Interprofessional education in prelicensure health and social care professions education: A systematic review

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Abstract

INTRODUCTION There is growing evidence supporting the importance of interprofessional education (IPE) and interprofessional collaborative practice (IPCP) in improving patient-centred care and outcomes. The purpose of this review was to examine how recent studies (2010–2020) designed, implemented, and evaluated IPE initiatives and determine whether these initiatives were effective in preparing health and social care (HASC) professional students for IPCP.

METHODS This review was guided by the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) checklist to filter the studies and extract and analyze the data. Eligible peer-reviewed studies required inclusion of two or more HASC professions in a prelicensure IPE context and description of student-centred learning outcomes. Thirty-seven studies were included in this review.

RESULTS Recent studies (2010–2020) are increasingly developing practice-based simulations, incorporating IPE into mandatory coursework, and employing qualitative and mixed methods to assess student experiences. Nonetheless, most interventions lacked the use of theoretical and conceptual frameworks, were generally non-representative of HASC professions other than medicine and nursing, and were short in duration.

DISCUSSION AND CONCLUSIONS It is not known whether the positive impacts associated with IPE experiences in the short-term studies would remain with the students into their professional lives. Longer interventions with greater intensity and more rigorous methodological and assessment methods are warranted. Future studies should employ larger, more inclusive sample sizes from a wider range of HASC professions; survey IPE program coordinators and facilitators; include patients in IPE development; and assess and report how their institutions are committed to fostering IPE and meeting IPE-relevant accreditation standards.

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Introduction

Increasing evidence suggests that interprofessional collaborative practice (IPCP) has potential to lead to enhanced recruitment and retention of health and social care (HASC)[1] service providers, improved patient-centred HASC outcomes, and reduced costs, resulting in improved HASC efficiency and quality (Berwick et al., 2008; Brandt et al., 2014; Cox et al., 2016; Grignon et al., 2013). The Centre for the Advancement of Interprofessional Education (CAIPE) defines *interprofessional education* (IPE) as "occasions when members or students of two or more professions learn with, from and about each other to improve collaboration and the quality of care and services" (2016, p. 1). Sustainable delivery (development, implementation, and evaluation) of IPE has the potential to lead to meaningful IPCP involving collaboration-ready HASC professional graduates (Grymonpre et al., 2016). As such, the World Health Organization (WHO), among others, has been promoting IPE as an important and innovative pedagogical approach to improve HASC outcomes (WHO, 2006, 2010, 2018, 2020) and address the global HASC workforce crisis (Grignon et al., 2013).

According to D'Amour and Oandasan (2005), the delivery of IPE is complex because it is influenced by interactions within and among several factors within the academic system: (i) teaching factors (e.g., student-centred learning context, faculty development, etc.); (ii) institutional factors (e.g., administrative support for IPE, provision of adequate resources, etc.); and (iii) systemic factors (e.g., IPE-specific accreditation standards, government regulation, etc.). Further, the delivery of IPE is threatened when these sets of factors are not purposefully and simultaneously addressed (Grymonpre et al., 2016).

It can be argued that systemic factors provide the impetus for enacting institutional factors, and in turn, institutional factors support the enactment of teaching factors. For example, institutional and teaching factors can be more easily addressed when the delivery of IPE is encouraged by regulatory bodies and mandated through accreditation standards. In turn, commitment by administrative structures and processes towards the development, implementation, and evaluation of IPE initiatives across several faculties and/or academic units that house the HASC professions results in the subsequent allocation of sufficient personnel, material, and financial resources for IPE. Such administrative undertakings ultimately include focusing not only on student-centredness, but also on various outcomes oriented at the facilitators and stakeholders of IPE initiatives, the patients, and the educational programs themselves (Azzam et al., 2021; Grymonpre et al., 2021).

While the research literature on these outcomes is relatively plentiful and dates back to the emergence of IPE in the 1960s, only recently and especially over the past decade, have IPE implementation and IPE research output accelerated in response to increasing emphasis on IPCP models by HASC systems and other related stakeholders (Steketee & O'Keefe, 2020). It has been almost a decade, however, since a comprehensive review and synthesis of research literature on prelicensure IPE initiatives has been conducted. Such periodic review is important to identify, appraise, and synthesize various IPE research initiatives focusing on the preparation of HASC professional students for IPCP. It is hoped that this systematic review can provide a summary of the latest research on IPE, especially the enablers and barriers for sustainable delivery of IPE, thus contributing to evidence-based IPE practices and eventually leading to improved patient-centred HASC outcomes.

The Present Study

The purpose of this systematic review was to examine how recent studies (2010–2020) designed, implemented, and evaluated IPE initiatives and determine whether these initiatives were effective in preparing HASC professional students for IPCP. Using the parameters delineated in the *PICOS framework* (Liberati et al., 2009), we developed the following research question, "What are the major trends and findings of IPE implementation studies conducted over the last decade (2010–2020)?"

Guided by this research question, our review scrutinized studies in a broad range of IPE factors including, but not limited to, curricular content and structure, student-centred interprofessional learning outcomes and

[1] The HASC professions include those professions that are mainly involved with treating and improving individuals' physical health, mental health, dental health, and ocular health (WHO, 2006).

competencies, recruitment strategies of participants, outcomes and assessment methods, strategies for faculty development, and organizational commitment and support. Examining these factors has potential to report innovative educational approaches and research methodologies, reveal prevailing challenges, inform best practices, and generate recommendations for future IPE studies. In so doing, we believe that this review considerably contributes to the growing IPE literature and informs the global efforts of supporting the design, implementation, and evaluation of sustainable IPE initiatives.

Methods

This review was guided by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019) and the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) checklist (Moher et al., 2015) and its accompanying document PRISMA-P 2015 Explanation and Elaboration (Shamseer et al., 2015) to demonstrate legitimacy, independence, and impartiality (Gupta et al, 2018). Further, the protocol for this review has been registered with the International Prospective Register of Systematic Reviews (PROSPERO; registration # CRD42021232141).

Establishing Inclusion and Exclusion Criteria

Studies that were not peer-reviewed, were written in a language other than English, and/or were published before 2010 were excluded from this review. Further, studies meeting the following criteria were included: (1) the study must involve HASC professions in a HASC professions educational setting; (2) the study must focus on prelicensure HASC professions education, which can occur at either undergraduate or graduate level; and (3) the study must involve an intervention within an IPE context. The intervention can utilize any accepted methodological approach within the quantitative, qualitative, and mixed methods traditions. Further, in keeping with the CAIPE (2016) definition of IPE, it is necessary for the learning outcomes reported from the intervention to involve students from at least two HASC professions where they learned "about, from and with each other" (p. 1).

Conducting the Search

With guidance from two academic librarians at our institution, four electronic databases were identified as appropriate for conducting our review as their literature coverage included both areas of health and health education. These databases are: (1) Cumulative Index to Nursing and Allied Health Literature (CINAHL); (2) the Education Resources Information Center (ERIC); (3) Scopus; and (4) PubMed. We developed and applied our comprehensive search strategy using the inclusion criteria. Figure 1 illustrates our search strategy used in PubMed, as an example.

1	(interprofessional OR inter-professional)
2	(interdisciplinary OR inter-disciplinary)
3	1 OR 2
4	(pre-licensure OR prelicensure OR pre licensure)
5	(pre-licensed OR prelicensed OR pre licensed)
6	4 OR 5
7	(education)
8	(collaboration)
9	(communication)
10	(collaborative practice)
11	(practice)
12	(teamwork)
13	7 OR 8 OR 9 OR 10 OR 11 OR 12
14	3 AND 6 AND 13
15	(2010:2020[pdat])

Figure 1. *The comprehensive search strategy for PubMed.*

Filtering the Studies

Search results of articles were uploaded to Covidence (Veritas Health Innovation Ltd, 2021). Once duplicates were removed, two authors (MA and JR) used the exclusion and inclusion criteria to independently screen the articles according to the modified PRISMA flowchart (Moher et al., 2009) illustrated in Figure 2. During each round, screening results were compared between screeners, and any discrepancies and ambiguities were resolved through discussion.

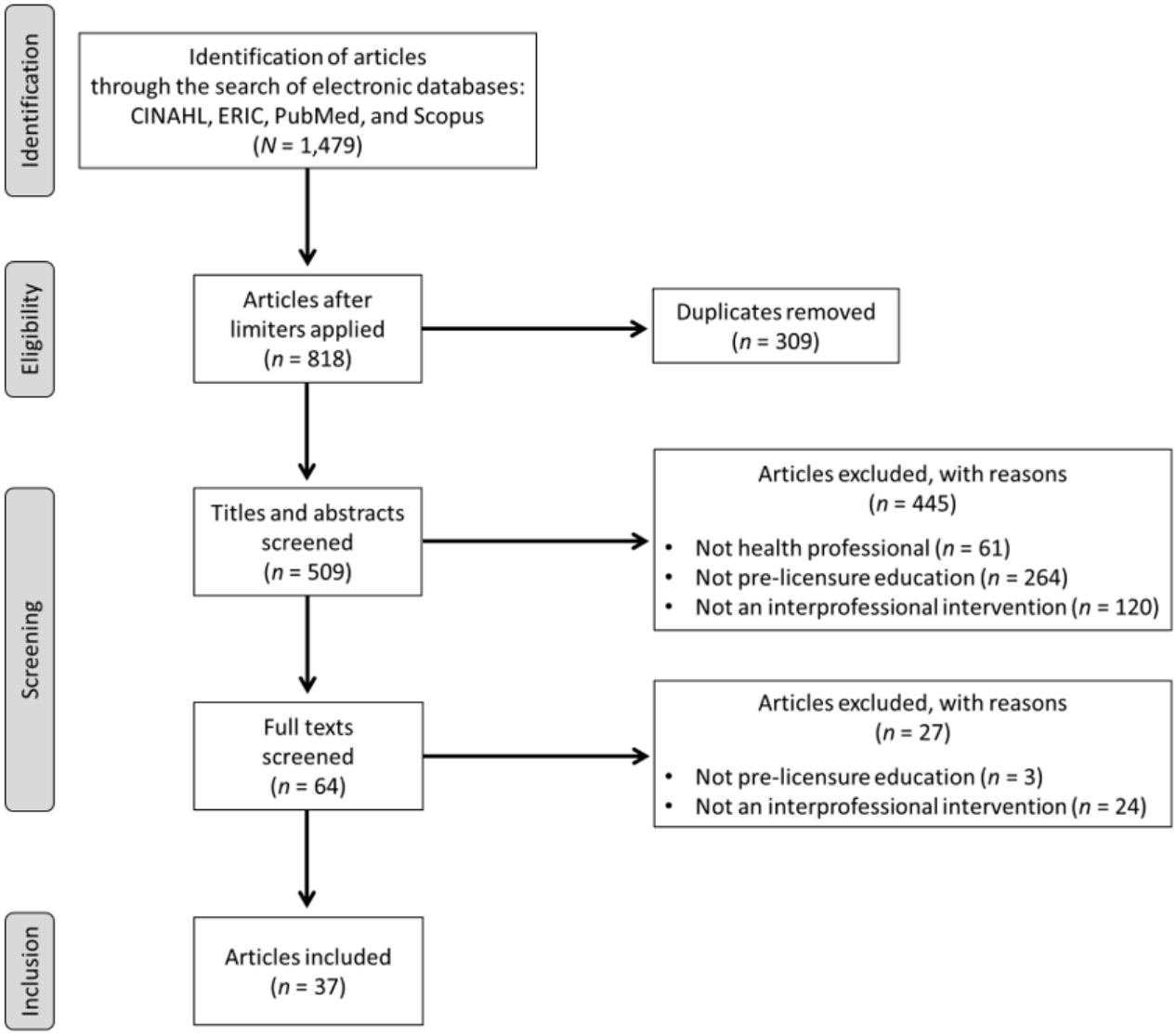

Figure 2. *A PRISMA flowchart illustrating the filtration of studies. Adapted from Moher et al. (2009). Notes: No identified articles published in 2010 or 2011 were previously reviewed; CINAHL: Cumulative Index to Nursing and Allied Health Literature; ERIC: Education Resources Information Center.*

Extracting the Data

We created a data extraction protocol, which we subsequently used, for the extraction of relevant elements, attributes, and procedures from the included studies. The data extraction protocol included a list of 44 items, which were categorized into five domains: (1) Details of Publication; (2) Study Profile; (3) Characteristics of Intervention; (4) Students/Participants; and (5) Educators/Facilitators (Table 1). Any variations in data extraction were resolved through discussion. Study authors were contacted via email to collect any unspecified data and/or clarify any discrepancies using open-ended questions.

Details of Publication

- Title of article
- Name(s) of author(s)
- Year of publication

Study Profile

- Country where study was conducted
- Institution(s) where study was conducted
- Research purpose(s)
- Research approach
- Research design
- Theoretical and/or conceptual framework(s)
- Recruitment strategies of participants
- Outcomes and assessment methods
- Instruments for data analysis
- Types of analyses conducted
- Limitations of the study

Characteristics of Intervention

- HASC professions included
- Subject area for intervention conducted
- Year(s) when intervention was conducted
- Duration of intervention
- Frequency of intervention
- Educational strategies
- Description of intervention development
- Developers of intervention
- Incentives given to participants and facilitators
- Type of participation (mandatory vs. optional)
- Administrative support
- Strategies for faculty development
- Challenges encountered

Students/Participants

- Number of participants involved per HASC profession
- Age range, median age, and mean age of participants
- Sex/gender of participants
- Level and year of study of participants
- Student-centred outcomes

Educators/Facilitators

- Number of facilitators involved per HASC profession
- Roles and responsibilities of facilitators
- Qualifications of facilitators
- Age range, median age, and mean age of facilitators
- Sex/gender of facilitators
- Number of years of facilitators' experience
- Facilitator-oriented outcomes

Table 1. *Non-exhaustive list of data to be extracted from included articles (n = 37)*

Analysis and Synthesis

Since the extracted studies were heterogeneous and diverse in methodology with respect to interventions, research approach, instrumentation, data collection and analysis, and outcomes, conducting a meta-analysis was not possible. Thus, we presented the results in narrative format (Ryan, 2013; Popay et al., 2006). Further stemming from our analysis, we illustrated the relationships within and between studies as well as their outcomes and the factors affecting those outcomes.

Results

Profiles of Included Studies

A total of 37 studies were analyzed in this systematic review (see Appendix). The majority of these studies were conducted in the United States (n = 20; 54%), followed by Canada (n = 13; 35%); see Table 2. Most of the studies were conducted across several HASC professional programs/faculties at a single institution (n = 31; 84%), whereas only six studies (16%), involving several HASC professions, were based on multi-institutional collaborations among up to seven institutions.

Further, more than half of the studies employed mixed methods approaches (n = 19; 51%) to report their findings, followed by quantitative methods (n = 13; 35%), which largely involved the use of well-established surveys with verified validity and reliability measures. Only three of these quantitative studies involved randomization of students to intervention and control groups, whereas others employed quasi-experimental designs with pre-intervention and/or post-intervention assessment tools. Only five of the studies (14%) employed qualitative approaches, which involved examining interview and/or focus group data using thematic analyses. Lastly, the majority of studies (n = 29; 78%) utilized non-probability, convenience sampling techniques to recruit participants, while only two (5%) mixed methods studies employed purposive sampling. See Table 2 for the comprehensive profiles of all included studies.

Category	n	%
Country		
United States	20	54
Canada	13	35
Australia	2	5
Germany	1	3
United Kingdom	1	3
Number of institutions involved		
One	31	84
Three	3	8
Four	2	5
Seven	1	3
Research approach		
Mixed methods	19	51
Quantitative	13	35
Qualitative	5	14
Recruitment strategies of participants		
Convenience sampling	29	78
Purposive sampling	2	5
Unspecified	6	16

Table 2. *Profiles of included studies (n = 37)*

The majority of studies (n = 23; 62%) neither employed theoretical nor conceptual frameworks[2] to lay foundation to or guide the research. Alternatively, 10 studies were supported by theories from social psychology and/or education, while six studies used conceptual frameworks. These 16 studies further described how these frameworks guided the development and implementation of their IPE interventions. The frameworks employed by included studies are listed in Table 3.

Description of Participants and Facilitators

A total of 6,904 students (μ = 187) participated across all IPE interventions, with significant variability in sample sizes among studies (range: 6–1,000; Figure 3). While some studies (n = 3; 8%) included students from up to 10 professions, approximately one-third of the studies (n = 12; 32%) included students from only two HASC professions—notably, medicine and nursing (Table 4). Nursing represented the most common HASC profession included across all studies (n = 31; 84%), followed by medicine (n = 26; 70%), physiotherapy (n = 18; 49%), and pharmacy (n = 16; 43%). Almost half of all participants were identified as medical students (n = 1,726; 25%) or nursing students (n = 1,312; 19%), while the professions of approximately 25% of all participants from eight different studies were not reported.

Twelve of the included studies (32%) incorporated their IPE interventions in the students' core coursework or clinical placements; therefore, participation was mandatory and course credits were awarded. Other studies (n = 18; 49%) implemented their interventions either as elective courses, where course credits and/or certificates of participation (n = 4), gift cards (n = 2), or candy bars (n = 1) were awarded; six studies provided no incentives; and five studies did not report any incentives. Further, three studies (8%) involved mandatory participation from students of some professions but only voluntary participation from students of other professions, where either course credits (n = 2) or honoraria (n = 1) were rewarded. Four more studies neither reported the type of participation (mandatory vs voluntary) nor the incentives to participants. None of the studies reported incentives to facilitators (Table 4).

Further, 12 studies reported that the faculty involved in developing and facilitating the IPE interventions were from the same HASC professions that the student participants represented. Other information regarding participants and facilitators (e.g., age, gender, academic level, qualifications and experience with IPE, etc.) was either inconsistently reported or unreported in the studies.

Characteristics of Interventions

More than one-third of the interventions (n = 14; 38%) were implemented as one-time workshops, lasting between two and 12 hours. Two interventions were implemented longitudinally over one or two years. Further, the majority of these interventions (n = 28; 76%) were mainly developed by faculty/researchers, whereas two studies reported contributions by students and/or alumni. None of the studies reported contributions by patients and/or their families.

Further, most studies (n = 23; 62%) utilized simulation-based approaches, four of which were implemented at practice-based placement sites, whereby interprofessional teams interacted with patients. Other studies (n = 13; 35%) utilized case-specific, problem-based learning strategies involving group discussions and reflections. Two of these studies incorporated online components, such as virtual discussions and e-learning modules. Lastly, all studies reported utilizing small-group learning; those that reported the sizes of these groups indicated two (n = 1), three to seven (n = 4), and eight to 12 (n = 5) participants per group. See Table 5 for the comprehensive characteristics of all interventions.

In addition, most of the interventions focused on clinical-based subject areas, with disease management (n = 10) being the most focused on subject area, followed by geriatric care (n = 8), and pain management (n = 4). Some studies also implemented interventions that focused on anatomical gross dissection (n = 3) and/or classroom-based discussions regarding IPE competencies (n = 4; Figure 4).

[2] Varpio et al. (2020) define a *theoretical framework* as a "logically developed and connected set of concepts and premises—developed from one or more theories—that a researcher creates to scaffold a study" (p. 990). Additionally, a *conceptual framework* can be described as "the justification for why a given study should be conducted. The conceptual framework (1) describes the state of known knowledge, usually through a literature review; (2) identifies gaps in our understanding of a phenomenon or problem; and (3) outlines the methodological underpinnings of the research project" (p. 990).

Framework	Used by
Social psychology theoretical frameworks	
Intergroup contact hypothesis (Allport, 1954)	Brewer & Flavell (2020)
Interprofessional socialization framework (Khalili et al., 2013)	Khalili & Orchard (2020); Price et al. (2020)
Narrative theory (Clark, 2014)	Price et al. (2020)
Six-factor model of psychological well-being (Ryff, 2014)	Allen et al. (2020)
Social Identity Theory (SIT; Kegan, 1983)	Stull & Blue (2016)
Educational/Learning theoretical frameworks	
Andragogy (Knowles, 1990)	Hodges & Massey (2015); Solomon & Salfi (2011)
Constructive alignment (Biggs, 1996)	Brewer & Flavell (2020)
Experiential learning (Kolb, 1984)	Reising et al. (2017); Rossler & Kimble (2016)
Presage-process-product model for IPE (Freeth & Reeves, 2004)	Brewer et al. (2017)
Conceptual frameworks	
Accreditation of Interprofessional Health Education (AIPHE, 2010, 2011)	MacKenzie et al. (2017)
A national interprofessional competency framework (CIHC, 2010)	MacKenzie et al. (2017)
Core competencies for interprofessional collaborative practice (IPEC, 2011)	Kerry et al. (2017)
Indiana University Team Education Advancing Collaboration in Healthcare (IUTEACH; IUCIPPE, 2016)	Reising et al. (2017)
Interprofessional capability framework (Brewer & Jones, 2013)	Brewer & Flavell (2020)
Interprofessional Education for Collaborative Patient-Centered Practice (D'Amour & Oandasan, 2005)	Park et al. (2014)
Standards for Quality Improvement Reporting Excellence (SQUIRE, Davidoff et al., 2008)	Delisle et al. (2016)

Notes: CIHC, Canadian Interprofessional Health Collaborative; IPEC, Interprofessional Education Collaborative; IUCIPPE, Indiana University Center for Interprofessional Practice and Education.

Table 3. *Frameworks employed by included studies*

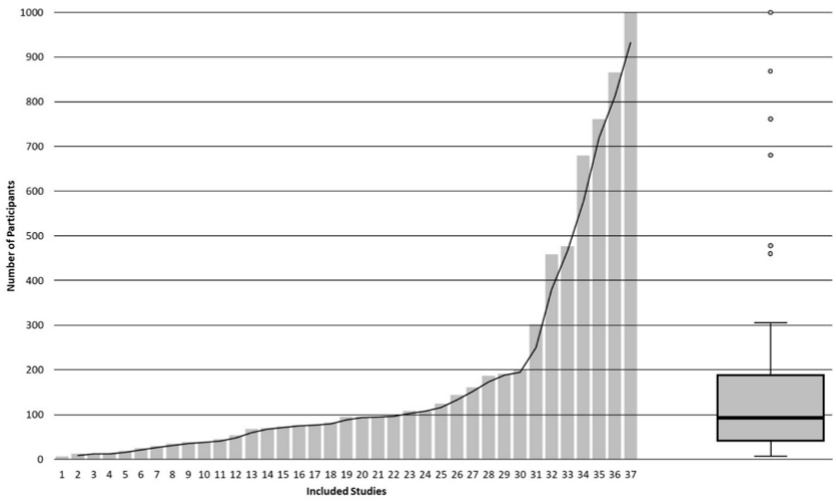

Figure 3. *Number of participants (N = 6,904; μ = 187; range: 6–1,000) in each of the reviewed interventions (n = 37). The box and whiskers plot illustrates the median: 94; inter-quartile range: 151.*

Student participants in included studies (n = 37)		
Category	n	%
Number of professions		
Two professions	12	32
Three professions	3	8
Four professions	5	14
Five professions	2	5
Six professions	4	11
Seven professions	7	19
Eight or more professions	3	8
Unspecified	1	3
Type of participation		
Mandatory	12	32
Voluntary	18	49
Either, depending on profession	3	8
No participation	1	3
Unspecified	3	8
Incentives to participants		
Course credit	18	49
Honorarium/Gift card	3	8
Candy bar	1	3
No incentive	7	19
Unspecified	8	22

Table 4. *Student participants in included studies (n = 37)*

Category	n	%
Duration of intervention		
One day or less	14	38
One to four weeks	6	16
Five to eight weeks	3	8
Nine to 14 weeks	4	11
One year or more	2	5
Unspecified	8	22
Developers of intervention		
Faculty/Clinicians/Researchers	28	76
Faculty and students/alumni	2	5
Unspecified	7	19
Educational strategies		
Small-group learning	37	100
Simulation-based without patients	19	51
Problem-based	13	35
Simulation-based with patients	4	11
Online components	2	5

Table 5. *Characteristics of interprofessional educational interventions (n = 36)*

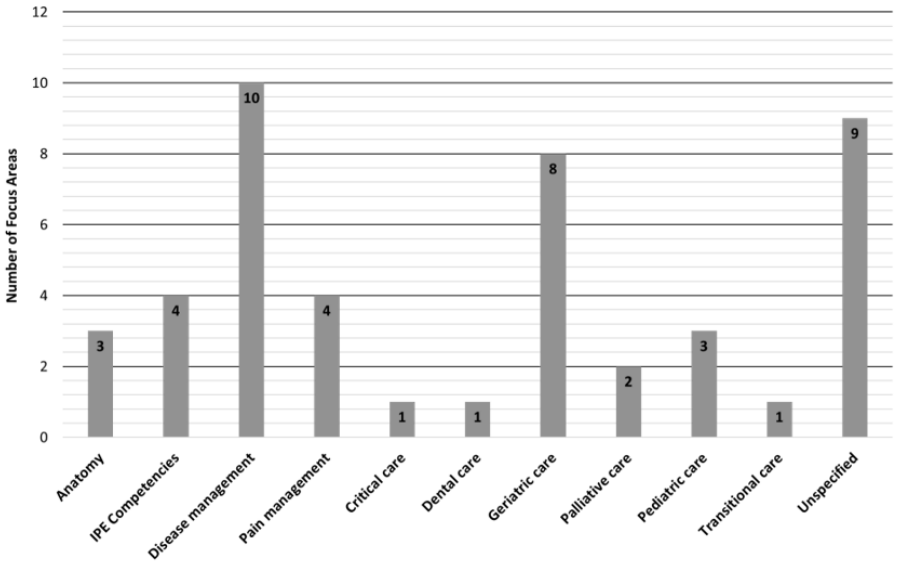

Figure 4. *Subject areas of the interprofessional education initiatives in included studies (n = 37).*

Outcomes and Assessment Methods

Among outcomes and assessment tools, student self-reporting surveys were most commonly used (n = 41), followed by semi-structured interviews and focus groups (n = 9), open-ended questions (n = 8), and observations (n = 3). Other assessment methods included the use of audio-recordings of group discussions; knowledge tests; and agent-based modeling (ABM) to create sociograms—visual representations of intragroup networking (Table 6).

The response rates to the surveys varied between 23% and 100%, with 13 of the studies not reporting response rates. The majority of surveys administered were well-known in the field with established validity and reliability, with the most commonly employed survey being the Revised Readiness for Interprofessional Learning Scale (RIPLS, McFadyen et al., 2006; n = 6), followed by the University of West of England Interprofessional Questionnaire (UWE-IPQ, Pollard et al., 2004; n = 4) and the revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007; n = 4). Further, nine studies employed unspecified, in-house surveys, which reported one or more of the following: student attitudes towards IPE, actual need for cooperation, knowledge gains, and effectiveness of the workshop. Five of these studies did not report validity and/or reliability.

Student-centred Outcomes

All studies reported student-centred interprofessional learning outcomes and competencies, with observed statistically significant increases for all quantitative survey subscales, which were substantiated with analyses of the qualitative data. We found three broad themes related to student-centred outcomes: (1) Positive Attitudes Towards Interprofessional Learning; (2) Formation of Interprofessional Identities; and (3) Positive Impacts of Facilitators.

Positive Attitudes Towards Interprofessional Learning

In pre-intervention and retrospective post-intervention surveys, students largely noted how the *perceived need for interprofessional collaboration* had been hindered by mono-professional education, which mainly contributed to their lack of awareness of other HASC professions and the professions' interconnectivity in the health delivery system. Following participation, the students generally reported having more positive perspectives towards interprofessional learning. Nonetheless, the students stated that they would prefer a more versatile curriculum that encompasses a multitude of teaching and learning methods, including both lecture-based profession-specific learning and group-based interprofessional learning. Additionally, it was noted that experiential learning in IPE directly enriched student learning by enabling them to gain content knowledge in relevant disciplines such as anatomy and physiology as well as enhance their skills and confidence with identifying and understanding key clinical elements associated with disease assessment, patient management, and administration of medication.

Outcomes and assessment measures	*n*
Quantitative surveys	41
Revised Readiness for Interprofessional Learning Scale (RIPLS, McFadyen et al., 2006)	6
University of West of England Interprofessional Questionnaire (UWE-IPQ, Pollard et al., 2004)	4
Revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007)	4
Attitudes Toward Health Care Teams Scale (ATHCTS; Heinemann et al. 1999)	3
Interprofessional Collaborative Competency Attainment Scale (ICCAS, Archibald et al., 2014)	3
Interprofessional Socialization and Valuing Scale (ISVS, King et al., 2010)	2
Team Skills Scale (TSS, Hepburn et al., 2002)	2
Dual Identity Scale (DIS, Khalili, 2013)	1
Health Professional Collaboration Scale (HPCS, Reese et al, 2010)	1
Jefferson Scale of Attitudes towards Physician-Nurse Collaboration (JSAPNC, Hojat et al., 1999)	1
Individualism-Collectivism Scale (ICS, Wagner, 1995)	1
Pain Knowledge and Beliefs Questionnaire (PKBQ; Hunter et al., 2008)	1
Professional Identity and Team Understanding (PITU, Adams et al., 2006)	1
Ryff's Psychological Well-Being Scale (RBWBS; Bayani et al., 2008)	1
Student Self-Assessment via the Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2 (SPICE-R2; Zorek et al., 2016)	1
Unspecified	9
Semi-structured interviews and focus groups	9
Open-ended (qualitative) surveys	8
Observations	3
Collaborative Behaviors Observational Assessment Tool (CBOAT; Blackhall et al., 2014)	1
Indiana University Simulation Integration Rubric (IUSIR; IUCIPPE, 2016)	1
Unspecified	1
Audio-recordings of group discussions	1
Knowledge tests	1
Agent-based modeling (ABM)	1

Notes: The number of surveys is more than the number of studies because some studies distributed more than one survey. IUCIPPE, Indiana University Center for Interprofessional Practice and Education.

Table 6. *Outcomes and assessment measures*

Formation of Interprofessional Identities

Both facilitators and students indicated that the interprofessional learning sessions helped the students form their interprofessional identities. Most of these students were upper-year students, who had already formulated their own professional identities and therefore possessed greater ability to focus on their interprofessional interactions. Nonetheless, first-year students indicated that participation enabled them to increase the understanding of their and others' professional identities and clarify the *roles and responsibilities* expected of each HASC profession. Further, some students appreciated that their IPE experiences lasted for weeks (as opposed to shorter experiences), thereby enabling them to have more meaningful and in-depth professional interactions with those from other HASC professions and opportunities to interrogate, reflect, and reframe stereotypical, misconceived, and outdated views of other professions and foster more meaningful relationships and long-lasting friendships with their peers from other professions.

Positive Impacts of Facilitators

Most studies (n = 32) neither reported providing administrative support nor faculty development. Those

that did report such resources stated that one-time training was provided to faculty, without any explicit strategies or examples. Nonetheless, students appreciated when their sessions were facilitated by adequately trained faculty facilitators—identified as influential role models who provided extensive feedback and guidance, successfully demonstrated interprofessional collaborative skills, and reinforced positive attitudes towards IPE and IPCP.

Challenges

The examined studies reported several challenges to sustainable delivery of IPE. We classified these challenges into two themes: (1) Logistical Difficulties; and (2) Differences in Students' Level of Learning.

Logistical Difficulties

Scheduling was identified as one of the most frequently reported challenges to IPE implementation. The HASC professions are usually housed in different departments and/or faculties. Thus, lack of alignment in class schedules and clinical rotations across professions hindered interdepartmental collaboration and created logistical barriers when attempting to find time that worked well for all participating professions. Further, due to the variations in programmatic requirements of the disparate HASC professional programs, recruitment of student participants was reported as a challenge.

Differences in Students' Level of Learning

Students in some professions, such as nursing and psychology, usually participated in their senior year and therefore had already formed their professional identities and had more clinical experiences, compared to students in professions such as medicine, occupational therapy, and physiotherapy. Further, junior students were generally frustrated by some IPE activities that occurred too early in their training, when authentic collaboration was limited.

Discussion

The major trends and findings in IPE research conducted over the last decade (2010–2020) were explored through this systematic review of 37 eligible studies. Our findings illustrated inconclusive evidence that the reviewed initiatives unquestionably lead to effective IPCP. The lack of ample evidence of IPE long-term positive outcomes, however, does not necessarily equate to evidence of IPE's futility. It was encouraging to observe that IPE studies in the last decade have increasingly employed qualitative and mixed methods approaches, as these diverse methodologies allow researchers to report a greater range of findings (Olson & Bialocerkowski, 2014; Reeves et al., 2013). It was also reassuring to observe that some IPE interventions implemented practice-based IPE—a practice deemed exemplary and innovative (Azzam et al., 2021). Further, students who participated in these IPE initiatives enhanced their understanding and proficiency in interprofessional knowledge, skills, and competencies, developed more positive attitudes and increased appreciation towards IPE and IPCP, and augmented their professional and interprofessional identities.

Nonetheless, most studies utilized self-reporting surveys, some of which were non-validated, to report these findings. Thus, the observed positive changes in students' knowledge, skills, and attitudes towards interprofessional learning and practice may have been influenced by self-reporting bias and confounding variables (Pollard et al., 2005) including age, gender, and personality traits—data that was neither collected nor evaluated. Hence, it would be difficult to verify whether the observed positive changes in students' knowledge, skills, and attitudes towards interprofessional learning and practice can be directly attributed to the curriculum (Reeves et al., 2015). More importantly, these self-reporting surveys are typically centred on *perceived* attitudes, where IPE's impact on the students' skills, behaviors, and dispositions are not assessed. Lastly, compared to longer and more sustained IPE interventions, evaluating the behavioural changes resulting from events lasting between a few hours to several weeks—which was the case for most of these interventions—raises concerns that the claimed effectiveness of these initiatives may be only temporary and thus cannot substantiate the sought-after, long-lasting influence of IPE on HASC professional students in preparing them for sustainable IPCP (Hammick et al., 2007; Lawn, 2016). Hence, it is in the best interest of the field for researchers to implement longitudinal IPE initiatives and more rigorous methodological and assessment methods (e.g., observational studies), through which they could more objectively evaluate IPE's long-term effects on student preparedness for IPCP throughout their education and as they transition into licensed HASC service providers during the first few

years of their careers (Lawn, 2016). That being said, concurrently administering validated self-reporting surveys may be valuable in collecting attitudinal data; researchers should, however, try to minimize respondent bias by having proper research design including a sufficiently large sample size.

Further, most studies in this review were neither theoretically nor conceptually guided—a finding that has regrettably been consistent over the past two decades (Abu-Rish et al., 2012; Lapkin et al., 2013; Zhang et al., 2011), indicating an overall absence of relationships between theory and its application to practice. The use of theoretical and/or conceptual frameworks in HASC professions educational programs, curricula, and syllabi is imperative for the effective development of IPE initiatives, helping identify the scope and objectives of the initiative and facilitating the evaluation of student-centred learning outcomes and competencies (Clark, 2006; Lawn, 2016). Those studies that were either theoretically and/or conceptually guided had appropriately utilized and thoroughly described social psychology and educational/learning theoretical and conceptual frameworks. These frameworks had been developed using a social constructivist lens, through which students interact and learn "with, from and about each other" (CAIPE, 2016, p. 1), make meaning of such experiences (Creswell & Poth, 2018), and form their own interprofessional attitudes, skills, and dispositions. Future studies are recommended to employ and test new frameworks and other frameworks used in previously published studies, with the long-term intention of converging onto unifying theories to frame IPE.

Most of the interventions were implemented in the form of elective coursework, which may result in selection bias due to the potential increased baseline interest of participating students in IPE, the subject area in which IPE is implemented, or both. This bias may influence the interpretation of results and lead to inaccurate conclusions. Further, the implementation of IPE with discrepant participatory expectations across professions—which was the case in several reviewed studies—can also be problematic. Grouping students who are obligated to participate in IPE with other students whose participation is non-mandatory may result in unreliable data as a result of mixing different participant groups. Students who voluntarily participate may lose interest and/or commitment throughout the intervention. This was also identified as a challenge by the Canadian Interprofessional Health Collaborative (CIHC) Accreditation Committee in a recent survey of academic programs (Azzam et al., manuscript submitted for publication). In addition to making participation in IPE compulsory for all educational programs, future studies should also be cautious to group students who are at dissimilar stages of their respective professional training. This is because students can effectively participate in IPE activities and reciprocally contribute to discussions only when they possess comparable clinical knowledge and skills (van Diggele et al., 2020).

Further, similar to previously reviewed studies (see Abu-Rish et al., 2012; Lapkin et al., 2013; Zhang et al., 2011), we observed minimal to no participation among HASC professions other than medicine and nursing. Approximately one-third of all interventions were comprised of a homogenous population of medical and nursing students *alone*. Although this high proportion of physicians and nurses is representative of the HASC workforce, it is important that IPE initiatives include and represent the broader HASC professions that would be typically expected to work together and are part of a patient's multidisciplinary HASC team. For example, an initiative that implements IPE in a post-operative care setting requires pain management, drug administration, and consultations regarding diet, lifestyle, and mental health. Therefore, such an initiative should typically involve students from medicine, nursing, pharmacy, dietetics, physiotherapy, occupational therapy, and social work. Further, the disproportionate recruitment of participants from different HASC professions results in the potential exclusion of important, diverse professional perspectives and undermines generalizability and transferability of findings. The findings of this study should accordingly be interpreted with the understanding of the limitations of the studies reviewed, including the number and variety of HASC professions represented within the IPE interventions.

Lastly, future studies should survey IPE program coordinators, facilitators, and preceptors to gain insights on their own perspectives; include patients in IPE development and explore their perspectives to emphasize and further improve patient-centred care; and, assess and report how their institutions are committed to fostering IPE, including how they address challenges as-

sociated with faculty development, scheduling, and resource allocation, in addition to meeting IPE-relevant accreditation standards.

Limitations

There are two major limitations to this systematic review. First, we created a non-exhaustive protocol to extract data from the eligible studies. An addition of an independent expert panel to review the protocol would have added rigor to the study. We may have overlooked valuable IPE elements that may have otherwise influenced the interpretation of our findings. We addressed this limitation by evaluating the research literature to identify the types of data that have been extracted in previously published systematic reviews. Second, similar to other reviews (see Abu-Rish et al., 2012), we did not formally assess the quality of included articles because we pursued to describe a comprehensive range of IPE activities. Our inclusion criteria that articles needed to be peer-reviewed acted as proxy for article quality.

Conclusions

This systematic review has shown that researchers in the IPE field are increasingly developing practice-based simulations, incorporating IPE into mandatory coursework, and employing qualitative methods to assess student experiences—indicating that, to some extent, the recommendations brought about in recent years have been effectuated. Nonetheless, these studies evaluated their initiatives neither for long-term impacts nor through patient-centred approaches; therefore, we cannot validate whether their initiatives necessarily lead to improved patient-centred HASC outcomes. Even so, the students' perceived positive attitudes and behaviours towards IPE and IPCP following participation, as measured in these studies, are promising and show that IPE, at the very least, has potential to lead to effective IPCP and improved HASC outcomes.

List of Abbreviations

ABM, agent-based modeling; AIPHE, Accreditation of Interprofessional Health Education; ATHCTS, Attitudes Toward Health Care Teams Scale; CAIPE, Centre for the Advancement of Interprofessional Education; CBOAT, Collaborative Behaviors Observational Assessment Tool; CIHC, Canadian Interprofessional Health Collaborative; CINAHL, Cumulative Index to Nursing and Allied Health Literature; DIS, Dual Identity Scale; ERIC, Education Resources Information Center; HASC, health and social care; HPCS, Health Professional Collaboration Scale; ICCAS, Interprofessional Collaborative Competency Attainment Scale; ICS, Individualism-Collectivism Scale; IECPCP, Interprofessional Education for Collaborative Patient-centered Practice; IEPS, Interdisciplinary Education Perception Scale; IPE, interprofessional education; IPEC, Interprofessional Education Collaborative; IPP, interprofessional practice; ISVS, Interprofessional Socialization and Valuing Scale; IUCIPPE, Indiana University Center for Interprofessional Practice and Education; IUSIR, Indiana University Simulation Integration Rubric; JSAPNC, Jefferson Scale of Attitudes towards Physician-Nurse Collaboration; PITU, Professional Identity and Team Understanding; PKBQ, Pain Knowledge and Beliefs Questionnaire; PRISMA-P, Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols; PROSPERO, International Prospective Register of Systematic Reviews; RBWBS, Ryff's Psychological Well-Being Scale; RIPLS; Revised Readiness for Interprofessional Learning Scale; SPICE-R2, Student Self-Assessment via the Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2; TSS, Team Skills Scale; UWE-IPQ, University of West of England Interprofessional Questionnaire; WHO, World Health Organization.

Availability of Data and Materials

The search strategies of individual electronic databases and all data sets for the current study are available from the corresponding author upon reasonable request.

Authors' Contributions

MA is the guarantor and the corresponding author of this article. MA drafted the manuscript. Both MA and AP contributed to the development of the inclusion and exclusion criteria, the search strategy, the data extraction criteria, and the strategy for the evaluation of included studies. MA conducted the search of electronic databases and export of all articles for screening. Both MA and JR independently screened the titles, abstracts, and full texts of articles and negotiated final inclusion of studies. Both MA and JR independently extracted the data from included studies and negotiated final extraction. Both MA and JR analyzed the

extracted data. MA created all figures and tables. All authors contributed to the discussion. All authors read, provided feedback, and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

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APPENDIX

Studies analyzed in the systematic review (*n* = 37)

Study ID	Country	Institutions	Research approach	Recruitment strategies of participants	Subject area	Duration of ntervention	Instruments for data collection
Achike et al., 2014	United States	William Carey University	Mixed methods	Convenience sampling	Disease management	120 minutes	Unspecified survey
Allen et al., 2020	United States	Dominican University	Quantitative	Convenience sampling	Disease management	Unspecified	Ryff's Psychological Well-Being Scale (RBWBS; Bayani et al., 2008)
Brashers et al., 2016	United States	University of Virginia	Mixed methods	Convenience sampling	Geriatric care; critical care; pediatric care; transitional care	2 years	Team Skills Scale (TSS; Hepburn et al., 2002); Collaborative Behaviors Observational Assessment Tool (CBOAT, Blackhall et al., 2014)
Brewer & Flavell, 2020	Australia	One; unspecified	Qualitative	Convenience sampling	Pediatric care; geriatric care	14 weeks	Observations
Brewer et al., 2017	Australia	Curtin University	Qualitative	Convenience sampling	Geriatric care; pediatric care	14 weeks	Focus groups
Buckley et al., 2012	United Kingdom	University of Birmingham; Birmingham City University; University of Worcester.	Mixed methods	Convenience sampling	Pain management; disease management	Half day	Unspecified survey
Cunningham et al., 2020	United States	Three; unspecified	Mixed methods	Convenience sampling	Geriatric care	45 minutes	Interprofessional Socialization and Valuing Scale (ISVS, King et al., 2010); focus groups
Delisle et al., 2016	Canada	University of Manitoba	Quantitative	Convenience sampling	Interprofessional comptencies	4 weeks	University of the West of England Interprofessional Questionnaire (UWE IPQ; Pollard et al., 2004)
Djukic et al., 2015	United States	One; unspecified	Quantitative	Convenience sampling	Geriatric care	1 year	Team Skills Scale (TSS; Hepburn et al., 2002); Attitudes Toward Health Care Teams Scale (ATHCTS; Heinemann et al. 1999)
Doucet et al., 2016	Canada	Dalhousie University	Qualitative	Convenience sampling	Unspecified	Unspecified	Interviews
Ekmekci, 2013	United States	One; unspecified	Quantitative	Unspecified	Unspecified	1 week	Sociograms
Erickson et al., 2016	United States	University of Wisconsin-Milwaukee; University of Virginia; University of Southern California	Quantitative	Convenience sampling	Pain management	3 hours	Unspecified survey

Fernandes et al., 2015	Canada	One; unspecified	Mixed methods	Convenience sampling	Gross anatomical dissection	10 weeks	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007); participants' feedback; focus groups
Fishman et al., 2020	United States	One; unspecified	Mixed methods	Unspecified	Pain management	150 minutes	Pain Knowledge and Beliefs Questionnaire (PKBQ; Hunter et al., 2008); open-ended questions
Hodges & Massey, 2015	United States	Mercer University	Mixed methods	Convenience sampling	Unspecified	4 weeks	Unspecified survey
Howell et al., 2012	United States	One; unspecified	Qualitative	Convenience sampling	Disease management	8 weeks	Interviews
Kaasalainen et al., 2015	Canada	Seven; unspecified	Mixed methods	Unspecified	Palliative care	Five days	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); Professional Identity and Team Understanding (PITU, Adams et al., 2006); open-ended questions
Kenaszchuk et al., 2012	Canada	One; unspecified	Quantitative	Convenience sampling	Palliative care	3 hours	revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007); University of the West of England Interprofessional Questionnaire (UWE-IPQ; Pollard et al., 2004); Attitudes Toward Health Care Teams Scale (ATHCTS; Heinemann et al. 1999)
Kerry et al., 2017	Germany	One; unspecified	Quantitative	Convenience sampling	Unspecified	3 weeks	Unspecified survey
Khalili & Orchard, 2020	Canada	One; unspecified	Mixed methods	Purposive sampling	Unspecified	5 weeks	Interprofessional Socialization and Valuing Scale (ISVS; King et al., 2010); Individualism-Collectivism Scale (ICS; Wagner, 1995); dual Identity Scale (DIS; Khalili, 2013); participants' reflections; audio-recorded small group workshop discussions
King et al., 2014	Canada	Four; unspecified	Quantitative	Convenience sampling	Geriatric care; disease management	3 hours	University of the West of England Interprofessional Questionnaire (UWE-IPQ; Pollard et al., 2004)

Langford et al., 2020	United States	University of Washington	Quantitative	Convenience sampling	Pain management; disease management	110 minutes	Interprofessional collaborative competency attainment scale (ICCAS; Archibald et al., 2014)
Lockeman et al., 2017	United States	One; unspecified	Mixed methods	Convenience sampling	Interprofessional competencies	2 months	Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2 (SPICE-R2; Zorek et al., 2016); participants' feedback
Luctkar-Flude et al., 2014	Canada	One; unspecified	Mixed methods	Convenience sampling	Disease management	150 minutes	University of the West of England Interprofessional Questionnaire (UWE-IPQ; Pollard et al., 2004); faculty feedback; observations
MacKenzie et al., 2017	Canada	Dalhousie University	Mixed methods	Unspecified	Disease management	90-minute	Interprofessional collaborative competency attainment scale (ICCAS; Archibald et al., 2014); observations; participants' reflections
New et al., 2015	United States	One; unspecified	Quantitative	Unspecified	Geriatric care	Unspecified	Unspecified survey; participants' reflections
Olaisen et al., 2014	United States	One; unspecified	Mixed methods	Purposeful sampling	Disease management	12 hours	Unspecified survey
O'Rourke & Brown, 2017	United States	One; unspecified	Mixed methods	Convenience sampling	Dental care	One day	Interprofessional collaborative competency attainment scale (ICCAS; Archibald et al., 2014); Attitudes Toward Health Care Teams Scale (ATHCTS; Heinemann et al. 1999); participants' feedback
Park et al., 2014	United States	One; unspecified	Quantitative	Convenience sampling	Geriatric care	Unspecified	Jefferson School of Attitudes Toward Physician-Nurse Collaboration (JSAPNC; Hojat et al., 1999)
Price et al., 2020	Canada	Dalhousie University	Qualitative	Convenience sampling	Unspecified	Unspecified	Interviews
Reising et al., 2017	United States	One; unspecified	Quantitative	Convenience sampling	Disease management	120 minutes	Observations using the Indiana University Simulation Integration Rubric (IUSIR)
Rossler & Kimble, 2016	United States	One; unspecified	Mixed methods	Convenience sampling	Unspecified	Unspecified	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); Health Professional Collaboration Scale (HPCS; Reese et al, 2010); focus groups

Solomon & Salfi, 2011	Canada	One; unspecified	Mixed methods	Convenience sampling	Unspecified	3 hours	revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007); focus groups
Solomon et al., 2010	Canada	Four; unspecified	Mixed methods	Convenience sampling	Interprofessional competencies	Unspecified	Unspecified survey; students' online discussions; focus groups
Stull & Blue, 2016	United States	One; unspecified	Quantitative	Convenience sampling	Interprofessional competencies	12 weeks	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); revised Interdisciplinary Education Perception Scale (IEPS; McFadyen et al., 2007)
Sytsma et al., 2015	United States	One; unspecified	Mixed methods	Unspecified	Gross anatomical dissection	Unspecified	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); follow-up, unspecified survey
Zheng et al., 2019	Canada	McMaster University	Mixed methods	Convenience sampling	Gross anatomical dissection	Not applicable; follow-up study	Revised Readiness for Interprofessional Learning Scale (RIPLS; McFadyen et al., 2006); open-ended questions