Cover sheet

Interprofessional education for health professionals.

A **BEME realist** review of what works, why, for whom and in what circumstances in undergraduate education.

Protocol

Review team

Demi Krystallidou PhD[1], **Maria Kersbergen** MSc[2], **Fien Mertens** MD[3], **Wietske Kuijer-Siebelink** PhD[2,4] Bruno Marchal* MD PhD[5], **Robin Miller** PhD[6], **Saskia Oosterbaan – Lodder** MD[7], **Nynke Scherpbier-de Haan** MD PhD[8], **Loes van Amsterdam** MSc B Cert PDP[9], **Marco Versluis** MD, PhD[10], **Cornelia Wermuth** PhD[11], **Peter Pype** MD PhD[3]

[1] University of Surrey, Centre for Translation Studies, Guildford, UK

[2] HAN University of Applied Sciences, Nijmegen, the Netherlands

[3] Ghent University, Department of Public Health and Primary Care, Ghent, Belgium

[4] Radboud University Medical Center, Nijmegen, the Netherlands

[5] Institute of Tropical Medicine, Antwerp, Belgium

[6] University of Birmingham, Department of Social Work and Social Care, Birmingham, UK

[7] OLVG Hospital, Amsterdam, the Netherlands

[8] Department of General Practice and Elderly Care Medicine, University Medical Centre Groningen, the Netherlands

[9] Independent social scientist, IJsselstein (UT), the Netherlands

[10] University of Groningen, Faculty of Medical Sciences, the Netherlands

[11] KU Leuven, Faculty of Arts, Antwerp, Belgium

Lead reviewer: Demi Krystallidou d.krystallidou@surrey.ac.uk

* realist support

Abstract

Background: Interprofessional Education (IPE) is essential for the development of a 'collaborative practice-ready' health workforce. To date, there is evidence that suggests mixed outcomes emerging from IPE interventions ranging from positive to no outcomes at all. Objective evidence of the contexts and mechanisms of IPE that are associated with positive outcomes in undergraduate education in health sciences is limited.

Objectives: With this review we seek to understand how exactly IPE in undergraduate education in health sciences and social work is implemented, which components of IPE work for which specific groups and under what circumstances.

Methods: We will conduct a realist review, which is a theory-driven interpretive approach to evidence synthesis. This method is appropriate because it applies realist logic of inquiry and aims to produce an explanatory analysis of an intervention. More specifically, realist methodology allows us to understand and explain what works, for whom and in what circumstances. In line with the realist methodology, we developed an initial programme theory by relying on the available literature, as well as by consulting stakeholders and drawing on the diverse expertise of our review team. The search strategy for the development of the refined programme theory will comprise the following: i) electronic database searching, ii) hand-searching of bibliographies, iii) 'cited by' searching, iv) stakeholder sessions, v) searching grey literature. The process of searching for available evidence will be iterative, will evolve and will be refocused as the review progresses. We will include documents based on whether they contain information that can contribute to the theory building (relevance) and whether the methods used to generate the relevant information are sound and trustworthy (rigour).

Data extraction will be conducted by means of annotation and note-taking methods according to the realist methodology. We will examine the collected and appraised evidence of the different outcomes within the initial programme theory and we will infer how these outcomes are caused in certain contexts through various mechanisms. The review will be reported according to the RAMESES publication standards.

Importance: At the end of the review we will propose a refined theory based on our understanding of the available evidence of what aspects of IPE in undergraduate health sciences work, for whom and in what circumstances. This type of theory will inform the development of future IPE interventions in undergraduate education in health sciences and in so doing it will address a gap in the existing literature on IPE. On a different level, the review will highlight a set of areas that merit further investigation, proposing in this way a research agenda that is relevant to the topic of the review.

1. Background to the topic

In 2006, the 59th World Health Assembly adopted resolution WHA59.23 calling for a rapid scaling up of health workforce production through a set of strategies including the use of "innovative approaches to teaching in industrialized and developing countries". One of the most promising ways forward according to the World Health Organization (WHO) can be found in interprofessional collaboration. In order for health professionals to be able to collaborate effectively and improve health outcomes, two or more people from different professional backgrounds must first be provided with opportunities to learn about, from and with each other. This Interprofessional Education (IPE) is essential for the development of a 'collaborative practice-ready' health workforce[1].

Although pre-1990 IPE research was scant and of a poorer quality, there has been a growing interest in IPE interventions post 1990.[2] This increase in interest has been followed by a rapidly expanding and theoretically more sophisticated period, moving away from what was previously a largely atheoretical period in IPE interventions. However, the literature suggests that descriptions and evaluations of IPE interventions still often lack reference to theoretical foundations[3-5] and that IPE interventions that are not underpinned by theory risk offering only partial insights without taking into account assumptions about how and why phenomena occur. [5] As such, there is a need for IPE interventions to be more underpinned by theory.

Previous reviews of the literature including meta-analyses have managed to provide some valuable insights into existing IPE interventions. However, as existing reviews have concluded, most studies on IPE have focused on the *effects* and *impact* of these interventions (and not on how effects and impact have been generated) and have reported on various outcomes ranging from positive to no outcomes for healthcare processes or patients.[6-10]

Studies have concluded that in order for IPE interventions to be successful, leadership at all levels in both academic and practice settings is required.[11] At the same time it is required that leaders of academic institutions understand the visionary mission of IPE and expected educational outcomes[12]. These administrative and academic leaders should be supportive in providing expertise and resources for effective delivery of IPE.[13] At the learners' level, studies have shown that incorporating IPE interventions within teaching pedagogies can be rightly pitched with the students' learning styles[14].

A recent systematic review concluded that IPE activities were an effective tool for improving attitudes toward interdisciplinary teamwork, communication, shared problem-solving, and knowledge and skills in preparation for collaboration with other members of interdisciplinary healthcare teams.[15] Positive results were found among several healthcare professions, supporting the incorporation of IPE in the academic preparation of future healthcare providers across disciplines. Although varied outcome measures were utilized across the studies, each showed some impact on attitudes and self-perceptions of interprofessional teamwork in the delivery of healthcare services.[15] Effective communication and collaborative efforts to find solutions to clinical issues across healthcare professions is essential for achieving the best outcomes for patients and establishing a positive work environment. [15]

A recent realist review on pre-registration interprofessional clinical education in the workplace concluded that the use of trained facilitators and the absence of negative role modelling were associated with successful programmes[16]. In addition, small mixed-professional groups, in which participants were

required to interact, discuss and reflect, tended to acquire an increase in their knowledge of the roles of others and teamwork skills[16]. Students placed in small interprofessional teams, undertaking a real-patient collaborative task followed by facilitated discussion, tended to also report a better understanding of the patient perspective, in addition to knowledge of the roles of other professions[16]. Educational interventions that focused on safety, or medication errors, were associated with gains in safety knowledge, and an awareness of the human factors involved in error prevention within teams[16]. In a similar vein, the continuous need for collaboration (e.g., in a student-led emergency department) allows students to develop IPE competencies while working as a team.[17] What is more, as shown in recent realist reviews, reflective practice is a core aspect in IPE (for pre-licensed, post-licensed, and/or graduate students, as well as continuing education for health and social care providers),[18] and leads to a deeper understanding of one's own and other professionals' role in the provision of care.[19] Last but not least, a number of key mechanisms related to IPE facilitators, such as role modelling, valuing diversity, reflection, group process, knowledge, skills and attitudes for IPE, lead to positive IPE outcomes.[20]

Opinions are divided as to when IPE interventions should be introduced in order for them to lead to positive outcomes. Some authors recommend that it should be introduced at the earliest opportunities in undergraduate education to avoid students developing negative stereotypes and attitudes of other health professionals, [21 22] while others have argued that IPE is better placed to occur later in a learner's education after they have felt secure in their professional roles.[23 24] Both sides have valid arguments and different competences are required at undergraduate and postgraduate level. However, we noted that in some reviews no clear distinction is made between undergraduate and postgraduate education in health sciences, which might affect the interpretation of findings and the conclusions that can be drawn. [10 25 26]

2. The realist approach

Despite the available evidence presented above, there is a need in the literature for more research in the IPE *processes* that would advance our understanding of *how* exactly IPE translates into practice, *which components* of IPE work *for which specific groups* and *under what circumstances*[7] in undergraduate health sciences education. Against this backdrop and in order to respond to the recent calls in the literature for better understanding of the components of IPE that (do not) work for specific groups of learners in undergraduate education in health sciences under certain circumstances and while taking a theory-led approach to it, we will perform a realist review of the literature on IPE in undergraduate education in health sciences. We chose this type of review because it provides a rationale and tools for synthesizing complex, difficult-to-interpret evidence from complex programs.[27] In particular, this type of literature review will allow us to unpack the mechanisms of how IPE interventions work (or why they fail) in particular contexts and settings by enabling us to understand what works in social interventions and allowing us to try to establish causal relationships. [28] As the review progresses, we anticipate encountering employment of various interventions in different settings with variable success. Yet, we expect that there will be common patterns among interventions in specific learner groups, within specific contexts, and under specific circumstances that will be successful or unsuccessful. We anticipate that there will be underlying educational theories at play that will be helpful in determining why interventions are effective. At the end of the review, we will propose a refined theory that can inform the development of future IPE interventions.

IPE interventions are complex interventions and have multiple components (which interact in non-linear ways), outcomes (some intended and some not) and long pathways to the desired outcome(s).[29] Every

intervention has to some extent some theoretical underpinnings, even when these are not always explicitly reported. A key component in the process of conducting a realist review is the development of programme theories. The term "refers to an abstracted description and/or diagram that lays out what a programme (or family of programs or interventions) comprises and how it is expected to work".[30] Programme theories serve two main functions in a realist review: i) to 'sketch the terrain' that will be investigated, and in the process to assist in refining the elements and scope for the review, and ii) to provide a structure for review findings.[30] With this in mind, and in line with the realist paradigm, we have developed an initial programme theory (IPT) which we will test at the later stages of the review and which will lead to a "refined theory"[31] that will inform the development, implementation and evaluation of future IPE interventions in undergraduate health sciences. Next to reviewing the available literature, we will rely on the expertise in healthcare education of members of our team and external experts (e.g. educationalists, curriculum developers, realist review experts, methodologists) in order to develop programme theories that explain what IPE interventions are effective, for whom, and under what circumstances in undergraduate health sciences education. We recognise that performing a realist review is an iterative process and therefore the programme theories that will emerge in the course of it will likely be dynamic and evolving throughout the study. At the conclusion of the study the members of our team will agree on any final theories that will be put forward.

3. Review objectives and research questions

Objectives:

- To identify and describe Intervention-Context-Actors-Mechanisms-Outcomes reported in the research and evaluation literature on IPE in undergraduate health sciences .

- To propose a theory of how contexts and mechanisms interact to produce specific outcomes in IPE in undergraduate health sciences in order to inform the development and implementation of IPE interventions in undergraduate education of health professionals.

The **research questions** we seek to answer are the following:

- What components of IPE interventions work in the undergraduate education of health professionals? (e.g. types of health care professions involved in the interventions; length of the interventions; 'maturity' of students involved; year of study they are in; specific educational modules; staff capacity building; workplace based learning or classroom; patient involvement; participants' reflections; practice- vs. theory oriented; participants' prior-knowledge)
- What are the outcomes (both intended and unintended) of IPE interventions in the undergraduate education of health professionals?
- By what contextual factors and mechanisms are IPE outcomes generated in the undergraduate education of health professionals?
- For whom do IPE interventions (not) work in the undergraduate education of health professionals? (Are the intended outcomes met and if so for whom? What are the unintended outcomes in specific groups of learners and facilitators?)

- In what circumstances do IPE interventions (not) work in the undergraduate education of health professionals? (In what circumstances are the intended outcomes met? In what circumstances do unintended outcomes emerge?)

4. Methods

In line with the RAMESES reporting standards I and II [32 33] we provide below a detailed account of the methodological and analytical processes we undertook for the development of our initial programme theory (IPT) and briefly outline the subsequent steps of our review.

4.1. Developing the Initial Programme Theory

In order to formulate the Initial Programme Theory (IPT), we relied on various sources of data: internal expert meeting (members of the review team), scoping search of the relevant literature, and sounding board sessions with stakeholders in IPE interventions.

In a number of consultations with the members of the review team (with experience in IPE interventions) following a review team meeting in June 2019, we identified a set of components that are key to IPE interventions and we inferred bi-directional causal relationships between context, mechanisms, outcomes and three different levels, namely students, faculty and institution, which could be relevant to context, mechanisms and outcomes. This allowed us to rely on our team's expertise in IPE, clinical practice, and education and identify a number of elements and potential mechanisms that could be of relevance to the scope of our review and informed the development of our scoping search in the literature while looking for relevant theories. We looked for existing theories in two distinct, yet complementary, ways: through a scoping search of the literature and by means of sounding board sessions with IPE experts.

First, we conducted a scoping search that was based on the combination of four key concepts that are relevant to the scope of our review: interprofessional + education + undergraduate + study design. (The search strategy can be found in the Annex). The initial scoping search was not meant to be exhaustive and was meant to serve only as a point of departure for the realist review. This search was performed in PubMed and Google Scholar (also covering parts of the grey literature). (The search strategy that was used in PubMed, shown in Annex, will be translated and refined for use in ERIC, ProQuest, Google Scholar at the subsequent stages of the review where we will be collecting evidence to test our IPT.) For the development of the IPT the grey literature was consulted only occasionally and helped us better understand the context within which the primary studies were situated. All the documents sourced within the scoping search were searched for theories relating to IPE interventions in undergraduate health education. The initial search revealed little evidence of theories explicitly linked to IPE interventions in undergraduate health sciences education. For this reason, we looked for primary studies that reported on IPE interventions in undergraduate health education. The initial scoping search in PubMed yielded 10,715 studies between 1990 and 2020. Of the first 200 most relevant studies (based on the Best Match algorithm of PubMed) we identified 20 studies which seemed to be more relevant to the scope of our review (e.g. detailed description of the implementation process). Members of the review team worked in pairs and extracted data from the 20 studies by relying on an extraction table that was developed and piloted by the review team (see Annex). From each study we extracted information on research aims/questions, research design/methodology, topic and context of the intervention, interprofessional learning goals, format and

strategies of the intervention, facilitators and barriers to the intervention, definition of interprofessional education, explicitly or implicitly stated theory, evaluation of the intervention and reported outcomes. Based on the extracted information we identified ICAMO configurations that allowed us to identify a set of relevant factors pertaining to the Intervention-Context-Actors-Mechanisms-Outcomes that were relevant to each study. We opted for the ICAMO instead of the more conventional CMO (Context-Mechanisms-Outcomes) configuration, as the former allowed us to better identify distinct modifications pertaining to each of these elements, and to better distinguish among the different elements of the configuration. Similar to Marchal et al [34] we found it useful to deliberately expand the traditional CMO configuration to include Intervention and Actors. This enabled us to collect detailed information on the implementation of the Intervention and to distinguish it from Context. (In earlier iterations of the data extraction process we noticed that there was at times an overlap between Intervention and Context that prevented us from seeing clearly the conditions under which Mechanisms would fire Outcomes.) In a similar fashion, including Actors allowed us to collect information that referred to the different groups of individuals involved in each intervention, namely Facilitators and Students, and to identify Mechanisms that related to each of them in specific Contexts.

In line with the recommendations put forward by Weger et al, [35] below we define the elements of the ICAMO configuration we used. Every element comes with a set of modalities that reflect the diversity that is inherent within each of these elements.

Intervention: IPE intervention in undergraduate health sciences.

Context: factors and conditions within which the IPE intervention takes place. The Context ideally needs to be conducive for the Intervention to trigger Mechanisms in Actors and bring about change.

Actors: individuals who are involved in and/or participate in the development, implementation, evaluation of the IPE intervention. We distinguish between *facilitators* of the IPE sessions and *students*, as each group has a prominent presence in the implementation of the intervention. Certain modalities apply to each (group of) facilitator(s) that ensure Mechanisms are triggered both at an individual, as well as interactional/interrelationship level. The influence of any other Actors who might play a key role but are not directly related to the development, implementation and evaluation of the Intervention (e.g. deans, line managers) is seen as part of the Context within which the Intervention took place. We also acknowledge the heterogeneity and diversity in the two groups of Actors: not two students or facilitators are alike and facilitators might wear multiple hats while being involved in the intervention. For example, a line manager (representing the institutional context) might co-develop an intervention (developer), which they might also co-facilitate (facilitator).

Mechanisms: what Actors actually think/feel when they are exposed to the Intervention, allowing them to learn interprofessionally (students) and/or to facilitate the intervention (facilitators). Considering that IPE interventions are social systems, therefore comprising *"the interplays of individual and institution, of agency and structure, and of micro and macro social processes",* [36] there is a great overlap of Mechanisms being triggered in the two identified groups of Actors. Also, Mechanisms operate at various levels and at different times (see also Westhorp [37]).

Outcomes: interprofessional competencies achieved through the intervention (including both intended and unintended outcomes). It is important to note that outcomes can occur in sequence allowing for

intermediate outcomes to occur (e.g. during the implementation/ learning process), which can lead to intended and/or unintended *end outcomes* upon completion of the intervention.

> E.g. Facilitators (Actors) with clinical expertise and pedagogic experience who trust and feel trusted in a team (Mechanism), display role model behaviour (intermediate outcome) during the implementation of the intervention. Their behaviour creates the conditions for the Context (within which the Intervention unfolds) to trigger specific Mechanisms in students (e.g. to trust students from other professions and feel trusted). This Mechanism can contribute to reaching end outcomes with regard to IPE roles and responsibilities.

Secondly, we identified stakeholders (i.e. IPE developers, facilitators, students, managers) with long-standing experience in and/or exposure to IPE interventions and ran a series of sounding board sessions with them. Two of them were 1:1 sessions between the lead reviewer (DK) and two stakeholders in the UK. The third session was organised as a focus group discussion with stakeholders in the Netherlands and was led by a member of the review team (NSdH). In all of these sessions participants were asked to reflect on the ICAMO configurations that the review team had previously identified in the selected primary studies. The participants were encouraged to share their knowledge of Mechanisms firing certain Outcomes for groups of Actors under certain Contexts in the Interventions they had developed, facilitated or participated in. All of the sessions were held online via Teams and Zoom due to the COVID-19 restrictions that prevented us from meeting with the stakeholders in person. All of the sessions were video recorded with the participants' consent and were viewed repeatedly by members of the review team who coded them for ICAMO configurations. Each session was coded by at least two independent coders. The lead reviewer (DK) compared the two codings of each session and produced a final coding for each of the sessions. The lead reviewer and the last author (PP) synthesized the ICAMO configurations that emerged from the scoping search of the literature and the sounding board sessions and identified relationships between the various elements of the ICAMO configurations leading to the development of our IPT.

At this stage it should be clarified that we noticed an interdependency among the various elements of the ICAMO configuration, which seems to be in line with the theory of generative causation as discussed in Pawson and Tiley.[36] For example, we noticed that the Intervention can condition/shape Mechanisms, which by extension can fire different Outcomes (e.g. while students might at first be reserved toward their peers from other disciplines (Mechanism), the Intervention can provide them with opportunities that allow them to get to know each other better and gradually become less reserved/more at ease with each other (intermediate outcome). Under certain conditions this can create the conditions for new Mechanisms to be triggered in the students, leading in this way to end outcomes that relate to IPE competencies. In a similar vein, Mechanisms can influence each other and/or can be a prerequisite for each other to emerge (see also Hewitt et al [38]). For example, in order for students to be able to communicate openly with their peers, some basic elements of trust are required.

4.2. Our Initial Programme Theory (IPT)

Our IPT comprises three main, multifaceted constructs that are relevant to the scope of this evaluation: ***development, implementation***, and ***evaluation*** of the IPE intervention. Each of these constructs is characterised by high levels of complexity and when viewed altogether they could provide a

comprehensive view of how IPE interventions work for certain groups of actors in specific contexts. Fig. 1 and 2 provide a visual representation of our IPT. Two observations should be made at this point: First, it should be emphasized that the current illustrations do not do justice to the complexity that is inherent in the IPE interventions, nor to the interconnectedness and fluidity among various elements operating at different levels, nor to the generative power of Mechanisms that can create the conditions for the Context to be adapted, triggering in this way intermediate and end Outcomes. For this reason we intend to demonstrate the final programme theory that will follow after testing, validating and/or refuting our IPT by means of a causal loop diagram[39]. Secondly, the two Figures are complementary to each other and items of one should be read in relation to items of the other (e.g. to gain a comprehensive view of how interventions work for the individuals involved in them, we should look at Intervention modalities, the Mechanisms they trigger in students, as well as at the combination of these Mechanisms and how they contribute to reaching aspects of the four IPEC core competencies and/or unintended outcomes, as shown in Fig 1.) At the same time, we should also look at the facilitator modalities, the broader Context and the Mechanisms they trigger in facilitators enabling them to reach specific intermediate outcomes, which, by extension, can create the conditions for specific Contexts to emerge within which specific student-related Mechanisms can contribute to achieving aspects of the core IPEC competences and/or unintended outcomes.

In each of these constructs the ICAMO configuration can be identified. We acknowledge the difficulty to depict the three constructs (development, implementation, evaluation) in Fig. 1 and 2 at this stage of the review. A list of identified elements that fall within each Intervention modality (Im), Context modality (Cm), Mechanism (M), Actor modality (AmF / AmS), Outcomes (O) is shown in Tables 1-5. The elements of each category were identified by means of thematic analysis of the ICAMO configurations that emerged from the scoping search of the literature and the sounding board sessions.

How Figures 1 and 2 should be read: While analysing the data that emerged from our scoping review and the sounding board sessions, we noticed that certain relationships between Interventions, Context, Actors (facilitators, students), Mechanisms and Outcomes seemed to be recurrent. However, the ways in which Outcomes were linked to the above categories were not always clearly indicated, meaning that the Mechanisms were not always easy to identify. We anticipate acquiring increased understanding of these relationships, and perhaps add more categories to the ones we have already identified and which form part of our IPT, as we proceed with the screening of the full texts of the included papers. In line with realist methodology, reviewers' gradually increasing understanding of the ongoing processes that are reported in the selected literature, becomes the means to disentangle the complexity that is inherent in the interplay between the Intervention, Context, Actors, Mechanisms and Outcomes. At this stage of the review, we acknowledge that we can only identify *basic* connections between the three columns presented in Fig 1 and 2, without being able yet to provide highly nuanced descriptions of the relationships between the categories placed in each of the three columns. For example, for now, we can only see that when IPE interventions are *relevant* (Fig 1 Im1), meaning that they are in line with students' level of existing knowledge/skills/competencies/attitudes, or include "out-of-the-comfort-zone" moments, see Table 1, Im1), then students are likely to *be interested/feel aroused* (Fig 1, M3), and therefore they are likely to engage in *teamwork* (Fig 1, CC4). The link between relevance of the intervention and student interest was identified during the scoping search of the literature (hence a straight-line arrow in Fig 1). Instead, the relationship between students being interested/feeling aroused and them engaging in teamwork was identified during the sounding board sessions (shown by means of a dotted arrow in Fig 1). Supplementary

explanations pertaining to each of the categories depicted in the three columns in Fig 1 and 2 can be found in Tables 1-5. The left column in Fig 1 and 2 corresponds either to Interventions, Actors and/or Context. The middle column shows an overview of potential Mechanisms, while the right column is reserved for Outcomes.

The legend below explains what the abbreviations included in Fig 1 and 2 mean.

Abbreviation	Full description	What it refers to…
Im	Intervention modalities	possible attributes attached to IPE interventions as identified in the scoping search and sounding board sessions
M	Mechanisms	processes experienced by Actors - either students (see Fig 1) or facilitators (see Fig 2) involved in the IPE interventions
CC	Core Competencies	outcomes related to IPEC core competencies including other/unintended outcomes
AmF	Actor modality Facilitator	skills, behaviour, personality characteristics associated with facilitators of IPE interventions
Cm	Context modalities	the broader context within which the IPE intervention takes place

Legend of abbreviations used in Fig 1 and 2

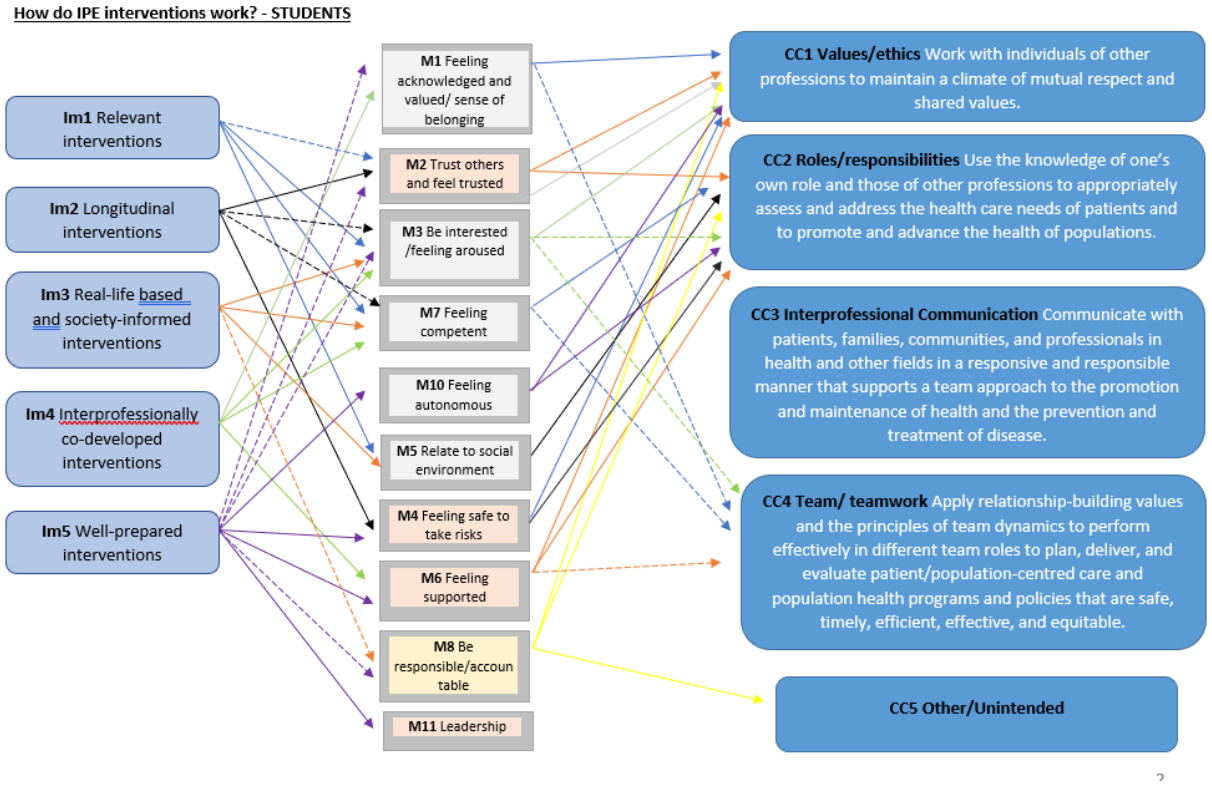

Fig. 1 IPT: student perspective

→ identified during the scoping search of the literature (and the sounding board sessions)

⇢ identified during the analysis of the sounding board sessions

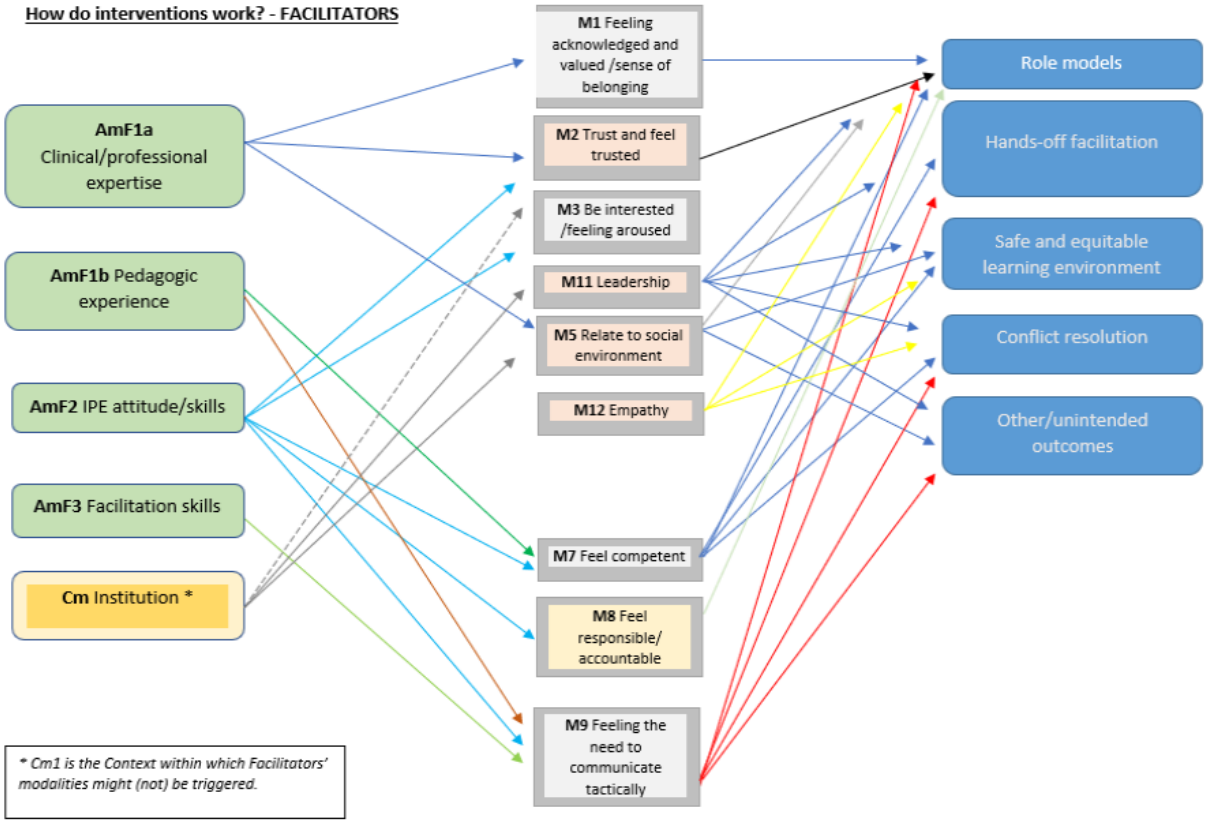

Fig. 2 IPT: facilitators' perspective

	Intervention *modalities* (Im)
Im1	**Relevance**
	I. in line with students' level of existing knowledge/skills/competencies/attitudes (i.e. readiness for IPE)
	II. might include "out-of-the-comfort-zone" moments
Im2	**Longitudinal approach**
	i. progressive exposure to IPE at all years of study

Im3	**Reality**	
	I.	Real life-informed cases / setting
	II.	Diversity (i.e. sociocultural/demographic/ethnic/…)
	III.	Holistic representation of patient-care (e.g. incl. carers)
Im4	**Interprofessionality**	
	i.	Co-developed by developers/facilitators from participating disciplines
	ii.	Enacted first by facilitators
	iii.	Evaluation of teamwork and team reflection
	iv.	Positive interprofessional communication among facilitators
Im5	**Preparation**	
	I.	provide required means and resources (i.e. incl. technical support for students and facilitators)
	II.	Piloted first in small groups before roll-out
	III.	Embedded in curriculum / extra-curricular (i.e. if not mandatory, can contribute to make students feel less interested because they might think it is not that important)
	IV.	Balanced representation of disciplines
	V.	Underpinned by IP educational theory
	VI.	acquisition of both technical (e.g. discipline specific) and non-technical skills (e.g. reflection)
	VII.	discipline-specific learning outcomes
	VIII.	shared IP learning objectives/goals
	IX.	"hands-on" student involvement; "hands-off" facilitation
	X.	Ice-breaking (i.e. aiming at elimination of biases)
	XI.	Ensure harmonious atmosphere
	XII.	Variety in tasks/methods
	XIII.	Right timing free from competing obligations (e.g. exams)
	XIV.	Extensive orientation provided to students

Table 1 All modalities were identified during the scoping search of the literature, except for those marked in blue, that were identified during the analysis of the sounding board sessions.

	Context *modalities* (Cm)	
Cm	**Institution**	
	i.	Shared vision across participating institutions/schools
	ii.	Behavioural norms
	iii.	Commitment and provision of resources
	iv.	Hierarchical structure
	v.	Voluntary involvement (of facilitators)
	vi.	Budgetary issues

Table 2 All modalities were identified during the scoping search of the literature, except for those marked in blue, that were identified during the analysis of the sounding board sessions.

	Actor *modalities* - FACILITATORS (AmF)	
AmF1	**Skills/knowledge**	
	i.	Clinical/professional expertise
	ii.	Pedagogic experience (e.g. mindful of students' different learning styles)
AmF2	**IPE attitude/skills**	
	I.	Sense of shared ownership / accountability
	II.	collaborative mindset/ engagement

AmF3	**IPE facilitation**
	i. "Hands-off" approach
	ii. Safe and equitable learning environment
	iii. Conflict resolution
	iv. Assessment of discipline-specific and IP behaviour and reflection
AmF4	**Role model –** *Serves as Outcome that is triggered by combined M that apply to Facilitators under certain C*
	I. Teamwork, collaborative mindset
	II. Respect and empathy toward other disciplines
AmF5	**Personality traits -*Not explicitly addressed as such in the sounding board sessions***
	i. Confidence
	ii. Empathy – *Can be either a M on a personal level OR intermediate O that might be passed on to Students*
	Actor *modalities* – STUDENTS (AmS)
AmS1	**Knowledge/Skills/Attitudes**
	I. Possess required knowledge/skills (e.g. first discipline-specific for early years, later IP-related for later years)
	II. Open-minded/inclusive/collaborative attitude
	III. Take ownership of their role
	IV. "hands-on" approach
AmS2	**Personality traits**
	i. Respect
	ii. Interest in learning
	iii. Social skills

Table 3 *All modalities were identified during the scoping search of the literature, except for those marked in blue, that were identified during the analysis of the sounding board sessions.*

	***Mechanisms* (M)**
M1	Feeling acknowledged and valued / Feel a sense of belonging (motivation learning theory)
M2	Trust and feel trusted
M3	Be interested / feeling aroused (e.g. situational interest)
M4	Feel safe to take risks (and fail) - *STUDENTS*
M5	Relate to social context/environment (self-determination theory)
M6	Feel supported - *STUDENTS*
M7	Feel competent (self-determination theory)
M8	Feel responsible/accountable
M9	Feel the need to communicate tactically - *FACILITATORS*
M10	Feel autonomous (self-determination theory) - *STUDENTS*
M11	Leadership
M12	Be empathic – *FACILITATORS*

Table 4 *All modalities were identified during the scoping search of the literature, except for those marked in blue, that were identified during the analysis of the sounding board sessions.*

	Outcomes related to IPEC core competencies + other/unintended CC1 – CC4 sub-competencies, as shown in: *Interprofessional Education Collaborative. (2016). Core competencies for interprofessional collaborative practice: 2016 update. Washington, DC: Interprofessional Education Collaborative.*
CC1	**Values/ethics**
CC2	**Roles/responsibilities**
CC3	**Interprofessional communication**
CC4	**Team/teamwork**
CC5	***Other/unintended***

Table 5 *All modalities were identified during the scoping search of the literature, except for those marked in blue, that were identified during the analysis of the sounding board sessions.*

5. Subsequent stages of our review

5.1. Main searching phase

In collaboration with a librarian/information specialist we will translate the search strategy of our scoping search for use in other databases, as briefly outlined above. We anticipate that the search strategy will require further testing, perhaps even expansion to account for the inclusion of additional disciplines, revision and modification during this phase. Next to the selected databases we will expand the search of grey literature by means of Google Scholar and PROQuest. In addition, next to hand-searching of bibliographies, 'cited by' searching we will also contact experts external to the review team. For a schematic illustration of the main searching phase and the sources of evidence that we will consult, see Fig. 3 below.

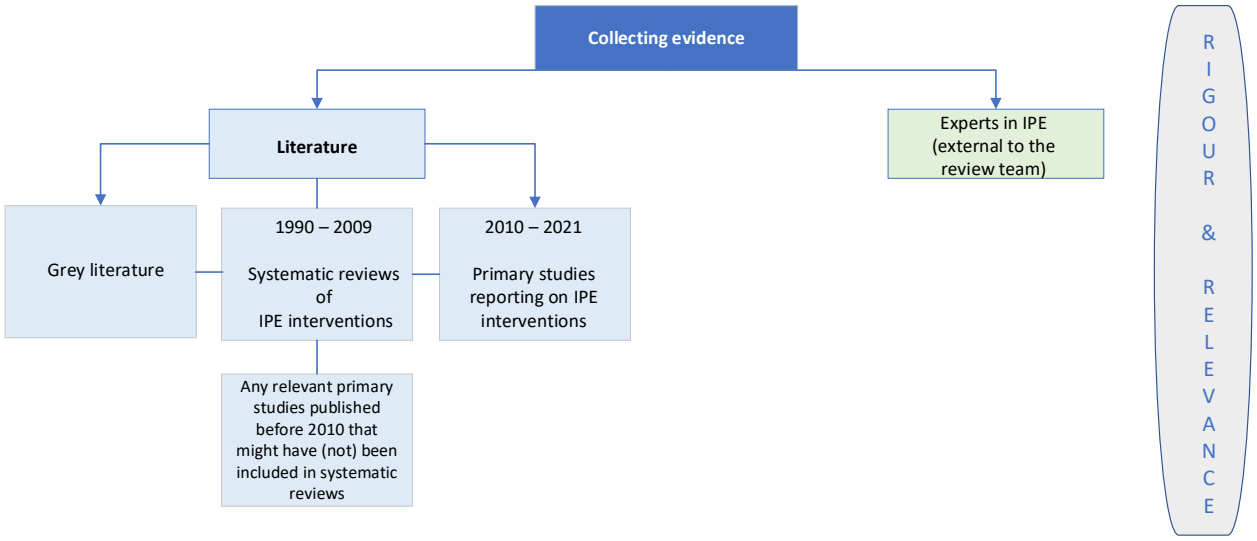

Fig. 3 Main searching phase

In line with the realist methodology we anticipate that searching is likely to be iterative as new or refined aspects of theory may be required to explain particular findings, or to examine specific aspects of particular processes. While new aspects of theory will be included, additional searches for evidence to support, refute, or refine those elements may be required. When theoretical saturation in one area will be reached, and no significant new findings will be emerging, searching will stop[40]. Considering that in our review we seek to understand and build theory about the effects of various contexts in relation to IPE interventions, we will ensure that research and evaluation documents about IPE interventions are included, so that important contexts are not overlooked[30].

5.2. Selection of documents

We will fist screen titles and abstracts to make a first selection of relevant documents whose full text will be consulted at a later stage. For our screening we will use Rayyan QCRI, a free software that is designed to help researchers working on systematic reviews, scoping reviews and other knowledge synthesis projects, by dramatically speeding up the process of screening and selecting studies. The tool allows for collaboration among reviewers during the screening process. Titles and abstracts will be screened by individual reviewers; full texts will be screened by pairs of reviewers. In case of disagreement, a 3Rd reviewer will screen the titles and abstracts and/or full text in question and help reach consensus.

In order to account for international variables, we will carefully examine documents according to their geographical and healthcare system context during the data extraction and synthesis. We will record the document selection process by means of an adapted Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[41] flow diagram in order to allow for traceability.

Following Wong et al [30] we will select documents based on their *relevance* (whether they contain information that can contribute to the theory building) and on their *rigour* (whether the methods used to generate the relevant information are sound and trustworthy). In order to screen documents against rigour and relevance, we will rely on inclusion criteria (see Table 6 below) which were guided by the focus of the review[30]. It should be noted that the inclusion criteria will be refined, if necessary, as we progress with the screening of the documents.

INCLUSION
1. The intervention is in line with the following **IPE definition:** *"Interprofessional education (IPE) occurs when students from two or more professions learn (in person or online) about, from and with each other to enable effective collaboration and improve health outcomes"*
2. The paper reports on the **interactive process of learning within the IPE intervention**
3. **Undergraduate education**: formal learning which leads to a degree and a professional qualification and which is generally undertaken at university, college, or medical school. The degree obtained upon successful completion of the formal training of students is in the disciplines represented in the list of professions selected by the review team:

	At least one of the participating student groups must lead to the following professions: *chiropodist/podiatrist, complementary therapists, dentists, dieticians/ nutritionist, doctors/physicians, dental hygienists, paramedics, (allied) health professional, psychologists, psychotherapists, midwives, nurses, pharmacists, physiotherapists, physical therapists, occupational therapists, radiographers, speech therapists, social workers*
4.	The paper reports either on the **development, or implementation, or evaluation** of the intervention, or on a combination of any of the above phases (e.g. implementation + evaluation). **Outcomes must be reported**

Table 6: Inclusion criteria that apply to the literature search

Additionally, in order to assess quality by using the concept of rigour, we will follow Brennan et al [42]and draw on a hybrid appraisal tool based on previous critical appraisal work, which will allow us to place selected papers on a continuum of conceptually rich (thick) or thin (weak) in description (see Figure 4 below). The tool has been found to be practical and useful in theory-driven reviews and will allow us to focus on the stronger sources of programme theories without excluding weaker sources that may make an important contribution[42].

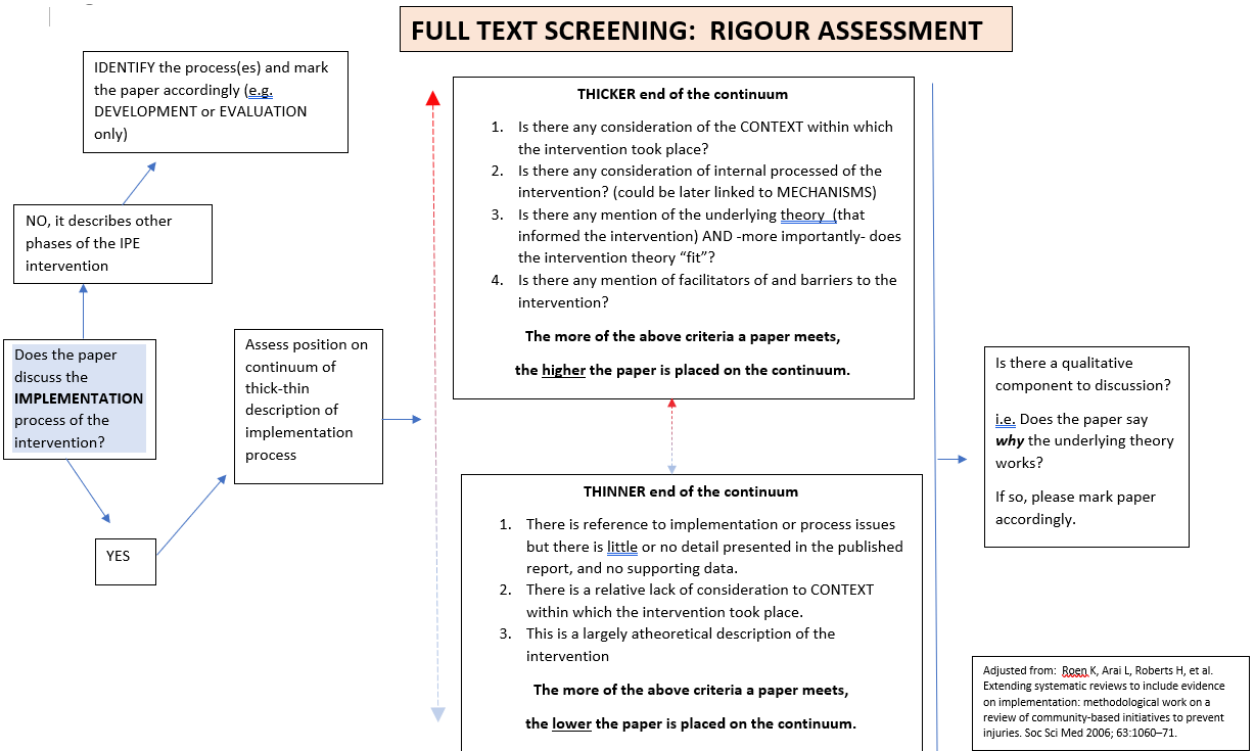

Fig. 4 Rigour assessment tool

We will screen each included paper against the criteria shown in Fig. 4. This will allow us to rank the included papers with the richest insights at the higher end of the continuum and start building our analysis from those, while also incorporating content from papers that are less rich, as the analytical structure emerges. We are aware that a single insight from a paper which might be originally ranked 'thin', may become central to the emerging theoretical framework during the data analysis. In other words, our original ranking from thickness to thinness will serve only as a starting point and our criteria for what constitutes relevance and insight may evolve and progress as the analysis unfolds. This might result in making the papers that seemed at first less relevant more relevant over time and possibly vice versa. We are aware that in realist methodology theoretical saturation is not needed on a concept for it to gain legitimacy in our analysis and that more important than that is the depth of insight and an understanding of ontologically deep mechanisms triggering in context. In other words, we will simply not seek the most popular themes. Instead, we will try to grasp deep and insightful causal claims that can explain how and why IPE interventions (do not) work for certain actors under specific circumstances (see our research questions).

Considering that searching for theory testing should be guided by the objectives and focus of the realist review and should be revised iteratively as new data emerge, we will search for different studies from a wide range of healthcare disciplines which we will use to test different aspects of the provisional theory. We will assess the primary studies and based on our assessment we will decide whether the evidence found in the studies can justify a revision of the emerging theory. While one small scale study might not be enough to revise the theory under construction, identifying the same finding in multiple studies might indeed justify a revision of the emerging theory. Decisions as to whether our IPT should be revised, against what evidence and in what respect, will be discussed within our team until consensus is reached.

5.3. Data extraction

A wide range of documents will be screened as they may all contribute in different ways to identifying and elucidating programme theories. A review team meeting and workshop will be 17ractice17 prior to the start of data extraction, to discuss the procedure, 17ractice data extraction and discuss dissimilarities. Data extraction of the selected documents will be undertaken by pairs of independent reviewers.

In realist reviews data extraction requires annotation and note-taking methods instead of fixed data extraction forms. To this end, in line with Mills et al, Wiese et al, Weetman et al[43-45] we will use a modified version of the BEME extraction form and apply a hybrid approach to data extraction as suggested by Weetman et al[45] in order to document basic information, document context, document details, intervention details, while at the same time manually annotating full texts for programme theory ideas. We anticipate that some details will not be identifiable in each included document. In case of unclear or missing information, the authors of the documents will be contacted. Annotation will be guided by the initial programme theory which was developed in earlier stages of the review, and which will be tested and refined against data that will emerge from the included documents.[45] The pairs of reviewers will manually screen and annotate the included documents in relation to ICAMO configurations and any theories related to the ways in which the intervention does or does not work. The reviewers' annotations will be discussed among the reviewers and the wider research team. Once we notice that the same mechanisms or ICAMO configurations resurface multiple times, we will perform two subordinate sampling tasks: i) to sample for *dissonance* i.e. papers that may contain a "counter hypothesis", and ii) to sample for

nuance i.e. articles that may add to our understanding of what is going on (see Booth et al[46]). We anticipate that in the first case this might require strategies such as sampling from different perspectives, from alternative contexts including criticisms and commentaries, found for example in grey literature. When it comes to nuance, this might require identifying fuller or richer accounts (e.g. process evaluations).

During the data extraction phase, we will appraise documents for *rigour*[30] (see above) by relying on the Realist and Meta-Review Evidence Synthesis: Evolving Standards (RAMESES) guidelines and standards[33]. In line with the realist methodology[30], we will not exclude documents solely based on rigour, as this could reduce rather than increase the validity and generalizability of review findings, as different parts of various documents can contribute altogether to the collection of evidence that will inform the programme theory testing and refinement.

5.4. Data synthesis

The review team will consolidate and synthesize the data that will emerge from earlier steps in an iterative manner. This will provide a fine-tuning of the understanding of the IPE interventions work[40] and will lead to a refined programme theory. We will interrogate the theory, according to Pawson et al[28] and assess what 'works'/ does not work, why/why not, for whom, to what extent and in what circumstances. More specifically, we will examine the evidence of the different outcomes within the IPT and we will infer how these outcomes are caused in certain contexts through various mechanisms. In order to synthesize the available evidence we will take a specific *'cut'* through the synthesis phase (synthesis to consider the same theory in comparative settings)[40], namely we will assume that particular programme theories work in some settings and not others and we will 'make sense of the patterns of winners and losers'[40].

Synthesis of the available evidence will be conducted through a process of reasoning that is structured around the following activities:

A. Juxtaposition of sources of evidence (evidence found in one document allows insights into evidence in another document)

B. Reconciliation of sources of evidence (finding the possible reasons for differing results in comparable circumstances)

C. Adjudication of sources of evidence (methodological strengths and/or weaknesses)

D. Consolidation of sources of evidence (in case of differing outcomes in particular contexts, an explanation will be constructed on how and why these outcomes occur differently)

E. Situation of sources of evidence (in case of differing outcomes in particular contexts, a possible explanation will be developed as to why they differ).[42 45]

In order to respond to the research questions we will seek to generate an explanation for the causal relationships between Intervention, Context, Actors, Mechanisms and Outcomes by cross-tabulating and comparing the ICAMOs in order to identify patterns of the contexts for positive and negative effects[45].

5.5. Refinement of the programme theory

At the end of the review we will refine and test the programme theory against the data that will be synthesized in previous stages of the review process. In addition, we will seek external experts' perspectives on the refined theory in order to check whether the refined programme theory reflects their

experiences in practice. The group of external experts (stakeholders) will comprise faculty members, students, policy makers, curriculum developers, educationalists. For each category of stakeholders we will organize a focus group discussion during which the stakeholders will be presented the results and analyses of the review and the refined theory and will be invited to share their perspectives and assist with the interpretation of the findings by the review team.

The review will be reported according to the RAMESES publication standards[33]

6.Dissemination

At the end of the review we will be able to build a final refined theory which will allow us to explain what works for undergraduate students in health education, why and under what circumstances. This will allow us to formulate a set of recommendations that will inform the design, development and evaluation of future IPE interventions in the undergraduate education of health professionals. The review findings will be disseminated in a peer reviewed journal (Medical Teacher), conference presentations, ready-to-use summaries for policy makers and curriculum developers.

Glossary

- **Realist review:** theory driven interpretive approach to evidence synthesis. It applies realist logic of inquiry to produce an explanatory analysis of an intervention that is, what works, for whom, in what circumstances, in what respects. It seeks to interrogate the theories that underpin the intervention being studied, in this case appraisal, to produce an explanatory analysis of it, that is, what works, for whom, in what circumstances, in what respects.[28] A realist synthesis takes a 'generative' approach to causation, that is, "to infer a causal **Outcome** (O) between two events (X and Y), one needs to understand the underlying **Mechanism** (M) that connects them and the **Context** (C) in which the relationship occurs."[42]

- **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*[47]

- **Health professionals:** *medical doctors* (both generalist and specialist practitioners, including public health doctors; *nursing professionals* including public health nurses; *midwifery professionals* including public health midwives; *dentists; pharmacists*; etc.

  The above groups of professionals are included in the list of health professionals as found in: *Transforming and Scaling Up Health Professionals' Education and Training: World Health Organization Guidelines 2013. Geneva: World Health Organization; 2013. Annex 1, Definition and list of health professionals. Available from: https://www.ncbi.nlm.nih.gov/books/NBK298950/*

  To this list we add *social workers* as IPE interventions in this profession fall within the immediate interests of our team.

- **Undergraduate education:** *formal learning which leads to a degree and a professional qualification and which is generally undertaken at university, college, or medical school.*[48] The degree obtained upon successful completion of the formal training of students is in the disciplines represented in the list of professions shown above.

Project timeline

October '19

- Protocol submission

March 2020

- Scoping search and initial programme theory development

July 2020 – March 2021

- Building of the search syntaxes
- Article screening: title/abstract and full text
- Article selection
- Developing and testing data extraction and coding sheet
- Data extraction
- Sounding board sessions with stakeholders (external to team of reviewers)
- Data analysis and synthesis to adjust and adapt initial programme theory

April 2021 – Dec 2021

- Submission of revised protocol incl. IPT
- Expand literature search
- Full text screening
- Data extraction and annotation

Jan 2022 – Febr 2022

- Build a refined programme theory

March 2022 – April 2022

- Present refined programme theory to stakeholders

May-July 2022

- Reporting and submitting for publication

Conflict of interest statement

There is no conflict of interest to declare for any member of the review group.

Plans for updating the review

The review team aims to update the review as needed.

Changes to the protocol

The composition of the review team has changed since February 2021. The team welcomed the expertise of the following new members: Maria Kersbergen, Wietske Kuijer-Siebelink, Saskia Oosterbaan – Lodder.

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Annex

PubMed

	Mesh	tiab	Search
1	"Attitude of Health Personnel"[Mesh:NoExp] "Cooperative Behavior" "Interdisciplinary Placement" "Interprofessional Relations" "Professional Competence" "Professionalism"	(Cross-Disciplinary AND Communications) Clinical Competenc* Clinical Skill Clinical Skills Collaborative Learning Cross-Disciplinary Communication Health Personnel Attitude Health Personnel Attitudes Interdisciplinary Communication Interdisciplinary Communications Interdisciplinary Health Team Interdisciplinary Placement Interprofessional Relations Multidisciplinary Communication Multidisciplinary Communications shared learning	"Interprofessional Relations"[Mesh] OR "Interprofessional Relations" [tiab] OR "Interdisciplinary Communication"[Mesh] OR "Interdisciplinary Communication" [tiab] OR "Interdisciplinary Communications" [tiab] OR "Multidisciplinary Communication" [tiab] OR "Multidisciplinary Communications" [tiab] OR "Cross-Disciplinary Communication" [tiab] OR ("Cross-Disciplinary"[tiab] AND Communications[tiab]) OR "Health Personnel Attitude" [tiab] OR "Health Personnel Attitudes" [tiab] OR "Attitude of Health Personnel"[Mesh:NoExp] OR "Interdisciplinary Health Team" [tiab] OR "Cooperative Behavior"[Mesh] OR "Professionalism"[Mesh] OR "Professional Competence"[Mesh] OR "Clinical Competenc*" [tiab] OR "Clinical Skill" [tiab] OR "Clinical Skills" [tiab] OR "Interdisciplinary Placement"[Mesh] OR “Interdisciplinary Placement” [tiab] OR "shared learning" [tiab] OR “Collaborative Learning” [tiab]
2	"Curriculum" "education" [Subheading] "Education"[Mesh:NoExp] "Education, Distance" "Education, Professional" "Interdisciplinary Studies" "Teaching"	Curricul* Education* Interdisciplinary Studies Short-Term Course Short-Term Courses Teaching Training Program Training Programs Workshop Workshops	"education" [Subheading] OR "Education"[Mesh:NoExp] OR "Education*" [tiab] OR "Workshops" [tiab] OR "Workshop" [tiab] OR "Training Programs" [tiab] OR "Training Program" [tiab] OR "Educational Activities" [tiab] OR "Educational Activity" [tiab] OR "Curriculum"[Mesh] OR "Curricul*" [tiab] OR "Short-Term Courses" [tiab] OR "Short-Term Course" [tiab] OR "Education, Distance"[Mesh] OR "Education, Professional"[Mesh] OR "Teaching"[Mesh] OR "Teaching" [tiab] OR "Interdisciplinary Studies"[Mesh] OR "Interdisciplinary Studies" [tiab]
3a	"Education, Medical, Undergraduate" "Education, Nursing, Associate" "Education, Nursing, Baccalaureate"	Baccalaureate Nursing Education Dental Student OR Dental Students	"Education, Medical, Undergraduate"[Mesh] OR "Undergraduate Medical Education" [tiab] OR "Education, Nursing, Associate"[Mesh] OR "Education,

	"Education, Nursing, Diploma Programs" "Education, Dental"[Mesh:NoExp] "Students, Health Occupations"[Mesh:NoExp] "Students, Dental" "Students, Medical" "Students, Nursing" "Students, Pharmacy"	Health Occupations Student OR Health Occupations Students Medical Student OR Medical Students Nursing Diploma Program OR Nursing Diploma Programs Nursing Student OR Nursing Students Pharmacy Student OR Pharmacy Students pre-licensure pre-qualifying Pupil Nurse OR Pupil Nurses Undergraduate Medical Education undergraduate student*	Nursing, Baccalaureate"[Mesh] OR "Baccalaureate Nursing Education" [tiab] OR "Education, Nursing, Diploma Programs"[Mesh] OR "Nursing Diploma Program" [tiab] OR "Nursing Diploma Programs" [tiab] OR "Education, Dental"[Mesh:NoExp] OR "Students, Health Occupations"[Mesh:NoExp] OR "Health Occupations Students" [tiab] OR "Health Occupations Student" [tiab] OR "Students, Dental"[Mesh] OR "Dental Students" [tiab] OR "Dental Student" [tiab] OR "Students, Medical"[Mesh] OR "Medical Students" [tiab] OR "Medical Student" [tiab] OR "Students, Nursing"[Mesh] OR "Pupil Nurses" [tiab] OR "Pupil Nurse" [tiab] OR "Nursing Student" [tiab] OR "Nursing Students" [tiab] OR "Students, Pharmacy"[Mesh] OR "Pharmacy Students" [tiab] OR "Pharmacy Student" [tiab] OR "undergraduate student*" [tiab] OR "pre-qualifying" [tiab] OR "pre-licensure" [tiab] OR "Social Workers"[Mesh] OR "Social Worker*"[tiab]
3b1 AND	Allied Health Occupations Allied Health Professional Chiropractic Complementary Therapies Dental hygienists Dentists Dietetics Midwifery Nurses Nutritionists Occupational therapists Pharmacists Physical Therapists Physicians Podiatry Psychotherapists Social workers	Allied health professional* Chiropod* Chiropract* Dentist* Dietician* Dietitian* Doctor* Hygienist* Midwif* midwives Nurse nurses Nutritionist* Occupational therapist* Paramedic* Pharmacist* Physical therapist* Physician* Physiotherapist* Podiatr* Psychotherapist* Radiographer* Social worker*	Chiropractic[Mesh] OR Complementary Therapies[Mesh] OR Dentists[Mesh] OR Nutritionists[Mesh] OR Dietetics[Mesh] OR Physicians[Mesh] OR Dental hygienists[Mesh] OR Allied Health professional[Mesh] OR Psychotherapists[Mesh] OR Midwifery[Mesh] OR Nurses[Mesh] OR Pharmacists[Mesh] OR Physical Therapists[Mesh] OR Podiatry[Mesh] OR Occupational therapists[Mesh] OR Social workers [Mesh] OR Allied Health Occupations[Mesh] OR Chiropod*[tiab] OR Chiropract*[tiab] OR Podiatr*[tiab] OR Dentist*[tiab] OR Nutritionist*[tiab] OR Dietician*[tiab] OR Dietitian*[tiab] OR Doctor*[tiab] OR Physician*[tiab] OR Psychotherapist*[tiab] OR Hygienist*[tiab] OR Paramedic*[tiab] OR Allied health professional*[tiab] OR Midwif*[tiab] OR midwives[tiab] OR Nurse[tiab] OR nurses[tiab] OR Pharmacist*[tiab] OR Physical therapist*[tiab] OR Physiotherapist*[tiab] OR Occupational therapist*[tiab] OR Social worker*[tiab] OR Radiographer*[tiab]

3b2	"Education, Medical, Undergraduate" Interprofessional Education	Undergraduate* Student Students Interprofessional education*	"Education, Medical, Undergraduate"[Mesh] OR Interprofessional Education[Mesh] OR Interprofessional education*[tiab] OR undergraduate*[tiab] OR Student[tiab] OR students[tiab]
4	"Case Reports" [Publication Type] "Clinical Study" [Publication Type:NoExp] "Cohort Studies"[Mesh:NoExp] "Comparative Study" [Publication Type] "Controlled Clinical Trial" [Publication Type] "Cross-Sectional Studies" "Evaluation Studies as Topic"[Mesh:NoExp] "Evaluation Study" [Publication Type] "Feasibility Studies" "Follow-Up Studies" "Historically Controlled Study" "Longitudinal Studies"[Mesh:NoExp] "Multicenter Studies as Topic" "Multicenter Study" [Publication Type] "Observational Study" [Publication Type] "Pilot Projects" "Pragmatic Clinical Trial" [Publication Type] "Pragmatic Clinical Trials as Topic" "Program Evaluation" "Prospective Studies" "Qualitative Research" "Retrospective Studies" "Validation Studies as Topic" "Validation Study" [Publication Type]	"Case Reports" "Clinical Study" "Cohort Study" "Comparative Study" "Controlled Clinical Trial" "Cross-Sectional Study" "Evaluation Study" "Feasibility Study" "Follow-Up Study" "Historically Controlled Study" "Longitudinal Study" "Multicenter Study" "Observational Study" "Pilot Project" "Pragmatic Clinical Trial" "Program Evaluation" "Prospective Study" “Qualitative research” “Qualitative study” "Retrospective Study" "Validation Study"	"Controlled Clinical Trial" [Publication Type] OR "Controlled Clinical Trial" [tiab] OR "Cohort Studies"[Mesh:NoExp] OR "Cohort Study" [tiab] OR "Follow-Up Studies"[Mesh] OR "Follow-Up Study" [tiab] OR "Longitudinal Studies"[Mesh:NoExp] OR "Longitudinal Study" [tiab] OR "Prospective Studies"[Mesh] OR "Prospective Study" [tiab] OR "Retrospective Studies"[Mesh] OR "Retrospective Study" [tiab] OR "Observational Study" [Publication Type] OR "Observational Study" [tiab] OR "Cross-Sectional Studies"[Mesh] OR "Cross-Sectional Study" [tiab] OR "Multicenter Study" [Publication Type] OR "Multicenter Study" [tiab] OR "Multicenter Studies as Topic"[Mesh] OR "Comparative Study" [Publication Type] OR "Comparative Study" [tiab] OR "Historically Controlled Study"[Mesh] OR "Historically Controlled Study"[tiab] OR "Case Reports" [Publication Type] OR "Case Reports" [tiab] OR "Clinical Study" [Publication Type:NoExp] OR "Clinical Study" [tiab] OR "Evaluation Study" [Publication Type] OR "Evaluation Study" [tiab] OR "Evaluation Studies as Topic"[Mesh:NoExp] OR "Feasibility Studies"[Mesh] OR "Feasibility Study" [tiab] OR "Pilot Projects"[Mesh] OR "Pilot Project" [tiab] OR "Program Evaluation"[Mesh] OR "Program Evaluation" [tiab] OR "Pragmatic Clinical Trial" [Publication Type] OR "Pragmatic Clinical Trial" [tiab] OR "Pragmatic Clinical Trials as Topic"[Mesh] OR "Validation Studies as Topic"[Mesh] OR "Validation Study" [Publication Type] OR "Validation Study" [tiab] OR "Qualitative Research"[tiab] OR “Qualitative research”[tiab] OR “Qualitative study”[tiab]
Search: 1 AND 2 AND (3a OR (3b1 AND 3b2)) AND 4 total ca. 8160 records (limit 01012010-2021)			

CINAHL (total ca. 3567 limit January 2010-end year 2021)

1.

((MH "Interprofessional Relations+") OR (MH "Cooperative Behavior") OR (MH "Attitude of Health Personnel+") OR (MH "Professionalism") OR (MH "Professional Competence") OR TI("Interprofessional Relations" OR "Interdisciplinary Communication" OR "Interdisciplinary Communications" OR "Multidisciplinary Communication" OR "Multidisciplinary Communications" OR "Cross-Disciplinary Communication" OR ("Cross-Disciplinary" AND Communications) OR "Health Personnel Attitude" OR "Health Personnel Attitudes" OR "Interdisciplinary Health Team" OR "Clinical Competenc*" OR "Clinical Skill" OR "Clinical Skills" OR "Interdisciplinary Placement" OR "shared learning" OR "Collaborative Learning") OR ("Interprofessional Relations" OR "Interdisciplinary Communication" OR "Interdisciplinary Communications" OR "Multidisciplinary Communication" OR "Multidisciplinary Communications" OR "Cross-Disciplinary Communication" OR ("Cross-Disciplinary" AND Communications) OR "Health Personnel Attitude" OR "Health Personnel Attitudes" OR "Interdisciplinary Health Team" OR "Clinical Competenc*" OR "Clinical Skill" OR "Clinical Skills" OR "Interdisciplinary Placement" OR "shared learning" OR "Collaborative Learning")

2.

((MW "ED") OR (MH "Education") OR (MH "Education, Health Sciences") OR (MH "Education, Chiropractic") OR (MH "Education, Baccalaureate+") OR (MH "Education, Associate+") OR (MH "Education, Health Sciences") OR (MH "Education, Dental") OR (MH "Education, Interdisciplinary") OR (MH "Education, Medical+") OR (MH "Education, Midwifery") OR (MH "Education, Nursing+") OR (MH "Education, Pharmacy") OR (MH "Education, Podiatry") OR (MH "Curriculum") OR (MH "Education, Non-Traditional+") OR (MH "Teaching+") OR TI("Education*" OR "Workshops" OR "Workshop" OR "Training Programs" OR "Training Program" OR "Educational Activities" OR "Educational Activity" OR "Curricul*" OR "Short-Term Courses" OR "Short-Term Course" OR "Teaching" OR "Interdisciplinary Studies" OR AB("Education*" OR "Workshops" OR "Workshop" OR "Training Programs" OR "Training Program" OR "Educational Activities" OR "Educational Activity" OR "Curricul*" OR "Short-Term Courses" OR "Short-Term Course" OR "Teaching" OR "Interdisciplinary Studies") OR AB("Education*" OR "Workshops" OR "Workshop" OR "Training Programs" OR "Training Program" OR "Educational Activities" OR "Educational Activity" OR "Curricul*" OR "Short-Term Courses" OR "Short-Term Course" OR "Teaching" OR "Interdisciplinary Studies" OR AB("Education*" OR "Workshops" OR "Workshop" OR "Training Programs" OR "Training Program" OR "Educational Activities" OR "Educational Activity" OR "Curricul*" OR "Short-Term Courses" OR "Short-Term Course" OR "Teaching" OR "Interdisciplinary Studies")

3a.

(MH "Education, Nursing, Associate") OR (MH "Education, Nursing, Baccalaureate+") OR (MH "Education, Nursing, Diploma Programs") OR (MH "Education, Dental") OR (MH "Students, Health Occupations+") OR (MH "Students, Undergraduate") ORst TI("Baccalaureate Nursing Education" OR "Undergraduate Medical Education" OR "Nursing Diploma Program" OR "Nursing Diploma Programs" OR "Health Occupations Students" OR "Health Occupations Student" OR "Dental Students" OR "Dental Student" OR "Medical Students" OR "Medical Student" OR "Pupil Nurses" OR "Pupil Nurse" OR "Nursing Student" OR "Nursing Students" OR "Pharmacy Students" OR "Pharmacy Student" OR "undergraduate student*" OR "pre-qualifying" OR "pre-licensure" OR "Social Worker*") OR AB("Baccalaureate Nursing Education" OR "Undergraduate Medical Education" OR "Nursing Diploma Program" OR "Nursing Diploma Programs" OR "Health Occupations Students" OR "Health Occupations Student" OR "Dental Students" OR "Dental Student" OR "Medical Students" OR "Medical Student" OR

"Pupil Nurses" OR "Pupil Nurse" OR "Nursing Student" OR "Nursing Students" OR "Pharmacy Students" OR "Pharmacy Student" OR "undergraduate student*" OR "pre-qualifying" OR "pre-licensure")

3b1 and 3b2

(((MH "Chiropractic+") OR (MH "Alternative Therapies+") OR (MH "Dentists+") OR (MH "Dietitians") OR (MH "Dietetics") OR (MH "Physicians+") OR (MH "Dental hygienists") OR (MH "Allied Health personnel") OR (MH "Psychotherapists") OR (MH "Midwives+") OR (MH "Nurses+") OR (MH "Pharmacists") OR (MH "Physical Therapists") OR (MH "Podiatry") OR (MH "Occupational therapists") OR (MH "Social workers") OR (MH "Allied Health Professions") OR TI(Chiropod* OR Chiropract* OR Podiatr* OR Dentist* OR Nutritionist* OR Dietician* OR Dietitian* OR Doctor* OR Physician* OR Psychotherapist* OR Hygienist* OR Paramedic* OR Allied health professional* OR Midwif* OR midwives OR Nurse OR nurses OR Pharmacist* OR Physical therapist* OR Physiotherapist* OR Occupational therapist* OR Social worker* OR Radiographer*) OR AB(Chiropod* OR Chiropract* OR Podiatr* OR Dentist* OR Nutritionist* OR Dietician* OR Dietitian* OR Doctor* OR Physician* OR Psychotherapist* OR Hygienist* OR Paramedic* OR Allied health professional* OR Midwif* OR midwives OR Nurse OR nurses OR Pharmacist* OR Physical therapist* OR Physiotherapist* OR Occupational therapist* OR Social worker* OR Radiographer*)) **AND (**(MH "Education, Interdisciplinary") OR (MH "Students, Undergraduate") OR TI(Interprofessional education* OR undergraduate* OR Student OR students) OR AB(Interprofessional education* OR undergraduate* OR Student OR students)**)))**

4

((MH "Clinical Trials") OR (MH "Prospective Studies+") OR (MH "Nonexperimental Studies+") OR (MH "Multicenter Studies") OR (MH "Historically Controlled Study") OR (MH "Comparative Studies+") OR (MH "Case Studies") OR (MH "Pilot Studies") OR (MH "Program Evaluation") OR (MH "Validation Studies") OR (MH "Evaluation Research+") OR TI("Cohort Study" OR "Follow-Up Study" OR "Longitudinal Study" OR "Prospective Study" OR "Retrospective Study" OR "Observational Study" OR "Cross-Sectional Study" OR "Multicenter Study" OR "Comparative Study" OR "Historically Controlled Study" OR "Case Reports" OR "Clinical Study" OR "Evaluation Study" OR "Feasibility Study" OR "Pilot Project" OR "Program Evaluation" OR "Controlled Clinical Trial" OR "Pragmatic Clinical Trial" OR "Validation Study" OR "Qualitative Research" OR "Qualitative research" OR "Qualitative study") OR AB ("Cohort Study" OR "Follow-Up Study" OR "Longitudinal Study" OR "Prospective Study" OR "Retrospective Study" OR "Observational Study" OR "Cross-Sectional Study" OR "Multicenter Study" OR "Comparative Study" OR "Historically Controlled Study" OR "Case Reports" OR "Clinical Study" OR "Evaluation Study" OR "Feasibility Study" OR "Pilot Project" OR "Program Evaluation" OR "Controlled Clinical Trial" OR "Pragmatic Clinical Trial" OR "Validation Study" OR "Qualitative Research" OR "Qualitative research" OR "Qualitative study")**)**

ERIC (total ca. 1025 records - limit 2010-2021)

1. Interprofessional

(Interprofessional relationship/ or Interdisciplinary approach/ or (Attitudes/ and exp Health personnel/) or Cooperation/ or Professionalism/ or (Exp Health personnel/ AND (Competence/ **OR** Expertise/)) or (Interdisciplinary Approach/ AND Placement/) or

(Cross-Disciplinary.tw. AND Communications.tw.) or Clinical Competenc* .tw. or Clinical Skill .tw. or Clinical Skills .tw. or Collaborative Learning.tw. or Cross-Disciplinary Communication .tw. or Health Personnel Attitude .tw. or Health Personnel Attitudes .tw. or Interdisciplinary Communication .tw. or Interdisciplinary Communications .tw. or Interdisciplinary Health Team .tw. or Interdisciplinary Placement .tw. or Interprofessional Relations .tw. or Multidisciplinary Communication .tw. or Multidisciplinary Communications .tw. or shared learning.tw.)

2. Education

(education/ or allied health occupations education/ or curriculum/ or distance education/ or health education/ or vocational education/ or professional development/ or professional education/ or "clinical teaching (health professions)"/ or medical education/ or (Interdisciplinary approach/ and (education/ or academic education/ or allied health occupations education/ or vocational education/)) or

Curricul* .tw. or Education* .tw. or Interdisciplinary Studies .tw. or Short-Term Course .tw. or Short-Term Courses .tw. or Teaching .tw. or Training Program .tw. or Training Programs .tw. or Workshop .tw. or Workshops.tw.)

3a Undergraduate

(medical education/ or nursing education/ or pharmaceutical education/ or Undergraduate Study/ or exp Undergraduate Students/ or Nursing Education/ or Associate Degrees/ or Bachelors Degrees/ or dental schools/ or dentistry/ or allied health occupations education/ or medical students/ or nursing students/ or pharmacy/ or social work/ or

Baccalaureate Nursing Education.tw. or Dental Student.tw. or Dental Students .tw. or Health Occupations Student.tw. or Health Occupations Students.tw. or Medical Student .tw. or Medical Students.tw. or Nursing Diploma Program.tw. or Nursing Diploma Programs.tw. or Nursing Student.tw. or Nursing Students.tw. or Pharmacy Student.tw. or Pharmacy Students.tw. or pre-licensure.tw. or pre-qualifying.tw. or Pupil Nurse.tw. or Pupil Nurses.tw. or Undergraduate Medical Education.tw. or undergraduate student*.tw.)

3b1

(exp Health Occupations/ or Health Personnel/ or exp therapy or Dentistry/ or Dietetics/ or Physicians/ or allied health occupations/ or allied health personnel/ or Psychotherapy/ or Obstetrics/ or Nurses/ or Pharmacy/ or Physical Therapy/ or Podiatry/ or Occupational Therapy/ or

Allied health professional*.tw. or Chiropod*.tw. or Chiropract*.tw. or Dentist*.tw. or Dietician*.tw. or Dietitian*.tw. or Doctor*.tw. or Hygienist*.tw. or Midwif*.tw. or midwives.tw. or Nurse.tw. or nurses.tw. or Nutritionist*.tw. or Occupational therapist*.tw. or Paramedic*.tw. or Pharmacist*.tw. or Physical therapist*.tw. or Physician*.tw. or Physiotherapist*.tw. or Podiatr*.tw. or Psychotherapist*.tw. or Radiographer*.tw. or Social worker*.tw.)

3b2

(medical education/ or nursing education/ or pharmaceutical education/ or Undergraduate Study/ or exp Undergraduate Students/ or Interdisciplinary approach/ OR Interprofessional relationschip/ or

Undergraduate*.tw. or Student.tw. or Students.tw. or Interprofessional education*.tw.)

4.

(Evaluation Methods/ or "outcomes of treatment"/ or Intervention/ or exp Longitudinal Studies/ or Followup studies/ or exp Case Studies/ or comparative analysis/ or Educational Research/ or Evaluation Methods/ or Evaluation/ or Feasibility studies/ or Program evaluation/ or Pilot Projects/ or control groups/ or experimental groups/ or randomized controlled trials/ or exp Test Validity/ or "Case Reports".tw. or "Clinical Study".tw. or "Cohort Study".tw. or "Comparative Study".tw. or "Controlled Clinical Trial".tw. or "Cross Sectional Study".tw. or "Evaluation Study".tw. or "Feasibility Study".tw. or "Follow Up Study".tw. or "Historically Controlled Study".tw. or "Longitudinal Study" .tw. or "Multicenter Study".tw. or "Observational Study".tw. or "Pilot Project".tw. or "Pragmatic Clinical Trial".tw. or "Program Evaluation".tw. or "Prospective Study".tw. or "Qualitative research".tw. or "Qualitative study".tw. or "Retrospective Study".tw. or "Validation Study".tw.)

Extraction table used in the scoping search

Authors	Year	Country	Title of paper	Research aims / questions of the paper	Research design / Methodology	Student groups *(for whom?)*	Topic of the IPE intervention *(what?)*	Interprofessional learning aims (overall goals or purpose of the IPE intervention)	Format /strategies of the intervention (e.g. lecture, small group discussion, role-play; PBL, etc)	IPE context *(circumstances)* (e.g. facilitators, barriers, incentives, ...)	IPE definition	Theory (explicitly stated or not)	Evaluation of the intervention	Reported outcomes