similar frameworks for IPE (Frenk et al., 2010; Gilbert et al., 2010; Stephenson & Richardson, 2008): they have different foci, either on a micro-, meso- or macrolevel and take several approaches (either learner-directed, context-directed, patient-directed, targeted to collaborative practice or to the population´s healthcare needs).

Oadasan (2005) proposed the IECPCP (Interdisciplinary Education for Collaborative, Patient-Centred Practice) Framework, which connects IPE and collaborative practice. Similarly to the above frameworks, issues concerning the learner and the educational context are considered essential components of IPE.

The document currently in force is the Framework for Action on Interprofessional Education and Collaborative Practice of the WHO. It emphasises the current status of IP collaboration, identifies the causes of (un)successful teamwork, and outlines strategies that decision makers can use within their local healthcare systems (Gilbert et al., 2010).

Similarly, but highlighting only higher education and focusing on healthcare professions, a committee of education leaders (Frenk et al., 2010) developed recommendations based on the global scope of healthcare needs. Main conclusions of this document include the need to develop new educational and instructional strategies for collaboration, focus on transformative learning and expand the interdependence of healthcare-related educational institutions. This framework is also suitable for planning revisions on the macro and meso levels of IPE.

Finally, on the curriculum level, Stephenson and Richardson (2008) published a framework which is client-focused and aligns with the WHO´s International Classification of Functioning, Disability and Health (ICF) as a framework for curricula. It aims to achieve interprofessional decision-making that focuses on improving the client´s overall status.

All the aforementioned frameworks may aid to both implement IPE as well as to guide policies and research. They also serve as guidance documents for educators wanting to introduce or revise IPE interventions.

5.3. Evidence on educational practices of IPE in the undergraduate setting

This section on the educational practice of IPE in the undergraduate setting provides an overview of and a critical appraisal of systematic reviews (SR) in the field of IPE.

SRs aim to analyse and inform disciplinary fields, such as IPE, in order to promote understanding and uncover gaps in that field. We searched for IPE reviews that focused on the undergraduate setting.

This section will provide an overview of the twelve SR selected in this literature review, their aims, methods used, followed by a critical appraisal using an approach recommended by the Joanna Briggs Institute (Aromataris & Munn, 2017). In Appendix B are the Tables with the summarised SRs included in this literature review.

In the last two decades, several systematic and scoping reviews have enriched our knowledge about IPE. They largely addressed three main topics: (1) the conceptual foundations of IPE and creation of theory-aligned competencies, such as role clarification, IP communication and teamwork, mutual respect and patient-centred care (Olson & Bialocerkowski, 2014); (2) the strengthening of evidence regarding competencies that facilitate IPE (Olson & Bialocerkowski, 2014; Reeves et al., 2016) and (3) the development of sustainable methods for IPE implementation into curricula and clinical practice (Abu-Rish et al., 2012).

The review by Abu-Rish (2012) selected IPE interventions involving pre-licensure health professionals because it aimed to pilot-test innovative IPE models used in healthcare students. This large-scale review included studies between 2005-2010 (therefore published before the IPEC report). However, I decided to include it in this selection because it updated the landmark review of Reeves et al. (2011) and addressed a wide range of IPE aspects (including structure and content of the curriculum, faculty recruitment and training, modes of facilitation of IPE, institutional leadership and financial support). Unfortunately, the academic level of students participating in the selected IPE programmes was not consistently reported, so no major conclusions can be drawn regarding optimal time for IPE introduction.

Olson & Bialocerkowski (2014) performed a methodologically inclusive systematic review to investigate university-based IPE in undergraduate allied health students. Results showed that IPE was effective and feasible, but the understanding behind its success was limited. Of relevance to this literature review, several included studies found that more experienced – and consequently older – students showed a clearer understanding of different healthcare roles and had better attitudes towards IPE and teamwork (Kenaszchuk et al., 2012; Mohaupt et al., 2012; Titzer et al., 2012). One study (Hayashi et al., 2012) showed that first-year students´ attitudes declined during a 6-month period after a prolonged IPE intervention, but a better attitude towards IPE was present two years after the intervention, when compared to the control group.

Another study (Wellmon et al., 2012) demonstrated that older students consistently showed much less favourable perceptions of IPE and teamwork. However, the authors could not pinpoint which factors – whether age, experience or social work – were associated with the decline. Also in 2013, Reeves et al. (2013) updated a Cochrane review investigating the impact of IPE on patient outcomes and patient care. Four of the six included studies reported positive outcomes for IPE.

Kent & Keating (2015) explored in their systematic review 26 studies about IPE interventions for entry level healthcare students. IPE occurred more frequently with nursing students (level unreported) and medical students (1st to 4th year). Unfortunately, the authors were unable to confidently determine the effect of IP student-led primary care clinics on both student and patient outcomes. In addition, no stratified analysis per year of studies was performed.

In 2016, Reeves conducted an update of a previous Best Evidence of Medical Education (BEME) review (Hammick et al., 2007) using the 3P model (Presage, Process, Product) and re-appraised the drivers for IPE, highlighting the importance of organizational support. Additionally, later studies reported more positive IPE outcomes. Of relevance to this project, undergraduate student age was found to be a factor influencing IPE, with younger students being overall more positive about their IP relationships (McFadyen et al., 2010). However, despite their more negative attitudes, older students were more active and participative in their IP roles (Pollard & Miers, 2008).

Visser et al. (2017) gave an overview of the studies that report barriers, facilitators or readiness for IPE. Of relevance to this literature review are the findings that, on an organizational level, attitudes towards healthcare teams for the same IPE training were significantly less positive one year after graduation, when compared with 3rd-year students (Makino et al., 2013). At a curricular level, readiness for IPE and professional identity was higher in the first year of studies and in students with prior IPE experience; and it declined significantly over time (Coster et al., 2008; Hansson et al., 2010; Hood et al., 2014; Keshtkaran et al., 2014; McFadyen et al., 2010; Solomon, 2011). Students in more advanced years seemed to be more proficient at achieving a combination of profession-specific and IPE learning goals (Jacobsen et al., 2009; Jakobsen et al., 2010). Finally, at an individual level, one paper showed that first-year students with a parent working in healthcare showed lower IPE scores (Cooper

et al., 2005) and another showed that younger students achieved more IPE learning outcomes than others who had already graduated (Anderson & Thorpe, 2008).

Also in 2017, Nelson et al. aimed for a clearer understanding of the different outcomes and approaches of team-training interventions in undergraduates. Their descriptive analysis review included 17 studies and demonstrated a gap in team-training-focused prelicensure IPE. Neither specific outcomes nor IPE approaches were particularly favoured. In the same year, Kent, Kayes, Glass & Rees (2017) included 27 studies in their realist review to inform the creation of evidence-based IPE activities on a local context. They could demonstrate that the combination of (1) patient-based activities with reflection/discussion and (2) trained faculty seemed to create the most positive factors in IPE. Unfortunately, comparisons between student years were not performed.

Guraya & Barr (2018) analysed 12 studies on the impact and effectiveness of IPE teaching in healthcare curricula. They could demonstrate positive outcomes of IPE interventions in various disciplines. The authors suggested more studies with qualitative standards and cost-benefit analysis to evaluate the effects of IPE educational interventions.

A more recent review (Fox et al., 2018) failed to shed some light into the outcomes of IPE. After searching for the effectiveness and assessment of IPE activities in a scoping review, results were inconclusive, because data was low on quality and studies were very heterogeneous. Finally, the authors questioned the adequacy of positivist methods to educational research and point out the need for further (and better) studies to examine IPE teaching. In this review, no subgroup analysis was conducted for age or previous IPE experience.

The last review on this topic is by O´Leary et al. (2019). In their thematic meta-analysis using the 3P model, they aimed to synthesise key stakeholders´ perspectives on the challenges of IP placements implementation. They included 41 studies, but only 16 were considered high-quality. They found 11 theoretical models to inform IPE, a lack of coordinated support within organizations and also a lack of clarity regarding the purpose of IP placements in students, educators and service users.

The findings of the systematic reviews reflect on the optimal timing to introduce IPE and whether immersion (i.e. continuous collaborative learning) or exposure (periodic collaborative activities) should be adopted (Hudson et al., 2016). As demonstrated, current undergraduate literature shows a trend to introduce IPE earlier, even in the first year of studies (Kozmenko et al., 2017), but this approach is not based on solid research. The optimal introduction of IPE in the medical curriculum will be the main topic to be addressed in this thesis.

6. Open questions regarding Interprofessional Education

6.1. Optimal time to introduce IPE in the Medical Curriculum

There is a broad consensus among educationalists and regulating bodies that IPE should occur at the undergraduate level (Frenk et al., 2010; Oandasan et al., 2006; WHO, 2010), and that the "siloing" of undergraduate medical education is a significant factor contributing to the shattered culture of the health system (Nelson et al., 2014). IPE may enhance attitudes toward collaboration and teamwork during training, leading to improved attitudes towards IP upon graduation. Nevertheless, the complexity of teaching for different health disciplines at the same time, the logistical problems and busy timetables raise issues concerning the introduction of IPE interventions. The optimal timing to introduce IPE and whether immersion (i.e. continuous collaborative learning) or exposure (periodic collaborative activities) should be adopted are still subject to debate. Gilbert (Gilbert, 2005) suggests exposure during the early years and immersion in the graduation year. Reasons for this include the optimal development of students´ professional identity before expecting them to work collaboratively with others. Furthermore, introduction of IPE so late in the curriculum may be deterred by the student´s focus on profession-specific clinical practice and immersion on vocation-specific stereotypes or negative attitudes (Hudson et al., 2016). Current undergraduate literature shows a trend to introduce IPE earlier, even in the first year of studies (Gilbert, 2005; Kozmenko et al., 2017), but the optimal timing for the IPE intervention remains to be determined.

6.2. Concept of IPE

The World Health Organization's Framework for Action in Interprofessional Education and Collaborative Practice (WHO, 2010) define IPE as an activity of "*students from two or more professions learn about, from, and with each other to enable effective collaboration and improve the quality of care*". However, a closer look at the literature reveals several different interpretations and interchangeable terms (Olenick et al., 2010):

- According to the Centre for Advancement of Interprofessional Education (CAIPE, 2021), IPE involves "*educators and learners from two or more health professions and their foundational disciplines, who jointly create and foster a collaborative learning environment.*"
- The Interprofessional Education for Collaborative Patient-Centred Practice (Wener et al., 2009) defines IPE as "*learning together to promote collaboration*" and further depicts three components in IPE: socialising healthcare professionals working together, developing mutual understanding and respect for various disciplines and imparting collaborative practice competencies.
- The Canadian Interprofessional Health Collaborative (CIHC 2010) defines IPE as "*occurring when students learn with, from and about one another*" adding that IPE takes place when "healthcare professionals learn collaboratively within and across disciplines to acquire knowledge, skills and values needed for working in teams"(CIHC, 2010).
- The IPEC report (IPEC, 2011) sets four different dimensions of expert panel recommendations on interprofessional core competencies, which are aligned with the WHO statements: (1) ethics and values, (2) roles and responsibilities, (3) interprofessional communication and (4) teamwork. This report provides a framework for high-quality, integrated patient care within each country's healthcare system.

Although the abovementioned definitions have overlapping terminologies and include aspects of interprofessionality, collaboration, shared values and socialisation, an apparent uniformity of the definition of IPE is lacking, which might contribute to the misunderstanding of IPE. The correct understanding of the concept of IPE has implications for the adequate implementation of IPE activities in healthcare personnel formation curricula and may affect students' attitudes towards collaborative practice (Khalili et al.,

2013). Therefore, the determination of a clear operational definition of IPE is the base for developing a more effective IPE design, delivery, and measurement.

6.3. Measurement of Attitudes towards Interprofessional Learning

Perceptions and attitudes are affective constructs that relate to student´s behaviour; more explicitly, "strong attitudes govern behaviour, and weak attitudes follow behaviour"(Visser et al., 2017). Attitudes play a key aspect in interprofessional collaboration, and they form and are modulated during education (Khalili et al., 2013). When students learn about interprofessional collaboration – be it in simulated or "real-life" environments – their attitudes "*should be strong enough to guide their behaviour*" (Holland et al., 2002). For IPE, this means that when collaboration is the learning outcome, one needs to assess the strength of the attitude rather than (only) observing behaviour (Visser et al., 2017).

Until very recently, only a few conceptual tools for assessing attitudes towards IPE existed (Thannhauser et al., 2010). The Readiness for Interprofessional Learning Scale (RIPLS)(Parsell & Bligh, 1999) and the extended RIPLS (Reid et al., 2006) are popular examples. Unfortunately, these scales were developed before 2011 and are outdated, because they do not integrate all four recommended interprofessional core competency domains of the IPEC report (IPEC, 2011). The same occurs with other popular scales like the University of West England Interprofessional Questionnaire (Pollard et al., 2004), the Jefferson Scale of Attitudes Toward Interprofessional Collaborative Work between Medical and Nursing Professionals (Hojat et al., 1999) and the Attitudes Towards Healthcare Teams Scale (Heinemann et al., 1999).

A new scale has been developed and validated in 2015 – the Interprofessional Attitudes Scale (IPAS) (Norris et al., 2015) – using items from the extended RIPLS and new items to embody all four IPEC domains. This scale was developed in English and needed validation for other populations.

7. Aims

Undergraduate Interprofessional Education aims to improve students' attitudes toward collaboration, teamwork, and lead to improved patient care upon graduation. There is evidence that interprofessional healthcare interventions improve patient outcomes.
However, several questions regarding interprofessional education remain unanswered. These include the determination of the optimal time to introduce IPE in the medical curriculum, the correct understanding of the definition of Interprofessional Learning by medical students and the adequate tool to measure attitudes towards interprofessional learning.

Therefore, the aims of this thesis are:

a) *Primary Aim:*

Aim 1: To ascertain the ideal time in the medical curriculum to introduce IPE interventions

b) Secondary Aims:

Aim 2: To validate an Interprofessional Attitudes Scale into the German language

Aim 3: To determine the facilitators and barriers for interprofessional education in the study population

Aim 4: To study the concept of Interprofessional Learning and its dimensions

Aim 5: To use a validated Interprofessional Attitudes Scale in an interprofessional simulation setting

Aim 1: To ascertain the ideal time in the medical curriculum to introduce IPE interventions

8. Ascertain the ideal time in the medical curriculum to introduce IPE interventions

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This first paper describes the current evidence about the optimal time to introduce IPE interventions in medical curricula, therefore addressing the primary aim (**Aim 1**) of this thesis. As the number of publications in IPE increased exponentially with the last years (Reeves et al., 2017), our aim was to carefully review the existing literature on evidence-based IPE to help to make oriented IPE decisions. We undertook a systematic literature review to determine the most effective time to introduce IPE to undergraduate medical students. Additionally, we were interested in exploring the nature of the training, the assessment methods and the study outcomes.

The systematic literature review was performed using PubMed, PsycINFO, EThOS, EMBASE, PEDro and SCOPUS. Search terms were composed of interprofession*, interprofessional education, inter professional, inter professionally, IPE, and medical student. Inclusion criteria were 1) the use of a validated scale for assessment of attitudes towards IPE, and results for more than 35 medical students; 2) peer-reviewed articles in English and German, including medical students; and 3) results for IPE interventions published after the 2011 Interprofessional Education Collaborative (IPEC) report. We identified and screened 3995 articles. After elimination of duplicates or non-relevant topics, 278 articles remained as potentially relevant for full text assessment. We used a data extraction form including study designs, training methods, participant data, assessment measures, results, and medical year of participants for each study.

This systematic review included 23 articles with a pre-test-post-test design. In total 5231 students, of which 62% (n = 3229) were medical students, experienced an IPE intervention. The median number of medical students in the IPE interventions was 100 [35–464]. Interventions varied in their type and topic.

The duration of interventions varied from 25 min to 6 months, and interprofessional groups ranged from 2 to 25 students. Nine studies (39%) reported data from first-year medical students, five (22%) from second-year students, six (26%) from third-year students, two (9%) from fourth-year students and one (4%) from sixth-year students. There were no studies including fifth-year students. The most frequently used assessment method was the Readiness for Interprofessional Learning Scale (RIPLS) (n= 6, 26%). About half of study outcomes showed a significant increase in positive attitudes towards interprofessional education after interventions across all medical years. This systematic review showed some evidence of a post-intervention change of attitudes towards IPE across different medical years studied. IPE was successfully introduced both in pre-clinical and clinical years of the medical curriculum. With respect to changes in attitudes to IPE, we could not demonstrate a difference between interventions delivered in early and later years of the curriculum.

Attitudes toward interprofessional collaboration seem to be more positive in older, hence more mature and experienced students. It seems that younger students may have a limited understanding of healthcare professionals´ roles and this may constrain the effectiveness of early IPE interventions. Published studies on this topic demonstrate a highly variable and inconsistent use of scales to assess changes in knowledge, behaviours and attitudes linked with participating in IPE. There is also a paucity of studies reporting medium- and long-term outcomes, and a restricted inclusion of theories to inform IPE interventions. In addition, the concept of IPE is inconsistently used throughout, with multiple interpretations of the WHO definition and its objectives. And despite having found increasing evidence supporting the advantages and benefits of IPE, the processes by which students learn about IP care were not completely understood.

Our methodology had limitations. We decided *a priori* to include only papers with at least 35 medical students. The reason was to have sufficiently powered studies in the sample. We also excluded studies in languages other than English or German. This may have led to some selection bias, or left out potentially relevant interventions. Because we were interested in IPE effects on medical students, we also excluded all studies that did not report specific results for medical students. This limited the number of positive studies available.

Similar to other systematic reviews, our work aimed to exclude all "lower quality" studies (i.e., non-randomised, non-experimental, qualitative studies) (Guraya & Barr, 2018; Kent & Keating, 2015; Reeves et al., 2013). Reflecting on our methods, we question whether they are adequate for social or educational research, as there are repeated appeals for more qualitative reviews in IPE (Thistlethwaite, 2012).

From our analysis we could not determine the best time to introduce IPE, as both pre-clinical and clinical IPE interventions showed some degree of success. It seems reasonable to conclude that interventions should be introduced in the early years and continue throughout the curriculum. The need for better-designed studies to address this gap of knowledge prompted our work in publication 2.

8.1. Publication 1: Berger-Estilita J, et al. BMC Med Educ. 2020 Aug 6;20(1):254.

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Attitudes towards Interprofessional education in the medical curriculum: a systematic review of the literature

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Abstract

Background: There is agreement among educators and professional bodies that interprofessional education needs to be implemented at the pre-registration level. We performed a systematic review assessing interprofessional learning interventions, measuring attitudes towards interprofessional education and involving pre-registration medical students across all years of medical education.

Methods: A systematic literature review was performed using PubMed, PsycINFO, EThOS, EMBASE, PEDro and SCOPUS. Search terms were composed of interprofession*, interprofessional education, inter professional, inter professionally, IPE, and medical student. Inclusion criteria were 1) the use of a validated scale for assessment of attitudes towards IPE, and results for more than 35 medical students; 2) peer-reviewed articles in English and German, including medical students; and 3) results for IPE interventions published after the 2011 Interprofessional Education Collaborative (IPEC) report. We identified and screened 3995 articles. After elimination of duplicates or non-relevant topics, 278 articles remained as potentially relevant for full text assessment. We used a data extraction form including study designs, training methods, participant data, assessment measures, results, and medical year of participants for each study. A planned comprehensive meta-analysis was not possible.

Results: This systematic review included 23 articles with a pre-test-post-test design. Interventions varied in their type and topic. Duration of interventions varied from 25 min to 6 months, and interprofessional groups ranged from 2 to 25 students. Nine studies (39%) reported data from first-year medical students, five (22%) from second-year students, six (26%) from third-year students, two (9%) from fourth-year students and one (4%) from sixth-year students. There were no studies including fifth-year students. The most frequently used assessment method was the Readiness for Interprofessional Learning Scale (RIPLS) ($n = 6$, 26%). About half of study outcomes showed a significant increase in positive attitudes towards interprofessional education after interventions across all medical years.

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Conclusions: This systematic review showed some evidence of a post-intervention change of attitudes towards IPE across different medical years studied. IPE was successfully introduced both in pre-clinical and clinical years of the medical curriculum. With respect to changes in attitudes to IPE, we could not demonstrate a difference between interventions delivered in early and later years of the curriculum.

Trial registration: PROSPERO registration number: CRD42020160964.

Keywords: Interprofessional education, IPE, Medical student, Pre-registration, Medical education, Attitudes, Medical curriculum

Background

According to the World Health Organization (WHO), Interprofessional Education (IPE) occurs when "students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes" [1]. Safe, high-quality, accessible, patient-centred care requires continuous development of interprofessional competencies [2], and IPE has repeatedly been called for, so that healthcare students can enter the workforce as effective collaborators [3–5].

A growing amount of empirical work shows that IPE can have a beneficial impact on learners' attitudes, knowledge, skills, and behaviours (the so-called collaborative competencies) [6, 7], and can positively affect professional practice and patient outcomes [8, 9]. IPE may enhance attitudes toward teamwork and collaboration, leading to improved patient care upon graduation. However, the optimal time to expose medical students to IPE is still subject to debate.

IPE may enhance attitudes toward collaboration and teamwork during training, leading to improved attitudes towards IP upon graduation. Nevertheless, the complexity of simultaneous teaching for different healthcare disciplines, as well as logistical problems and busy timetables raise issues concerning the introduction of IPE interventions. The optimal timing to introduce IPE and whether immersion (i.e. continuous collaborative learning) or exposure (periodic collaborative activities) should be adopted [10] are still subject to debate. Gilbert [11] suggests exposure during the early years and immersion in the graduation year. Reasons for this include ensuring the optimal development of students' professional identity before expecting them to work collaboratively with others. Furthermore, delaying the introduction of IPE to later in the curriculum may be deterred by the students' focus on profession-specific clinical practice, and immersion in vocation-specific stereotypes or negative attitudes [10]. Current undergraduate literature shows a tendency to introduce IPE earlier, even in the first year of studies [11, 12], but the most effective timing to perform PE interventions in the medical curriculum remains to be determined.

We undertook a systematic literature review to determine the most effective time to introduce IPE to pre-registration medical students. Additionally, we were interested in exploring the nature of the training, the assessment methods and the study outcomes. Our systematic review was guided by the research question: "What is the optimal time to institute interprofessional education interventions in the medical school curriculum?"

Methods

Study design

We performed a systematic review of the literature focusing on interprofessional learning interventions in pre-registration medical students and applied a review protocol based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement [13]. We also aimed to perform a meta-analysis with studies grouped by type of assessment. This systematic review was registered in PROSPERO (www.crd.york.ac.uk) with the number CRD42020160964.

Data sources and selection criteria

The systematic literature search was performed on December 12, 2019, using the databases PubMed, PsycINFO, EThOS, EMBASE, PEDro and SCOPUS. The following keywords and subject headings were used as search terms: *interprofession**, *interprofessional education*, *inter professional*, *inter professionally*, *IPE*, and *medical student*. We included all peer-reviewed articles in English and German that reported on evaluative studies of IPE interventions including medical students, and were published after the 2011 Interprofessional Education Collaborative (IPEC) report [2]. The full search strategy is available in an additional word file [see Additional file 1]. In addition, we included articles found in the reference lists of previous reviews on IPE, discovered as a result of the search for IPE interventions [4, 6, 9, 14–22].

Inclusion criteria

We included studies that reported on assessment of knowledge, skills or attitudes (KSA), with an IPE intervention, and that reported quantitative results with a validated IPE instrument. We included only studies using previously comprehensive validated instruments according to various psychometric tests. Validated questionnaires provide reliable and valid results, and can be used to benchmark or compare results on an international level [23], and make statistical comparisons, therefore increasing rigour and allowing for a meta-analysis. One limitation of the use of validated questionnaires is the lack of further piloting or cultural adaptation, which may induce bias. We also narrowed our search to groups of at least 35 medical students in the same year of their medical education programme, to ensure an adequate sample size for statistical validity. To avoid interventions in overlapping years of education, we selected studies reporting on interventions with a duration of at most 6 months (regardless of the type of intervention, the study programme, and the educational year of other students taking part). Although we encountered qualitative IPE studies, we chose a positivist approach because it better aligned with our intention to perform a meta-analysis.

Exclusion criteria

We excluded conference contributions and abstracts without a related peer-reviewed published article. We also excluded all non-validated questionnaires and articles without available full-text in English or German.

Identification of potentially eligible studies

After the primary search, all titles and abstracts were screened and duplicates or non-relevant articles were excluded. The full text of the remaining articles was read by two authors (JBE and AF) to identify the eligible articles for this review. All potentially eligible articles were imported into a software platform for systematic reviews (http://rayyan.qcri.org) [24] to expedite the screening of abstracts and titles and to determine the final selection of eligible studies. The two authors initially performed selection in a blinded mode with three options: "include", "exclude" and "maybe". After finishing the first personal assessment, results were unblinded and

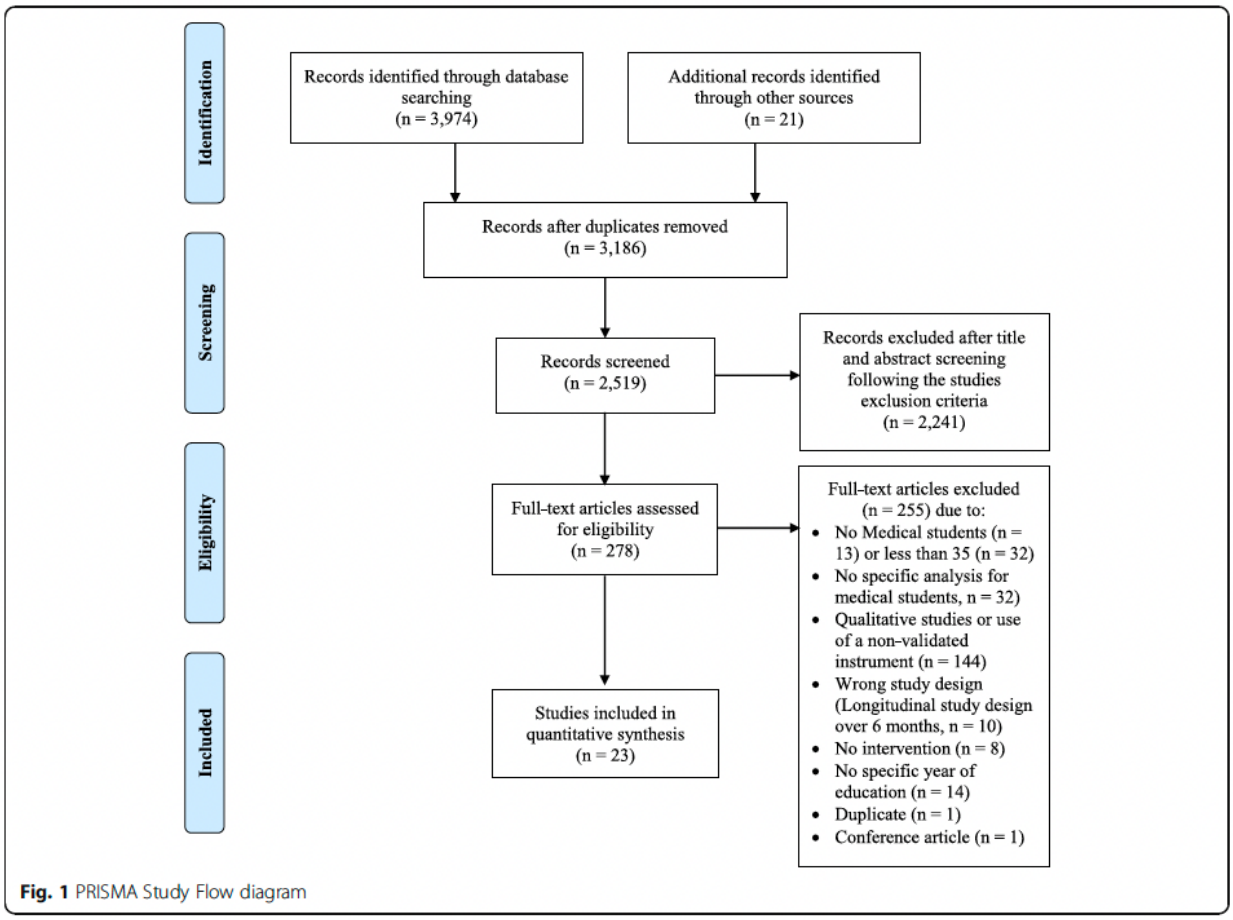

Fig. 1 PRISMA Study Flow diagram

disagreements were resolved by discussion of individual papers to find consensus. The study selection process is outlined in the PRISMA Flow Diagram – Fig. 1.

Data extraction and synthesis

The data extraction form was developed by two reviewers, informed by the form from Reeves et al. [9] but modified to include important aspects specific to this review, including ratio of study year to total duration of studies and classification of "early" or "late" depending if the IPE intervention occurred in the first or second half of medical studies. The reviewers extracted additional data regarding the context of study, recruitment, description of participants, study design, results and conclusions. The analysis of the risk of bias was performed independently, at a later stage. RG moderated in case of disagreement.

Upon completion of article extraction, data were analysed using the Statistical Package for the Social Sciences (SPSS). 23.0. (IBM Corp., Armonk NY, USA). We report descriptive statistics for quantitative data (median, IQR). Data extracted were synthesised in a narrative manner, using an integrative and aggregative approach [25].

Quality assessment and risk of bias

The quality of included studies was also evaluated by JBE and HC using a standardised critical appraisal tool, the McMaster Critical Review Form for Quantitative Studies [26]. If research articles met each criterion outlined in the appraisal guidelines, they received a score of "one" for that item, or, if they did not, a score of "zero". Item scores were then summed to provide a score of a maximum of 16, with 16 indicating excellent methodological rigour. The quality was defined as poor when the overall score was 8 or less, fair if 9–10, good if 11–12, very good if 13–14 and excellent if 15–16 [27]. This tool was chosen for this systematic review as it is published, freely available, has been used extensively, and can be applied to a range of research designs [28]. Differences in judgment were resolved through discussion.

Statistics

A meta-analysis for those studies using the Readiness of Interprofessional Learning Scale (RIPLS) [10, 29–33] was attempted with the R meta package [34], as this scale was most often used. Otherwise, descriptive analyses were conducted, including frequencies. Where applicable, scales were reversed by subtracting the mean from the maximum score for the scale to ensure a consistent direction of effects across studies. Weighted means of subscales were calculated for each study using the number of participants as weights. Pooling of estimates on the single-item level was not possible, as Sheu et al. [30] only reported on subscale level. Estimates of weighted means of subscales are reported with 95% confidence intervals (CIs). A random effects model was used with the inverse variance method for pooling of estimates across the remaining studies using RIPLS. Standard deviations of mean changes were not given and had to be calculated according to Cochrane's Handbook [35], which introduced further uncertainty by the need to choose a more or less random correlation coefficient for standard deviations.The meta-analysis was conducted using R 3.5.0 statistical package (R Foundation for Statistical Computing, Vienna, Austria) after related content was extracted and all remaining analyses were conducted by SPSS v.23 (IBM Corp. in Armonk, NY, USA).

Results

Trial flow

The literature search retrieved 3995 articles. After applying the inclusion and exclusion criteria and removing duplicates, 23 articles were included in the review [10, 29–33, 36–52] (see PRISMA Flow diagram, Fig. 1). All studies had a pre-test-post-test design. Basic characteristics of educational interventions are presented in Table 1. We present an overview of characteristics of the included studies in Table 2.

Participants

In total 5231 students, of which 62% (n = 3229) were medical students, experienced an IPE intervention. The median number of MS in the IPE interventions was 100 [35–464]. Nine studies (39%) reported data for first-year medical students [10, 29–31, 36–40], five (22%) for second-year students [41–45], six (26%) for third-year students [32, 46–50], two (9%) for fourth-year [33, 51] and one for sixth-year medical students [52]. No study reported interventions occurring in the fifth year. Most studies (65%) [10, 29–31, 36–41, 43–46, 48] were performed in the first half of the medical curriculum. Three studies [10, 45, 50] (13%) involved only medical students. In all the interventions across all the studies, the other professional groups in the IPE intervention included nursing, pharmacy, dental medicine, physical therapy, biomedical science, occupational therapy, physician's assistant, radiotherapy and dietetics students (Table 2).

Study designs and locations

The study design was mainly cross-sectional (n = 16). Only two studies (9%) were randomised [39, 40]. Most studies took place in the USA (n = 14) [30–32, 37, 38, 40–44, 47, 49–52] and in Europe (n = 5, Germany, Italy, Spain, Sweden and the United Kingdom) [36, 39, 45, 46, 48].

Table 1 Categorised description and characteristics of the 23 included studies (Findings of individual studies could belong to more than one category)

Category	n (%)
Study design	
cross-sectional	16 (64)
prospective cohort	2 (8)
quasi-experimental	4 (16)
randomised	2 (8)
mixed-methods	1 (4)
with pre-test-post-test assessment	23 (100)
Frequency of course	
single time activity	11 (47.8)
multiple times occurring during the year	2 (8.7)
annually	10 (43.5)
Duration of educational intervention	
< 6 h	9 (39.1)
> 6 h, < 1 week	2 (8.7)
1–8 weeks	7 (30.4)
over 8 weeks, up to one semester	5 (21.7)
Educational strategies (*n* = 44)	
small-group discussion	7 (15.9)
simulation	6 (13.6)
workshops	5 (11.4)
large-group lecture	4 (9.1)
community-based projects	4 (9.1)
reflective exercises	4 (9.1)
clinical teaching/direct patient interaction	3 (6.8)
patient case analysis	2 (4.5)
shadowing	2 (4.5)
eLearning	2 (4.5)
other (e.g., family visits, joint lab sessions)	5 (11.4)
Professions represented	
only medical students	3 (13)
*two**	12 (52.2)
*three**	4 (17.4)
*four professions or more**	4 (17.4)
Outcomes (*n* = 49)	
attitudes	38 (77.6)
satisfaction	8 (16.3)
skills	1 (2)
other	2 (4.1)
Assessment methods (n = 46)	
self-reported questionnaire *(attitudes/satisfaction)*	35 (76.1)
debriefs/interviews/focus groups	1 (2.2)
program feedback/evaluation	4 (8.7)
knowledge test	1 (2.2)
ratings for skill performance	2 (4.3)
other	3 (6.5)
Reliability reported	4 (12.8)
Validity reported	4 (12.8)

Interventions

Interventions varied in their type and topic. Most frequently, faculty chose IPE interventions on the topic of chronic care [e.g., Alzheimer's disease [42], end-of-life issues [49], geriatric care [44], long-term conditions [10, 33, 36, 41, 52] (*n* = 8)] or acute care (*n* = 4) [30, 32, 43, 51]. Other topics were communication (*n* = 2) [37, 46]; medication plans and errors (*n* = 3) [38, 44, 47] and teaching aimed at influencing interprofessional knowledge, attitudes and skills [29, 31, 39, 40, 45, 48, 53]. Duration of interventions varied from 25 min [50] to 6 months [37], and interprofessional group size ranged from 2 [42, 48] to 25 [49] students. The main educational strategies were small group discussions (*n* = 7) [30, 31, 36–38, 47, 48], simulations (*n* = 6) [32, 41, 43, 49–51] and workshops (*n* = 5) [38–40, 44, 47]. The majority of the reported interventions (48%, *n* = 11) were held a single time, and 39% (*n* = 9) lasted less than 6 h.

Assessment measures and outcomes

All studies reported learning outcomes. We could identify 49 different outcome measurements with 46 different assessment methods, but the majority (76%, *n* = 35) were questionnaires. The most frequent outcomes were attitudes towards IPE and/or other professions (78%, *n* = 38) and satisfaction (16%, *n* = 8). Eight studies (35%) used more than one validated instrument to evaluate the experience; four studies [30, 40, 42, 51] used two instruments, and the other four [32, 33, 39, 49] used three. The most commonly used method for assessing attitudes towards IPE was the RIPLS, used in six studies (26%) [10, 29–33], but a total of 22 different scales were used:

- Attitudes to Health Professionals Questionnaire (AHPQ) [36]
- Common Ground Instrument (CGI) [36]
- Scale of Attitudes toward Physician-Pharmacist Collaboration (SATP2C) [38, 40, 44]
- Sociocultural Attitudes in Medicine Inventory (SAMI) [30]
- Jefferson Scale of Empathy (JSE) [39, 40]
- Jefferson Scale of Attitudes toward Physician-Nurse Collaboration (JSAPNC) [39, 48, 49]

- Jefferson Scale of Physician Lifelong Learning (JeffSPLL) [39]
- Interprofessional Collaborative Competency Attainment Scale (ICCAS) [41]
- Attitudes Toward Collaboration Scale (ATCS) [42],
- Attitudes Toward Interdisciplinary Teams Scale (ATITS) [42]
- Interprofessional Educative Collaborative Competency Self-Assessment Instrument (IPEC CSI) [43]
- Interdisciplinary Education Perception Scale (IEPS) [45]
- University of the West of England Interprofessional Questionnaire (UWE-IP-D) [46]
- Attitudes Towards Health Care Teams Scale (ATHC TS) [33, 42, 47, 49]
- Self-Efficacy for Interprofessional Experimental Learning (SEIEL) [50]
- Teamwork Assessment Scale (TAS) [32]
- Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) Teamwork Attitude Questionnaire (T-TAQ) [32]
- Team Skills Scale (TSS) [33]
- Student Perceptions of Interprofessional Clinical Education (SPICE-R2) [51]
- Healthcare Stereotypes Scale (HSS) [51]
- Interprofessional Socialization and Valuing Scale (ISVS) [52]

Findings

Over half of the studies ($n = 13$) [29, 32, 33, 36–39, 41, 43, 45, 49, 51, 52] showed a significant increase in positive attitudes towards IP after the interventions. Nine studies (39%) showed no significant changes in medical students' attitudes towards IPE [30, 31, 40, 42, 44, 46–48, 50], while one demonstrated an increase in negative attitudes towards IPE after the intervention [10]. In years 1 and 2 IPE interventions appear longer in duration. Late IPE interventions show a trend to be longer and more statistically significant (Fig. 2). The sample size is too low for further comparisons.

Methodological rigour

There was 91% agreement (kappa = 0.772) between the reviewers on the scores elicited by the McMaster Critical Review Form for Quantitative Studies [26], which represents good inter-rater reliability [54]. Consensus was reached on the disagreements after discussion. Methodological rigour scores ranged from 7 to 15 out of a maximum of 16. An additional word file shows the scoring in more detail [see Additional file 2]. Most studies ($n = 18$) were rated as either "Good" [10, 31, 36–38, 44, 47, 49, 51, 52], "Very Good" [29, 30, 39, 41, 45, 48] or "Excellent" [33].

Meta-analysis

Initially we planned to undertake a meta-analysis of all studies included in the review. However, with such a broad range of instruments and therefore covering various different factors, it was not feasible. Instead, we performed the analysis with the RIPLS – as it was the most frequently used instrument –in the knowledge that this would only represent 26% of the articles in this review.

Due to the heterogeneity in the reporting of RIPLS results, a sound estimation of summary scores across studies was hampered. Whereas Darlow et al. [33] and Hudson et al. [10] used altered instruments with more than 19 items, Chua et al. [29], Paige et al. [32], Sheu et al. [30] and Sytsma et al. [31] used the original 19-item RIPLS. Nevertheless, in the article by Paige et al. [32], the item "*For small group learning to work, students need to trust and respect each other.*" is missing and the author did not respond to an email inquiring further information. Combined with extensive heterogeneity in reporting as well as statistically tested (Cochrane's $Q < 0.01$ for the meta-analysis of Chua et al. [29], Paige et al. [32], Sheu et al. [30] and Sytsma et al. [31] for the subscales team, identity and role (see supplemental digital file Additional file 3/Table 3: Original RIPLS scores for Chua et al., Paige et al., Systma et al. and Sheu et al., supplemental_material_IPE_RIPLS_original_data.xls) the combination of the single study data for a summary measure seems prone to error. Additionally, authors used means and standard deviations in the original articles, which are not the appropriate summary measures for Likert scaled items. As Sheu et al. [30] only reported the means and standard deviations of RIPLS-subscales, a merging of information for meta-analysis was only possible on that level and not on a single item level. Furthermore, the standard deviations for the mean changes (difference of scores pre-test-post-test) were not given and had to be estimated according to Cochrane's Handbook (16.1.3.2 Imputing standard deviations for changes from baseline), which introduced further uncertainty by the need to choose a rather random correlation coefficient of standard deviations (0.4 in our case). With regard to the pragmatic heterogeneity of interventions across studies, an ordinary pre-test-post-test score difference is a too simple way to capture the information created by the original studies. All in all, a meta-analysis could not be performed because of the high heterogeneity of the instruments used and the inconsistent data reporting.

Discussion

In this systematic review, we analysed IPE interventions based on 23 studies published between 2011 and 2019. Our findings show that medical students were exposed to IPE interventions at various points in their training, and we could establish evidence of effectiveness of IPE.

Table 2 Extraction grid for selected studies

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
Chua et al. [28]	pre-test-post-test	SGP	1/5 Early	Student Medical Education Conference 2013 (IPE components) with IP workshops and plenary sessions	Effectiveness of an IP conference in improving attitudes towards IPE	N/A	MS ($n = 281$; 79,8%) NS ($n = 71$;20, 2%) total $n = 352$	N/A	RIPLS $n = 1$	**Significantly increase** in post-test; pre-test M (SD) = 81.54(7.36) vs post-test M (SD) = 85.51(8.08); (***p < 0.001***) Students with previous IPE experience scored higher in the pre-test
Hawkes et al. [29]	pre-test-post-test	UK	1/5 Early	7-week IPE preparation of a care management plan	Assessment of 1st-year students' attitudes towards other HCP	7 weeks	MS ($n = 100$; 45,2%) PS ($n = 68$; 30, 8%) NS ($n = 53$; 24%) total $n = 221$	N/A	AHPQ $n = 1$	All professions saw a statistically **significant increase** (**p < 0.01**) in how '**caring**' they were perceived to be by all students after IPL
Hess et al. [30]	pre-test-post-test	USA	1/4 Early	Communication skills: asynchronous, online, self-directed learning modules, alternating with live small group session; Recording of SP	Effectiveness of a course in teaching patient-centred IP communication	4 × 20 hours in 6 months	MS ($n = 67$; 54%) PS ($n = 57$; 46%) total $n = 124$	6–7	CGI $n = 1$	Communication skill construct scores & global rating scores (pre-test M (SD) = 2.2(0.5); Median (IQR) = 2.0(2.0–2.5) vs post-test M (SD) = 4.1(0.6); Median (IQR) = 4.0(3.8–4.5) **significantly increased** for both (MS&PS) post-test compared to pre-test (***p < 0.01***) pre-test scores for rapport building higher for MS
Hudson et al. [11]	Cross-sectional pre-test-post-test	AUS	1/4 Early	Chronic care; ICE with local HCP teams	Exploration of changes in MS attitudes toward IPL & patient-centred care	3 weeks in total	MS ($n = 279$; 100%) total $n = 279$	N/A	RIPLS $n = 1$	post-test scores **significantly decreased**; negative attitudes towards IPE: teamwork and collaboration (M = 40.64, SEM = 0.21 vs M = 39.45, SEM = 0.25; p < 0.001); professional identity (M = 30.53, SEM = 0.21 vs M = 29.18, SEM = 0.23; $p < 0.001$); patient-centredness (M = 23.42, SEM = 0.11 vs M = 23.07, SEM = 0.13; $p < 0.01$)
Quesnelle et al. [31]	pre-test-post-test	USA	1/4 Early	Medication; Multi-institutional tele-health TBL event on pharmacogenomics; unique treatment plan for a patient	Assessment of a multi-institutional tele-health TBL activity	2 h (SS)	MS ($n = 67$; 74,4%) PS ($n = 23$; 25,6%) total $n = 90$	8	SATP2C $n = 1$	Post-test **significantly increased** Results for shift by category: Responsibility and Accountability M (SEM) = 0.21(+/−.06), p < 0.005; Shared Authority M (SEM) = 0.08(+/−.06), $p < 0.005$; Interprofessional Education M (SEM) = 0.14(+/.05), $p < 0.05$;

Table 2 Extraction grid for selected studies *(Continued)*

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
										Pharmacogenomics Confidence M (SEM) = 0.56(+/−.09), $p < 0.005$
Sheu et al. [32]	prospective cohort study, pre-test-post-test	USA	1/4 Early	Student-Run Clinic, including preparatory didactic sessions on health disparities & cultural competencies appropriate to the target population & work in the clinic	Analyse the impact of student-run clinic on students	Variable	MS ($n = 93$; 51,1%) NS ($n = 31$; 17%) PS ($n = 58$; 31, 9%) total $n = 182$	N/A	SAMI RIPLS $n = 2$	**No changes for MS but previous high positive attitudes** RIPLS M (SD) pre vs post by subscales: Team: 4.49 (0.44) vs 4.32 (0.44); Identity: 4.31(0.51) vs 4.04(0.56); Role: 2.71(0.61) vs 2.85(0.68) SAMI M (SD) pre vs post: Exposure 4.02 (.58) vs 4.03 (.58); Perception 3.76(.70) vs 3.83(.67)
Sytsma et al. [33]	quasi-experimental pre-test-post-test	USA	1/4 Early	mono and IP teams interventions: 1. Social event, 2. Peer-teaching in Anatomy dissection lab, and 3. Collaborative clinical problem-solving sessions	Describe an IPE experience in gross anatomy and report its lasting impact	7 weeks	MS ($n = 35$; 66%) PT ($n = 18$; 34%) total $n = 53$	8–12	RIPLS $n = 1$	Overall, students showed **positive attitudes towards IPE, no significant changes** in the post-test; pre vs post total M (SD): 81.54(7.36) vs 85.51(8.08);
Tuirán-Gutiérrez et al. [34]	experimental randomised pre-test-post-test	SP	1/7 Early	Experimental group received IP training in collaborative work (control group received training on drug addiction prevention)	Are there role differences in early IP training? Does IP training improve attitudes towards IPE?	18 × 2 hours over 4 months	MS ($n = 84$; 48,6%) NS ($n = 89$; 51,4%) total $n = 173$	N/A	JSE JSAPNC JeffSPLL $n = 3$	Post-test scores for MS in the IPE group remained stable Pre-vs post M (SD) JSAPNC: 48(6) vs 48(7); JSE-S: 104(12) vs 100(14) JeffSPLL-MS: 46(4) vs 46(6) **significant deterioration in the control group** in the development of collaborative work skills, pre vs post control group: M (SD) = 47(6) vs 44(7) $p < 0.01$
Van Winkle et al. [35]	randomized, prospective cohort study pre-test-post-test	USA	1/4 Early	IP Workshop: Session 1: Management of 2 cases Session 2: individual reflection exercise	Measure changes in collaboration scores after an IP workshop	2 × 50 min (2–7 days)	PS ($n = 215$; 42,8%) MS ($n = 205$; 40,8%) BM ($n = 82$; 16,3%) total $n = 502$	6	SATP2C Modified JSE $n = 2$	High baseline commitment scores did not change for MS: SATP2C max 65: pre M = 54; education component increased significantly after IPE for 82% of MS ($p = 0.015$), the increase in scores for the other 2 factors (13 items) was not significant ($p = 0.76$) modified JSE correlated positively (Pearson correlation coefficient (r) values was 0.38 (p,0.0001)
Haber	pre-test-post-	USA	2/4	IP simulation: SP for	Effectiveness of an IP	1 h (SS)	MS ($n = 310$;	8	ICCAS	Significant change ($p < 0.001$)

Table 2 Extraction grid for selected studies *(Continued)*

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
et al. [36]	test		Early	physical examination providing patient-centred care of an older adult with dia betes and periodontal disease	clinical simulation and case study experience		50,2%) NS ($n = 150$; 24,3%) DS ($n = 158$; 25,6%) total $n = 618$		$n = 1$	in ICCAS and each of the 6 IP-competency domains ($p < 0.0001$) pre vs post M 4.63 vs 5.3/5.4 MS had lower mean post-test scores compared to other students
McCaffrey et al. [37]	interventional study, pre-test-post-test	USA	2/3,5 Late	IP team approach: diagnosis and treatment of dementia with (1) informative session and (2) participation in five clinical exercises	Enhanced competency in Alzheimer's & IP approach to roles of care	15 weeks	MS ($n = 74$; 61,7%) NS ($n = 46$; 38,3%) total $n = 120$	2	ATITS ATCS $n = 2$	MS with higher initial scores on knowledge test; **significant increase** in positive attitudes toward patients, disease and opinion post-test in the intervention group compared to control group ($p = 0.02$); attitudes towards IPE remains stable
Pinto et al. [38]	pre-test-post-test	USA	2/4 Early	Simulation (stroke, assessing the patient & developing a care plan, followed by debriefing)	Examination of an IP stroke simulation with SP on student IP growth	50 min	MS ($n = 70$; 37,2%) PA ($n = 12$; 6,4%) NS (=44; 23, 4%) PT ($n = 28$;14, 9%) OT ($n = 34$; 18, 1%) total $n = 188$	5	IPEC $n = 1$	MS with **significant increase** in "values" and "interaction" post-test: IPEC: Values Domain: Mean Diff 0.79; 95% CI 0.13–1.45; *p*-Value 0.0205; Interactions Domain: Mean Diff: 1.91; 95% CI 1.07–2.76; p-value < 0.0001
Shrader et al. [39]	randomized pre-test-post-test	USA	2/4 Early	MUSC Senior Mentor Program: in-home interview, medication history, identification of medication-related issues & group discussions	Impact of a geriatric medication activity on student's attitudes towards IPE and determination of student satisfaction	12 h/ Semester	MS (n = 101; 64,7%) PS ($n = 55$; 35, 3%) total $n = 156$	3	SATP2C $n = 1$	Post: two items significant increased, one item significant decrease in attitudes for MS
Zanotti et al. [40]	pre-test-post-test	IT	2/6 Early	Interactions with HCP with (1) on-site observation and (2) review of experience in IP activities	Improved attitudes towards IP teamwork in MS after a new program	50 h over 1–2 weeks	MS ($n = 277$; 100%) total $n = 277$	N/A	IEPS CSI $n = 1$	**Significant improvements** after IPE training in 3 items (mem) and all item (women) M (SD) pre vs post: Competency & Autonomy 29.23 (3.51) vs 31.17 (3.58); ***p < 0.001***; Perceived need for cooperation 8.52 (1.21) vs 8.89 (1.12); **$p < 0.001$**; Perception of actual cooperation 17.67 (2.92) vs 19.43 (2.90); **$p < 0.001$**; Understanding others' values 9.99 (1.62) vs10.30

Table 2 Extraction grid for selected studies *(Continued)*

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
										(1.65); ***p* = 0.005** (only for women significant)
Berger et al. [41]	intervention, comparison group, pre-test-post-test	GER	3/6 Early	team communication seminar (eMonoprofessional MP (MS) compared with IP small groups)	Develop, "pilot" and evaluate a seminar on team communication	3½ hours (SS)	MS (*n* = 145; 87,9%) NS (*n* = 20; 12, 1%) total *n* = 165	10–12	UWE-IP-D *n* = 1	**Significant positive changes** Communication and Teamwork Scale (Pre: M (IP) = 18.5;M (MP) = 18.0; *p* = 0.82) and post both showed significant (p < 0.01) positive changes (Post: M (IP) = 17.2, M (MP) = 17.4); Interprofessional Learning Scale IP group more positive baseline mean score (Pre: M (IP) = 20.6, M (MP) = 25.8; *p* < 0.01). both groups showed significant (*p* < 0.01) positive changes (Post: M (IP) = 19.1, M (MP) = 23.3)
Bridgeman et al. [42]	pre-test-post-test	USA	3/4 Late	IPE workshop "medication errors prevention"	Expose learners to IPE competencies and compare pre- to post workshop changes	3 h (SS)	MS (*n* = 43; 21,4%) PS (*n* = 140; 69,7%) PA (*n* = 18; 8, 9%) total *n* = 201	5	ATHCTS *n* = 1	Attitudes improved after IPE, although MS attitudes improved only for team values (subscale 1): Subscale 1 pre % max core vs post % max score 73.0 ± 12.8 vs 76.9 ± 15.8 95% CI − 3.93 (− 6.59, − 1.27), *p* = 0.005; subscale 2 pre % max core vs post % max score 73.3 ± 13.7 vs 75.0 ± 17.2; 95 CI − 1.67 (− 4.74, 1.39); *p*-value n.s.; subscale 3 pre % max core vs post % max score 42.6 ± 17.0 vs 46.4 ± 12.5; 95% CI − 3.84 (− 8.43, 0.75); p-value n.s.
Friman et al. [43]	Mixed-methods exploratory, pre-test-post-test	SWE	3/6 Early	IPE workshop skill stations (Doppler assessment & compression therapy) + 1 case-based reflection on professional identity	Influence of a shared learning activity on attitudes towards IPE	3 h (SS)	MS (*n* = 101; 45,7%) NS (*n* = 120; 54,3%) total *n* = 221	2	JSAPNC *n* = 1	No differences in the MS group over time but initial high scores: pre vs post sum score means (max 60): 51.76 vs 51.76
Erickson et al. [44]	pre-test-post-test	USA	3/4 Late	IPE workshop "Difficult Discussions" (EOL care & communication, simulation)	Reports outcomes after IPE workshop	1½ hours (SS)	MS (*n* = 71; 53%) NS (*n* = 63; 47%) total *n* = 134	25	JSAPNC ATHCTS SEIEL *n* = 3	MS had higher scores post IPE in the ATHCT post-intervention (Mean (SD) 2.1 (6.1); *p* = .004 and "Quality Process in Teams" Mean (SD) 2.2 (5.6) *p* = .001, no change on the total scale
Oza et al. [45]	Cross-sectional observational	USA	3/4 Late	OSCE: Interprofessional case	Relationship between attitudes towards IPE	25 min	MS (*n* = 464; 100%)	N/A	SEIEL *n* = 1	Students' self-efficacy for IP was associated with IP collaborative

Table 2 Extraction grid for selected studies *(Continued)*

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
	pre-test-post-test				& (1) self-efficacy, (2) prior extracurricular IP, (3) previous IPE		total *n* = 464			practice, self-efficacy for feedback and evaluation were not; Mean SEIEL scores were high. For factor 1, interprofessional teamwork, M (SD) 7.9 (1.3, range 2.0–10.0) and for factor 2, interprofessional feedback and evaluation 7.1 (1.5, range 1.3–10.0).
Paige et al. [46]	quasi-experimental pre-test-post-test	USA	3/4 Late	Acute care; Simulation (dual major trauma scenarios with immediate structured debriefing)	Does IP SBT change behaviour over the course & is it as effective as team training?	2 h (SS)	MS (*n* = 118; 47,8%), NS (*n* = 129; 52, 2%) total *n* = 247	3–8	TAS RIPLS T-TAQ *n* = 3	**Statistically significant improvement** in 10 of 19 RIPLS items, particularly in teamwork and team-based skills, T-TAQ: statistically significant improvements in the team structure subscale
Darlow et al. [47]	prospective controlled trial, pre-test-post-test	NZ	4/6 Late	Chronic care, IP workshops: people with LTC, e-learning platform, visits to a patient in the com munity, peer-presentation, group discussion	Evaluate if an IPE programme for managing people with LTC changes students' attitudes to IP teams	11 h over 4 weeks	MS (*n* = 36; 43,4%), PT (*n* = 12; 14,5%) RT (*n* = 26; 31,3%) DiS (n = 9; 10,8%) total *n* = 83	3	ATHCTS RIPLS TSS *n* = 3	Mean post-intervention attitude scores were **significantly higher in the intervention group** than the control group for all scales. The mean difference for the ATHCTS was 0.17 (95%CI 0.05 to 0.30; $p = 0.006$); RIPLS was 0.30 (95%CI 0.16 to 0.43; $p < 0.001$), TSS was 0.71 (95%CI 0.49 to 0.92; $p < 0.001$)
Lockeman et al. [48]	quasi-experimental pre-test-post-test	USA	4/4 Late	Acute care, simulation: collaboration around acutely ill patients (ACLS algorithms)	Can a series of IP SBT promote changes in attitudes & stereotypes of HCP students	3x2hours over 2 weeks	MS (*n* = 163; 51,1%), NS (*n* = 156; 48,9%) total *n* = 319	6–7	SPICE-R2 HSS *n* = 2	No changes in HSS for MS **Statistically significant increase** in SPICE-R2 ratings from pre- to posttest: SPICE-R2 total scale pre M (SD) vs post M (SD) 4.23(0.47) vs 4.56(0.42), $p < 0.001$; Teamwork subscale pre vs post 4.18(0.52) vs 4.55(0.46), $p < 0.001$; Roles/Responsibilities subscale 4.00(0.58) vs 4.41(0.50), $p < 0.001$; Patient Outcomes subscale 4.52(0.48) vs 4.71(0.41), $p < 0.001$;
Seaman et al. [49]	descriptive matched before-after study, pre-test-post-test	AUS	6/6 Late	Ambulatory clinical placement, two of four clinical outpatient areas, in IP pairs, interact with HCP supporting the care of patients with chronic illnesses in	Examine students' beliefs, behaviours and attitudes in relation to IP socialisation in ambulatory care	2 weeks	MS (*n* = 45; 72,6%) NS (*n* = 17; 27,4%) total *n* = 62	2	ISVS *n* = 1	Significant increase of ISVS score in posttest with a mean improvement of 6.76 for the overall ISVS score ($p < 0.001$)

Table 2 Extraction grid for selected studies *(Continued)*

Study	Design	Country	Year*	Educational intervention	Research objectives	Duration	Type & number of students	Group size	Name & number of outcomes	Results
				hospital outpatient clinics and during home visits						

*ratio of study year to total duration of studies and classification of "Early" or "Late" depending if the IPE intervention occurred in the first or second half of medical studies
Abbreviations: countries: *SGP* Singapore, *UK* United Kingdom, *USA* United States of America, *AUS* Australia, *SP* Spain, *IT* Italy, *GER* Germany, *SWE* Sweden, *NZ* New Zealand; interventions: *IPE* interprofessional education, *IP* interprofessional, *IPL* interprofessional learning, *MP* monoprofessional; *TBL* team-based learning =, *HCP* health care professional, *SP* standardised patient, *ICE* interdisciplinary clinical experience, *SBT* simulation-based training, *OSCE* objective structured clinical examination, *ACLS* advanced cardiac life support, *LTC* long-term conditions, *EOL* end-of-life; students: *MS* medical, *NS* nursing, *PS* pharmacy, *PT* physical therapy, *BM* biomedical science, *DS* dental medicine, *RT* radiation therapy, *DiS* dietetics, *PA* physician's assistant, *OT* occupational therapy; instruments: *RIPLS* Readiness for Interprofessional Learning Scale, *AHPQ* Attitudes to Health Professionals Questionnaire, *CGI* Common Ground Instrument, *SATP2C* Scale of Attitudes toward Physician-Pharmacist Collaboration, *SAMI* Sociocultural Attitudes in Medicine Inventory, *JSE* Jefferson Scale of Empathy, *JSAPNC* Jefferson Scale of Attitudes toward Physician-Nurse Collaboration, *JeffSPLL* Jefferson Scale of Physician Lifelong Learning, *ICCAS* Interprofessional Collaborative Competency Attainment Scale, *ATCS* Attitudes Towards Collaboration Scale, *ATITS* Attitudes Toward Interdisciplinary Teams Scale, *IPEC CSI* Interprofessional Education Collaborative IPEC Competency Self-assessment Instrument, *IEPS* Interdisciplinary Education Perception Scale, *UWE-IP-D* University of the West of England Interprofessional Questionnaire (German Version), *ATHCTS* Attitudes Towards Health Care Teams Scale, *SEIEL* Self-Efficacy for Interprofessional Experimental Learning, *TAS* Teamwork Assessment Scale, *T-TAQ* Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) Teamwork Attitude Questionnaire, *TSS* Team Skills Scale, *SPICE-R2* Student Perceptions of Interprofessional Clinical Education, *HSS* Healthcare Stereotypes Scale, *ISVS* Interprofessional Socialization and Valuing Scale; results: *M* Mean, *SD* Standard deviation, *vs* versus, *SEM* standard error of the mean, *IQR* interquartile range, *p* *p*-value, 95%; *CI* confidence intervall

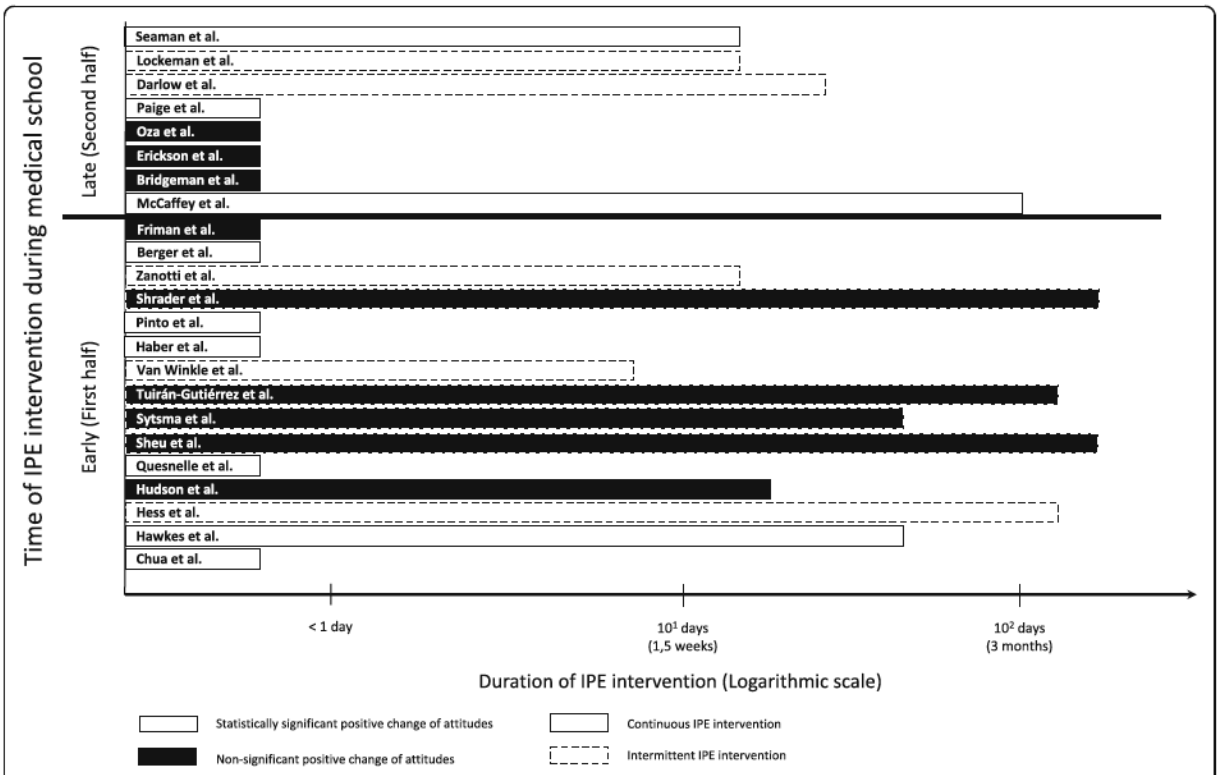

Fig. 2 Bar chart: Outcome and duration of IPE interventions in selected articles, according to early (first half) or late (second half) time of medical school. White bars: statistically significant positive change of attitudes; Grey bars: Non-significant positive change of attitudes; full line: continuous IPE intervention; dotted line: intermittent IPE intervention

Three studies involved only medical students and therefore did not meet the WHO definition of IPE. However, they reported on interprofessional interventions and therefore were not excluded from this systematic review.

All years except the fifth study year were represented, so no preference for pre-clinical or clinical years could be observed. However, studies in the first four years of medical education were more frequent. This may reflect variation in the length of pre-registration medical education programmes worldwide. In the USA, medical school consists mainly of 4 years of training (generally preceded by a 3–4-year Bachelor's degree), while in Europe it averages 6 years (without a preceding program) [55].

In Europe, most medical university programmes are public, and rather larger cohorts of students are educated (e.g., Germany has 36 public and only two private medical schools, and almost 10,000 new medical students per educational year, leading to an average class size of over 260 students) [56], while in the USA (141 fully-accredited medical schools), more than one third are private ($n = 56$) and class size is much smaller, with an average of 146 students per educational year [56, 57]. This may also explain the higher frequency of studies from the USA, as implementing IPE elements could be more feasible with smaller classes, and private medical schools may suffer more pressure to evaluate their programmes.

The optimal timing to introduce IPE is still subject to debate [10]. In clinical years it may seem reasonable, as it contributes to optimal development of students' professional identities and gives them experience in working collaboratively with students in different health professions [11]. However, the introduction of IPE so late in the medical curriculum may be complicated by the students' focus on profession-specific clinical practice [10]. On the other hand, introducing IPE early in pre-registration healthcare courses may be useful in breaking down negative attitudes and avoiding stereotypes [58–60].

From our analysis we could not determine the best time to introduce IPE, as both pre-clinical and clinical IPE interventions showed some degree of success. It appears that late IPE interventions show a trend to be longer and more statistically significant. It seems reasonable to conclude that interventions should be introduced in the early years and continue throughout the curriculum. More well-designed studies are needed to address this gap in knowledge.

Published IPE interventions had a pre-test-post-test design and most studies were cross-sectional. Interventions varied in their type and topic, group sizes were small and most activities were only performed once. There was also a paucity of studies reporting medium and long-term outcomes. Most studies (78%) were of good or very good quality, although a small proportion still scored poorly. This is consistent with previous reviews [4, 6, 15, 18]. This trend limits the development of strategies for targeting long-term behaviour changes and potential to positively impact patient outcomes. Longer interventions and longitudinal follow-up of learning outcomes are key to identifying robust outcomes that lead to changes in practice. An increasing number of studies now report mid- and long-term outcomes, but – as we can see from our own sample – these are still a minority. More studies are needed in models for pre-licensure IPE interventions (including adequate evaluation of their effectiveness), particularly regarding long-term outcomes [9, 31, 61]. In situations where prolonged IPE training is not feasible due to organizational limitations, intermittent interventions may be a good strategy [47]. The heterogeneity of most outcome measures may also limit the ability to draw conclusions about best practices and has, in our case, prevented the accomplishment of a meta-analysis.

Studies were most frequently assessed with RIPLS. The Readiness for Interprofessional Learning Scale, developed in 1999, was among the first scales developed for measurement of attitudes towards interprofessional learning [62]. It has been translated and acculturated into several languages [63]. The scale is very popular, but it has not been updated, it fails to embody all the dimensions of the Core Competencies for Interprofessional Collaborative Practice [2], and its conceptual framework has recently been questioned [63]. Additionally, concerns about its low internal consistency at item level and subscale results – raised by the RIPLS authors themselves – perpetuate the debate of what exactly the RIPLS is measuring [64] and there have even been past recommendations to abandon the scale altogether [23, 65]. Finally, some newer scales, more aligned with the IPEC dimensions, have also been successfully tested and acculturated [66, 67]. While educators, curriculum planners and policy makers continue to struggle to identify methods of interprofessional education that lead to better practice [9], clearer measures of interprofessional competency are needed to assess the outcomes from health professional degree programs and to determine what approaches to interprofessional education benefit patients and communities.

The results from this review and from individual studies should be interpreted with caution: students' educational backgrounds, as well as attitudes, expectations and stereotypes, may vary considerably between institutions and countries and may influence how the IPE interventions are experienced. This probably accounts for many differences in effectiveness of IPE activities in different settings [15]. Additionally, a few studies described a "package" of interprofessional activities, and medical curricula differ significantly, which may introduce more bias. University IPE programmes should agree on a comparable methodology that aligns with research in IPE (e.g., larger cohorts, multi-centre studies) and should focus on fewer instruments to measure IPE, adequately assessed for validity, responsiveness, reliability, and interpretability [45].

There is a broad variation in the length of the medical curriculum between continents and countries. Most of the studies didn't explain their specific curriculum to the reader. For many articles, we were not able to determine the total length of purported medical studies and therefore determine whether the IPE intervention took place in the final year, which would have been relevant to this literature review. To bridge this gap in knowledge we propose that future research should briefly describe their specific medical curriculum.

Our methodology also has limitations. We decided a priori to include only papers with a at least 35 medical students. The reason was to have sufficiently powered studies in the sample. However, this may have led to some selection bias, or left out potentially relevant interventions. Because we were interested in IPE effects on medical students, we also excluded all studies that did not report specific results for medical students. This limited the number of positive studies available. Similar to other systematic reviews, our work aimed to exclude all "lower quality" studies (i.e., non-randomised, non-experimental, qualitative studies) [9, 16, 20]. Reflecting on our methods, we question whether they are adequate for social or educational research, as there are repeated appeals for more qualitative reviews in IPE [61].

Unfortunately, there were also several issues that made a meta-analysis impossible. First, as RIPLS uses a Likert scale (therefore, an ordinal scale), central tendency statements should be calculated with the median value. However, most studies in this sample chose to report the mean. This is acceptable if one assumes equal distances between items, but it is very unrealistic. Additionally, students responding to pre- and post-intervention questionnaires were pooled cohorts, and items differed in wording (questionnaires were slightly modified). In given studies, some items were not reported. In other studies, items were sometimes scored reversely (negative attitudes), and some studies did not report the change in score which is the outcome of interest for the meta-analysis.

Conclusions

This systematic review showed some evidence of a post-intervention change of attitudes towards IPE across different medical years studied. IPE was successfully introduced both in pre-clinical and clinical years of the medical curriculum. However, we found great variability in the scales chosen to evaluate changes in knowledge, behaviours and attitudes linked with participation in IPE. There was a paucity of studies reporting medium and long-term outcomes. The heterogeneity of results prevents further comparisons or the performance of a rigorous meta-analysis.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12909-020-02176-4.

Additional file 1. Literature research for Review about interprofessional education for medical students. Detailed description of the search, including extracted hits, stratified by database.

Additional file 2. Methodological rigour assessment of the included studies using the modified McMaster Critical Review Form for Quantitative Studies.

Additional file 3. Table 3: Original RIPLS scores for Chua et al., Paige et al., Systma et al. and Sheu et al.

Abbreviations

AHPQ: Attitudes to Health Professionals Questionnaire; ATCS: Attitudes Toward Collaboration Scale; ATHCTS: Attitudes Towards Health Care Teams Scale; ATITS: Attitudes Toward Interdisciplinary Teams Scale; CGI: Common Ground Instrument; HSS: Healthcare Stereotypes Scale; ICCAS: Interprofessional Collaborative Competency Attainment Scale; IEPS: Interdisciplinary Education Perception Scale; IPE: Interprofessional Education; IPEC: Interprofessional Education Collaborative; IPECSI: Interprofessional Educative Collaborative Competency Self-Assessment Instrument; ISVS: Interprofessional Socialization and Valuing Scale; JeffSPLL: Jefferson Scale of Physician Lifelong Learning; JSAPNC: Jefferson Scale of Attitudes toward Physician-Nurse Collaboration; JSE: Jefferson Scale of Empathy; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses; PROSPERO: International prospective register of systematic reviews; RIPLS: Readiness for Interprofessional Learning Scale; SAMI: Sociocultural Attitudes in Medicine Inventory; SATP2C: Scale of Attitudes toward Physician-Pharmacist Collaboration; SEIEL: Self-Efficacy for Interprofessional Experimental Learning; SPICE-R2: Student Perceptions of Interprofessional Clinical Education; TAS: Teamwork Assessment Scale; TSS: Team Skills Scale; T-TAQ: Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) Teamwork Attitude Questionnaire; UWE-IP-D: University of the West of England Interprofessional Questionnaire

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Authors' contributions

JBE, AF and RG contributed to study design and analysed all the articles. MH conducted the literature search and performed the meta-analysis. HC and JBE performed the article quality analysis. All authors contributed to the interpretation of the results. All authors contributed important intellectual content to the paper and approved the final version.

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Publisher's Note

Aim 2: To validate an Interprofessional Attitudes Scale into the German language

9. Validation of an Interprofessional Attitudes Scale in the German language

Pedersen TH, Cignacco E, Meuli J, Habermann F, **Berger-Estilita J**, Greif R. The German interprofessional attitudes scale: translation, cultural adaptation, and validation. GMS J Med Educ. 2020 Apr 15;37(3):Doc32. doi: 10.3205/zma001325.

This paper describes the translation, cultural adaptation and validation of the original American Interprofessional Attitudes Scale (IPAS) into German, therefore addressing **Aim 2** of this thesis. The main rationale for this validation was the implementation of obstetric hybrid-simulation and interprofessional collaboration between midwives and anaesthetists in labor emergencies at the Bern Simulation and CPR Centre of the Bern University Hospital.

The evaluation instrument is validated according to good scientific practice and the procedure is presented very clearly and comprehensibly.

As previously discussed, there are only a limited number of tools for assessing IPE outcomes (Thannhauser et al., 2010). The Readiness for Interprofessional Learning Scale (RIPLS)(Parsell & Bligh, 1999) and the extended RIPLS(Reid et al., 2006) are popular tools that assess interprofessional attitudes and have, therefore, been translated in several languages (Cloutier et al., 2015; Mahler et al., 2014; Norgaard et al., 2016; Tamura et al., 2012). However, these scales were developed before the 2011 *Core Competencies for Interprofessional Collaborative Practice (IPEC)* report(IPEC, 2011) and fail to embody all four recommended interprofessional core competency domains. This limitation has been overcome by the Interprofessional Attitudes Scale (IPAS)(Norris et al., 2015), that uses items derived from the extended RIPLS and new items to cover all four IPEC report competency domains. The IPAS has 27 survey questions that load into 5 subscales: 1) teamwork, roles and responsibilities; 2) patient-centeredness; 3) interprofessional bias; 4) diversity and ethics and 5) community-centeredness.

In the beginning of the project, a German version of the IPAS was needed, to be used for the education of healthcare students. Other considered aspects for validating the scale included the possibility for international research opportunities and collaborations, to corroborate further knowledge acquired in IPE.

We, therefore, set to translate and acculturate the English IPAS into the German language and perform psychometrical analysis to have a validated tool for the assessment of interprofessional attitudes in our students. From a methodological aspect, we followed the five steps recommended by the International Society of Pharmaeconomics and Outcome Research (ISPOR)(Wild et al., 2005) for the translation and the cultural adaptation of scales:

1) Translation of the English IPAS into German

2) Cognitive interviews to rephrase or delete items in the German version, if they were not comprehensible or relevant to potential users.

3) Validity, established by the Content Validity Index (CVI)

4) Exploratory factor analysis (EFA) to uncover the underlying structure of items and create meaningful subscales

5) Cronbach's alpha calculation for single items, subscales, and the whole scale to assess internal consistency

The translated G-IPAS (Appendix A) showed good reliability and replicated the factor structure of the original version of the IPAS to be used in German-speaking countries. Furthermore, the G-IPAS showed similar internal consistency when compared to the original version (Norris et al., 2015). Although the factor structure was replicated, high correlation between individual items was found, indicating that these items may not represent different dimensions. This validation process led to the deletion of the subscale *"Interprofessional Bias"* and re-distribution of items from subscale *"Diversity and Ethics"* to the remaining three subscales: *"Teamwork, Roles and Responsibilities", "Patient-centeredness"* and the renamed subscale *"Health Care Provision"*. The cultural adaptation was important to sharpen the wording for a more precise German understanding and to shorten wording of some questions, since an average German text is approximately one-third longer than the same in English.

At the end of this work, we could conclude that the G-IPAS was a reliable instrument, representative of the item dimension of the original IPAS and a validated tool for the assessment of interprofessional attitudes in German-speaking countries.

This paper added original and relevant content to the limited number of available tools to measure interprofessional attitudes in German-speaking countries.

Interprofessional Education OPEN ACCESS This is the English version. The German version starts at p. 10. article

The German interprofessional attitudes scale: translation, cultural adaptation, and validation

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Abstract

Objectives: The implementation of obstetric hybrid simulation and interprofessional collaboration between midwives and anesthetists in labor emergencies fostered the need to evaluate the impact of such a program. The original Interprofessional Attitude Scale (IPAS) assesses interprofessional attitudes among health professional students and includes the 2011 and 2016 Interprofessional Collaborative Practice report competency domains. The purpose of this study was to create a German version of the IPAS (G-IPAS) to use for the education of healthcare students.

Methods: We performed the translation and validation of the IPAS in five steps:

1. translation to German according to the International Society of Pharmaeconomics and Outcome Research guidelines;
2. nine cognitive interviews with healthcare professionals and students;
3. calculation of the Content Validity Index (CVI) by expert opinion;
4. exploratory factor analysis (EFA); and
5. internal consistency by Cronbach's alpha.

All study participants gave written informed consent and the cantonal ethics committee waived further ethical approval.

Results: The cognitive interviews led to replacement of single-item wording. We retained 27 items for CVI analysis. The averaged overall CVI was 0.79, with 15 items ≥0.89. 185 students (70 medicine, 51 nursing, 48 physiotherapy, and 16 midwifery) contributed with data for the EFA and it produced three subscales. *"Teamwork, roles, and responsibilities"* with factor loadings ≥0.49, *"Patient-centeredness"* with factor loadings ≥0.31, and *"Community-centeredness"* with factor loadings ≥0.57. Two items of the total scale were deleted, and four items were redistributed to another subscale. Cronbach's alpha for the overall G-IPAS scale was 0.87. After deleting and redistributing items in subscales, a new Scale-CVI/Average was calculated and was 0.82.

Conclusions: Based on a rigorous validation process, the G-IPAS provides a reliable tool to assess attitudes towards interprofessional education among different healthcare professions in German-speaking countries.

Keywords: interprofessional attitudes, assessment, psychometric testing, transcultural translation

Introduction

Interprofessional collaborative practice has become a landmark to address complex healthcare issues. Evidence indicates that skillful interprofessional education (IPE) fosters effective collaborative practice [1]. According to World Health Organization, IPE occurs when "students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes" [2]. The Interprofessional Education Collaborative Expert Panel (IPEC) reported that safe, high-quality, accessible, patient-centered care requires continuous development of interprofessional competencies by students of different health professions as part of their learning process to enter workforce with skills for effective teamwork and team-based care [3].

The implementation of obstetric hybrid simulation and interprofessional collaboration between midwives and anesthetists in labor emergencies at Bern University Hospital, Switzerland fostered the need to evaluate the impact of such a program. Obstetric hybrid-simulation embraces actresses playing pregnant women giving birth, to provide a "close-to-real-life" learning situation. Participants practice interprofessional competence, partly under stress, without risk for the laboring woman and newborn. During video-assisted debriefing, participants

share their experiences and hereby learn about each other's professions, responsibilities, perspectives, and attitudes.

Until recently, a paucity of conceptual frameworks and tools existed for assessing IPE outcomes [4]. The Readiness for Interprofessional Learning Scale (RIPLS) [5] and the extended RIPLS [6] are established tools assessing interprofessional (IP) attitudes with translations in several languages [7], [8], [9], [10] applied in different cultural contexts. For the German speaking countries exists a German version of the University of the West of England Interprofessional Questionnaire (UWE-IP) [11]. These scales were developed before the 2011 *Core Competencies for Interprofessional Collaborative Practice (IPEC)* report and fail to embody all four recommended IP core-competency domains: values/ethics for IP-practice; roles/responsibilities; IP-communication; and teams/teamwork [3]. A new scale was developed and validated in 2015, the Interprofessional Attitudes Scale (IPAS) [12], using items from the extended RIPLS and new items to cover all four IPEC-report competency domains. The updated IPEC report on *Core Competencies for Interprofessional Collaborative Practice* from 2016 does still have the same four core competencies [13].

The IPAS has 27 survey-questions that load into 5 subscales:

1. teamwork, roles, and responsibilities (TRR);
2. patient-centeredness (PC);
3. interprofessional bias (IB);
4. diversity and ethics (DE) and
5. community-centeredness (CC) [12].

Currently, no German version of the IPAS exists. Using the same tool in different countries may provide opportunities for international research in order to corroborate further knowledge acquired in IPE [14]. The purpose of this study was to translate the English IPAS into German and perform psychometrical analysis to have a validated tool for the assessment of interprofessional attitudes.

Methods

To establish a German IPAS (G-IPAS) we looked to the principles recommended by the International Society of Pharmaeconomics and Outcome Research (ISPOR) [15] for the translation and the cultural adaptation (see figure 1):

1. Translation of the English IPAS into German,
2. Cognitive interviews to rephrase or delete items in the German version, if they were not comprehensible or relevant to potential users,
3. Validity established by the Content Validity Index (CVI),
4. Exploratory factor analysis (EFA) to uncover the underlying structure of items and create meaningful subscales, and
5. Cronbach's alpha calculation for single items, subscales, and the whole scale to assess internal consistency

Because validation is not part of the ISPOR guidelines, we added a validity analysis between stage I and J: this included a content validity analysis using the Content Validity Index (CVI); an exploratory factor analysis to uncover the underlying structure of the items and create meaningful subscales, and we calculated Cronbach's alpha for assessment of internal consistency.

Step 1: Translation of the original IPAS

After obtaining permission from the authors, the English IPAS was translated and harmonized by five native German speakers from Germany, Switzerland, and Austria with health care background [12]. The five translations were merged into a single version in a nominal group discussion. The nominal group technique takes advantage of pooled judgments. That means that the judgments of a variety of people with varied talents, knowledge, and skills will be used together. By doing this, the resulting ideas are likely to be better than those that might be obtained by other methods [16], [17]. This merged G-IPAS was then translated back into English by a native English speaker. The original American version, the version translated back into English, and the German version were then compared and harmonized to ensure the conceptual equivalence between the different IPAS versions in another nominal group discussion. The final harmonized G-IPAS version was then proofread before it was used in the cognitive interviews.

Step 2: Cognitive interviews

Covering step G to I of the ISPOR guidelines (see figure 1) [15], the G-IPAS was pre-tested among nine healthcare professionals and students. We conducted cognitive interviews with three bachelor's degree students from the midwifery program of the University of Applied Sciences Bern, three certified registered anesthesia nurses, and three anesthesia residents of the Department of Anesthesiology and Pain Therapy, Bern University Hospital in Switzerland. All participants had experience in interprofessional teaching and simulation. Cognitive interviews intensively probe the thought processes of individuals who are presented with those inquiries and help researchers discover how well their questions are working, where they are failing, and determine how they can improve [18]. The interview goal was to rephrase or delete items from the G-IPAS, if items were not comprehensible or relevant to potential users. All participants were asked two questions about every item in the G-IPAS:

1. *"Can you repeat the item in your own words?"*, and
2. *"What is your understanding of this item?"*.

Two members of the study group (TP medical doctor, JM research associate) recorded the interviews, debriefed the results orally, and adjusted the items according to the results. After proofreading, the German IPAS was ready for validation.

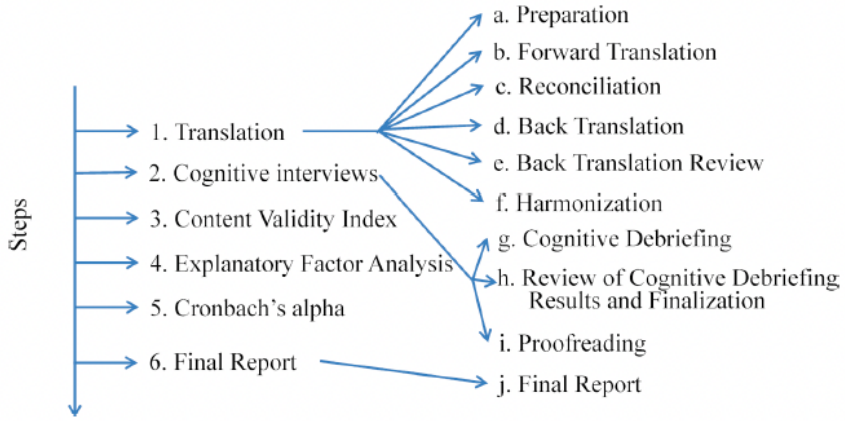

Figure 1: Steps of the study, Bern, 2016

Step 3: Content validity of the translated G-IPAS

After the cognitive interviews, we calculated a Content Validity Index (CVI) for each item and for the whole scale using expert opinion [19]. We asked nine health care providers with experience in interprofessional teaching and simulation (three midwives, three anesthesia nurses,and three consultants in anesthesia, all nine with >10 years of experience) to rate the relevance of each item on a scale from 1-4, with 1=not, 2=somewhat, 3=quite, and 4=highly relevant. The agreement among experts was assessed by calculating the Item Content-Validity Indexes (I-CVI). The I-CVI computes by the number of experts giving a rating of 3 or 4, divided by the total number of experts. Items with an I-CVI >0.78 are considered having excellent content validity, whereas items ≤0.78 needs to be revised [20]. We assessed the validity of the entire questionnaire with the averaged I-CVI across all items, called Scale-CVI/Average (S-CVI/Ave). An S-CVI ≥0.8 is acceptable [21], [22] and ≥0.90 means excellent content validity [23].

Step 4: Exploratory factor analysis

We asked medical, nursing, physiotherapy, and midwife students from the University of Bern and the University of Applied Sciences of Bern to fill out the G-IPAS after class. The EFA intends to uncover the underlying structure of the items. We followed Osborne/Costello's recommendations [24] using principal axis factoring (PAF) for non-parametric data. The correlation matrix was inspected for evidence of coefficients greater than 0.3, indicating strength of the intercorrelation among items. We tested the sampling adequacy for factor analysis using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy [25]. A KMO index of 0.6 was the accepted minimum value for a good factor analysis [26]. We performed a scree test [27] to decide the number of factors to retain (see figure 2). Factors were extracted based on eigenvalues >1 [25]. Finally, we conducted a Direct Oblimin rotation to assure a more accurate and reproducible factor solution [24].

Step 5: Assessment of internal consistency (Cronbach's alpha and item total correlation)

After performing the EFA, we tested the internal consistency of the instrument by calculating Cronbach's alpha for single items, for subgroups, and for the final scale as a whole. We reversed negatively formulated items before checking internal consistency. An alpha value of >0.70 was regarded as satisfactory [28], [29]. We also calculated the item total correlation to show how highly correlated each item is with the overall scale. An item should correlate with the total score above 0.3, but not above 0.7 [30].
Stata/SE 14.1 (Stata Corp. LP, College Station, TX, USA) analyzed all data.

Results

Step 1: Translation of the original IPAS

The original IPAS word count is about 2,500 characters including spaces, while the G-IPAS ended up with about 3,500 characters. In correspond to the English version, G-IPAS entailed five dimensions and 27 items in total after translation.

Step 2: Cognitive interviews

After the first six interviews, items were adjusted according to comments from the interviewees. The remaining three interviews led again to re-adjustment of items. The input from the cognitive interviews led to replacement of single-item wording (e.g. *"Empathie (empathy)" instead of "Mitgefühl (sympathy)"* in patient-centeredness (PC2) (see attachment 1 for the English and German items). Item wording was shortened: e.g. *"Vertrauen (trust)"* instead of *"Vertrauensverhältnisses (relation of trust)"* in (PC1), and *"Rollen (roles)"* instead of *"Rollenverständnis (role understanding)"*. In total, 16 out of 27 items underwent a word change based on the cognitive interviews. Interviewees questioned the relevance of some items in European healthcare context, especially for the dimension

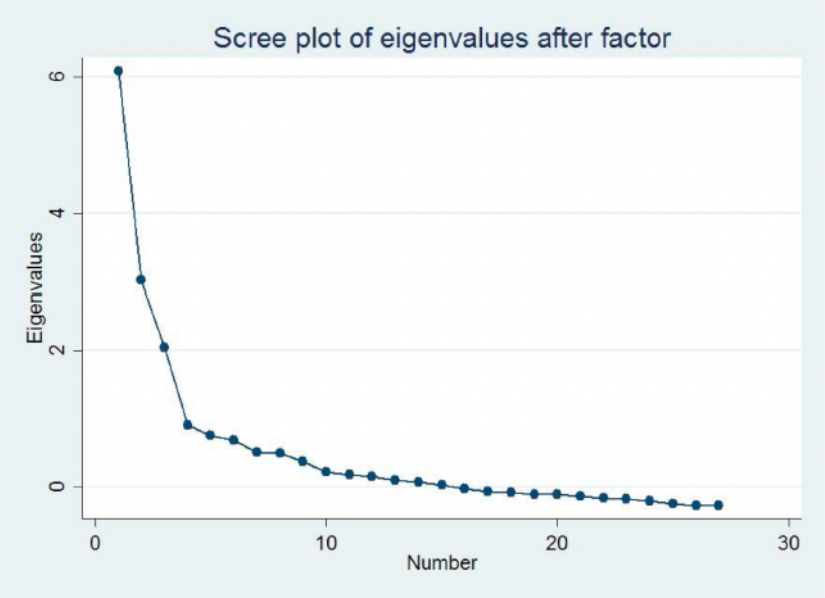

Figure 2: Scree plot of Eigenvalues, Bern, 2016

"Community-centeredness" (e.g. item CC3 *"It is important for health professionals to work with legislators to develop laws, regulations, and policies that improve health care"*). All 27 items were retained for further CVI.

Step 3: Content validity of the translated G-IPAS

The G-IPAS average content validity index with all 27 items is 0.79. 15 items (56%) had an I-CVI ≥0.89 (see table 1). Eight items had an I-CVI between 0.56 and 0.78, and four items had an I-CVI ≤0.44. Before we deleted items with low CVI, we performed EFA to test the underlying structure of G-IPAS to have a sound basis to delete or retain items.

Step 4: Exploratory factor analysis

For EFA and internal consistency testing, 185 students (70 medicine, 51 nursing, 48 physiotherapy, and 16 midwifery) filled in the questionnaire with a 100% response rate (see table 2, Demographic data).

The 27 items of the G-IPAS were subject to principal component analysis (PCA) [21]. Prior to PCA, we assessed the suitability of data for factor analysis. Inspection of the correlation matrix revealed many coefficients of 0.3 and above. The KMO value was 0.82, exceeding the recommended value of 0.6 and supporting the factorability of the correlation matrix.

We used scree plot for factor extraction, which showed three data points above the break, and we retained three factors (see figure 2). These three factors were the only factors with an eigenvalue >1 (see attachment 1, displaying Eigenvalues and variances).

All nine items in dimension *"Teamwork, roles, and responsibilities"* had factor loadings ≥0.49 on factor 1. Further analysis of the rotated solution in the pattern matrix is presented in attachment 1. Items in the dimension *"Patient-centeredness"* had factor loadings ≥0.31 on factor 3 (five items). All six items in the dimension *"Community-centeredness"* had factor loadings ≥0.57 on factor 2. For the dimension *"Interprofessional bias"*, the item IB1 did not have loadings above 0.30 on any factors. Item IB2 loaded negatively on factor 3, but was not negatively formulated. Item DE1 in the dimension *"Diversity and Ethics"* loaded on factor 2 with 0.39. The three other items in *"Diversity and Ethics"* loaded on factor 3.

Decision to keep or delete items

IB1, IB2, and IB3 were deleted based on low CVI and EFA results. IB1 and IB2 had low I-CVI's of 0.44 and 0.56 and neither had loadings >0.30 on any of the three factors in the EFA. We deleted IB3 because of low I-CVI (0.67). We integrated the rest of the items into three groups based on which factor they loaded on.

TRR1-TRR9 stayed together in the dimension *"Teamwork, roles and responsibilities"*.

DE2-4 were assembled with PC1-5 in the subgroup *"Patient-centeredness"*.

DE1 was assembled with CC1-6 in a new dimension called *"Healthcare Provision"* (see attachment 2: Final German-IPAS).

After deleting and redistributing items in subgroups, a new S-CVI/Ave was calculated. The new value was 0.82 (see table 1).

Table 1: Content validity index (CVI), Bern, 2016

Item	Experts in agreement	Item CVI	New Subgroup
TRR1	7	0.78	TRR
TRR2	8	0.89	TRR
TRR3	6	0.67	TRR
TRR4	8	0.89	TRR
TRR5	9	1.00	TRR
TRR6	9	1.00	TRR
TRR7	9	1.00	TRR
TRR8[a]	1	0.11	TRR
TRR9	4	0.44	TRR
PC1	9	1.00	PC
PC2	9	1.00	PC
PC3	9	1.00	PC
PC4	9	1.00	PC
PC5	9	1.00	PC
IB1	4	0.44	Deleted
IB2	5	0.56	Deleted
IB3	6	0.67	Deleted
DE1	8	0.89	HP
DE2	8	0.89	PC
DE3	9	1.00	PC
DE4	9	1.00	PC
CC1	8	0.89	HP
CC2	6	0.67	HP
CC3	7	0.78	HP
CC4	7	0.78	HP
CC5	6	0.67	HP
CC6	3	0.33	HP
	S-CVI/Ave	**0.79**	
	Final S-CVI/Ave[b]	**0.82**	

Abbreviations: TRR = Teamwork, roles and responsibilities, PC = Patient-centeredness, IB = Interprofessional bias, DE= diversity and ethics, CC = community-centeredness, HP= Healthcare Provision-S-CVI/Ave = Scale-CVI/ Average .
[a]TRR8 is negatively formulated.
[b]Scale-CVI after deletion of the three items IB1, IB2, IB3.

Step 5: Cronbach's alpha and item total correlation

The IPAS scale had moderate to good internal consistency (Cronbach's alpha coefficient between 0.62 and 0.92) [12]. 18 items had a value between 0.30 and 0.70, five above 0.70 and only one item had a value of 0.26 (see table 3). The overall G-IPAS Cronbach's alpha after deleting and redistributing of items was 0.87, showing very good internal consistency.

Discussion

We have described the translation of the original American Interprofessional Attitudes Scale (IPAS) into German. The translated G-IPAS shows good reliability and replicated the factor structure of the original IPAS version. Therefore, it can be recommended for the use in German-speaking countries. Furthermore, G-IPAS shows similar internal consistency when compared to the original version [12]. Although the factor structure was replicated, high correlation between individual items was found, indicating that these items may not represent different dimensions.

The original IPAS was based on RIPLS and extended RIPLS [6], whose psychometric integrity for measuring interprofessional education has been criticized [12], [31], [32], [33]. However, IPAS shows consistent improvements over RIPLS regarding psychometric characteristics. RIPLS was criticized for its *evidence for validity* because students did not have any direct input to the development of the instrument; in contrast students and faculty developed IPAS. For the cultural adaptation process of the G-IPAS, we invited health care providers and students from several German-speaking countries, thereby enhancing cultural adaptation and ensuring that the perspectives of users and issues relevant to an interprofessional training were captured by G-IPAS. Additionally, RIPLS did not report the relationship between the construct and outcome being measured. In our German translation and cultural adaptation, we have performed such "think aloud" interviews with the cognitive interviews to overcome that limitation. Additionally, both RIPLS and the original IPAS have subscales with Cronbach's alpha below 0.70, while the G-IPAS does not, which is another hint that the cultural adaptation worked properly for G-IPAS.

RIPLS did not report reliability information [31]. External *evidence for reliability* is not applicable to the IPAS, since it is not measuring a "stable" phenomenon. We assessed internal reliability for G-IPAS with backward and forward translation, cognitive interviewing, CVI, EFA, and Cronbach's alpha. The described internal reliability provides sufficient homogeneity of the G-IPAS and its items to make sure that the measurement of interprofessional attitudes in the German-speaking countries is understandable and makes sense to its user. We ensured that the adopted items of the G-IPAS really do measure what is intended, and that the single items of G-IPAS are built up in a coherent way to measure interprofessional attitudes.

The cultural adaptation was important to sharpen the wording for a more precise German understanding. To validate our cultural adaptations in this translation, we calculated I-CVI and S-CVI [19]. Four original IPAS items scored low as these items were not well adapted to the German-speaking healthcare environment. That might explain why the average content validity index was 0.82, slightly below the recommended average of 0.90.

CVI together with EFA sharpened the cultural adaptation, by deleting items that made no sense in the central European health care environment. Interestingly, in this EFA all nine items in the subscale *"Teamwork, roles and responsibilities"* loaded on factor 1, all five items in the subscale *"Patient-centeredness"* loaded on factor 2, and all six items in the subscale *"Community-centeredness"* loaded on factor 3 (see attachment 1). This reinforced us to keep these subscales in the G-IPAS. In contrast, we

Table 2: Demographics of participants for explanatory factor analysis (n=185), Bern, 2016

Characteristic		
Age, median (IQR)		24 (22-26)
Sex male, n (%)		40 (22)
Field of study, n (%)	*Midwifery*[a]	16 (9)
	Medicine[b]	70 (38)
	Nursing[a]	51 (28)
	Physiotherapy[a]	48 (26)
Current year of education, n (%)	*1*	9 (5)
	2	106 (57)
	6	70 (38)

[a]Bern University of Applied Sciences
[b]University of Bern

Table 3: Item-Total Correlations and Cronbach's alpha for the final German IPAS, Bern, 2016

Item	Item Total Correlation	Cronbach's alpha
TRR1	0.67	0.86
TRR2	0.71	0.86
TRR3	0.71	0.86
TRR4	0.63	0.87
TRR5	0.47	0.88
TRR6	0.68	0.86
TRR7	0.72	0.86
TRR8	0.45	0.88
TRR9	0.58	0.87
TRR overall		**0.88**
PC1	0.26	0.80
PC2	0.57	0.75
PC3	0.57	0.75
PC4	0.51	0.76
PC5	0.55	0.75
PC6	0.58	0.74
PC7	0.41	0.77
PC8	0.47	0.76
PC overall		**0.78**
HCP1	0.61	0.83
HCP2	0.73	0.82
HCP3	0.74	0.81
HCP4	0.67	0.82
HCP5	0.70	0.82
HCP6	0.54	0.84
HCP7	0.35	0.87
HCP overall		**0.85**
German IPAS overall		**0.87**

Abbreviations: TRR = Teamwork, roles and responsibilities, PC = Patient-centeredness, HCP = Health care provision

found very low loading and double loading on factors in *"Interprofessional Bias"* and *"Diversity and Ethics"*. That called for better cultural adaptation for the German-speaking area of healthcare.

All items in the subscale *"Interprofessional Bias"* scored low in I-CVI (see table 1), and loaded on the same factor in the EFA. As this subscale only has three items but should have at least 5 factors [24] and reached a lower Cronbach's alpha in the original IPAS compared to other subscales, the question arose if this subscale should stay in the G-IPAS. The authors of the original IPAS kept it *"because the attitudes it assesses impact several IPEC Report core competencies"* [12]. Going through the IPEC Report and its core competencies, the words *"prejudice"*, *"assumptions"*, *"judgement"*, *"bias"*, or *"tendentious"* do not appear [3]. As these core words to assess interprofessional attitudes were not directly mentioned in the report, we found it reasonable to delete the entire subscale from G-IPAS.

The items from *"Diversity and Ethics"* did not consistently load on only one factor. Based on factor loading we distributed these items to the three remaining subscales. Items DE2, DE3, and DE4 are patient related (communication across cultures, respecting the privacy of patients,

providing equal treatment despite background). As they loaded on the same factor as items in *"Patient-centeredness"*, we allocated them to *"Patient-centeredness"*. Item DE1 (respecting other health professions) loaded on the same factor as items in the subgroup *"Community-centeredness"*, and we placed DE1 in that subgroup, as the addition of that extra item made the subgroup more solid [24]. Because of all these results from the cultural adaptation, we renamed the subscale *"Community-centeredness"* to *"Health Care Provision"*.

Finally, a Cronbach's alpha of 0.87 for the whole scale provided satisfactory internal consistency of the new G-IPAS (*"Teamwork, roles and responsibilities"* scored 0.88, *"Patient-centeredness"* 0.78, *"Health care provision"* 0.85). The item total correlation reconfirmed that G-IPAS is a valid instrument, as 18 items had a score of 0.30 to 0.70. Only one item correlated below 0.30 (PC1 *"Establishing trust with my patients is important to me"*). We did not delete it, because establishing trust with patients seems to be an important competence in IPE. The five items with an item total correlation above 0.70 (TRR2, TRR3, TRR7, HCP2, HCP3) were kept too, as these questions are essential to assess interprofessional attitudes.

G-IPAS has some limitations. RIPLS was criticized for not having validity evidence based on relationship to other variables, meaning the degree to which the score of an instrument correlates to scores obtained by others, for example, if the instrument measures outcomes of IPE as directly observed by an assessor. The original IPAS and the G-IPAS also have this limitation. As intended and unintended consequences of an instrument's use are relevant to its applicability, G-IPAS ratings from students of IPE events must be analyzed to extract such evidence.

Our EFA sample size was not identical to the original IPAS and this might have influenced our results. A larger sample size definitively increases the confidence in the factor analysis results and the power to detect significant changes among the constructs that were measured. However, the subject to item ratio was 6:1, which is considered adequate for factor analysis [26] and the use of self-report instruments is a challenge when measuring interprofessional outcomes [11].

We did not perform a confirmatory factor analysis (CFA). In our opinion the CFA comes as a later step that we can perform when we have used the G-IPAS and collected further data.

Conclusion

The original American IPAS with five subscales was translated, culturally adapted, and validated, hereby creating the German IPAS (G-IPAS). This validation process led to the deletion of the subscale *"Interprofessional Bias"* and re-distribution of items from the subscale *"Diversity and Ethics"* to the remaining three subscales: *"Teamwork, Roles and Responsibilities"*, *"Patient-centeredness"* and the renamed subscale *"Health Care Provision"*.

The G-IPAS is a reliable instrument, which appropriately represents the items of the original IPAS, and is a validated tool for the assessment of interprofessional attitudes in interprofessional education and interprofessional training to be used in German-speaking countries.

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Ethical approval

The Cantonal Ethics Committee of Bern reviewed the study protocol ("Req-2016-00176/ 12.04.2016"). The Ethics Committee granted a waiver for the study as that research project does not fall under the Swiss Human Research Act (Art. 2, Abs.1). All study participants gave written informed consent before participating in this study.

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Previous presentations

A preliminary report was presented in poster form at the Congress for Health Care Professionals "Interprofessionalität – Realität oder Mythos?" 4 March 2016. Preliminary results were accepted for a poster presentation at the 31st ICM Triennial Congress June 2017, Toronto, Canada. Preliminary results were presented in an oral presentation at SPSIM Congress, March 2017 Bern.

Competing interests

The authors declare that they have no competing interests.

Attachments

Available from https://www.egms.de/en/journals/zma/2020-37/zma001325.shtml

1. Attachment_1.pdf (156 KB)

Factor loading results of an exploratory factor analysis of the German Interprofessional Attitudes Scale, Bern, 2016

2. Attachment_2.pdf (431 KB)
Final version German IPAS

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Erratum

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Aim 1: To ascertain the ideal time in the medical curriculum to introduce IPE interventions

Aim 3: To determine the facilitators and barriers for interprofessional education in the study population

10. Determine the optimal time to introduce interprofessional education activities in the medical curriculum, and explore facilitators and barriers for its introduction

Berger-Estilita J, Chiang H, Stricker D, Fuchs A, Greif R, McAleer S. Attitudes of medical students towards interprofessional education: A mixed-methods study. PLoS One. 2020 Oct 21;15(10):e0240835. doi: 10.1371/journal.pone.0240835.

As the results of the systematic review (**Publication 1**) were inconclusive, we performed a well-designed mixed-methods study to revisit our primary aim (**Aim 1**) and to determine the facilitators and barriers for the introduction of interprofessional education in the study population **(Aim 3)**. We set to explore both the attitudes towards interprofessionality and the impact IPE experiences had in a large group of medical students.

The aims of this study were: (1) to determine whether there were changes in attitudes towards interprofessionality between the bachelors (pre-clinical) and masters (clinical) programme of the curriculum by using a validated attitudes scale, (2) to ascertain the ideal time in the medical curriculum to introduce IPE interventions, and (3) a) to perform na added confirmatory analysis of the instrument´s validity and reliability, therefore completing the validation process.

In the quantitative part of the study, 683 medical students from all six years of medical studies at the University of Bern, Switzerland replied to an online survey about attitudes towards interprofessional learning using an interprofessional attitudes scale. On the qualitative part, 31 medical students took part in nine semi-structured one-hour interviews which focussed on their experience in interprofessional learning and the possible impact such learning might have on their own professional development.

Comment of methodological aspects

This study seemed best justified with post-positivism as an ontological view (nature of reality). While the post-positivist paradigm relies on positivist components like empirical testing and controlled conditions, the outcomes of the investigation are only an estimation of the truth, "with unobservables acknowledged to have existence and be capable of explaining the functioning of observable phenomena" (Bronowski, 1956; Kuhn, 1962; Popper, 1959).

This is the case of the measurement of attitudes. The use of a scale to measure attitudes towards interprofessionalism – in this case, the G-IPAS – enables the transformation of interiorised, "unobservable" variables into palpable measurements. The introduction of the qualitative design in the study ensures that this research also explores the wider social issues that are inherent to interprofessional educational interventions. The qualitative methodology was added with two main purposes: (1) to search for possible explanations for the results of the quantitative section and (2) to limit the bias induced by the use of a composite scale. We also developed the semi-structured interview guidance document (Appendix C) from preliminary results of the G-IPAS scale analysis to increase construct validity. The findings of the qualitative analysis were triangulated with data from the cross-sectional survey. Triangulation refers to the use of several research methods in the study of the same phenomenon in order to arrive at a fair conclusion (Schifferdecker & Reed, 2009). Although it was outside the scope of this study to use critical multiplism it its purest sense, the use of triangulation warranted the adherence to the methodology of post-positivism. Because the project used quantitative and qualitative designs, the methodology can be defined as a mixed-method.

The study included a sequential qualitative-quantitative mixed-methods design based on Schifferdecker & Reed´s explanatory model (2009). Data from the quantitative survey was gathered using an online survey platform (Surveymonkey®). Demographic data, year of studies, previous IPE experience, previous work in healthcare, ties to healthcare and all 24 items of the G-IPAS (Pedersen et al., 2020) were collected. The findings from the initial quantitative data analysis were used to guide and further explore themes in a qualitative approach (Schifferdecker & Reed, 2009). In the second phase, semi-structured interviews were used to explore individual students´ experiences with IPE interventions and the impact it had on their continuous professional development.

We used the G-IPAS to measure attitudes towards interprofessional learning. The cross-sectional design, classically used in conjunction with the survey method, is adequate in this setting because it focuses on the relationships between the explanatory and the outcome

variables – so called because there is no intervention. However, surveys are known to display some disadvantages, including data being affected by the characteristics of the respondents and usually having a relatively low response rate (Robson & McCartan, 2016).

We used a non-probability convenience sample and included all medical students from the Faculty of Medicine of the UniBe enrolled in the school year 2019/2020. While calculating sample size, we used the recommendations of Borg & Gall for survey research (Borg & Gall, 1989): the sample size should include at least one hundred observations for each of the major sub-groups. Therefore, we aimed to include 100 students for each year, and at least 600 students overall. Inferential statistics were used for data analysis. Because the G-IPAS had only recently been translated and acculturated into the German language, we performed an additional confirmatory analysis of its validity and reliability.

After completion of online G-IPAS questionnaire, students could to tick a box signalling their availability to participate in the semi-structured interviews. In line with Creswell´s (2007) recommendations, we used a purposive sample of all participants for the qualitative phase from the pool used in the quantitative phase, so to best represent their experiences or views. Students who agreed to participate were invited to semi-structured interviews. In this phase we aimed to explore the collaboration between medical students and other healthcare groups and students' experiences and views about IPE. Data originating from the semi-structured interviews was processed according to the Miles and Huberman (Miles et al., 2014) framework for data analysis. All interviews were coded in a phased fashion, with interim analysis, to check for saturation.

We used a known protocol (Castillo-Montoya, 2016) to develop a semi-structured interview guide (Appendix C). We first ensured that interview questions were aligned with our research questions; we then constructed an inquiry-based conversation; we asked for external feedback on interview protocols; and we piloted the interview guide amongst peers. The question route was developed to explore in-depth knowledge of the concept of IPE, its advantages and disadvantages, and optimal time for introducing IPE in the medical curriculum.

We considered several measures to ensure good data quality. we used online questionnaires because they are more practical, secure and fast, and exclude observation bias and experimenter expectancy (Barber, 1976).

In addition, the G-IPAS instrument has been adequately validated and culturally adapted to the German language, which strengthens reliability and internal validity. We also addressed the threats of participant error, attitude performance fluctuation and participant bias by reassuring participants that their data was confidential and there was complete anonymity (Campbell & Stanley, 1963; Punch & Oancea, 2014).

In qualitative design, major threats to validity include the potential inaccuracy or incompleteness of data description, which can be damped by a good-quality video and audio recording; inaccurate or preconcerted interpretation of one´s findings, which can be tackled with a solid description of how interpretation was reached (Mason, 1996): and not considering alternative explanations for the topic one is studying (so-called "theory" threat) (Maxwell, 1992). This can be countered by actively seeking data that is dissonant from the given theory. Finally, one major critique to the trustworthiness of qualitative design is that of replicability: it is virtually impossible to recreate identical circumstances in qualitative data collection and analysis. Known strategies for dealing with threats to validity used in this study include the use of both data and method triangulation, member-checking (also known as participant validation)(Morse, 2015), peer support (by the attribution of a supervisor) and an audit trail (Robson & McCartan, 2016).

Finally, with the use of triangulation of different data sources I can enhance objectivity and strengthen intersubjective agreement (Robson & McCartan, 2016). Credibility can also be intensified by a thorough methodologic description.

Study Findings

Quantitative Analysis

Confirmatory analysis of the instrument´s Validity and Reliability

The initial three-factor model Teamwork, Roles & Responsibilities (TVF), Patient-centeredness (PZ) and Healthcare Provision (GHV) together explain 48% of the total variance. After rotation, a simple structure with loadings on to the three components emerged. This is consistent with previous research (Pedersen et al., 2020). The calculated Cronbach's alpha for G-IPAS was 0,855.

Results from the G-IPAS questionnaire

Six-hundred and seventy-seven students replied to the online survey (response rate: 43,7%).

There was a statistically significant main effect for gender (p=0.007), with female students showing overall higher mean GIPAS scores. There was a significant difference in scores for pre-clinical years and clinical years (p= 0.024).

Qualitative Analysis

Overall, students welcomed IP courses but were disappointed because of the lack of actual IP (i.e., inadequate setting, disorganized interventions). Medical students perceived to have significantly less experience than their IP counterparts. Most students did not experience IPE except for the IV line placement course. The IP offer during the Medical course was considered insufficient.

Barriers to IPE implementation

Issues regarding the competition with the current medical curriculum, the risk of unbalanced learning and other dangers were explored. Students were uncomfortable with being taught by non-doctors because they feared other HCP would not be aware of their training or be knowledgeable of their curriculum. There was an outspoken fear of loss of medical identity, loss of medical specialization (because knowledge is shared) and fear of being less thorough in their own medical curriculum. The lack of assessment of such activities labeled IPE interventions as secondary.

On a course level, the implementation may be challenging because the content, format and frequency rarely accommodate all students involved. The use of IPE interventions *per se* does not guarantee student interaction. Competencies outside a given role of HP may be taught, which can lead to a false sense of ability and may have legal consequences (by performing skills outside of set competencies). Additionally, it may enhance prejudices against other HCP groups because of single participant´s characteristics from each group.

Finally, several barriers were mentioned on an institutional level: bureaucratic obstacles of combining curricula from different faculties, organizational aspects (lack of infrastructures to accommodate all students, difficulty in coordinating rotations, etc), time constraints, monetary constraints and deanery or political barriers (resistance to change).

Table 2: Barriers to IPE elements

Student level	Course level	Institutional level
competition with medical curriculum	inadequate content & format	resistance to change
unbalanced learning	difficult implementation	organizational factors
legal dangers & prejudice	unrealistic learning objectives	bureaucracy
		political factors

Expectations of IPE

One third of students agreed that IPE should start as early as the first year of studies. Such an approach would have clear advantages: it would be easier to implement because students would have similar backgrounds; early interaction, shared learning and networking would contribute to build mutual respect from an early stage; basic science and other overlapping topics are possible, which can then evolve to clinical interactions later in the curriculum; and there is no benefit of starting later. Opinions against early IPE introduction included students being overwhelmed by an overloaded, integrative year; the role of "doctor" not being yet clearly defined; and that prejudices against other HCO exist regardless and before medical school. On the other hand, 11 students pointed out that the IPE introduction should occur just before or during clinical years (from the 3rd year onwards). The reasoning behind is includes a better integration of the IPE content with clinical practice, the previous acquisition of basic clinical knowledge which would facilitate the focus on the IP component and the broader diversity of activities that could be offered.

The main wished-for interventions would occur in clinical years and included topics like basic life support training, clinical skills training (mostly regarding history and physical examination of organs and systems), handover and rounds, non-technical skills and communication training. Trial (taster) days and areas of shared responsibility (medication errors, hospital hygiene, ethics, etc) were also acknowledged. Potential healthcare students to be included were nurses, physiotherapists, midwives and operating room technicians.

Courses should be practical (tutorials, case-studies, clinical skills trainings, PBL groups, case-based learning) and lectures should be avoided. Other options mentioned included seminars or course days about topics which are relevant to more than one profession or the use of simulation for soft skill and clinical skill training. Some students recommended that such courses should occur during clinical rotations and include other healthcare students. The IP groups should, when possible, be maintained throughout the year to allow for a deeper social interaction.

Students would rather have IPE in smaller groups (4-6 participants, mixed ratio 1:1 or 1:2) to allow for a better interpersonal experience and communication. As for the preferred duration, these should be course blocks for approx. 1-4 hours, entailing a full morning or afternoon. IP courses should have an optional character. Students favoured regular IPE interventions, with course repetitions.

Table 3: Category "Expectations of IPE" elements and representative cites

Subtheme with explanation
When *to introduce IPE in medical training*
first year (increase in mutual respect, common learning outcomes, students with similar backgrounds)
before clinical encounters (previous medical knowledge, more focus on the IP component, clinically relevant teaching)
repeatedly
How *to introduce IPE in medical training*
Course format (practical interventions, small groups, blocks of 1-4h)
Course frequency (weekly →biannually)
Topics addressed (pre-clinical years: basic sciences; clinical years: clinically relevant topics)

Through the use of the G-IPAS, a recently validated interprofessional attitudes scale for German-speakers (Pedersen et al., 2020), we could demonstrate that Bernese medical students display very positive attitudes toward IPE in all study years.

This corroborates previous findings of a previous Bernese cohort using another IP attitudes scale (Luderer et al., 2017) and reflects similar findings from other countries (Chua et al., 2015; Ruebling et al., 2014). The reason for such a high scoring may be a ceiling effect caused by the early exposure to IPE interventions in the Faculty of Medicine of the University of Bern. Women had overall more positive attitudes towards interprofessionality. This has been reported before in selected studies. A Swedish study in 2011 (Wilhelmsson et al., 2011), using RIPLS, examined a sample of 670 students and concluded that female students were more likely to work in a team. Another study by a Swedish group, using the Jefferson Scale toward Physician-Nurse collaboration, showed again more positive attitudes towards teamwork among female students (Hansson et al., 2010). More recently, Zanotti et al (2015) reported a significant effect of gender in the IEPS empathy subscale after an IP program with observations, IP experiences and nurse coaching. To our knowledge, no other studies have reported such a gender effect. It may be that women from the analysed countries (Sweden, Northern Italy and now Switzerland) may be growing up in a more democratic and egalitarian society, with a strengthened women's position. The feeling of being equal to males and having equal expectations of work can make such differences more visible. Although many healthcare systems still maintain traditional hierarchical structures and gender roles, they may be transitioning into a more gender-neutral teamwork and patient-centred culture, particularly in central and northern Europe. This is clearly an issue worth exploring in further studies.

Students in pre-clinical years were also significantly associated with higher G-IPAS scores. Such a high attitude score has been shown in the past, with use of other measuring scales, both for the healthcare student population in general (Coster et al., 2008; Hudson et al., 2016; Kozmenko et al., 2017; McFadyen et al., 2010; Pollard et al., 2006) and medicine in particular (de Oliveira et al., 2018; Kozmenko et al., 2017): despite the high enthusiasm for IPE in the beginning of their training, students become less receptive to IPE as the years pass.

These findings are of concern because good relationships with colleagues and patients, which are likely fostered by IPE and patient-centeredness, have been shown in previous studies to increase patient satisfaction, promote treatment compliance and protect against malpractice claims(Hojat, 2007). In my view, this observed decline should therefore be specifically targeted in future interventions: the UniBe has more IPE-oriented interventions in pre-clinical years,

and this new evidence could favour additional introduction of more IPE-directed activities later in the curriculum.

Factors contributing to this decline in interprofessional attitudes can be found in literature and include older age (McFadyen et al., 2010), previous IP contact (Anderson & Thorpe, 2008), previous less positive experiences in IPE (Coster et al., 2008; Hudson et al., 2016; Visser et al., 2017) and having parents working in healthcare (Cooper et al., 2005). Although specifically targeted for the Bernese sample, none of these factors showed association with the decline in attitudes. A recent study by Oza et al (2015) applying a regression analysis to a large cohort of medical students, also failed to find such associations with the aforementioned variables. The absence of association in larger cohorts may be more statistically trustworthy and the association of these factors in IPE decline should be specifically addressed in higher powered studies.

One third of students mentioned the importance of the early introduction of IPE in the curriculum, as it facilitated an early interaction and network, contributing to mutual respect and reducing stereotypes. In this setting, students can join an interprofessional team without bringing a well-developed "doctor professional identity"(Hudson et al., 2016). This is also supported by the Social Identity Theory (Tajfel & Turner, 1979), where stronger definitions of individual professional roles may lead to intergroup discrimination. Finally, introducing IPE early in the curriculum is likely to have an impact on students´ ability to assume their given roles and responsibilities, which is a basic principle of professionalism (Scavenius et al., 2006). Like Scavenius (2006), we are convinced that if students are given the possibility to work as part of a team early in their basic training, they can develop a clearer insight to a patient-centred approach and reduce their stereotyped views of other HCPs. Finally, learning interprofessional teamwork skills in the workplace additionally to clinical responsibilities and patient care, may increase extraneous cognitive load (Sweller, 1994; Young et al., 2014) and be far from ideal. Learning these skills may be better served within basic sciences courses, as they provide a more favourable framework for the initiation of IPE (McKinlay & Pullon, 2014). The decline in student´s attitudes towards IPE observed in the quantitative analysis, coupled with a 1/3 of students mentioning clear disadvantages of early IPE implementation is worrisome.

Hudson et al (2016) suggested that such a decline may arise due to the nature of the intervention and how negatively students experienced it. On the other hand, Sytsma et al. (2015) argue that the benefit of conducting IPE later in training is to allow students to be more confident in their professional roles and responsibilities. Being taught by other HCP (non-doctors) also induces a lack of motivation to be involved in the IPE intervention (Hudson et al., 2016). All the above, coupled with an underdeveloped professional identity, may have been the reason for the decline. Interestingly, such concerns were also raised among Bernese students, who were uncomfortable with being taught by non-doctors.

Both educators and curriculum designers should take all these observations into account in order to offer more authentic interdisciplinary experiences, with the healthcare team and the patient engaging in interprofessional problem-solving activities. Such significant learning experiences have an impact on how medical students approach and internalise the patient-centeredness (Bombeke et al., 2010).

It was puzzling to be faced with the outspoken fear of loss of medical identity and how some students lacked positive attitudes towards IP. A similar fear of danger of blurring professional boundaries was a topic in other studies (Friman et al., 2017; Krause et al., 2014). Although understandable that medical students may lack professional maturity to project the benefits of such IPE experiences, one cannot completely overlook the fact that the true change in mindset among professions that have for so long operated independently takes time.

On reflection, we see how this still is an important issue for students undergoing IPL. The introduction of small-group reflections, facilitated by adequate role models, may allow students to reflect on their own professional and personal attitude towards patients, to express their moral judgements from their observations of other healthcare professionals´ interactions and to share these experiences within a safe learning environment. Such experiences throughout training programmes may reduce anxieties and fears about future professional collaboration.

Most mentioned barriers to IPE implementation have been described elsewhere. Interestingly, students could replicate almost all barriers mentioned in Gilbert et al. (2005) and Lawlis et al. (2014), particularly regarding resistance to IPE by students of faculty, lack of an established framework and difficulty in coordinating coursework.

It is known that such barriers are able to influence both the outcome as well as the sustainability of an IPE program (Lawlis et al., 2014). In their review, Lawlis et al. also recommend a way to overcome these barriers by means of faculty development plans. Faculty development encourages staff commitment and buy-in and eases a professional and institutional culture chance in a "bottom-up" approach.

The social component of IPE was mentioned several times during the interviews, particularly in the definition of IPR, as a goal and as an advantage to IPE. Students considered networking beneficial, both inside and outside the workplace. By engaging in IP relationships on a personal level, students would be able to learn about each other´s training in informal settings and even foster friendships. This is a perspective we had not considered before and also a point not frequently explored in literature. The social component repeatedly mentioned in the interviews mirrors many of the components of Social Learning Theory (Bandura, 1986): learning is also a social and relational process, frequently occurring around authentic and meaningful patient cases (Friman et al., 2017; Oza et al., 2015). Such findings show beyond doubt that "formal" or planned educational IPE experiences also create "informal" opportunities to socialise and be acquainted in a personal level. These informal arenas can, therefore, stimulate and set a solid basis for IP collaboration (Reeves, 2000).
Also disturbing were how some students showed a stereotyped view and regarded interaction between health professions as difficult, despite being at the beginning of their professional career. Similar results were described in other studies (Kolb et al., 2017; Pollard & Miers, 2008). Unfortunately, stereotypes formed by professional interaction and societal views on professional roles are not easily changed with educational interactions (Reeves, 2000).

There are several limitations to this analysis: first, the cross-sectional design prevents the observation of cohort evolution within their medical studies and further pre-post analysis. As this study was conducted at a single university, care must be taken in the generalization of its conclusions: nevertheless, we tried to overcome this limitation by targeting an adequate sample size- Additionally, we had concerns about the first use of a new scale. The best way to measure attitudes after IPE remains an open question, since no single instrument offers an adequate solution to many educators and researchers in the field (Gillan et al., 2011).

Although the G-IPAS was translated and acculturated into German and has shown very solid reliability data and factorial structure, it may not be the appropriate tool for the study´s context. Another limitation originates from the voluntary completion of the G-IPAS, making the sample not necessarily representative of the whole cohort. Only 43% of students replied to the questionnaire, so generalizations should be made cautiously. Social desirability bias was also a threat, considering that the G-IPAS was self-reported. Finally, measuring beliefs and attitudes does not indicate true skill proficiency in interprofessional work and future research should include more ability-oriented measures, aiming for outcomes in levels 3 and 4 of Kirkpatrick´s pyramid (Kirkpatrick & Kirkpatrick, 2006).

Despite these limitations, this study´s findings provide valuable insight to faculty at the University of Bern and similar structure universities on areas where IPE can be focused. Additionally, it has several strengths: it included a large sample of medical students, increasing the power of the finding and used a mixed-methodology design – which correlated a self-reported score with data from semi-structured interviews – to obtain breadth and depth in the data(Punch & Oancea, 2014). The use of this methodology is considered as an effective evaluation strategy that more closely aligns education with IP delivery (IOM, 2015)

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RESEARCH ARTICLE

Attitudes of medical students towards interprofessional education: A mixed-methods study

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Abstract

Background

Interprofessional Education (IPE) aims to improve students' attitudes towards collaboration, teamwork, and leads to improved patient care upon graduation. However, the best time to introduce IPE into the undergraduate curriculum is still under debate.

Methods

We used a mixed-methods design based on a sequential explanatory model. Medical students from all six years at the University of Bern, Switzerland (n = 683) completed an online survey about attitudes towards interprofessional learning using a scale validated for German speakers (G-IPAS). Thirty-one medical students participated in nine semi-structured interviews focusing on their experience in interprofessional learning and on the possible impact it might have on their professional development.

Results

Women showed better attitudes in the G-IPAS across all years ($p = 0{,}007$). Pre-clinical students showed more positive attitudes towards IPE [Year 1 to Year 3 ($p = 0.011$)]. Students correctly defined IPE and its core dimensions. They appealed for more organized IPE interventions throughout the curriculum. Students also acknowledged the relevance of IPE for their future professional performance.

Conclusions

These findings support an early introduction of IPE into the medical curriculum. Although students realise that interprofessional learning is fundamental to high-quality patient care, there are still obstacles and stereotypes to overcome.

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Competing interests: RG is the Board Director of Training and Education for the European Resuscitation Council, the Task Force Chair Education, Implementation, and Team of ILCOR, and member of the direction of the MME Programme of the University of Bern. SM is the Programme Director and Senior Lecturer at the Centre for Medical Education, University of Dundee. This does not alter our adherence to PLOS ONE policies on sharing data and materials. The remaining authors report no competing interests. We confirm that this manuscript is not under consideration by another journal. It is our own work and was not sponsored by the industry.

Trial registration

ISRCTN 41715934.

Introduction

The World Health Organization (WHO) defines Interprofessional Education (IPE) as, when "students from two or more professions learn about, from, and with each other to enable effective collaboration and improve the quality of care" [1]. Evidence shows that interprofessional (IP) healthcare interventions improve patient outcomes, such as higher medication safety or reduced length of hospital stay [2] by enhancing the communication and interpersonal skills of healthcare professionals, as well as their collaboration and teamwork skills [3]. The Interprofessional Collaborative Practice (IPEC) outlines IPE's core competencies which concentrate on four main domains: Ethics & Values, Roles & Responsibilities, IP Communication and Teamwork [4].

Nevertheless, the complexity of teaching for different healthcare disciplines, logistical problems and busy timetables raise issues concerning the introduction of IPE interventions. Current undergraduate literature shows a trend for earlier IPE introduction [5, 6], but the optimal timing for the IPE intervention is unclear [7].

IPE interventions can be measured by using validated attitudes scales based on IPE domains. Until recently, only a few conceptual tools for assessing attitudes towards IPE existed [8]. The Readiness for Interprofessional Learning Scale (RIPLS) [9] and the extended RIPLS [10] are common examples. Unfortunately, many scales were developed before the IPEC report, and do not integrate all four recommended core competencies [11]. The Interprofessional Attitudes Scale (IPAS) [12]–developed and validated in 2015—uses items from the extended RIPLS and new items to embody all four IPEC domains. This scale has been validated for German speakers [13].

The Medical Faculty of the University of Bern (UniBe) is one of the largest in Switzerland with about 1500 students. The study of Medicine starts with a 3-year bachelors programme focusing on basic science (e.g. physics, chemistry, biology, physiology, biochemistry and anatomy) followed by a 3-year masters programme with a strong practical focus, composed mostly of small group interactions (problem-based learning) and clinical clerkships [14]. Since 2010 the medical faculty and nursing schools have been offering optional two half-day interprofessional internships for their students in the first and third semesters. Further interprofessional activities include a compulsory seminar on confidentiality in cooperation with the Bern University of Applied Sciences and the Institute for Medical Education of the University of Bern (UniBe) as well as the compulsory Intravenous Cannulation course, both taught in the first academic year, during which the learning groups and the team of peer tutors are interprofessionally allocated.

The aims of this study are: (1) to determine whether there are changes in attitudes towards interprofessionality between the bachelors (pre-clinical) and masters (clinical) programme of the curriculum by using a validated attitudes scale, and (2) to ascertain the ideal time in the medical curriculum to introduce IPE interventions.

Materials and methods

We used a sequential qualitative-quantitative mixed methods design [15]. The quantitative cross-sectional survey collected students' demographic data and included all 24 items of the

German Interprofessional Attitudes Scale G-IPAS [13] using an online platform (SurveyMonkey Inc, San Mateo, California, USA). Semi-structured interviews explored individual students' experiences with IPE interventions, and the impact they had on their professional development. All medical students actively enrolled in the Faculty of Medicine of the University of Bern, Switzerland, during the academic year 2019/2020 were eligible for inclusion in the study. The study was conducted in German.

Ethical considerations

The participants gave written informed consent and the Bern Cantonal Ethics Committee (Req-2019-00743, 23.08.2019) waived the need for ethics approval. The survey link included a covering letter reiterating the goals of the study and "consent by participation" was obtained [16]. We used ID numbers to code students and requested no identifying data. Data was stored in a secure repository accessible to the investigators only. All procedures from this investigation followed the Helsinki Declaration [17]. All researchers complied with the Data Protection Act [18] and the Swiss Law for Human Research [19]. This study was registered with the number ISRCTN41715934.

Procedure

Students received an e-mail from the Medical Faculty deanery in October 2019 with the link to the online G-IPAS survey via the online platform. The survey was open from 7th October to 15th December 2019, and two reminders were sent.

The German Interprofessional Attitudes Scale is a 24-item questionnaire with 3 subscales ("*Teamwork, Roles and Responsibilities*", "*Patient-centeredness*" and "*Healthcare Provision*"). Participants had to answer the questions using a Likert scale with 1 representing "Strongly Disagree", 2 "Disagree", 3 "Neutral", 4 "Agree" and 5 "Strongly Agree". The G-IPAS has been shown to be a reliable instrument, representative of the original American IPAS dimensions [12] and it has been translated, culturally adapted and validated in German-speaking countries for the assessment of interprofessional attitudes [13].

After completion of the online G-IPAS questionnaire, students were invited to participate in nine semi-structured interviews, which took place at the Department of Anaesthesiology and Pain Therapy, Inselspital, Bern, Switzerland in November 2019. An interview guide was used to conduct the one-hour session. Students provided demographic data (e.g. age, year of studies) and were asked about their understanding of IPE and the (dis)advantages of this type of teaching strategy. We discussed the survey results and asked their opinion on optimal IPE interventions (duration, format and content). Data was audio- and video recorded.

Sampling

For the quantitative phase, we used a non-probability convenience sample and included all medical students from the Bern Faculty of Medicine enrolled in the academic year 2019/2020 (n = 1550). We aimed to include 100 students for each year, and at least 600 students overall, following recommendations for sample size survey research [20]. As the study was sequential in nature, it was impossible to pre-emptively select participants for the qualitative phase. We used purposive sampling for the nine semi-structured interview groups.

Data analysis

We performed a descriptive analysis of the survey data with sub-group analysis per year of studies. Global scale, dimensions, and individual items were assessed for normal distribution

with the Shapiro-Wilks test and visual assessment of residuals and Q-Q Plots. Two-way analysis of variance (ANOVA) with gender and the stratified study years (year 1 to 6) as between subjects' factors were conducted separately for the means of all subscores as well as the mean overall G-IPAS score as dependent variables. Separate independent samples t-tests were conducted for the between subjects' factor previous experience in healthcare and having parents working in the healthcare system for the overall G-IPAS score, with correction for multiple testing. Additionally, an independent samples t-test was conducted to compare the overall G-IPAS score in pre-clinical (years 1–3) and clinical years (years 4–6). Quantitative data was analysed with SPSS v26 (IBM, New York, USA).

Because the G-IPAS has only recently been introduced, we decided to perform an additional confirmatory analysis of its validity and reliability. For survey validity, we used a factor analysis using the Scree test for factor extraction and Varimax rotation with Kaiser-normalization. Data was assessed for factorability with Bartlett´s test of sphericity, and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. For reliability, Cronbach's alpha was determined. Cronbach's alpha should be at least of 0.7 for the instrument to be considered reliable [21].

Data from the semi-structured interviews was processed according to the Miles and Huberman [22] framework for data analysis: data segmenting, editing and summarizing, followed by data display, and finally conclusion verification. HC transcribed all interviews. JBE and HC corrected and verified transcriptions of the interviews and we sent summaries of the interview to each participant as a form of respondent validation [23]. JBE and HC both coded the first group interview independently using the software MaxQDA2020® (Verbi, Berlin, Germany) and agreed on the coding scheme for the remaining interviews. Memoing was performed parallel to coding. All interviews were coded in a phased fashion, with interim analysis, to check for saturation.

Direct quotations from the interviews were translated into English using a functionalist approach of *creation of equivalent translation structures* as described by Enzenhofer and Resch [24]. One author (HC, German-speaking) translated the citations from German to English *ipsis verbis* with the aid of an online tool (Google Translate®). The second author (SM, English-speaking), performed changes to ensure that the target text could be understood by the reader.

Results

Quantitative analysis

Six-hundred and seventy-seven students replied to the online survey (response rate: 43,7%). Incomplete questionnaires (n = 111) were excluded and 4 students did not report year of studies. We included 562 completed questionnaires in the final analysis.

Confirmatory analysis of the instrument's validity and reliability

The initial three-factor model (Teamwork, Roles & Responsibilities, Patient-centeredness and Healthcare Provision) explained 48% of the total variance. After rotation, a simple structure with loadings on to the three components emerged. This is consistent with previous research [13]. The calculated Cronbach's alpha for G-IPAS was 0.855.

Demographic characteristics

Participants' demographics are shown in Table 1. 54% of the students reported previous experience as healthcare providers and over 80% of participants were Swiss German. Most frequent IPEs mentioned were the Intravenous Cannulation course (n = 125), the Confidentiality seminar (n = 98), and the optional interprofessional rotation (n = 43).

Table 1. Participant´s demographics for the quantitative data.

Year of studies	Year 1 (n = 74)	Year 2 (n = 84)	Year 3 (n = 108)	Year 4 (n = 93)	Year 5 (n = 103)	Year 6 (n = 100)	Total (n = 562)
Women [n(%)]	50 (68)	56 (67)	71 (66)	68 (66)	71 (69)	63 (63)	379 (67)
Age (mean ± SD)	20.5±2.4	21.1±2.0	22.6±3.4	23.4±2.6	24.1±2.0	25.6±2.0	23.1±3.0
Previous IPE interventions [n (%)]							
None	69 (95)	38 (45)	38 (35)	25 (27)	57 (55)	60 (60)	287 (51)
≤ 2 courses	2 (3)	44 (52)	64 (59)	55 (60)	40 (39)	31(31)	236 (42)
> 2 courses	2 (3)	2 (2)	6 (6)	12 (13)	6 (6)	8 (8)	36 (6)
Previous experience in healthcare [n (%)]							
yes	31(42)	51 (61)	62 (56)	37 (40)	60 (58)	60 (60)	301 (54)
Parents working in the healthcare system [n(%)]							
yes	25 (34)	26 (31)	32 (30)	41 (44)	44 (43)	34 (34)	202 (36)

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German interprofessional attitudes scale questionnaire

Table 2 shows the mean scores of each G-IPAS item. Five of the nine items in the subscale "Teamwork, Roles and Responsibilities", six of the eight in "Patient-Centeredness" and one in "Health Provision" were significantly higher in females. In the subscale analysis, only "Teamwork, Roles and Responsibilities" decreased significantly with an increase in study years ($p<0.001$). Males showed lower mean scores in the subscale "Teamwork, Roles and Responsibilities" ($p = 0.002$) and "Patient-centeredness" ($p<0.001$) but not in the subscale "Health Provision" (Table 3).

The two-way ANOVA of the G-IPAS mean score showed a statistically significant main effect for gender ($F(1, 550) = 7.129$, $p = 0.008$, $\eta^2_p = 0.013$), with women achieving overall higher mean GIPAS scores. The main effect of study year ($F(5, 550) = 2.109$, $p = 0.063$, $\eta^2_p = 0.019$) and the interaction effect between gender and study year ($F(5, 550) = 1.927$, $p = 0.088$, $\eta^2_p = 0.017$) was not statistically significant. The independent samples t-tests showed no statistically significant differences for previous experience in healthcare and having parents working in the healthcare system.

An independent samples t-test revealed a significant difference in the means of the overall G-IPAS score between pre-clinical ($M = 4.22$, $SD = 0.40$) and clinical years ($M = 4.13$, $SD = 0.40$) ($p = 0.007$).

Qualitative analysis

We performed nine group interviews (maximum of 4 students each), 31 participants in total. All study years were represented [Year 1: n = 5 (16%), Year 2: n = 8 (26%), Year 3: n = 2 (7%), Year 4: n = 8 (26%), Year 5: n = 7 (23%), Year 6: n = 1 (3%)]. There were 20 female students (64,5%), 16 (51.6%) students had previous experience in healthcare work, 24 students (77.4%) had at least one parent working in healthcare, and 19 students (61.3%) had healthcare professionals as close friends. Table 4 depicts the overall frequency of the quotes in each of the interviews. There were similar distributions of codes across genders and years of study.

Three main categories emerged from the focus groups: a) *awareness of IPE*, b) *barriers to IPE*, and c) *expectations of IPE*.

a) Awareness of IPE

Definition of interprofessional education. The interviews demonstrated that students could correctly define IPE, as per the WHO definition [1] (Table 5, Quote 1). Learning opportunities appeared when topics overlap and are relevant for the healthcare groups involved.

Table 2. Mean values for G-IPAS individual components.

Item[a]	German Interprofessional Attitudes Scale (G-IPAS) (n = 562)	Women	Men	Total	*p* value
	Teamwork, roles and responsibilities [Mean(SD)]				
TFV1	*Shared learning before graduation will help me become a better team worker*	3.79 (1.01)	3.55 (1.13)	3.71 (1.05)	**0.015**
TFV2	*Shared learning will help me think positively about other professionals*	3.33 (1.09)	3.14 (1.18)	3.27 (1.12)	0.059
TFV3	*Learning with other students will help me become a more effective member of a health care team.*	3.91 (1.01)	3.58 (1.20)	3.81 (1.08)	**0.001**
TFV4	*Shared learning with other health sciences students will increase my ability to understand clinical problems.*	3.30 (1.05)	3.12 (1.09)	3.24 (1.06)	0.061
TFV5	*Patients would ultimately benefit if health sciences students worked together to solve patient problems.*	4.20 (0.93)	3.96 (0.92)	4.12 (0.93)	**0.004**
TFV6	*Shared learning with other health sciences students will help me communicate better with patients and other professionals.*	4.03 (0.10)	3.69 (1.11)	3.92 (1.05)	**0.000**
TFV7	*I would welcome the opportunity to work on small group projects with other health sciences students.*	3.48 (1.18)	3.43 (1.23)	3.47 (1,19)	0.644
TFV8[c]	*It is not necessary for health sciences students to learn together*	3.72 (1.07)	3.34 (1.28)	2.4 (1.15)	**0.001**
TFV9	*Shared learning will help me understand my own limitations*	3.23 (1.11)	3.29 (1.14)	3.25 (1.12)	0.550
	Patient-centeredness [Mean(SD)]				
PZ1	*Establishing trust with my patients is important to me*	4.90 (0.31)	4.81 (0.40)	4.88 (0.34)	**0.008**
PZ2	*It is important for me to communicate compassion to my patients*	4.87 (0.39)	4.71 (0.50)	4.81 (0.43)	**0.000**
PZ3	*Thinking about the patient as a person is important in getting treatment right*	4.75 (0.50)	4.59 (0.59)	4.70 (0.53)	**0.002**
PZ4	*In my profession, one needs skills in interacting and cooperating with patients*	4.88 (0.39)	4.83 (0.45)	4.86 (0.41)	0.166
PZ5	*It is important for me to understand the patient's side of the problem*	4.80 (0.46)	4.68 (0.56)	4.76 (0.50)	**0.018**
PZ6	*It is important for health professionals to understand what it takes to effectively communicate across cultures*	4.66 (0.53)	4.52 (0.68)	4.62 (0.59)	**0.017**
PZ7	*It is important for health professionals to respect the dignity and privacy of patients while maintaining confidentiality in the delivery of team-based care*	4.81 (0.42)	4.75 (0.53)	4.79 (0.46)	0.172
PZ8	*It is important for health professionals to provide excellent treatment to patients regardless of their background (e.g., race, ethnicity, gender, sexual orientation, religion, class, national origin, immigration status, or ability)*	4.95 (0.22)	4.89 (0.38)	4.93 (0.28)	**0.035**
	Healthcare Provision [Mean(SD)]				
GHV1	*It is important for health professionals to work with public health administrators and policy makers to improve delivery of health care*	4.07 (0.78)	4.20 (0.88)	4.11 (0.82)	0.069
GHV2	*It is important for health professionals to work on projects to promote community and public health*	4.14 (0.80)	4.17 (0.86)	4.15 (0.82)	0.684
GHV3	*It is important for health professionals to work with the legislators to develop laws, regulations, and policies that improve health care*	4.07 (0.82)	4.28 (0.76)	4.14 (0.80)	**0.002**
GHV4	*It is important for health professionals to work with non-clinicians to deliver more effective health care.*	4.06 (0.84)	4.09 (0.97)	4.07 (0.88)	0.737
GHV5	*It is important for health professionals to focus on populations and communities, in addition to individual patients, to deliver effective health care*	4.02 (0.87)	4.18 (0.86)	4.07 (0.87)	0.052
GHV6	*It is important for health professionals to be advocates for the health of patients and communities*	4.16 (0.85)	4.23 (0.90)	4.19 (0.87)	0.343
GHV7	*It is important for health professionals to respect the unique cultures, values, roles/responsibilities, and expertise of other health professions*	4.65 (0.56)	4.56 (0.59)	4.62 (0.57)	0.071

[a]The items have been translated from the German language. TFV = Teamwork, roles and responsibilities, PZ = Patient-centredness, GHV = Health Provision.

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Table 3. Mean scores for the G-IPAS score and subscale scores, stratified by gender and year of studies.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Overall average		*p* value
Overall Scores	**Women (n = 50)**	**Men (n = 24)**	**Women (n = 56)**	**Men (n = 28)**	**Women (n = 71)**	**Men (n = 37)**	**Women (n = 68)**	**Men (n = 25)**	**Women (n = 71)**	**Men (n = 32)**	**Women (n = 63)**	**Men (n = 37)**	**Women (n = 379)**	**Men (n = 183)**	
Teamwork, roles and responsibilities [Mean (SD)]	3.95 (0.59)	3.70 (0.63)	3.63 (0.80)	3.74 (0.81)	3.73 (0.52)	3.57 (0.61)	3.61 (0.74)	3.08 (0.90)	3.60 (0.75)	3.47 (0.82)	3.5 (0.83)	3.20 (1.05)	3.67 (0.72)	3.46 (0.84)	**0.002**
	3.87 (0.61)		**3.67 (0.81)**		**3.68 (0.56)**		**3.47 (0.81)**		**3.56 (0.77)**		**3.39 (0.92)**		**3.60 (0.77)**		
Patient-centeredness [Mean(SD)]	4.85 (0.2)	4.58 (0.40)	4.76 (0.31)	4.78 (0,33)	4.82 (0.24)	4.75 (0.34)	4.83 (0.2)	4.70 (0.26)	4.85 (0.22)	4.76 (0.32)	4.83 (0.22)	4.72 (0.35)	4.83 (0.23)	4.72 (0.33)	**0.000**
	4.76 (0.31)		**4.76 (0.32)**		**4.80 (0.28)**		**4.79 (0.23)**		**4.82 (0.25)**		**4.79 (0.29)**		**4.79 (0,28)**		
Healthcare Provision [Mean(SD)]	4.33 (0.54)	3.99 (0.70)	4.08 (0.70)	4.31 (0.56)	4.20 (0.48)	4.26 (0.57)	4.08 (0.53)	4.34 (0.49)	4.18 (0.55)	4.23 (0.61)	4.14 (0.59)	4.28 (0.55)	4.17 (0.57)	4.24 (0.58)	0.207
	4.22 (0.61)		**4.16 (0.67)**		**4.22 (0.52)**		**4.16 (0.54)**		**4.02 (0.57)**		**4.19 (0.57)**		**4.19 (0.57)**		
Overall G-IPAS [Mean (SD)]	4.36 (0.35)	4.08 (0.48)	4.14 (0.48)	4.25 (0.46)	4.23 (0.29)	4.16 (0.39)	4.16 (0.38)	3.99 (0.38)	4.19 (0.36)	4.13 (0.36)	4.07 (0.35)	4.01 (0.38)	4.11 (0.44)	4.20 (0.40)	**0.008**
	4.27 (0.41)		**4.17 (0.48)**		**4.12 (0.32)**		**4.11 (0.38)**		**4.11 (0.38)**		**4.05 (0.36)**		**4.12 (0.36)**		

P-values indicate the significance of the main effect gender for the overall average Scores obtained from the separate ANOVAs.

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Such interventions allow for exchange of knowledge or skills and sharing of different experiences, which improves understanding and communication between groups, and builds trust. IPE can refer to learning about the roles, responsibilities, competencies and duties of other healthcare professionals (Table 5, Quotes 2 and 3). It was also noted that IPE benefits patient care and helps build a social network of people within the working environment (Table 5, Quote 4).

Recognition of interprofessional education in the medical curriculum. The most vividly recalled experience was the intravenous cannulation workshop, currently being taught during the first year of studies. The course was considered interprofessional because it was taught by a registered nurse and held in a small-group workshop, with groups of up to six students (including nurses, midwives and sometimes pre-hospital technicians). All participants mentioned that it was a positive experience and that they profited from the course. Main positive aspects mentioned included: (1) the teaching and then the practice with a skilled nursing student; (2) the relaxed, informal interaction; and (3) the exchange of information and guidance from the nursing students, with tips from daily practice.

> *"I could even benefit a lot from the nursing students or the midwives. You really noticed that they already did it on real people when we were still practicing on the models. And they already had routine and could give us good practical advice."* (Interview 2, Student 2)

> *"The intravenous cannulation (. . .) was shown by the nursing student and not by the course instructor, who was a medical student in the higher year because he simply said that the nurse could do it better and had more experience. I thought that was extremely good, that he then said that she could do better and should show it."* (Interview 7, Student 2)

> *"(. . .) we were deliberately divided into my group, that you were always with someone who was not a medical student, which I found very exciting."* (Interview 5, Student 3)

> *"I could benefit [from the intravenous cannulation course] because we had a qualified nurse (. . .), who could actually show me how it worked, better than the instructor. And otherwise, it was a relaxed atmosphere."* (Interview 8, Student 2)

However, most students realised that nursing students already had the given competency and were bored/frustrated during the workshop. Some medical students observed other peers

Table 4. Coding frequency across all interviews.

	Frequency (n)	Percentage (%)
Participant´s age	31	3.33
Participant´s year of studies	31	3.33
Participant´s previous work experience	15	1.61
Participant´s ties with healthcare	41	4.40
Comments on filling the GIPAS form	25	2.68
Definition of IPE	44	4.72
Goals of IPE	48	5.15
Advantages of IPE	112	12.02
Disadvantages of IPE	101	10.84
Examples of IPE during medical course	96	10.30
Attitudes towards IPE	63	6.76
Attitudes: Absence of IPE	34	3.65
Examples of wished for interventions	70	7.51
Desired format of the IPE course	71	7.62
Desired Year of studies for IPE	92	9.87
Desired Frequency of IPE	50	5.36
Ideal group size for IPE interventions	8	0.86
Total number of coded citations	932	100

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having discriminating attitudes towards nursing students. Most were unhappy to be in a workshop where they knew less than their nursing counterparts and could not contribute to any exchange in knowledge.

> *"[During the intravenous cannulation course] I heard from many nursing students that they didn't understand that they were doing there. They could already do it and had clinical experience. It was therefore unnecessary for them to take the course and a waste of time"* (Interview 5, Student 1)

> *"I noticed that a colleague of mine got upset about the teaching at the intravenous cannulation course and mentioned that "she is just a nurse anyway". I then asked him directly, "that means that she can do less?" And he answered "yes" and stood by it. He really meant it, and only because the nurse had other competencies. And he was a first-year student."* (Interview 7, Student 1)

Table 5. Subcategory "definition of IPE" elements and representative cites.

Subtheme with explanation	Representative cites (exemplary) from semi-structured interviews
Definition of IPE Learning that occurs with 2 or more different health professionals or healthcare students • about each other´s professions • with other professions about a common topic • to enable effective collaboration • to improve patient outcomes	Quote 1, Interview 8, Student 3: *"(. . .) at least 1 person from a different professional group is present as a medical student."* Quote 2, Interview 1, Student 2: "*I can only agree with the keyword "more efficient cooperation". I think it is all about having the knowledge and understanding, what are the tasks, the competencies of another team member and how can you support and benefit from each other."* Quote 3, Interview 1, Student 3: "*Who does which tasks–it is important that you learn that, so that you focus on the patient."* Quote 4, Interview 6, Student 3: *(. . .) so that people who work in the health sector optimally form a network with each other and work effectively together."*

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"I don't know what the others should learn from us. We can't do anything! Maybe we know more, but that doesn't interest them that deeply either." (Interview 2, Student 2)

It was also noted that if groups were not deliberately mixed, students from the same profession tended to group together and quality learning was impacted. A medical student who had a nursing background added:

"(. . .) I have been doing the VP course as a tutor. (. . .) I personally make sure that I do not have a group of doctors in the groups and that the nurses are separate, but that I mix them up a bit (. . .). [It is important that] they work side by side (. . .)" (Interview 8, Student 1)

However, the absence of follow-up courses or further skills training and having it assessment only in the third year of studies were all reasons to consider the workshop inadequate for the first year curriculum.

Another IPE experience mentioned was the two-hour Confidentiality seminar, occurring with law students or with nursing students. Participants attended this seminar in their first year of studies. Most students hinted that the course was not well structured and that students did not mix, so the experience was not really IP. The reason for it being interprofessional was the common topic rather than the interaction between groups.

Five students had additionally chosen to take part in an interprofessional clerkship offered by the University of Bern, consisting of two interprofessional days (first day: nursing students have a shared histology lesson with medical students; second day: nutritional care with student role-play). All students found the IP clerkship very positive. Nursing and clinical clerkships in clinical years, as well as lectures with other professional groups, were also considered IP interventions.

"I found it so important in my nursing internship that I saw what they actually do, what their tasks are. Because I also noticed from myself that I have a completely wrong picture of what this profession actually is. Because I just thought, a qualified nurse, well. . . and then I saw what they actually do." (Interview 2, Student 2)

"We went to lectures for six months with law students. As it was about health law, medical students were also invited. It was very interesting, the law students asked a lot of medical questions which were clear to us, but we didn't know anything about when they mentioned court issues." (Interview 3, Student 1)

Overall, students welcomed IP courses but were disappointed because of the lack of actual IP (i.e., inadequate setting, disorganized interventions). Medical students felt they had significantly less experience than their IP counterparts.

"I actually thought [the IPE] was good in the beginning, but in the end we never worked together. (. . .)I think we medical doctors had a lot less experience and it was actually the wrong setting to somehow mix us." (Interview 8, Student 2)

"In the intravenous cannulation course, nurses could perform the skill already, because they already had patient contact. And I had zero experience. I profited a lot from them, but I couldn't give them anything in return." (Interview 5, Student 1)

The IP offer during the Medical course was insufficient: medical students were aware that doctors deal with many other health care professions, and for medical students it would be important to know about other professions' training, roles and responsibilities during the medical

curriculum. Most students did not experience IPE, except for the Intravenous Cannulation course, and one student interviewed had no recollection of any IP interactions during training.

> *"We had a couple of IP courses with nursing students during our studies. I thought it was cool, but I think it shouldn't stop there. We will have to deal with so many healthcare groups in the future that it is important to get to know these people during medical studies: what they learn, what they can do and where their limits are. So that we can understand them a little better."* (Interview 5, Student 2)

Overarching goals of IPE. Table 6 summarises all the mentioned goals of IPE with the respective quotations. Students named several goals of IPE, segmented into 5 main subcategories:

1. *Profession-linked perspectives*, and *work-oriented learning*: Students were aware that to achieve these goals for application in future daily practice, interactive learning between professional groups was necessary (Table 6, Quote 5).
2. *Improvement of teamwork*: IPE leads to better understanding of the daily routine, work distribution, and duties of other healthcare groups, thus preventing misunderstandings and miscommunication. Enhanced communication through IPE was pointed out as a contributing factor for improved interaction between different professional groups (Table 6, Quote 5).
3. *Reduction of prejudices* in the workplace: Early contact with other healthcare groups could "prevent" the endorsement of stereotypes, and lead to a workplace environment that is open-minded and where there is mutual respect (Table 6, Quote 8).
4. *Enhancement of a patient-centred approach*: IPE implies that patient care is performed collectively, and the patient lies in the centre of care.
5. *Support of workplace wellbeing*: Several students mentioned IPE could create *workplace wellbeing*, particularly by improving social relationships both in and outside work, and by reducing miscommunication, and therefore frustration levels (Table 6, Quote 10).

Table 6. Subcategory "overarching goals of IPE" elements and representative quotations.

Subtheme with explanation	Representative cites (exemplary) from semi-structured interviews
Overarching goals of IPE • learning together and gaining a more work-oriented perspective • improvement of teamwork • reduction of prejudices • increase in patient-centeredness • improvement of wellbeing in the workplace	Quote 5, Interview 5, Student 1: "(. . .) you have the exchange between different professions very early [during medical school] so you don't come clueless to the hospital later." Quote 6, Interview 1, Student 2: "*You (. . .) become aware of the [roles of team members] and focus on working together."* Quote 7, Interview 6, Student 3: "*If you have IP communication beforehand, future work with other healthcare groups will be simplified."* Quote 8, Interview 7, Student 2: "*not letting doctors feel superior to the nurses and correct the stereotype that "nurses only do what we do not want to do cause it´s not good enough or not challenging enough for us"* Quote 9, Interview 2, Student 3: *"I think it is important to learn to appreciate what others do for the patient. During medical school we do not see the whole spectrum [of health care]. Especially the care or the physiotherapy or ergotherapy, too, contribute a lot—and we do not learn about that"* Quote 10, Interview 5, Student 3: *"Also to reduce frustration in the hospital—nurses are frustrated with doctors and the other way around; [IPE] may help"*

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A frequently visited component of IPE was the *enhancement of workplace well-being*. Students were regardful that finding commonalities in different healthcare professions intensifies social relations both inside and outside the workplace, leading to a social benefit. Some students mentioned a financial advantage of IPE, as satisfied staff are more likely to remain in post thus reducing overall costings. Finally, all of the above lead to less medical mistakes, which can increase patient safety.

b) Barriers to IPE implementation

Issues regarding the *competition with the current medical curriculum*, *the risk of unbalanced learning* and *other dangers* were explored. Students feel they already have an overloaded schedule, so additional IPE interventions could be difficult to implement. They were uncomfortable with being taught by non-doctors because they feared other health care professionals would not be aware of their training or be knowledgeable about their curriculum. The lack of assessment of such activities labels IPE interventions as secondary, superfluous or less relevant. There was an outspoken fear of loss of medical identity, loss of medical specialization (because knowledge is shared), and fear of being less thorough in their own medical curriculum.

> *"You may not get to the level you would need in medical studies if you work with professional groups that are in a specific area that does not have to reach such a high level. And that you may be slowed down a lot in areas."* (Interview 8, Student 1)

> "*It depends on the topic. (. . .) you may have extreme differences in knowledge and personally, I don't think it's so great when I'm somewhere and then I realize that, compared to the others, I don't know anything. I somehow feel stupid and superfluous. I can benefit from the others, but (. . .) it is uncomfortable if you do not participate."* (Interview 8, Student 4*)*

On a *course level*, the use of IPE interventions *per se* does not guarantee student interaction. If the IPE experience is not perceived as good by all students, there is a risk that they will consider it unnecessary. The implementation of such activities may be challenging because the content, format and frequency rarely accommodate all students involved. There was a frequently mentioned fear that students would not benefit from the topics due to their diverse backgrounds or varying levels of knowledge on a given subject. Medical students were concerned that topics would be approached too superficially. This could lead to boredom and frustration or create a feeling of unworthiness.

The teaching of competencies outside a given role can lead to a false sense of ability and may have legal consequences (by performing skills outside of set competencies). Additionally, it may enhance prejudices against other health care professions because of single participant's characteristics from each group.

> *"Simply the basic requirements for the [IPE] course were so different that it did not really contribute to bringing these two professional groups closer together, but rather the opposite."* (Interview 1, Student 2)

> *It is difficult to bring the shared content across at a common level so that it is adequate for both groups"* (Interview 6, Student 4)

> *"It is a tightrope walk. IPE is necessary, but it can also be too much."* (Interview 3, Student 4)

Finally, several barriers were mentioned on an *institutional level*: bureaucratic obstacles of combining curricula from different faculties, organizational aspects e.g. lack of infrastructures

to accommodate all students, difficulty in coordinating rotations, time constraints, monetary constraints and deanery or political barriers (resistance to change).

> *"[Barriers include] organization and also coordination with the various training plans. Because we are not learning the same things completely in parallel."* (Interview 6, Student 4*)*

c) Expectations of IPE

Ten students agreed that IPE should start as early as the first year of studies. They mentioned several advantages for early IPE introduction which included (1) easier implementation (as students would have similar backgrounds) and (2) the encouragement of early interaction, shared learning and networking, which would contribute to the building of mutual respect from an early stage. Students suggested starting with basic science and other overlapping topics, which could then evolve to clinical interactions later in the curriculum.

> *"And if you start early, you are more sensitive, then you get used to the interprofessional and working together. I think that makes a big difference, even if you are snobbish in the beginning (. . .)."*(Interview 7, Student 3)

Reasons opposed to an early IPE introduction included students being overwhelmed by an overloaded, integrative year; the role of "doctor" not being yet clearly defined and prejudices against other health care professions existing before medical school. On the other hand, eleven students pointed out that the IPE introduction should occur just before or during clinical years (from the third year onwards). For them, it meant a better integration of the IPE content with clinical practice, the previous acquisition of basic clinical knowledge which would facilitate the focus on the IP component, and the broader diversity of activities that could be offered. One student was concerned that such an approach would be too late to prevent the development of prejudices. Five students mentioned it was important to have IPE on a frequent, recurrent basis.

> *"I have the feeling that it is worthwhile, especially later, the more practical it becomes and the more practical things you do, the more it makes sense to integrate IPL. Because the first few years are so theoretical, integration doesn't bring you much."*(Interview 3, Student 3)
>
> *"But I think that you will probably benefit more from the exchange when you get closer to the clinical semesters. Because [in pre-clinical years] the roles are not yet clearly distributed. Later on the interprofessionality is more noticeable."*(Interview 9, Student 1)
>
> *"If you just look, whether only earlier or only late, I don't know which would be better. But repeatedly would be good."* (Interview 5, Student 2)

For pre-clinical years, students preferred IPE courses on overlapping topics from basic sciences (e.g., anatomy, physiology, pharmacology. Potential healthcare students to be included were nurses, physiotherapists, midwives and operating room technicians. Courses should be practical (tutorials, case studies, clinical skills trainings, problem-based learning groups, case-based learning) and lectures should be avoided. Other options mentioned included seminars or course days about topics which are relevant to more than one profession or the use of simulation for soft skill and clinical skill training. Some students recommended that such courses should occur during clinical rotations and include other healthcare students. The IP groups should, when possible, be maintained throughout the year to allow for a deeper social interaction.

Students would rather have IPE in smaller groups (4–6 participants, mixed ratio 1:1 or 1:2) to allow for a better interpersonal experience and communication. As for the preferred duration, they felt these should be course blocks of approximately 1–4 hours, entailing a full morning or afternoon. IP courses should have an optional character.

> *"If they are smaller groups, if you really have to communicate and interact, then you get to know each other on a more human level and there are many prejudices that can be eliminated."*(Interview 3, Student 2)

> "*IPE courses not too often, twice a semester, then increase frequency to once per month towards the end of medical school"* (Interview 6, Student 2)

Students favored regular IPE interventions, with course repetitions. Participants did not agree on an adequate frequency: while some wished for IPE to occur on a weekly, fortnightly or monthly basis, others preferred only once or twice every semester. Some students were concerned about the time it would take to prepare for weekly IPE (e.g., communication) trainings.

Regarding the topic of the IPE intervention, students chose basic science topics for pre-clinical years (including anatomy, biology and patient confidentiality). For clinical years, the main desired interventions included topics like basic life support training, clinical skills training (mostly regarding history and physical examination of organs and systems), handover and rounds, non-technical skills and communication training. Trial (taster) days and areas of shared responsibility (medication errors, hospital hygiene, ethics) were also acknowledged as being useful.

> *"I think the focus for IPE is a little bit different. When we are with among medical students, it is often about acquiring knowledge and when it is interdisciplinary, it is more about learning soft skills and how to use them in everyday life."* (Interview 4, Student 1)

Discussion

This study explored medical students´ attitudes and perceptions towards the main components of IPE in Bern University. The students displayed positive attitudes towards IPE across all study years in individual items, subscales averages and in the global G-IPAS score. This supports findings from a previous Bernese cohort using another interprofessional attitudes scale [25] and reflects similar findings from other countries [26, 27]. Such positive attitudes may be due to a ceiling effect caused by the early exposure to IPE interventions in the Faculty of Medicine of the University of Bern.

Females had significantly more positive attitudes towards interprofessionality in the overall G-IPAS and for the subscales of "teamwork, roles and responsibilities" and "patient-centeredness". Selected studies from Sweden [28, 29], using either the RIPLS or the Jefferson Scale also showed more positive attitudes towards teamwork in females. Others [30] reported a significant effect of gender in the IEPS empathy subscale. No other studies seem to report such a gender effect. Females from these countries (Sweden, Northern Italy, and now Switzerland) may be acculturating in more democratic societies that have a strong egalitarian view of women's position in the workforce. The feeling of being equal to males and having equal work expectations can make such differences more visible. Although many healthcare systems still maintain traditional hierarchical structures and gender roles, they may be transitioning into a more gender-neutral teamwork and patient-centred culture, particularly in central and northern Europe. This is an issue worth exploring in further studies.

Students in pre-clinical years had significantly higher G-IPAS scores. Other studies showed a similar positive attitudes score, both for the healthcare student population in general [6, 31–34] and medicine in particular [6, 35].

One third of students mentioned the importance of the early introduction of IPE in the curriculum, as it facilitated an early interaction and network, contributing to mutual respect and reducing stereotypes. Thus, students can join an interprofessional team without bringing a well-developed "doctor professional identity" [34]. Social Identity Theory [36] supports this: stronger definitions of individual professional roles may lead to intergroup discrimination. Introducing IPE early in the curriculum is likely to have an impact on students' ability to assume their given roles and responsibilities, which is a basic principle of professionalism [37]. Finally, having to learn interprofessional teamwork skills in the workplace in addition to clinical responsibilities and patient care, may increase extraneous cognitive load [38, 39]. Learning these skills may be better served within basic sciences courses, as they provide a more favourable framework for the initiation of IPE [40] Early introduction of IPE would also tackle lower levels of prejudice, promoting more positive attitudes [41].

Factors contributing to this decline in interprofessional attitudes include being more experienced in the healthcare field [32], having previous interprofessional contact [42], having had less positive experiences in IPE [31, 34, 43] and having parents working in healthcare [44]. Although specifically targeted for the Bernese sample, none of these factors showed a significant association with the decline in attitudes. A recent study by Oza et al. [45] applying a regression analysis to a large cohort of medical students, also failed to find such associations with the aforementioned variables. The absence of any association in larger cohorts may be more statistically trustworthy, and the association of these factors in IPE decline should be specifically addressed in higher powered studies.

The decline in students' attitudes towards IPE observed in the quantitative analysis, coupled with 30% of the participants mentioning clear disadvantages of early IPE implementation is worrisome. This is of concern because good relationships with colleagues and patients–likely fostered by IPE–increase patient satisfaction, promote treatment compliance and protect against malpractice claims [46]. Hudson et al. [34] suggested this may be due to the nature of the intervention and how negatively students experienced it. Being taught by non-doctors also reduces medical students´ motivation to participate in IPE interventions [34]. The arguments above, coupled with an underdeveloped professional identity, may have been the reason for the decline. On-going team training may tackle this, as it has been shown to be central in the sustainability of a shared understanding of professional roles [47, 48]. In the present study, students favoured regular IPE to maintain interprofessional proficiency. Both findings reinforce the need to offer health care professional students enough opportunities to interact and learn together from the first year of studies and throughout their careers.

Students had an outspoken fear of loss of medical identity and some showed no positive attitudes towards interprofessionality. Others, despite being at the beginning of their professional career, showed a stereotypical view and regarded interaction between health professions as difficult, which is similar to previous findings [49–52]. Although medical students may lack professional maturity to project the benefits of such IPE experiences, it takes time for a true change in mindset to occur, particularly among professions that have for so long operated independently [53]. Unfortunately, stereotypes formed by professional interaction and societal views on professional roles are not easily modified by educational interactions alone [54]. The introduction of small-group reflections, facilitated by adequate role models, may allow students to remodel their own professional and personal attitude towards patients, to express their moral judgements from their observations of other healthcare professionals' interactions and to share these experiences within a safe learning environment [48]. Such experiences

throughout training programmes may reduce anxieties and fears about future professional collaboration [34].

Students mentioned barriers similar to those noted previously [5, 55], particularly regarding resistance to IPE by students or faculty, difficulty in coordinating coursework and lack of an established framework. Such barriers are able to influence both the outcome as well as the sustainability of an IPE programme [55]. Lawlis [55] also recommends a way to overcome these barriers by means of faculty development plans. Faculty development encourages staff commitment and buy-in, and eases a professional and institutional culture change, in a "bottom up" approach.

The social component of IPE was mentioned as a goal and as an advantage. Students considered the networking beneficial, and by engaging on interprofessional relationships on a personal level, they could learn about each other's curricula in informal settings and even foster friendships. This is a point not frequently explored in the literature. The social aspect repeatedly mentioned in the interviews mirrors many of the components of Social Learning Theory [56]. Learning is also a social and relational process, frequently occurring around authentic and meaningful patient cases [45, 49]. Such findings show that "formal" or planned educational IPE experiences also create "informal" opportunities to socialise and be acquainted on a personal level. These "informal arenas can, therefore, stimulate and set a solid basis for interprofessional collaboration" [54].

All of these observations should be considered in order to offer more authentic interdisciplinary experiences, with the healthcare team and the patient engaging in interprofessional problem-solving activities. Such significant learning interactions have a clear impact on how medical students internalise and approach patient-centeredness [57].

There are limitations to this study: first, the cross-sectional design did not allow for the observation of cohort evolution within their studies and further pre-post analysis. The single-centre design limits the generalization of its conclusions. We tried to overcome this limitation by targeting an adequate sample size, which is one of the largest in IPE literature.

We also cannot assume that our qualitative data can be translated by the simple translation of words, because words and meanings are not equivalent in different languages and language carries a cultural meaning. Although we have used a known approach to translation of our quotes from German to English by two native speakers, our translation may still suffer from misinterpretation and the translated text may break away from the original.

Additionally, we had concerns about the first use of a new scale. Although the G-IPAS was translated and acculturated into German and has shown very solid reliability data and factorial structure, it may not be the appropriate tool for the study´s context. Social desirability bias was also a threat, considering that the G-IPAS was self-reported. Finally, measuring beliefs and attitudes does not indicate true skill proficiency in interprofessional work, and future research should include more ability-oriented measures, aiming for outcomes in levels 3 and 4 of Kirkpatrick´s hierarchy [58].

Conclusions

Although IPE has only recently been introduced in many healthcare training settings, medical schools and other health professional training institutions have the means to provide opportunities to encourage collaborative interactions early in training. This study´s findings, collected directly from the students, provide valuable insights for the faculty at the University of Bern and for similarly structured universities into the state of IPE in the current programme and potential areas suitable for IPE. They also promote a greater understanding of the difficulties educators and organizations face and encourage discussion about when and how medical

schools should address interprofessional learning. The results from this mixed-methods study demonstrate that medical students are ready for IPE experiences early in their studies.

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Aim 4: To study the concept of Interprofessional Learning and its dimensions

11. Study the concept of Interprofessional Learning and its dimensions

Joana Berger-Estilita, Sofia Merlo, Sissel Guttormsen, Alexander Fuchs, Robert Greif, Hsin Chiang, Pre-licensure medical students' knowledge and views on interprofessional learning: a qualitative analysis based on real-world data, Front Educ - Higher Education (accepted for publication)

This study aimed to determine the characteristics and attributes of the definition of IPE and to distinguish between the defining and incorrect attributes of IPE in a medical student population **(Aim 4 of the thesis)**. Moreover, we aim to develop a conceptual framework of IPE in a microcontext and determine the weight of each component of the IPE definition.

We performed a qualitative methodology approach to promote comprehensiveness, understanding and validity of a proposed framework on the concept of IPE. Our framework was developed using the conceptual framework analysis technique from Miles and Huberman (2014). He defined a conceptual framework as 'a visual or written product that explains, either graphically or in narrative form, the main objectives to be studied and the presumed relationships among them' (Miles et al., 2014). At the heart of this methodology lies an interpretative approach to social reality, offering understanding of the concept, instead of establishing causal relationships intended to provide outcomes.

We used data from semi-structured interviews from **Publication 3** to investigate medical students' perceptions of the definition of IPE. The interviewers acted solely as facilitators, encouraging contributions from all participants and validating different views. The study was conducted in German. The framework analysis presented in this paper is an independent, post hoc sub-study of the group interview dataset mentioned in the previous publication (Berger-Estilita, Chiang, et al., 2020).

Before transcript analysis, a basic category system was created, based on the existing definitions on IPE using the Podsakoff recommendations (Podsakoff et al., 2016). First, we identified all attributes from the abovementioned five representative definitions of IPE. Then, we organized those attributes by themes and sorted them in a hierarchy of increasingly complex attributes, where each attribute subsumes elements of the preceding lower level. (Figure 2).

We determined three levels, according to increased complexity of the concept:

- Level One—"Interprofessional": attributes related to work with individuals of other professions
- Level Two—"Teamwork": attributes related to knowledge of different roles, related to communication with patients, families and other health care professionals in a responsible manner, to attributes supporting a team approach and to building team dynamics, and related to patient-centred care.
- Level Three—"Societal": attributes related to working to maintain a climate of mutual respect, shared values/ethics and social interactions.

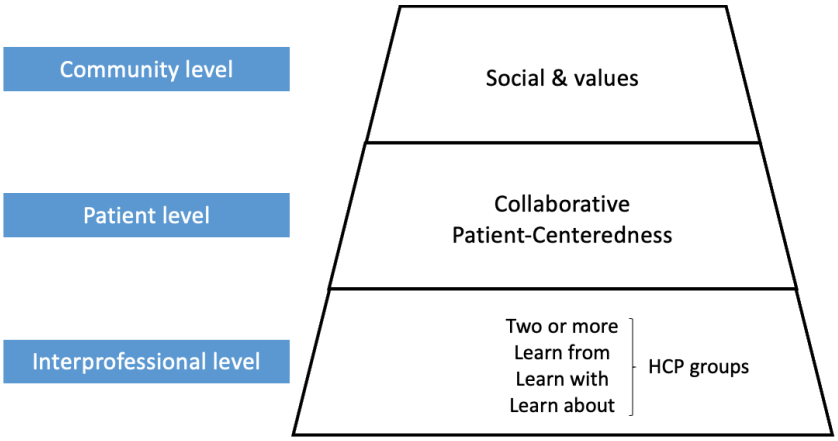

Figure 2: Three-level IPE Framework

Deductively created three-level IPE framework, according to an increased concept complexity; HCP: Healthcare professionals.

The fourth stage of the Podsakoff (2016) recommendations included refinement of the conceptual definition by adding attributes explored by inductive coding. To comply with this step, we re-analysed transcripts using inductive thematic coding. We also performed a qualitative concept analysis study according to Walker and Avant's methodology (Walker & Avant, 2005) by determining a standard and contrary model of IPE according to Olenick's concept (2010) and searching for cites in the text that would fit both models.

Several categories emerged from the semi-structured interviews. Students were aware of the intended meaning of IPE, as per WHO definition (2010). After being questioned, students could spontaneously give attributes of IPE concerning the four core competencies of the IPEC report (2011):

i. *Views on Values/Ethics for interprofessional practice*

Participants underlined that IPE promoted mutual understanding and shared mental models, facilitating future interprofessional relationships. IPE is able to break down barriers and reduce prejudices. When learning together, participants accept that other healthcare professionals perform some skills better, and this fosters mutual respect and trust. Students mentioned that IPE enhances patient-centred care: by leading to greater work efficiency and potentiating a more positive working environment, patients may feel that healthcare professionals listen more attentively and have a more accurate overview of their problems.

ii. *Views on Roles and Responsibilities*

Students mentioned that IPE improves the extent of knowledge of other healthcare students' roles, skills and abilities, and optimizes cooperation while reducing misunderstandings. IPE makes one have a different perspective and be sensitive to how other healthcare professionals judge a situation. This clarifies the practical relevance of their work.

iii. *Views on Interprofessional communication*

IPE benefits communication between healthcare students regardless of the course content. Communication promotes shared mental models, can facilitate future interprofessional relationships and a smoother settling into clinical practice. Good communication benefits collaboration and leads to better patient care. It also embodies a patient-centred approach, with multi-way communication between the patient, nurse and doctor. All this increases satisfaction in the workplace.

iv. *Views on Teams and Teamwork*

Being conscious of what the other healthcare professions' students learn leads to better cooperation and improves teamwork. IPE-experienced physicians will have a broader knowledge of available possibilities and delegate when appropriate, therefore showing better attitudes towards teamwork. IPE reduces the effort to make teamwork efficient (facilitating

interaction in hand-overs or rounds). This leads to easier integration in the workplace, enhances in-hospital social connections, and increases employee satisfaction.

v. *Other views*

IPE can mimic a natural work environment, and students will learn clinically-relevant subjects and problem-solving, making learning more motivating and purposeful. IPE also teaches how to behave in a professional context.

Cultivating interprofessionality leads to more organised and efficient teamwork and a better working atmosphere. This improves patient safety (teams make fewer mistakes) and employee well-being. More satisfied employees are less inclined to leave to other institutions. Students noted that this combination of a more stable workforce and increased productivity would lead to financial benefits.

vi. *Further attributes for the concept definition*

We created 16 additional codes inductively, covering concepts not previously integrated into the definitions. Code frequency for the inductive codes is summarized in Table 3.

"Communication" was the most frequent inductive code, and students found it to have a central role in IPE. If health professionals are not forced to communicate, then they remain siloed. Communication between different health professionals is the starting point for exchanging ideas and coordinating teams. Many students argued that interprofessional learning training should notably include communication skills. Students also related "communication" to higher attributes of IPE. Improved communication between healthcare professionals might lead to more satisfied team members, working with less friction, and reducing the time and energy spent on overcoming issues arising from lack of communication. "Role recognition" was the second most frequent inductive code. Students valued the understanding of different healthcare professionals' competencies in interprofessional learning. Such role recognition facilitates task distribution by correctly assessing what each professional group can do and marks out the limits of each profession, suiting mutual expectations. Students mentioned that recognizing roles leads to the empowerment of each profession and enables better team performance and task completion.

We also frequently coded segments with "Preparation for practice". Interprofessional learning seems more relevant for medical students in clinical settings, where role attribution is commonly applied. "Preparation for practice" was meant to promote early sensitisation to teamwork facilitate future workplace interactions and skills, therefore smoothing the transition into clinical practice.
As higher interprofessional learning components, students mentioned the possibility of early networking, avoiding prejudices, and fostering horizontal leadership strategies.

A conceptual framework for IPE definition derived from the above results is presented in Figure 3. We determined four levels, according to the increased complexity of the concept:

- Level One—Interprofessional: as previously
- Level Two—Patient: attributes related to role attribution of different team players, collaboration between other healthcare professionals with the patient at the centre of care
- Level Three— Team dynamics: attributes related to optimal teamwork, improved communication, work ethics and respectful interaction between team members
- Level Four—Societal (broader education outcomes): attributes related to relationships with other professions outside the work environment to improve wellbeing, patient care and advance learning.

The framework structure loosely resembles a Japanese temple; therefore, it was called the 'IPE pagoda'.

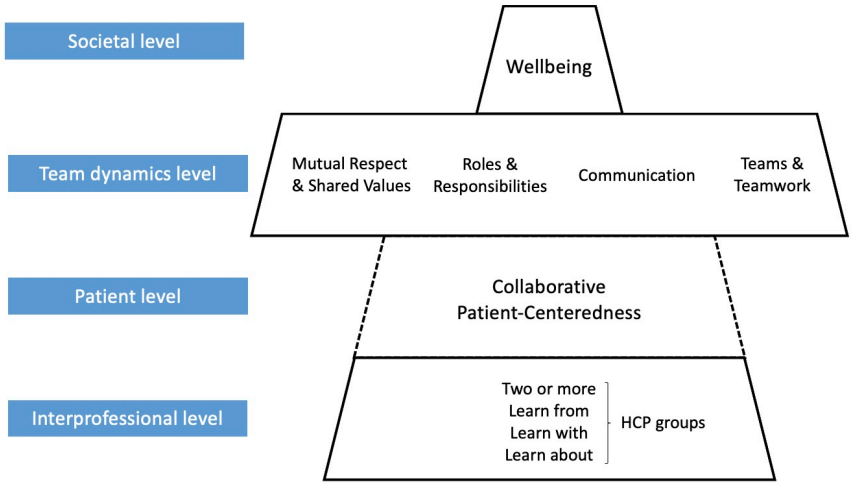

Figure 3: Updated conceptual framework on IPE, the "IPE pagoda". HCP: Healthcare professionals.

This qualitative study demonstrates that medical students at a university that offers one interprofessional internship could identify all the concepts present in international definitions of IPE. However, we verified that students gave different weights to different attributes. Additionally, two-thirds of medical students identified interprofessional learning cases incorrectly. These results both support and build on recent definitions of IPE. The additional themes identified in this study expand on previous literature on this topic (CAIPE, 2021; IPEC, 2011, 2016; Wener et al., 2009). This is important because it demonstrates that IPE plays a more expansive role in pre-licensure students' medical education than previously thought (Berger-Estilita, Fuchs, et al., 2020; Hudson et al., 2016). Further, this is the first study in available IPE literature to confirm the four major principles of IPE as outlined by the IPEC report.

On the ***interprofessional level*** of the framework, we were surprised to observe that "learning about" other HCP groups was more expressive than "learning from" or "learning with".

The emphasis on the concept of "learning about" likely reflects a lack of knowledge about other healthcare professions. This might be a consequence of the traditional "siloed" education of medical professions, which often leads to first exposure to IPE only in later stages of the training (Berger-Estilita, Chiang, et al., 2020; Berger-Estilita, Fuchs, et al., 2020). It may

also explain why two-thirds of medical students identified interprofessional learning examples incorrectly.

On ***the patient level***, patient-centeredness was mentioned in only one-fifth of the coded cites. Patient-centredness is increasingly prioritised across medical schools and practice, but it is challenging to teach (Parent et al., 2016). IPE might still be underrepresented in the medical curriculum of the University of Bern, as most teaching is 'disease-centred', which reduces most probable awareness of the "patient-centred" style (Krupat et al., 1999). Our results may also suggest that medical students have not yet fully evolved beyond the physician's role as expert HCP and collaborator into more differentiated Canadian Medical Education Directives for Specialists (CanMEDS) competencies as advocate and manager (Frank et al., 2015).

We hypothesise that as medical students become more comfortable with their role as medical expert, they can glean different impressions from clinical encounters and develop their other intrinsic roles, as recommended in the Principal Relevant Objectives and Framework for Integrative Learning and Education in Switzerland – PROFILES (Michaud & Jucker-Kupper, 2017). Alternatively, it may be that in the course of their clinical training, they are forced to address the roles of other HCPs and thus broaden their view of interprofessionality. This is in alignment with other studies, that if students are given the possibility to work as part of a team, they can develop a more precise insight to a patient-centred approach (Scavenius et al., 2006). While such issues will need to be addressed in further studies, it seems reasonable to recommend that if medical students show little awareness of patient-centeredness, they should be more exposed to interprofessional activities during their training (Krupat et al., 1999).

Surprisingly, the social component of IPE was often mentioned. Students considered networking beneficial, both inside and outside the workplace. By engaging in interprofessional relationships, students learn about each other's curricula in informal settings and even foster friendships.

This aspect of IPE is not frequently explored in the literature. The social element repeatedly mentioned in the interviews mirrors the Social Learning theory (Bandura, 1986).

Learning is also a social and relational process, frequently occurring around authentic and meaningful patient treatment (Friman et al., 2017). These findings support that "formal" or planned educational IPE experiences also create "informal" opportunities to socialise and be acquainted on a personal level. Therefore, these 'informal arenas can stimulate and set a solid basis for interprofessional collaboration'(Reeves, 2000).

Incorporating 'well-being' at the top of the framework adds novelty to the IPE concept. Well-being can be defined as 'a dynamic state that refers to individuals' ability to develop their potential, work productively and creatively, build strong and positive relationships with others, and contribute to their community'(Beddington et al., 2008). This definition is deeply related to the previous concepts of interprofessionality. Interprofessional studies show that negative interprofessional interactions between nurses and physicians increase the likelihood of nurse burnout and may be a critical factor in decreasing nurse well-being, increasing turnover, and worsening patient outcomes, (Dow et al., 2019; Sinclair et al., 2015). However, well-being research on physicians and medical students is less established. Dow et al. (2019) argued that using an interprofessional approach may aid in identifying factors and establishing interventions to support the well-being of different professions better. These recommendations closely align with our real-world findings that added 'wellbeing' into the framework.

Our study has limitations. First, the authors are aware that the reported findings may not represent other cohorts of medical students in Switzerland or elsewhere, so care must be taken in generalisations. There was also a potential for selection bias as students were recruited voluntarily. The extent to which the semi-structured interviews added to or validated the previous definitions, in that the validation was provided only by medical students, may also be considered a limitation. We acknowledge that our findings might have been richer if clinicians, educators or other healthcare professions students had been involved.

Moreover, group interviews may also have introduced social desirability bias and the potential for recall bias. Finally, from the methodological perspective, we used a modified version of the original model-contrary-borderline case concept proposed by Olenick (2010).

By only using the model and the contrary cases, we might have used very high standards to classify medical students' experiences with IPE, leading to a high percentage of examples rated 'contrary case'.

Aim 5: To use a validated Interprofessional Attitudes Scale in an interprofessional simulation setting

12. Use of a validated Interprofessional Attitudes Scale in an interprofessional simulation setting

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This paper aimed to assess the potential benefit of a hybrid, interprofessional simulation on interprofessional attitudes of student midwives as measured by the G-IPAS, and whether a potential beneficial effect is sustained over time. We, therefore, could complete **Aim 5** of this thesis and apply the fully validated G-IPAS for research purposes in an interprofessional context.

The Bern Simulation and Cardiopulmonary Resuscitation (CPR) Centre at Bern University Hospital (Bern, Switzerland) implemented interprofessional hybrid simulation for obstetric emergencies for student midwifes in their final year of training. The simulation was conducted with anaesthesia fellows or consultants with experience in obstetric anaesthesia, and an actress playing the role of the woman in labour. However, little is known about the repercussions of interprofessional education in midwifery. The present study addresses this gap in particular. The aim of the study was to determine the benefit of a single 4-h interprofessional hybrid simulation on interprofessional attitudes of student midwives, as measured by the G-IPAS, and whether any beneficial effects are sustained over time. For this prospective cohort study, we recruited final-year student midwives from two Swiss midwifery schools: Division of Midwifery, Department of Health Professions, Bern University of Applied Sciences, in Bern (Bern cohort); and Health Division, Institute of Midwifery, Zürich University of Applied Sciences, in Winterthur (Zürich cohort). For the Bern cohort the G-IPAS questionnaire was completed by the participants at baseline and after the single session of the 4-h interprofessional hybrid simulation, and again 3 months later. For the Zürich cohort, the G-IPAS was completed at a given point (baseline) and 3 months later, without participation in any simulation.

The primary outcome of the study was the difference in the total score of the G-IPAS before (baseline) and directly after the simulation. Secondary outcomes were: comparison of the primary outcome with the G-IPAS three months after simulation, in the Bern cohort; comparison of the G-IPAS between the Bern and Zürich cohorts at baseline and 3 months later; and analysis of the G-IPAS subscale scores.

The main findings show that midwife students improved their attitudes toward interprofessionalism directly after the interprofessional simulation session and the G-IPAS scores decreased over the 3-month periods in both of the cohorts. In the Bern (simulation) cohort, at 3 months, the G-IPAS returned to the level of before the simulation, while in the Zürich (control) cohort it was lower after three months than at baseline. Therefore, the simulation cohort showed less decay of attitudes towards interprofessionality, when compared to the control group. This study is in line with previous investigations in other areas of medicine, which have also consistently shown immediate effects of simulation-based training, when compared with no training (Cook et al., 2011).

Analysis of the different G-IPAS subscales revealed the areas where simulation made its impact. In particular, significant improvements were seen for student perception towards 'Teamwork, roles and responsibilities' and 'Healthcare provision'. Two factors might have influenced these: first, the participants acted in their professional roles and responsibilities in an interprofessional team while working in an emergency scenario, which clearly directed the assessment to the specific interactions. Secondly, the video-supported debriefing directly after each simulation scenario focused on team collaboration and communication. Finally, the feedback from the simulated patient reinforced the reflection of the different roles and their perception from the point of view of the 'customer' of the healthcare.

To determine the decay over time of the acquired changes in attitudes towards interprofessionalism after simulation, we also assessed participant attitudes three months after the simulation, in comparison with a 'control' cohort without any simulation programme in their curriculum. It has been shown that improved healthcare provider skills decline 3 months after training (Govender et al., 2010), even in interprofessional simulation studies where obstetric emergencies are the object of the training (Walker et al., 2013). However, a recent study that applied regression analysis to a large cohort of medical students failed to find these associations.

This conflicting evidence on the retention or decline in the interprofessional attitudes needs to be specifically addressed in properly powered and designed studies. To our surprise, our control cohort also self-reported lower interprofessional attitudes after three months. This is puzzling, and might have been due to further exposure to profession-specific stereotypes in the later stages of their training (Berger-Estilita, Chiang, et al., 2020; Hudson et al., 2016).

A limitation of this study is the non-randomised design. As the simulation is a mandatory part of the midwife student curriculum, we were not able to randomise some of the students to simulation and the others not. Therefore, we decided to compare the simulation participants to another cohort. The two groups of students were at the same level in their curriculum and previous interprofessional education, but only the cohort in Bern participated in the simulation. Indeed, we cannot guarantee that both cohorts are directly comparable, but they were not significantly different for age, and professional educational programme. Our sampling and measurement method were the same for both study sites, and this represented the only feasible way to have a comparator in the given setting.

12.1. Publication 4: Pedersen & Berger-Estilita. Nurse Educ Today. 2021 May;100:104872

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Attitudes towards interprofessionalism among midwife students after hybrid-simulation: A prospective cohort study

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ABSTRACT

Background: Team performance, communication and leadership enhance the quality and effectiveness of interprofessional collaborations between midwifery students and anaesthetists in obstetric emergencies. The realistic setting of hybrid simulation provides practice for interprofessional competencies in a stressful environment without putting women at risk during childbirth.
Objectives: We investigated how full-scale interprofessional hybrid simulation affects the attitudes towards interprofessionalism of final year midwife students.
Design: Two-centre prospective cohort study.
Settings: Bern Simulation and CPR Centre of the Department of Anaesthesiology and Pain Medicine at the Bern University Hospital (Bern, Switzerland) and Zürich University of Applied Sciences.
Participants: Final year midwife students from Bern University of Applied Sciences and Zürich University of Applied Sciences, both from the German-speaking Switzerland.
Methods: One cohort was exposed to hybrid simulation and the other served as control. The simulation group filled in the German Interprofessional Attitude Scale (G-IPAS) before and after simulation, and then again three months later. The control group filled in two sets of G-IPAS questionnaires three months apart.
Results: The total G-IPAS score increased significantly towards a more positive interprofessional attitude directly after the hybrid simulation. This increase was not sustained over the observation period of three months, although the score remained significantly higher than the score of the cohort without simulation.
Conclusions: A novel interprofessional hybrid simulation for obstetric emergencies for midwifery students promoted improved attitudes towards interprofessionalism immediately after simulation. These attitudes were improved compared to a control cohort without simulation, and the difference between the two cohorts remained three months after simulation. Future studies might focus on whether improved interprofessional attitudes lead to better healthcare and safety for women and children during childbirth.

1. Introduction

Obstetric emergencies are life threatening and unpredictable. Childbirth can become complicated without warning for situations such as cord prolapse, shoulder dystocia and eclampsia, which require synchronised and efficient responses from the interdisciplinary team (Cornthwaite et al., 2013). Given the rarity of such complications, hospital staff are infrequently exposed to these high-risk emergencies, and therefore they lack the learning experiences for their management.

Interprofessional collaborative practice has become a landmark to address such complex healthcare issues as it promotes teamwork, which has been shown to prevent morbidity and mortality for mothers and babies (Cornthwaite et al., 2013). There is a growing pool of empirical studies that show that interprofessional education can have beneficial impacts on learner attitudes, knowledge, skills, and behaviour (e.g., collaborative competencies) (Abu-Rish et al., 2012; Makino et al., 2013),

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and can positively affect professional practice and patient outcomes (Kent and Keating, 2013; Reeves et al., 2013).

According to the World Health Organisation, interprofessional education occurs when "students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" (World Health Organisation, 2010). Safe, high-quality, accessible, patient-centred care requires continuous development of interprofessional competencies (Interprofessional Education Collaborative, 2011), and its use has repeatedly been called for, so that healthcare students can enter the workforce as effective collaborators (Frenk et al., 2010; Medicine, 2015; Reeves et al., 2016).

To meet these demands, the Bern Simulation and Cardiopulmonary Resuscitation (CPR) Centre at Bern University Hospital (Bern, Switzerland) implemented interprofessional hybrid simulation for obstetric emergencies for student midwives in their final year of training. The simulation was conducted with anaesthesia fellows or consultants with experience in obstetric anaesthesia, and an actress playing the role of the woman in labour. Simulated patients are lay persons or actors trained to portray specific medical roles or symptoms. These highly trained non-physicians, who take on the roles of patients, can use low-fidelity training as wearable or augmentative technology to realistically replicate patient encounters (Stillman and Swanson, 1987). Such combined use of humans and devices is defined as "hybrid simulation", which has been successfully used in the past in anaesthesiology (Berger-Estilita et al., 2020c).

Interprofessional simulation exposes students to interprofessional education experiences early in their training in a safe learning environment. Although current evidence shows a trend to introduce interprofessional education early in the healthcare curriculum (Berger-Estilita et al., 2020a; Berger-Estilita et al., 2020b), little is known about the repercussions of interprofessional education in midwifery. The present study addresses this gap in particular for the impact of an interprofessional education experience in hybrid simulation on the interprofessional attitudes of midwife students, with the use of the German-Interprofessional Assessment Scale (G-IPAS) (Pedersen et al., 2020), an interprofessional attitudes scale that has been validated for German speakers.

The aim of the present study was to determine the benefit of a hybrid interprofessional simulation on interprofessional attitudes of student midwives, as measured by the G-IPAS, and whether any beneficial effects were sustained over time.

2. Methods

The Cantonal Ethics Committee of Bern (Switzerland; registrations number Req-2016-00176/12.04.2016) waived the need for ethical approval. For this prospective cohort study, we recruited final-year midwife students from two Swiss midwifery schools: Division of Midwifery, Department of Health Professions, Bern University of Applied Sciences, in Bern (Bern cohort); and Health Division, Institute of Midwifery, Zürich University of Applied Sciences, in Winterthur (Zürich cohort). These midwife students were enrolled in the year 2017, and they provided written informed consent to participate.

2.1. Study design

In this prospective cohort study (Fig. 1), the G-IPAS questionnaire was completed by the participants from the Bern cohort immediately before (baseline) and immediately after the single session of the four-hour interprofessional hybrid simulation, and then again three months later. For the Zürich cohort, the G-IPAS was completed at a given point (baseline) and three months later, without participation in any simulation.

2.2. Participants and setting

We used convenience sampling without sample size calculation to recruit participants for this study. All final-year student midwives from the Bern University of Applied Sciences took part in the full-scale, interprofessional, hybrid simulation together with anaesthetists experienced in obstetric anaesthesia (Bern cohort). Participants in the Zürich cohort were final-year midwife students from the Zürich University of Applied Sciences in the same study year, who were not exposed to the simulation, as it was not part of their curriculum.

The Bern cohort participated in one session of 4 h hybrid simulation at the Bern Simulation and CPR Centre of the Department of Anaesthesiology and Pain Medicine at the Bern University Hospital (Bern, Switzerland) in May–July 2017, in groups of five to seven participants. Before the simulation, the participants were briefed on the process and goals of the simulation, to familiarise themselves with the simulation environment and equipment. A code number was assigned to each student, and all other faculty were blind to the code assignment, and the students were informed that their responses would not affect their academic grading. The students then provided their informed consent, and completed their first G-IPAS ("baseline").

After this initial briefing, a single session that included three different obstetric scenarios with a simulated patient playing a woman in labour was carried out. Immediately after the scenarios, an instructor-led video-assisted debriefing took place with the entire group. Although each scenario had pre-defined learning outcomes and a guided script, the scenarios had slight variations and were not standardised. The simulation was led by two interdisciplinary instructors (one midwife,

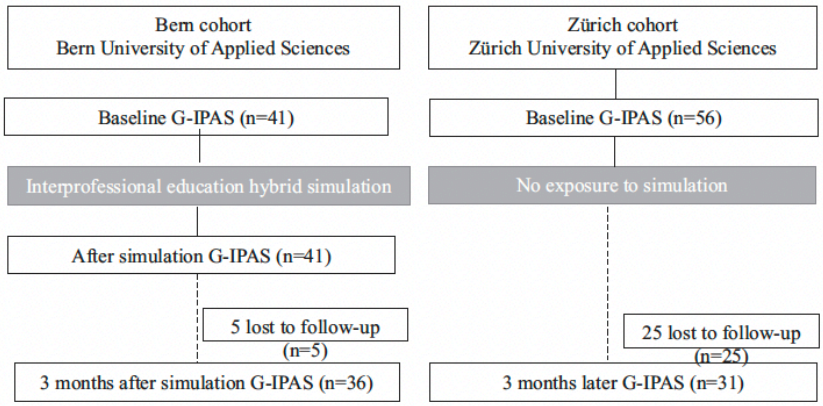

Fig. 1. Study flowchart. G-IPAS, German Interprofessional Attitude Scale.

one anaesthetist) who were trained and certified according to EuSim regulations (www.eusim.org). All of the debriefings reflected the medical processes involved with the cases, but focused specifically on human factors like leadership, teamwork, communication and mutual collaboration.

Immediately after the simulation and debriefing, the participants completed their second G-IPAS ("after"). Here the students rated their interprofessional attitudes at the moment after simulation. The follow-up assessment used the same G-IPAS and was filled in three months later. The follow-up was closed in September 2017.

The Zürich cohort comprised final-year midwife students from Zürich University of Applied Sciences (control, without simulation) who were also asked to fill in the same G-IPAS as baseline and then again three months later. Students who were not present at the time of the second G-IPAS were invited by email. Data from the Zürich cohort was collected in March and June 2017.

2.3. Measurements

The G-IPAS measures attitudes towards interprofessionality. The original American IPAS scale with five subscales (Norris et al., 2015) was translated and culturally adapted to German, giving rise to the G-IPAS (Pedersen et al., 2020). The G-IPAS is a 24-item questionnaire that consists of three subscales: "Teamwork, roles and responsibilities"; "Patient centeredness"; and "Healthcare provision". For each item, the participants are asked to reply using a Likert scale from 1 to 5, where: 1 represents "Strongly disagree"; 2, "Disagree"; 3, "Neutral"; 4, "Agree"; and 5, "Strongly agree". The G-IPAS has been shown to be a reliable instrument that is representative of the original IPAS dimensions, and it has been validated in German-speaking countries for assessment of interprofessional attitudes (Pedersen et al., 2020).

The primary outcome of the study was the difference in the total score of the G-IPAS before (baseline) and directly after the simulation. Secondary outcomes were: comparison of the primary outcome with the G-IPAS three months after simulation, in the Bern cohort; comparison of the G-IPAS between the Bern and Zürich cohorts at baseline and three months later; and analysis of the G-IPAS subscale scores.

2.4. Statistics

The data are presented as means ±standard deviation, median (interquartile range) [range], or percentages if not otherwise mentioned. The student demographics are reported as descriptive statistics. Parametric data were compared using Student's *t*-tests, and non-parametric data with Mann–Whitney *U* tests or Wilcoxon signed rank tests with Bonferroni corrections, as appropriate. A probability of <0.05 was considered significant. All of the statistics were calculated with Stata/SE 14.2 (Stata Corp. LP, College Station, TX, USA).

3. Results

3.1. Demographics

Forty-one midwife students from Bern who participated in the simulation were included, 36 of whom were also available for the three-month follow-up G-IPAS. Fifty-six students from the control group in Zürich were included, where 31 also participated in the follow-up (Fig. 1). All of these participants were female. In the Bern cohort, they had a mean age of 25.0 ± 5.2 years, and in the Zürich cohort, 24.4 ± 4.8 years ($p = 0.510$).

3.2. Primary outcome

As the primary outcome, the baseline median total G-IPAS score for

Table 1
Scores for the individual and total G-IPAS for the two different cohorts.

G-IPAS score	Bern			p-Value[a]			Zürich		p-Value		
	Simulation			Baseline	After vs.	Baseline vs.	No simulation		Bern vs. Zürich[b]		Zürich
	Baseline (*n* = 41)	After (n = 41)	3 months (*n* = 36)	vs. after	3 months	3 months	Baseline (*n* = 56)	3 months (*n* = 31)	Baseline	3 months	Baseline vs. 3 months[a]
Teamwork, roles, and responsibilities[c]											
Median	34	40	34.5	**<0.001**	**<0.001**	0.363	34	32	0.427	**0.026**	**0.012**
Interquartile range	31–37	37–43	31.5				28–36	28–36			
Range	23–45	25–45	22–44				14–41	21–40			
Patient centeredness[d]											
Median	40	40	40	0.176	0.675	0.473	40	40	0.955	0.610	0.666
Interquartile range	40–40	40–40	40–40				40–40	40–40			
Range	31–40	31–40	36–40				34–40	37–40			
Healthcare provision[e]											
Median	29	30	29	**<0.001**	**0.009**	0.347	29	28	0.664	0.522	**0.042**
Interquartile range	27–31	29–32	27–31				27–32	25–30			
Range	21–35	21–35	21–35				22–35	23–35			
Total G-IPAS score[f]											
Median	103	110	104	**<0.001**	**<0.001**	0.721	102	100.5	0.499	**0.019**	**0.013**
Interquartile range	98–107	107–115	99–107				97–107	96–104			
Range	87–117	88–120	89–110				83–113	89–109			

Bold text: significant differences.
[a] Wilcoxon signed rank.
[b] Mann–Whitney.
[c] Minimum, 9; maximum, 45.
[d] Minimum, 8; maximum, 40.
[e] Minimum, 7; maximum, 35.
[f] Minimum, 24; maximum, 120.

the Bern cohort (i.e., before simulation) was significantly increased directly after simulation (103 vs. 110; $p < 0.001$) (Table 1).

3.3. Secondary outcomes

For the assessment three months after the simulation in the Bern cohort, the significantly increased median total G-IPAS after simulation had returned to baseline (110 vs. 104; $p = 0.721$; Table 1).

Over the three-month period from baseline in the Zürich cohort (without simulation), the median total G-IPAS showed a significant decrease (102 vs. 100.5; $p = 0.013$). This decrease was attributed to the two subscales of "Teamwork, roles, and responsibilities" (34 vs. 32; $p = 0.012$) and "Healthcare provision" (29 vs. 28; $p = 0.042$) (Table 1), with no change seen for the "Patient centeredness" subcategory (40 vs. 40; $p = 0.666$).

In the comparison between the Bern and Zürich cohorts, there was no difference in the baseline median total G-IPAS (103 vs. 102; $p = 0.499$) (Table 1). After the three-month period, the Bern cohort showed a significantly higher median total G-IPAS over the Zürich cohort (104 vs. 100.5; $p = 0.019$) due to the significant decrease in this control cohort (Table 1). This difference was a result in the significantly lower score in the Zürich cohort for the subscale "Teamwork, roles and responsibilities" (34.5 vs. 32; p = 0.012) (Table 1).

In the G-IPAS subscales for the Bern cohort, there was a significant increase in the rating after the simulation for "Teamwork, roles and responsibilities" (34 vs. 40; $p < 0.001$) and "Healthcare provision" (29 vs. 30; p < 0.001) (Table 1), with no difference in the "Patient-centeredness" subcategory. None of the subscales were different for the comparison from before simulation to three months later (Table 1).

4. Discussion

This study investigated the effects of a single four-hour interprofessional hybrid simulation on interprofessional attitudes of student midwives. This interprofessional simulation on obstetric emergencies was a mandatory part of the final year curriculum of the midwife education at the Bern University of Applied Sciences. The main findings show that midwife students improved their attitudes towards interprofessionalism directly after the interprofessional simulation session.

Here, the G-IPAS scores decreased over the three-month period in both of the cohorts. In the Bern (simulation) cohort, the G-IPAS scores returned to the level before simulation after three months, while in the Zürich (control) cohort, the G-IPAS scores were lower than at baseline after three months. Therefore, the simulation cohort showed less decay of attitudes towards interprofessionality, when compared to the control group.

This study is in line with previous investigations in other areas of medicine, which have also consistently shown immediate effects of simulation-based training, when compared with no training (Cook et al., 2011). Mowat et al. (2017) used the Readiness for Interprofessional Learning Scale and demonstrated that in an interprofessional continuing educational programme the attitudes towards interprofessionalism increased significantly directly after the programme for physicians, dentists, dental hygienists and nurses, but decreased to baseline 6 months later. In a similar pre-post test assessment, Wilcox et al. (2017) also reported an increase after simulation in attitudes towards interprofessionalism in nursing, social work and medical students, although they did not investigate the long-term effects of their intervention. Indeed, attitudes towards interprofessionalism are often measured at only one time point, with the goal to investigate differences between different healthcare professionals (Bode et al., 2016; Maharajan et al., 2017; Sollami et al., 2018; Woermann et al., 2016), and most studies have failed to measure mid-term and long-term outcomes (Berger-Estilita et al., 2020b). This thus leaves a gap in the literature that will be worth exploring in future studies.

Analysis of the different G-IPAS subscales revealed the areas where simulation made its impact. In particular, significant improvements were seen for student perception towards "Teamwork, roles and responsibilities" and "Healthcare provision". Two factors might have influenced these: first, the participants acted in their professional roles and responsibilities in an interprofessional team while working in an emergency scenario, which clearly directed the assessment to the specific interactions. Secondly, the video-supported debriefing directly after each simulation scenario focused on team collaboration and communication. Finally, the feedback from the simulated patient reinforced the reflection of the different roles and their perception from the point of view of the "customer" of the healthcare.

Most studies that have evaluated the immediate effects of interprofessional education are at risk of overestimation of the improved attitudes following simulation-based medical education. To determine the decay over time of the acquired changes in attitudes towards interprofessionalism after simulation, we also assessed participant attitudes three months after the simulation, in comparison with a control cohort without any simulation programme in their curriculum. It has been shown that improved healthcare provider skills decline three months after training (Govender et al., 2010), even in interprofessional simulation studies where obstetric emergencies are the object of the training (Walker et al., 2013). The factors postulated to contribute to the decline in interprofessional attitudes include being more experienced in the healthcare field (McFadyen et al., 2010), having previous interprofessional contact (Anderson and Thorpe, 2008) or previous less positive experiences in interprofessional education (Coster et al., 2008; Hudson et al., 2016a; Visser et al., 2017), and having parents working in healthcare (Cooper et al., 2005). However, a recent study that applied regression analysis to a large cohort of medical students failed to find these associations (Oza et al., 2015). This conflicting evidence on the retention or decline in the interprofessional attitudes needs to be specifically addressed in properly powered and designed studies. To our surprise, our control cohort also self-reported lower interprofessional attitudes after three months. This is puzzling, and might have been due to further exposure to profession-specific stereotypes in the later stages of their training (Berger-Estilita et al., 2020a; Hudson et al., 2016b). However, the decrease in attitudes was more accentuated for the control group. It appears that even a single short simulation exposure to interprofessional learning can increase the awareness and importance of interprofessionalism in healthcare directly after the educational event, which can lead to higher levels compared to programmes that do not provide such experiences for their students.

These findings nurture the discussion on the optimal strategies and timing to introduce interprofessional education in a midwifery curriculum, particularly whether immersion (i.e. continuous collaborative learning) or exposure (i.e., periodic collaborative activities) should be adopted (Hudson et al., 2016b). Gilbert (2005) suggested exposure during the early years and immersion in the graduation year, arguing that students need to develop a professional identity before they can be expecting to work collaboratively with others. In a recent single-centre study, we demonstrated the importance of early introduction of interprofessional education into the curriculum, as it facilitated early interactions and a network, which contributed to enhanced professionalism and reduction of stereotypes (Berger-Estilita et al., 2020a). On the other hand, introduction of interprofessionalism late in a curriculum might be deterred by the student focus on profession-specific clinical practice and their immersion in vocation-specific stereotypes or negative attitudes (Hudson et al., 2016b). Whether this will have a direct influence on maintenance of interprofessional attitudes still remains unclear. In the present case, offering interprofessional simulation to midwives earlier in their curriculum was not feasible due to the curriculum and its practical clinical rotation for the different obstetric departments.

A limitation of our study is the non-randomised design. As the simulation is a mandatory part of the midwife student curriculum, we were not able to randomise some of the students to simulation and the

others not. Therefore, we decided to compare the simulation participants to another cohort. Switzerland has four midwifery schools: Bern and Zurich (German speaking), and Lausanne and Geneva (French speaking). The two German-speaking midwifery schools that participated in our study are situated 150 km apart. The two groups of students were at the same level in their curriculum and previous interprofessional education, but only the cohort in Bern participated in the simulation. Indeed, we cannot guarantee that both cohorts are directly comparable, but they were not significantly different for age and professional educational programme. Our sampling and measurement method were the same for both study sites, and this represented the only feasible way to have a comparator in the given setting.

The measurement tool used, the G-IPAS, was translated and culturally adapted into German, and it has shown solid reliable data and factorial structure (Pedersen et al., 2020). This specific validation for this population allowed for internal generalisability. However, there might be a concern about this use of a new scale (Berger-Estilita et al., 2020a). The best way to measure attitudes after interprofessional education remains an open question, as "no single instrument offers an adequate solution to many educators and researchers in the field" (Gillan et al., 2011).

5. Conclusions

A novel interprofessional hybrid simulation for obstetric emergencies for midwifery students promoted improved attitudes towards interprofessionalism immediately after simulation. These attitudes were improved compared to a control cohort without simulation, and there was still a difference between the two cohorts three months after simulation, although the attitudes of the intervention group returned to baseline level. Future studies might focus on whether improved interprofessional attitudes leads to better healthcare and safety for women and children during childbirth. However, uncertainty remains regarding whether a such interprofessional curriculum should be implemented as continuous interprofessional education or as an isolated experience.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Conclusions and Recommendations

13. Conclusions and recommendations

Undergraduate education is part of a role-forming process, shaping individuals into a future profession (Khalili et al., 2013). Interprofessional education aims to prepare future healthcare professionals with the resources necessary for adequate patient care as part of a collaborative team. IP skills are therefore, in the modern healthcare practice environment, critical to all healthcare practitioners in all practice settings (IOM, 2010).

At the end of this thesis, several conclusions can be made:

1. The literature has long suggested that introducing undergraduate IPE – whichever year – could lead to improved working relationships between different HCPs. It has been recommended that IPE be introduced early in undergraduate healthcare courses, as this may be useful in breaking down negative attitudes and avoiding stereotypical views (Ahmad et al., 2013; Areskog, 1988; Parsell & Bligh, 1998). Although this is a logical statement, many study results are controversial and there are no clear trends on when IPE interventions should be introduced.
2. There was a high degree of positive attitudes towards IPE in medical students, with women showing better attitudes towards interprofessionalism. Medical students showed more positive attitudes towards IPE in pre-clinical years. This result was validated in the semi-structured interviews, with most students expecting IPE interventions from the pre-clinical years onwards. Students were aware of the relevance of IPE for their future professional performance. These findings support the early introduction of IPE in a medical curriculum. Although students are aware that interprofessional learning is fundamental to high-quality patient care, there are still obstacles and stereotypes to overcome.
3. The G-IPAS was a reliable instrument, representative of the item dimension of the original IPAS and a validated tool for the assessment of interprofessional attitudes in German-speaking countries. The paper on the G-IPAS validation added original and relevant content to the limited number of available tools to measure interprofessional attitudes in German-speaking countries.

4. We deepened the understanding of previously identified definitions of IPE, and we identified new attributes of the definition. By adding "wellbeing" as a component of interprofessionality, curriculum planners are supported to offer more objective and authentic interprofessional experiences. Such significant learning interactions might impact how medical students internalise and approach patient-centeredness and experience professional wellbeing.
5. Even a single short simulation exposure to interprofessional learning can increase the awareness and importance of interprofessionalism in healthcare directly after the educational event, which can lead to higher levels compared to programmes that do not provide such experiences for their students.
6. Limitations of this thesis include a sub-optimal response rate, which preclude the generalization of results past a single institution. Further research is needed to describe the structure and the impact of IPE interventions in medical faculties.

While interprofessional collaboration is an expected competency to be taught at undergraduate and postgraduate levels, IPE has only recently been taken up in healthcare training, and such programs lack goal-oriented evaluation. However, medical schools and other health professional training institutions provide opportunities within their individual programmes to encourage collaborative interactions early in training healthcare professionals. The results from this study corroborate findings that medical students are ready for IPE experiences at the beginning of their studies.

Our findings generate a greater understanding of the difficulties educators and organizations face and encourage discussion on when and with which interventions medical schools should address interprofessional learning. Additionally, we underline several considerations that educators may include when considering interprofessional activities, particularly the importance of considering all levels of interprofessionality and having clear objectives for each level. Our interprofessional learning framework brings oversight to what appears to be a longitudinal process underscored by its use to improve patient outcomes, team dynamics between professionals, and individual and collective wellbeing. More attention must be paid to the learning environment of IPE activities to facilitate open, frank, and effective interactions.

After conducting this work and based on its findings, we agree that effective IPE should: (1) allow for collaborative knowledge creation, (2) be experimental in nature, (3) address barriers lifted by social identity, stereotypes and professional socialization, and (4) encourage reflective practice.

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Appendices

15. Appendices

a. Appendix A: German Interprofessional Attitudes Scale (G-IPAS)

Interprofessional Attitudes Scale

INSELSPITAL
UNIVERSITÄTSSPITAL BERN
HOPITAL UNIVERSITAIRE DE BERNE
BERN UNIVERSITY HOSPITAL

Datum: _____

Alter: _____ Geschlecht: M □ W □

Studienrichtung/ Beruf im Gesundheitswesen:

_____

Aktuelles Studienjahr / Berufsjahre : _____

Vergangene Teilnahmen an interprofessionellen Veranstaltungen: Ja □ Nein □

Wenn Ja, welche: _____

Studien ID:

1 = Trifft nicht zu
2 = Trifft eher nicht zu
3 = Teils-teils
4 = Trifft eher zu
5 = Trifft zu

Bitte zutreffende Aussage ankreuzen:

1. Teamarbeit, Funktionen und Verantwortlichkeiten

1	Interprofessionelles Lernen während des Studiums wird mir helfen, im Team besser zu arbeiten.	1 □ 2 □ 3 □ 4 □ 5 □
2	Gemeinsames Lernen wird mir helfen positiv über andere Berufsgruppen zu denken.	1 □ 2 □ 3 □ 4 □ 5 □
3	Lernen mit Studierenden anderer Gesundheitsberufe fördert meine Teamfähigkeit.	1 □ 2 □ 3 □ 4 □ 5 □
4	Gemeinsames Lernen mit Studierenden anderer Gesundheitsberufe wird meine Fähigkeit verbessern, klinische Problemen zu verstehen.	1 □ 2 □ 3 □ 4 □ 5 □
5	Patienten würden davon profitieren, wenn Studierende aus verschiedenen Gesundheitsberufen miteinander an der Lösung von Patientenproblemen arbeiten.	1 □ 2 □ 3 □ 4 □ 5 □
6	Gemeinsames Lernen mit Studierenden anderer Gesundheitsberufe wird mir helfen, besser mit Patienten und anderem Fachpersonal zu kommunizieren.	1 □ 2 □ 3 □ 4 □ 5 □
7	Ich würde es begrüssen, an Projekten in Kleingruppen mit Studierenden anderer Gesundheitsberufe zu arbeiten.	1 □ 2 □ 3 □ 4 □ 5 □
8	Für Studierende von Gesundheitsberufen ist es nicht notwendig miteinander zu lernen.	1 □ 2 □ 3 □ 4 □ 5 □
9	Gemeinsames Lernen wird mir helfen meine eigenen Grenzen zu erkennen.	1 □ 2 □ 3 □ 4 □ 5 □

Bitte wenden!

2. Patientenzentriertheit

1	Der Aufbau von Vertrauen zwischen meinen Patienten und mir ist mir wichtig.	1 □ 2 □ 3 □ 4 □ 5 □
2	Es ist mir wichtig, meinen Patienten gegenüber Empathie zu zeigen.	1 □ 2 □ 3 □ 4 □ 5 □
3	Den Patienten als Individuum wahrzunehmen, ist für den Behandlungserfolg sehr wichtig.	1 □ 2 □ 3 □ 4 □ 5 □
4	In meinem Beruf braucht man die Fähigkeit mit Patienten zu interagieren und auf Patienten einzugehen.	1 □ 2 □ 3 □ 4 □ 5 □
5	Es ist mir wichtig, die Sichtweise des Patienten zu verstehen.	1 □ 2 □ 3 □ 4 □ 5 □
6	Für medizinisches Fachpersonal ist es wichtig zu verstehen, wie man erfolgreich mit Menschen verschiedener kultureller Hintergründe kommuniziert.	1 □ 2 □ 3 □ 4 □ 5 □
7	Für medizinisches Fachpersonal ist es wichtig bei der Patientenversorgung im Team, unter Einhaltung der Schweigepflicht, die Würde und Privatsphäre des Patienten zu wahren.	1 □ 2 □ 3 □ 4 □ 5 □
8	Für medizinisches Fachpersonal ist es wichtig dem Patienten unabhängig von seinem persönlichen Hintergrund eine optimale Behandlung zu gewähren (z.B. unabhängig von sexueller Orientierung, Geschlecht, Konfession, sozialer Stellung, ethnischer Herkunft, Immigrationsstatus oder Behinderung).	1 □ 2 □ 3 □ 4 □ 5 □

3. Gesundheitsversorgung

Für medizinisches Fachpersonal ist es wichtig…

1	… mit Entscheidungsträgern im Gesundheitswesen aus Verwaltung und Politik zusammenzuarbeiten, um die Gewährleistung der Gesundheitsversorgung zu verbessern.	1 □ 2 □ 3 □ 4 □ 5 □
2	… an Projekten zur Verbesserung der öffentlichen Gesundheit mitzuarbeiten.	1 □ 2 □ 3 □ 4 □ 5 □
3	… an Gesetzgebungen, Verordnungen und politischen Strategien zur Verbesserung der Gesundheitsversorgung mitzuwirken.	1 □ 2 □ 3 □ 4 □ 5 □
4	… zusammen mit nicht klinisch-tätigen Berufsgruppen an einer Verbesserung der Effektivität der Gesundheitsversorgung zu arbeiten.	1 □ 2 □ 3 □ 4 □ 5 □
5	… sich neben der individuellen Patientenversorgung auch auf die Allgemeinheit zu konzentrieren, um eine effektive Gesundheitsversorgung anbieten zu können.	1 □ 2 □ 3 □ 4 □ 5 □
6	… Fürsprecher für die Gesundheit von Patienten und der Allgemeinheit zu sein.	1 □ 2 □ 3 □ 4 □ 5 □
7	… die Eigenheiten, Werte, Rollen, Verantwortlichkeiten und Expertise anderer Gesundheitsberufe zu respektieren.	1 □ 2 □ 3 □ 4 □ 5 □

b. Appendix B: Twelve Systematic Reviews on IPE

(Abu-Rish et al., 2012); Current trends in interprofessional education of health sciences students: a literature review

Objectives	1. To detail the types of approaches to IPE for health professionals 2. To identify areas for strengthening IPE research
Search Strategy	Medline, CINAHL, ERIC, ISI Web of Knowledge, EMBASE, and Campbell Collaboration (2005-2010); adapted for each electronic database, aimed at types of IPE interventions. Inclusion: IP mix of pre-licensure healthcare students AND intervention with emphasis on IP skills AND assessment that demonstrated effectiveness of IP on learning outcomes; English language.
Analysis	Development of an online data extraction tool including 49 items grouped into seven categories (study profile, characteristics of the educational intervention, type and number of students, faculty roles and responsibilities, assessment methods, outcome measures and other information)
Results/Findings	83 studies were included in the pool • IP faculty are not the sole developers of programs (students, family members and families act as co-developers) • Most frequent educational formats were small-group discussions and PBL • Different types of educational formats (incl. clinical teaching, direct patient interaction, community-based projects and simulation) • Small percentage of studies that reported reliability and validity of assessment instruments • Areas for improvement: (1) many reported IPE programs are not guided by frameworks, (2) inconsistency in reporting details of study settings, population and outcomes (3)only a few studies had a longitudinal follow-up of IPE outcomes and (4) minimal attention to issues related to faculty development (preventing replication)
Significance/ Direction	Large-scale review that exclusively targets IPE for healthcare students in the undergraduate setting/ Encouragement of structured reporting guidelines in the IPE field

(Reeves et al., 2013); Interprofessional education: effects on professional practice and healthcare outcomes (update)

Objectives	To assess the effectiveness of IPE interventions compared to uniprofessional education interventions or no intervention.
Search Strategy	Cochrane, MEDLINE and CINAHL and handsearch of the Journal of Interprofessional Care, IPE conference proceedings and websites of IPE organisations (2006 – 2011). Inclusion: RCTs of IPE interventions that reported objectively measured or self-reported patient/process outcomes
Analysis	At least two review authors independently assessed the eligibility of potentially relevant studies. 1. Narrative review 2. Data extraction and assessment of study quality[(1) type of study, (2) study setting, (3) study participants, (4)description of education programme, (5) description of other interventions, (6) main outcome measures, (7) results, (8) other information]
Results/Findings	9 new studies, added to the six studies from 2008 (IPE interventions vs no educational intervention) • IPE produced positive outcomes in the following areas: collaborative team behaviour in operating rooms, diabetes care, emergency department culture and clinical error reduction; mental health practitioner competencies and management of care in domestic violence; • four of the studies reported mixed outcomes and four studies showed no impact of IPE
Significance/ Direction	it is not possible to draw generalisable inferences about the effectiveness and key elements of IPE/ The following three measures were suggested for the future: studies that assess the effectiveness of IPE interventions vs profession-specific interventions; second, high-quality RCTs examining processes relating to the IPE; third, cost-benefit analyses.

(Lapkin et al., 2013): A systematic review of the effectiveness of interprofessional education on health professional programs

Objectives	Identify the best available evidence for the effectiveness of university-based interprofessional education for health students
Search Strategy	AMED, CINAHL, CENTRAL, Dissertations and Theses, EMBASE, ERIC, journals@ovid, MEDLINE, Proquest PsycINFO (* – Feb 2011); Inclusion: studies with students from at least two undergraduate or post-graduate health professions submitted to an IPE intervention; university-based approaches to IPE; objectively-measured/self-reported educational outcomes or validated instruments; RCTs and quasi-experimental studies only.
Analysis	1. Quality analysis through an internal 10-point scale (accepted when five or more criteria met) 2. Data extraction including details about interventions, participants, dropouts and withdrawals, study methods and outcomes.
Results/Findings	9 studies included • Evidence of attitudinal change in three studies, and two studies reported mixed findings. In one study, IPE attitudes improved post-intervention but returned to normal after 3-4 months. No study reported completely negative outcomes as result of an IPE intervention • Three studies reported mixed results related to the learning outcomes, while the remaining 6 showed improvement in interprofessionality • IPE intervention approaches varied
Significance/ Direction	Student´s attitudes towards IP collaboration may be enhanced through IPE, but little evidence exists that this benefit is sustained over time/ The small number of studies limits generalizability/ Future high-quality RCTs in cluster-randomised designs would improve the evidence of IPE

(Olson & Bialocerkowski, 2014); Interprofessional education in allied health: a systematic review

Objectives	To describe the models of university-based allied health IPE in mode of delivery, duration of IPE activities, class sizes, placement of IPE activities within the curriculum, participating health professions and student characteristics and describe the outcomes associated with university-based allied health IPE
Search Strategy	AMED, EMBASE, CINHAL, Cochrane, Medline, PubMed, PEDro, Sportdiscus, Science Direct and Web of Knowledge (1988 – Jan 2013); Inclusion: studies describing the outcome of IPE activities performed by undergraduate students from allied healthcare professions; work published in English.
Analysis	3. Quality analysis through standardized critical appraisal tools (McMaster Critical Review Form for Quantitative Studies, McMaster Critical Review Form for Qualitative Studies, McGill Mixed-Methods Appraisal Tool Screening) 4. Data extraction using a standardized data extraction tool, including (1) the IPE model, (2) Institutional characteristics, (3) Student characteristics, (4) Theories used to plan IPE programs and (5) IPE Outcomes from multiple stakeholder perspectives
Results/Findings	17 studies included IPE model: mostly patient scenarios, simulation or practice-based learning. Format varied. IPE was perceived as more relevant when taught in small, stable groups. Institutional characteristics: none of the studies provided detailed descriptions of the institutions. Student characteristics: mostly undergraduates, under 24 years-old, with varying levels of experience. Diverging findings related to student maturity and outcome measures. Theories: more frequent theories used were Alport´s intergroup contact theory, Benner´s theory and the constructivist learning theory. IPE Outcomes: None reported longitudinal outcomes. Most studies focused on assessing feasibility. Barriers to success were also reported (i.e., short duration, lack of IT, limited experience or awareness of professional role, differences in power status, low participation rates). Physiotherapy and Medical students took more often leadership roles, with limited engagement.
Significance/ Direction	Results shows that IPE is beneficial, but the reasons behind it are unclear/ Need to reconceptualize IPE as a process within a system (instead of a transferable intervention) and prioritise methods to understand its complexity.

(Kent & Keating, 2015); Interprofessional education in primary health care for entry level students – a systematic literature review

Objectives	To determine what is known about IPE interventions for entry level health care students on the primary care setting; To summarise disciplines that participated in the included studies, reported frameworks or models, provided services and targeted users.
Search Strategy	Ovid MEDLINE, EMBASE, CINHAL (* – Mar 2014); Inclusion: programs with students at entry level; minimum of two professional groups; primary, outpatient or ambulatory setting; description of interactivity in the delivery of care; work published in English. Exclusion: projects consisting of home visits; publications reporting student or patient satisfaction only; letters, editorials and abstracts without full text.
Analysis	1. Systematic Review 2. Data extraction using a standardized data extraction tool, including (1) country, (2) student discipline and year level, (3) diagnostic groups attending the clinic, (4) consultation offered, (5) data on student learning and (6) patient outcomes. Assessment of quality of the data by use of the PEDro scale. Qualitative studies were assessed using an internal 24-point scale 3. Meta-analysis with a random effects model
Results/Findings	26 studies included • IPE most frequently with nursing students (level unreported) and medical students (1st to 4th year) • Observation of a significant post-intervention effect in the meta-analysis • Student-led clinics, mostly for health screening and assessment. Various structures and mode of student attendance • positive teamwork and collaboration skills outcomes (83%); increased understanding of the roles of others (67%); increased competence in communication and time management skills (42%) and confidence (24%); increased socio-cultural awareness (29%); perceived patient gain and patient-centeredness (17%) • Patient outcomes were rarely assessed
Significance/ Direction	The authors were unable to confidently determine the effect of IP student-led primary care clinics on student and patient outcomes/ Faculty commitment to IPE should enable randomized studies to better evaluate the effectiveness of IPE programs.

(Reeves et al., 2016); A BEME systematic review of the effects of interprofessional education: BEME Guide No. 39

Objectives	1. Update of BEME review(Hammick et al., 2007) 2. Review the effectiveness of different types of IPE interventions 3. Evaluations of educational experiences
Search Strategy	Medline, CINAHL, BEI and ASSIA (2005-2014); adapted for each electronic database, aimed at types of IPE interventions. Inclusion: evaluation of IPE experiences; work published in English and French
Analysis	Outcome of IPE assessed 1. Definition of IPE in a realist review 2. Quality (quality of study; quality of information) 3. 3P Model: Presage, Process, Product (Biggs, 1993), adapted by Freeth and Reeves (Freeth & Reeves, 2004) 4. Outcomes model used: Barr´s (Barr et al., 2005) extended version of Kirkpatrick´s classic educational outcomes
Results/Findings	25 studies added to 21 studies from Hammick, 2007 / 3P Model findings Presage: drivers for IPE re-appraised (importance of organizational support), time-spatial factors and funding; teacher quality and faculty development for facilitation, role-modeling; learner professions and numbers, stereotypes and hierarchies. Process: facilitation of IPE through teambuilding, coaching and mentoring; customisation; learner choice, shared reflection, facilitated debriefing and informal learning. Product: key products cover all levels of Barr´s version of Kirkpatrick´s educational outcomes. More positive outcomes are reported.
Significance/ Direction	Description of the growth of IPE evidence/ Will help educators (stakeholders) make more informed judgements about the use of different IPE initiatives

(Kent et al., 2017); Pre-registration interprofessional clinical education in the workplace: a realist review

Objectives	To inform the development of evidence-based curriculum IPE activities for an healthcare network in southeastern Australia and to explore which interventions are most relevant to a local context
Search Strategy	Ovid MEDLINE,CINAHL, EMBASE and Google Scholar; Inclusion: studies involving pre-registration students from healthcare professions who were learning in a clinical placement; interventions described the context, the interactions, the clinical and curriculum content and student outcomes. Work published in English only. Exclusion: evaluations on reaction outcome level, or studies exploring outcomes on patients, educators or organizations; absence of clear descriptions of relevant data. Interventions on training wards.
Analysis	1. Realist Synthesis 2. Quality assured through the use of the MERSQI checklist (qualitative studies) and an internal checklist for quantitative studies 3. Use of a data extraction template: (1) contextual data, (2) intervention data (3) Mechanisms (i.e., learning theory, role of staff, organization)
Results/Findings	27 studies included • Students learn about the roles of others and gain teamwork skills when they interact, discuss and reflect (mechanism), regardless of the educational format • Patient-based learning (as a context) with discussion and reflection (mechanism) show an additional positive effect in outcomes • Safety-focused interventions (context) with discussion of team practices (mechanism) contribute to safety awareness (positive outcome) • Trained facilitators modelling collaborative practice (mechanism) can promote positive outcomes and reduce stereotypes on other professions
Significance/ Direction	The combination of patient-based activities with discussion/reflection and trained faculty seem to create the most positive factors in IPE/ Interventions should be targeted at small groups of learners from different professions engaging in a process of assessing real patients (patient-centeredness), followed by facilitated discussion and reflection. Faculty development is recommended to minimize negative outcomes of IPE interventions.

(Nelson et al., 2017); Interprofessional Team Training at the Prelicensure Level: a Review of the Literature

Objectives	To gain a better understanding of the various approaches and outcomes of team-training initiatives in prelicensure curricula
Search Strategy	MEDLINE, PsycINFO, EMBSE, Business Source Premier and CINAHL (2000 – Aug 2014); Inclusion: English-language, peer-reviewed evaluative studies of team-training programs´ effects on KSA in prelicensure healthcare students.
Analysis	1. Descriptive analysis review 2. Use of a data extraction form (study design, training methods, participant data, assessment measure and results)
Results/Findings	17 studies included Study design: mostly single-group pre-test/post-test, followed by RCT or comparison studies. Training methods: mostly didactic, interactive lectures combined with another method (role-play, simulation, SPs, problem-solving). Most common curriculum bases were SBAR tool and CRM principles. Participants: Half with students from at least 2 professions (mostly medical and nursing). The composition is not representative of the actual composition of an IP team Assessment: Team performance assessments, mostly observer checkliststs (Communication and Teamwork Skills Assessment, MHPTS, ANTS and modifications of OR Teamwork Assessment Scales. Five studies assessed knowledge, other five attitudes and six evaluated team-skills self-evaluations. Results: sixteen studies found improvements in KSA. The variety of assessment measures precludes an adequate comparison.
Significance/ Direction	Little consistency between studies reflect that there is no favorable choice to perform team-training at a prelicensure level. There is a gap in team-training-focused prelicensure IPE/ Team-training curricula should be incorporated more broadly into preexisting IPE programs and more studies should be performed to develop adequate assessment measures.

(Visser et al., 2017); Perceptions of residents, medical and nursing students about Interprofessional education: a systematic review of the quantitative and qualitative literature

Objectives	To explore to what extent IPE interventions investigate or incorporate the affective component of learning in their design
Search Strategy	PubMed, Ebsco/ERIC, Ebsco/psycInfo and Ebsco/CINAHL; Inclusion: studies sampling medical or nursing students and medical residents in a clinical setting; all types of studies (qualitative/quantitative, empirical) where attitudes were assessed; journal publications only, in English. Exclusion: specific medical or specific nursing education initiatives; studies on validation of an instrument or stand-alone eLearning.
Analysis	1. Narrative Synthesis 2. Categorisation (Readiness for IPE, Facilitators and Barriers) and sub-categorisation into levels (organisational, process, individual)
Results/Findings	65 studies included Readiness for IPE: (1) organisational: lack of interactions jeopardize IPC; (2) process: readiness declines over time; (3) individual: females were more ready than males; stereotyped views; earlier healthcare experience was beneficial, younger students achieved more learning outcomes. Facilitators: (1) organisational: getting acquainted and having time to socialize; previous work experience in healthcare; (2) process: immersion in collaboration; exposure to IP teams, stimulating teamwork training; teacher-facilitated reflection; shared learning; learning in an authentic context, integrating IPE and specific learning goals in older students; (3) individual: being available and receptive, relatedness within/outside the group, having role clarity. Barriers: (1) organisational: belonging to a social group: medical students perceived nurses as having a less positive status; dissonance between faculty statements and educational practice; miscommunication; poorer ICP attitudes in postgraduate students; gaps in role-perception; (2) process: combining IPE and profession-specific learning objectives; teachers who just transmit knowledge; lack of assessment; being in the ward all day; (3) individual: unprofessional behaviour and emphasizing knowledge at the cost of teamwork
Significance/ Direction	Barriers to IPC are underreported/ More studies are needed on barriers to IPE on an individual and process level and on the mechanisms that link readiness for IPE to IPC behaviour

(Guraya & Barr, 2018); The effectiveness of interprofessional education in healthcare: a systematic review and meta-analysis

Objectives	To analyse the effectiveness and impact of teaching and developing IPE modules in healthcare
Search Strategy	Ovid, ISI Knowledge if Science, PubMed (2000-2016); Inclusion: quantitative articles using empirical pre-post design criteria, English only. Exclusion: review and editorial articles, commentaries, opinions and conference proceedings.
Analysis	1. Manual synthesis of studies 2. Meta-analysis using random effects model
Results/Findings	12 studies included • Significant improvements in pre and post-status scores after IPE in various medical fields • Improvement in KSAs by introducing IPE modules at different stages of undergraduate training • No major inferences about key-elements of IPE and its effectiveness
Significance/ Direction	Positive outcomes of IPE interventions in various disciplines/ Authors suggest further RCTs with qualitative standards and cost-benefit analysis to assess the effects of IPE educational interventions. Clinical leadership can play a role in connecting IPE to collaborative practice.

(Fox et al., 2018); Teaching interprofessional teamwork skills to health professional students: A scoping review

Objectives	To answer the questions: 1. What teaching methods are most effective when engaging healthcare students in IPE activities? 2. How are these activities assessed? 3. What variables influence the success of these activities?
Search Strategy	PubMed, ERIC, Cochrane library and SCOPUS (up to 2015); adapted for each electronic database, aimed at types of IPE interventions. Inclusion: different students working together in IP teams, interventions to improve IP teamwork, assessment of outcomes related to teamwork; work published in English. Exclusion: educational interventions involving qualified health professionals alone; conference abstracts; papers in the search that did not produce an accessible abstract
Analysis	3. Scoping review 4. Screening process and abstraction of included studies 5. Manual extraction of data according to the following categories: teaching methods and context, assessment tool, learner characteristics, outcomes achieved.
Results/Findings	33 studies included (range 8-4099 students) Teaching methods: (1)Activities prior to the IPE: not well detailed, mainly eLearning/individual activities; (2) IPE intervention: most common Simulation or Simulated patients; mixed requirements (mandatory for medical students), various settings (Sim lab, in situ, etc); Duration from single setting to 3 years; Including 2 or 3 healthcare professions[medical (100%), nursing (82%), physiotherapy (27%), pharmacy (18%)]. Students reported positive changes in attitudes towards other healthcare professionals post-intervention. Assessment measures: varied. Fifteen studies developed their own scale. Most assessment tools relied on student self-report. Assessment did not emphasise teamwork or behaviour. No assessment tool addressed all 11 domains of the IPEC competencies.
Significance/ Direction	Results are inconclusive, data is low in quality due to study heterogeneity/ Investigators should consider alternative methods to randomisation while still providing rigor. Further studies are needed to examine the best approach to teaching teamwork to healthcare students.

(O'Leary et al., 2019), "Bumping along": a qualitative metasynthesis of challenges to interprofessional placements

Objectives	1. To synthesise key stakeholders´ perspectives on the challenges of IP placements implementation 2. To develop recommendations to support these IP placements as a model
Search Strategy	PubMed, (up to 2015); Inclusion: qualitative and mixed-methods research where the primary focus is IPE undertake in an interprofessional placements; Research including student participants (undergraduate or postgraduate),educators) or service-users; English only. Exclusion: Quantitative data, qualitative data in the form of responses to open-ended questions in surveys and questionnaires or written reflections; descriptive reports, editorials, commentaries; continuing education programs; IPE that does not involve direct patient interaction and student teams consisting of medical and nursing students only.
Analysis	1. Qualitative, thematic metasynthesis (guided by the ENTREQ statement) 2. 3P Model: Presage, Process, Product (Biggs, 1993) 3. Search string devised with the librarian and development of three key themes (building theoretical foundations, layering leadership, negotiating new realities) 4. Independent quality appraisal using CASP
Results/Findings	41 studies included (16 high-quality; 13 moderate-quality; 12 low-quality) Building theoretical foundations (presage): 11 theoretical models (4 micro-level: Leicester model of IP, integrative pedagogy, Kirkpatrick framework, interprofessional mentorship; 7 meso-level: PBL, complexity theory, contact theory, self-presentation theory, sociocultural theory, 3P theory and situated learning). The application of theory was inconsistent. Layering leadership (process): Although there was consistent leadership, IPP lacked coordinated support within organizations. Negotiating new realities (product): lack of clarity regarding the purpose of IPP in students, educators and service users. Educators expressed concern about working interprofessionally. Peer support was a strategy identified to overcome these concerns. IPP was seen as a mechanism for change in healthcare education.
Significance/ Direction	More robust theoretical foundations could support IPE; layered leadership could mitigate the vulnerability of relying on individual stakeholders; sustaining an IPP is challenging and requires changes in practice

c. Appendix C: Semi-structured Interviews Questions – Guidance Document

Medical Students´Attitudes towards Interprofessional Education

Before we begin:

1. Greetings, thank for students presence and participation, re-emphasise that the interview will be video and audio-recorded and then played for the investigator team, for coding and transcription purposes. Guarantee that all information will remain anonymous.
2. Ask for written voluntary consent to participate in the interview.
3. Explain that, first and foremost, our interest in the focus group is to value the ideas of students and their contribution.
4. Set the ground rules for group discussion (role of facilitators, role of the assistant, audio and video taping, raising hands, do not speak at the same time=
5. **Start the video and audio-recording devices**

Introduction (5 Minutes)

1. Explanation that the focus group will be divided into different sections
2. Short presentation round
3. Experience and background of participants:
   - Age (Make a note on gender)
   - Year of medical studies/Semester
   - Previous work/ academic experience
   - Previous experience/contact with healthcare-related professions
   – Are there healthcare students in your friend circle?
4. Ask about the experience of filling up the questionnaire, what the participants thought was the purpose of it.

Survey (15 Minutes)

1. What do you think interprofessional education (IPE) is?
2. What are the aims of IPE? (learning to **communicate**, learn important issues together, learn about another profession, learning how **roles are defined for practice**, leaning about the research of the other profession, learn about **interprofessional collaboration in practice**)
3. What is your view on IPE? When could it be of use during your training or during your professional life?
4. Ask if students had any interprofessional education experience in the past.
5. Explain briefly the purpose of the study (to determine when medical students have a better attitude towards interprofessional learning)
6. What do you think could be positive effects of shared learning? (if silence, focus on **professional relationships**, **shared educational aims**, **effects on teamwork**)
7. What could be the not so positive effects of shared learning? (**hierarchical structure**, **social identity**, **prejudice**, **stereotyping**)
8. Present the results from the survey (dependent of survey results)
9. Discuss the results of the survey* (dependent of survey results)

Study (20 Minutes)

1. Do you think interprofessional education is feasible? Would it be something you would like to take part of? Why? What are, for you, the main benefits of IPL?
2. Do you think IPE is different that other learning strategies? In which cases (if any)? And how is it different?
3. What are the main barriers to interprofessional learning?
4. How can this contribute to a change in practice?
5. Would you like to participate in such an experience? Why?

Final Remarks (5 Minutes)

1. Can you suggest some possible applications of IPE in the University of Bern? How could they be implemented?

d. Appendix D: Ethics Committee Request Decision

Gesundheits- und Fürsorgedirektion des Kantons Bern

Direction de la santé publique et de la prévoyance sociale du canton de Berne

Kantonale Ethikkommission für die Forschung

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Bern, 23.08.2019

Zuständigkeitsabklärung

BASEC-Nr: Req-2019-00743 **Eingangsdatum:** 07/08/2019

Titel: Attitudes from medical students towards interprofessional collaboration: a mixed-methods Case Study

Ergebnis der Zuständigkeitsabklärung

☒ **Nicht zuständig**, d.h. das Vorhaben ist nicht bewilligungspflichtig
Begründung: Das Vorhaben fällt nicht unter das Humanforschungsgesetz, Art. 2, Abs. 1

☐ **Zuständig**: Bewilligung gemäss Humanforschungsgesetz, Art. 2, Abs. 1 **notwendig**.
Bitte reichen Sie der KEK ein Gesuch gemäss www.swissethics.ch ein

Gebühren: CHF 200.-- (Tarifcode 6.0)
Rechnung folgt

Datum/Ort: 23.08.2019/Bern

Prof. Dr. med. Christian Seiler
Präsident

Dr. sc. nat. Dorothy Pfiffner
Leiterin wissenschaftliches Sekretariat