
REVIEW OF THE LITERATURE

Interprofessional education among musculoskeletal healthcare professions: A scoping review

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ABSTRACT

Objective: To examine peer-reviewed literature involving undergraduate interprofessional education (IPE) focusing on musculoskeletal (MSK) healthcare professions.

Methods: Methodological searches were conducted on electronic databases PubMed, Scopus, ERIC, and ProQuest. No date restrictions were applied. English sources (qualitative and quantitative methodological studies, conference papers and proceedings, systematic reviews, grey literature, unpublished materials, theses, and dissertations) were included. A researcher, independent reviewer, and research librarian completed the search and data extraction from June to October 2023. Disagreements were resolved by discussion. ATLAS.ti was used to analyze data by generating codes linked to the text. Findings were reported in a narrative format and by using tables.

Results: Initially, 2894 articles were retrieved and screened for relevance. After rigorous screening procedures, 18 articles from various countries were deemed eligible for inclusion. The included studies were conducted within the date range of 2010 to 2024. The included studies employed mixed methods ($n = 9$), quantitative ($n = 5$), and qualitative ($n = 4$) approaches. Combined medical and physiotherapy student cohorts were prominently featured in 67% ($n = 12$) of the reviewed studies. All 18 studies incorporated the implementation and/or evaluation of an IPE intervention. Thematic analysis revealed 5 overarching themes, encompassing the benefits, barriers, interventions, strategies, evaluation, and general findings related to IPE.

Conclusion: The reviewed literature emphasizes a significant gap in IPE initiatives concerning various MSK health providers, including chiropractors, podiatrists, biokineticists, and osteopaths. This paucity accentuates the need for further exploration and evaluation of IPE within MSK-specific contexts, crucial for addressing and mitigating the escalating global burden of MSK diseases.

Key Indexing Terms: Interprofessional Education; Education; Professional; Chiropractic; Musculoskeletal care; Interprofessional Collaboration

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INTRODUCTION

The prevalence of communicable diseases like HIV/AIDS, malaria, and tuberculosis, along with noncommunicable ailments such as cardiovascular diseases and diabetes, often relegates musculoskeletal (MSK) conditions to a lower priority within global health systems. As populations age, the incidence of MSK conditions rises with increasing multimorbidity, placing further strain and challenges on health system resources.^{1–3} Managing MSK conditions often necessitates integrating modest resources and strategies rather than relying on expensive medical devices, facilities, or medications for effective treatment.⁴ As a response, interest in optimizing interprofessional collaboration (IPC) and how it

might be supported by appropriate forms of interprofessional education (IPE), has grown.⁵

There is international promotion of IPE by health organizations as IPE interventions have been shown to improve health professions teamwork, increase communication among colleagues, patients, and patient families, and increase the quality of care, thereby improving patient outcomes.⁶ IPE has also shown to instill respect and appreciation for individual but complementary professions within healthcare, which promotes continued shared values.^{7,8} The literature recommends the implementation of IPE into undergraduate clinical training to facilitate successful IPC, which would help alleviate the complexities and burdens on health systems.^{6,9} Health students tend to receive education and clinical training in profession-specific isolation, resulting in poor knowledge regarding other health

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professions, limiting the potential for IPC in the workplace. IPC and IPE can potentially improve interprofessional health-care and patient outcomes, highlighting their importance in the education and training of healthcare students.^{6,10}

Although numerous papers have explored IPE among health sciences students and physiotherapy students,^{11–16} there is still a lack of strong evidence of implementation of IPC in the MSK context.¹ It must be highlighted that most studies often only include physiotherapy as part of the IPC team, leaving a gap in the literature on the value of IPC, including other MSK-focused professions such as chiropractors, podiatrists, biokineticists, and osteopaths.¹ Another identified barrier to successful IPC, and the impetus for this scoping review, is the lack of structured IPE between students of health professions and the intensified lack of IPE among undergraduate students, specifically in the range of MSK health professions. Current reviews that are available focus predominantly on medical students in MSK healthcare, with no single review offering a map of literature incorporating pragmatic IPE interventions within MSK healthcare education that would include numerous MSK healthcare profession students.^{17–20} The findings of this scoping review have the potential to inform stakeholders of MSK professions, healthcare systems, and education institutions on pragmatic IPE implementation among undergraduate students of MSK healthcare professions on IPE practices in the workplace, establish interprofessional relationships, and guide curriculum with the overarching imperative to address the increasing burden of MSK conditions on a global scale.

Notwithstanding the above, it would appear that MSK conditions are often overseen by individual primary healthcare professionals, with minimal collaboration among other MSK care experts who offer nonpharmacological treatments or allied care. Typical MSK therapy modalities encompass manual therapy, exercise and rehabilitation, and psychosocial interventions provided by chiropractors, podiatrists, biokineticists, physiotherapists, and osteopaths, emphasizing the imperative for collaborative efforts.^{1,21}

As a point of departure to developing IPC in this context, we aim to systematically examine evidence from published and unpublished works to identify, characterize, and summarize works on IPE interventions among undergraduate students of MSK healthcare professions.

METHODS

Study Design

This scoping review was steered by the central research question around what literature is available regarding IPE among students of MSK healthcare professions. Identified subquestions inquired about the nature of evidence relevant to IPE within the context of musculoskeletal healthcare students, approaches that have been used in former research studies involving IPE in musculoskeletal healthcare student contexts and what could be deduced from the existing literature about IPE intervention implementation and/or evaluation in MSK healthcare students.

This scoping review was completed using the framework for scoping reviews by Arksey and O'Malley (2005) and Levac et al (2010), to search, collect, and synthesize relevant works and literature that addressed the broad research questions identified.^{22,23} The Preferred Reporting Items for Systematic Reviews and

Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) was used with reporting.²⁴ The study protocol was registered with Open Science Framework on April 7, 2023, osf.io/c27n4.

Search Strategy

The search strategy was developed a priori with the assistance of an experienced librarian. Four databases (PubMed, Scopus, ERIC, and ProQuest) were electronically searched after an initial pilot search. The search was performed between June and October 2023. The search included all articles and documents published and accessible without a defined starting timeline. The lack of a defined date range ensured that the full spectrum of available literature was included, as IPE has been in use for several years and all strategies were considered valuable and relevant to the research question. A combination of indexing terms (MeSH and non-MeSH) was used to develop the search strategy that was adapted to incorporate non-specific MSK health professions, as it was noted that most titles did not define which professions were included within MSK for that context. The full search strategy is depicted in Table 1 of the online Supplementary File.

Study Selection

The review aligned the study selection with the research question by following the Joanna Briggs Institute's (JBI) Population, Concept, Context (PCC) framework for scoping reviews²⁵ to determine the inclusion and exclusion criteria. The participants/population considered for this study included any undergraduate student from a MSK healthcare profession in a higher education setting; these domains ranged from chiropractic, physiotherapy, podiatry, biokinetics, and osteopathy to orthopedic specialists. In this study, 'undergraduate' denotes any student currently enrolled in a higher education institution and actively working towards their initial academic degree. This scoping review considered studies documenting the pragmatic implementation of an IPE intervention or activity among undergraduate students from MSK healthcare professions within the higher education setting. The context of this scoping review focused on studies that implemented and/or evaluated IPE interventions in the higher education setting among students belonging to any healthcare profession with a specialty in the MSK system.^{25–27}

This scoping review considered all study designs relevant to the research question, including qualitative, quantitative, and mixed methods designs. Qualitative designs included, but were not limited to, phenomenological, ethnographical, grounded theory, qualitative description, and action research designs. If eligible, systematic reviews, unpublished literature, grey literature, opinion papers, conference papers and proceedings, institutional and government protocols or guidelines, theses, and dissertations were reviewed and included. Literature was not limited by geographical location; only sources available in English were considered. Date restrictions were not enforced because it was important to consider all IPE-related literature and to ensure the inclusion of the maximum number of works.

The initial search results were exported from the database into a compatible format and imported into Excel (Microsoft Corporation) where the data were organized for analysis by both researchers. Data organization involved standardizing information structure within the spreadsheet and formatting the sheet. Each of the 2 reviewers was given access to a

unique Excel worksheet containing the final title and abstract list for each database screened. The sheet used voting buttons for reviewers to indicate their decision. There were 3 options available: “Yes”, “No,” and “Maybe.” These sheets were completed independently, and the reviewers were unable to see each other’s voting until the screening process was complete. After the screening phase, a summary sheet collated the results, and the reviewers met to discuss and resolve conflicts. Conflicts requiring resolution were defined as either a difference in vote or both votes being maybe and were resolved by discussion and mutual agreement. The final list of selected titles and abstracts informed the search for full titles. Potentially relevant studies were retrieved in full, and their article details were imported into Mendeley 2.74.0 (Mendeley Ltd.). All selected full-text sources were imported into ATLAS.ti (version 8, ATLAS.ti Scientific Software Development GmbH) for review and analysis. The full text of selected articles was assessed in detail against the inclusion criteria by both reviewers, and a final inclusion decision was made. Reasons for exclusion of full-text studies that did not meet the inclusion criteria were recorded and reported in the scoping review. The results of the search, study selection, and inclusion process are reported in full in the scoping review and presented in a Preferred Reporting Items for Scoping Reviews (PRISMA-ScR) flow diagram (Fig. 1).^{25,28,29}

Data Extraction

Data from the included sources was extracted using ATLAS.ti, where we organized the information according to each of the research questions. Several benefits of using computer-assisted qualitative data analysis software (CAQDAS) have been described when organizing the data from the sources included.³⁰ We used strategies described by Smit and Scherman (2021), where we coded information in the articles, categorized these codes, and then created code groups and themes by revisiting the research questions.³⁰ Deductive extraction was initially used to collect data after 2 reviewers piloted 5 articles according to the extraction parameters. This was done to ensure that the extraction process was consistent and accurate. Iterative changes to the extraction process were made as needed. Modifications included the addition of subsections for barriers and study results. The data extraction was completed by 1 reviewer and checked for accuracy by a second reviewer. The second and then a third reviewer extracted a code and quotation list from ATLAS.ti and reread each source vertically while comparing text and codes for congruency. Once each source had been read and checked, codes were horizontally compared across themes with the texts in the sources for consistency and strength of groundedness. Where discrepancies existed, or clarification was required, this was resolved through discussion and mutual agreement. Details on the data that were extracted are represented in Table 2 of the online Supplementary File.³¹

Synthesis

The codes and themes of the included studies were analyzed and reported descriptively in this review. A qualitative content analysis methodology was used to construct a narrative regarding the existing landscape of IPE studies involving musculoskeletal (MSK) healthcare students. This narrative particularly emphasizes the implementation and evaluation of

various IPE interventions within this context. Inductive extraction was then used to code and categorize the data to allow for data synthesis. This was done collaboratively, where the researchers met 3 times face to face, and the data was iteratively extracted and coded.^{25,32}

RESULTS

From the electronic searches, 2894 articles and documents were initially identified and catalogued in Excel, 2893 articles and documents from 4 electronic databases, and 1 document from the World Health Organization. After screening titles and abstracts, 2858 articles were excluded. Thirty-six full-text articles underwent dual reviewer screening, removing 8 duplicates; 4 articles were deemed inappropriate for lacking IPE interventions. This left 24 full-text articles that were then imported into ATLAS.ti. Further criteria-based screening of the full texts excluded 6 more articles, yielding 18 included papers (Fig. 1). Results will be presented in 2 sections: the first detailing study features, followed by content organized by identified themes.

Features of Included Papers

Table 3 of the online Supplementary File details a summary of the features of the reviewed papers. The studies included in this review were undertaken in Australia (n = 3),^{33–35} Canada (n = 4),^{36–39} Germany (n = 1),¹⁷ Honduras (n=1),⁴⁰ Malaysia (n=1)¹⁹ and the United States (n = 8).^{20,41–47} Eighty-three percent (n = 15) of the reviewed papers were published in the last decade (between 2014 and 2024)^{17,19,20,33–36,39–45,47} while the remaining 3 were published in 2010.^{37,38,46} There were a range of study designs in the included papers, 9 were mixed methods,^{20,33–35,40,41,43,45,47} 5 were quantitative,^{17,19,39,42,44} and 4 were of a qualitative design.^{36–38,46} The most common combination of student cohorts used in the IPE intervention studies were medical and physiotherapy students, utilized in 67% (n = 12) of the reviewed studies.^{17,33–35,38–41,43–46} Further details on student cohorts used, including the number of participants per student cohort, are listed in Table 3 of the online Supplementary File.

All 18 studies included the implementation and/or evaluation of an IPE intervention. Of these, 14 (77.7%) studies prefaced their IPE interventions with an introductory session to address objectives, outcomes, and necessary baseline knowledge and for students to meet each other.^{17,19,20,33,35,36,38,39,41–46} Sixteen (88.8%) studies incorporated group or collective learning,^{17,19,20,33,35,36,38,39,41–46} and all 18 studies were conducted in person rather than in an online format.^{17,19,20,33–47} Seventeen (94.4%) studies were delivered synchronously,^{19,20,33–47} while only 1 (5.5%) combined asynchronous and synchronous learning.¹⁷

Three (16.6%) studies were inferred to be implicit^{36,43,44} while 10 (55.5%) were inferred to be explicit in nature.^{17,33–35,37,39,41–43,45} Four (22.2%) studies were surmised to have offered didactic learning,^{19,34,39,43} while only 1 (5.5%) study was recorded as autodidactic.³⁶ IPE interventions ranged from simulation-based learning,^{19,41,43} didactic lectures,^{17,19,39,43,46} workshops,³⁹ shadowing,^{17,19,38,39,43,46} team-based learning (TBL),^{35,41,46} case-based presentations or learning,^{41,46} peer teaching,^{36,45} clinical setting activities^{33,34,37,40,42,44,47} to mock clinical setting activities.²⁰ Timing and durations of IPE interventions varied greatly and

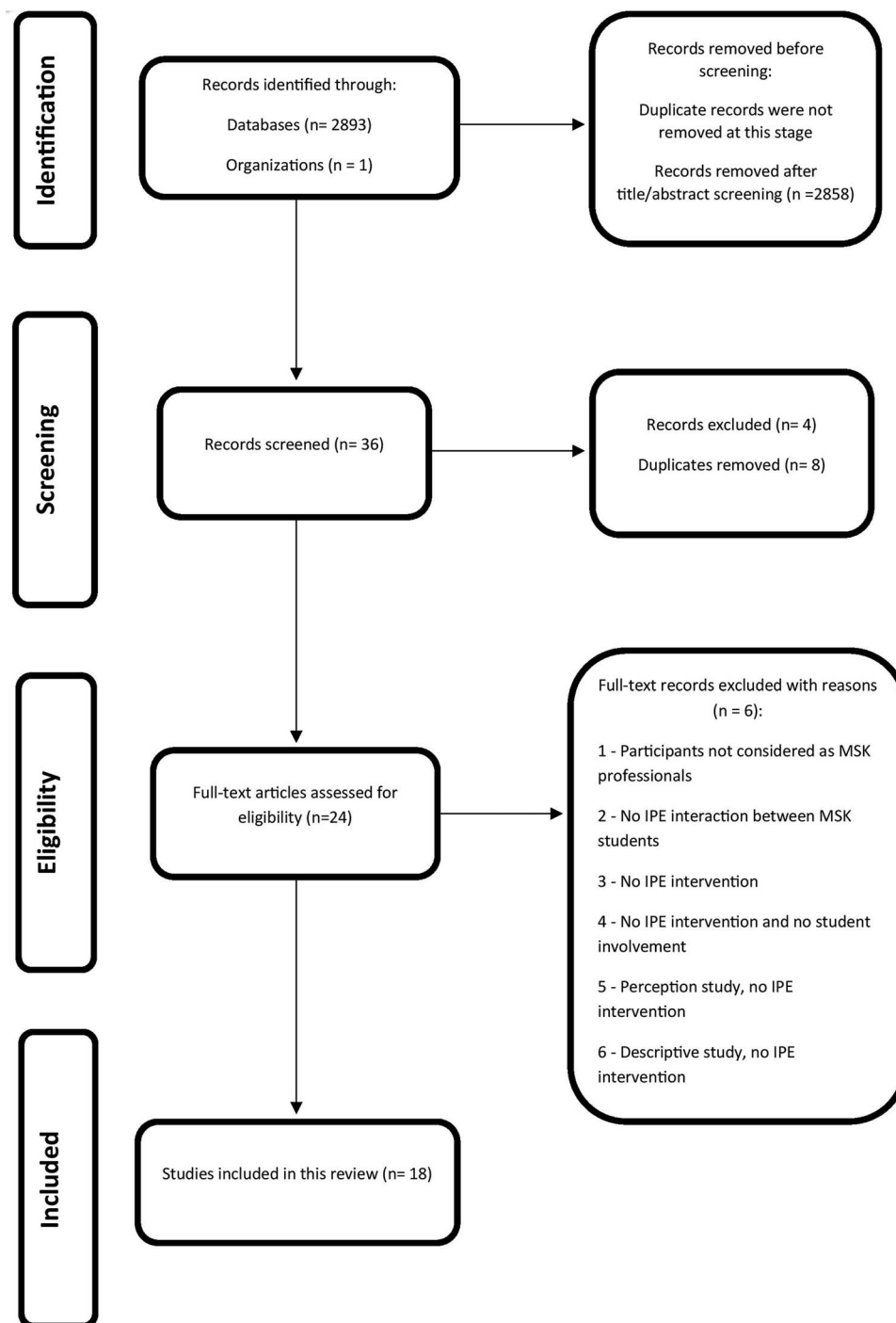


Figure 1 - PRISMA flow diagram.

ranged from a few hours to weekly, monthly, and annually, specified further in Table 3 of the online Supplementary File.

Regarding the evaluation of the IPE interventions, 9 studies incorporated pre- and post-test evaluation,^{19,34–36,39,41,42,44} while 9 studies only used a post-test evaluation.^{17,20,33,40,43,45–47} When reporting on evaluation types, 8 (44.4%) studies^{17,20,36,39,42,44,45,47} evaluated the acquisition of knowledge by student, 11 (61.1%) studies^{17,19,33,34,36,37,40,41,44,45,47} investigated student attitudes, perceptions and beliefs, 2 (11.1%) studies^{33,47} evaluated patient

benefit, 2 (11.1%) studies^{39,42} examined student skill development, and 3 (16.6%) studies^{39,45,46} evaluated the intervention itself.

The Readiness for Interprofessional Learning Scale (RIPLS) was used in 4 (22.2%) of the 18 studies.^{19,34,35,41} The Individual Readiness Assurance Test (iRAT) was used in 1 study (5.5%)⁴⁴ while 3 (16.6%) studies^{36,39,44} indicated the use of multiple-choice questions (MCQs). A further study used a Likert-style survey.⁴² One (5.5%) study used both the Student Stereotypes

Rating Questionnaire (SSRQ) and the Consumer Assessment of Health Plans Study (CAHPS) patient survey.⁴⁷ The remaining studies did not provide further detail on the types of surveys or questionnaires used. For the studies with a qualitative component, 12 (66.6%) studies^{20,33,35–38,40,41,43,45–47} used reflective comments, and 2 (11.1%)^{34,37} used focus group discussions.

Identified Themes From Content of Included Studies

The selected sources were analyzed using ATLAS.ti, and codes were generated that linked to the text within each source as described previously. Code names were changed and combined where relevant for congruency, and they were then analyzed for convergence and grouped into categories of commonality. These categories gave rise to 5 dominant themes that encapsulated (1) Benefits of IPE, (2) Barriers to IPE, (3) IPE interventions and strategies, (4) IPE evaluation, and (5) General findings.

1. Benefits of IPE

Four studies highlighted the potential benefits of IPE.^{33,44,46,47} One study noted improved student perceptions of professional legitimacy.⁴⁷ Another reported benefits from decentralized and centralized IPE approaches.⁴⁶ Luetmer (2018) found that IPE interventions reinforced interprofessional teamwork and facilitated anatomical knowledge application.⁴⁴ Another study emphasized that IPE interventions effectively addressed core skills, providing authentic learning experiences.³³

2. Barriers to IPE

Nine studies^{17,20,33,35,37,39,44–46} identified barriers to IPE interventions. Six studies^{17,33,37,44–46} reported time constraints, including inadequate preparation and task completion time. Three studies emphasized aligning activities to student needs, such as defining expectations,³⁷ using structured patient cases,³⁵ and interactive topics.³³ Logistical planning and implementation were barriers in 2 studies,^{39,46} while funding was noted as a barrier in another study.²⁰ Three studies highlighted the importance of considering student cohorts, including balanced ratios,³⁵ skill levels,³³ and IPE sustainability across faculties.⁴⁶ One study found it challenging to evaluate comprehensive IPE outcomes.⁴⁶

3. IPE Interventions and Strategies

This scoping review identified numerous IPE implementation strategies across 17 studies, with the exclusion of 1 study.⁴⁷ A Canadian study³⁶ used peer-teaching activities where students designed teaching plans reviewed by instructors. An Australian study³⁴ developed a common assessment form for preseason amateur sports assessments, while another American bi-annual IPE program⁴¹ randomly assigned students to interprofessional teams for simulated patient care activities. Another Canadian study³⁷ incorporated clinical components, community engagement, mentorship, and reflective journaling to foster experiential learning. An Australian study³⁵ adopted TBL focused on back pain, including preclass reading, lectures, quizzes, and feedback. An American study⁴² implemented a weeklong multidisciplinary musculoskeletal education experience with simulated clinical activities, and another²⁰ introduced a Mock Clinic workshop with real patients and immediate

feedback. An Australian 3-phase program³³ included workshops and a chronic pain management program, while another American-based study⁴³ used didactic and simulation-based activities to develop critical thinking and observation skills. A modified TBL experience with an ultrasound modality emphasized interaction and problem-solving.⁴⁴ A Honduras study⁴⁰ involved interprofessional service learning in a rural community, while 1 American study⁴⁵ designed an IPE session with near-peer interactions, anatomy dissections, and breakout sessions. Another American study⁴⁶ implemented centralized and decentralized IPE models with panel discussions, simulations, home visits, and reflections. A German study¹⁷ revised the curriculum to teach interdisciplinary topics across qualification levels, and 1 of the Canadian studies³⁸ initiated interprofessional shadowing experiences at chiropractic institutions. A Malaysian study¹⁹ developed an experiential learning model with interprofessional meetings, lectures, seminars, and simulation clinic sessions, and another Canadian study³⁹ organized physiotherapist-led workshops with theoretical presentations and hands-on practice. These strategies promoted collaboration, communication, and interprofessional learning. The approaches used in this study reflected the learning context and utilized tailored strategies that encouraged collaboration, communication, and learning in an interprofessional context.

4. IPE Evaluation

All 18 studies in this scoping review utilized diverse qualitative and quantitative evaluation methods to assess IPE effectiveness and outcomes. Six studies used pre- and post-test methodologies,^{19,36,39,41,42,44} 1 study used a pretest quiz,³⁵ and 10 studies used posttest evaluations.^{17,20,33,34,37,38,40,43,45–47} A Canadian study³⁶ used pretest clinical case-based MCQs to collect demographic data, knowledge, beliefs, and experiences, followed by posttest questions to assess changes. An Australian study³⁴ employed RIPLS scores and focus groups for sporting preseason assessments and follow-up evaluations. An American study⁴¹ used pre- and post-test RIPLS with qualitative questions to gauge attitudes and perceptions. Another Canadian study³⁷ conducted posttest focus groups and weekly reflective journals. Other studies from the United States, Honduras, Australia, Germany, Malaysia, and Canada employed surveys, questionnaires, qualitative interviews, reflections, and course evaluations, capturing various dimensions such as knowledge acquisition, attitudes, perceptions, and overall program experiences.

5. General Findings

The main findings from 15 IPE studies in this scoping review revealed key themes: professional identity, collaboration, patient benefit, positivity toward IPE, acknowledgment of IPE activities, challenges, and recommendations. Seven studies noted that students recognized the importance of understanding their own roles before appreciating interprofessional (IP) care, gaining better insights into other professions. Stereotyping was identified as an issue.^{19,33–35,37,43,45} Nine studies^{19,33,34,37,40,41,43,45,47} reported increased confidence in communication and teamwork, highlighting the importance of collaboration and respect for diverse views. Eight studies^{19,34,35,37,40,42,44,46} emphasized the benefits of multidisciplinary teams in patient care, with increased confidence in managing MSK conditions. Six studies^{20,33,39,41,43,45} showed positive attitudes towards IPE, with students willing to

engage in future activities. Three studies^{20,35,43} appreciated immediate feedback, TBL, and real patient interaction. Challenges included poor planning, lack of time, and authentic interactions.^{20,37,46} Recommendations for continuing IPE in the curriculum were positive.⁴¹

DISCUSSION

This scoping review examined primary IPE studies to identify and summarize IPE interventions among undergraduate MSK healthcare students. Eighteen studies met the inclusion criteria, with 83% (n = 15) conducted in the last decade. The studies originated from various countries, including Honduras (n = 1), Germany (n = 1), Malaysia (n = 1), Australia (n = 3), Canada (n = 4), and the United States (n = 8). These findings align with other scoping reviews, which also found a predominance of studies from developed countries like Canada, the United States, the United Kingdom, and Australia.⁴⁸ This highlights the advanced IPE leadership and scholarship in these regions.⁴⁹

Addressing the first research question about the nature of evidence for IPE implementation among musculoskeletal healthcare students, this scoping review found that most studies used mixed methods, followed by quantitative and then qualitative designs. This mirrors findings from other IPE research reviews, showing a preference for mixed methods.⁵⁰ Mixed methods are favored for their ability to provide comprehensive information and context, reflecting the complex interrelations in IPE education among students, faculty, institutions, and patient care.⁵¹

The most common MSK health professional student combinations in our review were medical and physiotherapy students. This aligns with other IPE reviews showing frequent use of these groups.^{49,52,53} The predominance of medical students may be due to the long-established nature of the medical profession and logistical challenges in coordinating IPE across different institutions and academic calendars.⁵⁰

The second research question addressed the types of approaches or interventions used in IPE for musculoskeletal healthcare students. All 18 studies examined implementation and evaluation of an IPE intervention with at least 1 MSK healthcare student cohort. Most IPE interventions were integrated into curricula or formal academic outcomes, similar to findings in other reviews.^{49,53} Embedding IPE in prequalification curricula is preferred to develop student's knowledge, attitudes, skills, and habits.⁵⁴ However, not all studies formally integrated IPE into curricula; some used informal activities like IPE discussions.⁵⁵ Fourteen studies^{17,19,20,33,35,36,38,39,41-46} included an introductory session to outline objectives, expectations, and content, facilitating student familiarity and social engagement. Such sessions were noted to foster collaborative relationships that support future formal IPE activities.^{56,57} Seventeen studies in our review employed synchronous delivery, consistent with findings from Bogossian et al (2022).⁴⁹

Sixteen studies (88.8%)^{17,19,20,33,35,36,38,39,41-46} utilized group or collective learning, while 17 (94.4%)^{17,19,20,33-46} were conducted face to face. Understanding professional histories, roles, and cultures is crucial in IPE, where collective learning enhances collaboration skills.⁵⁶ Small group learning is widely recognized as effective in IPE, including in our review.^{49,55} Interestingly, while our review emphasized in-person

sessions, other studies suggest online sessions can be equally or more effective in IPE, demonstrating the efficacy of online approaches.^{58,59}

Three studies^{36,43,44} employed implicit learning, while 10 utilized explicit learning.^{17,33-35,37,39,41-43,45} Explicit learning is preferred for its defined and planned nature compared to implicit learning, which is unpredictable.⁴⁹ Four studies^{19,34,39,43} employed didactic learning, and 1 study³⁶ used autodidactic methods. The approaches in the remaining studies were unspecified. Didactic learning is recognized as effective in small-group IPE settings, potentially explaining its prevalence.⁶⁰ Session timings varied widely across studies, from hours to annual schedules, consistent with findings from other scoping reviews.^{11,49}

The IPE interventions used in the included studies were simulation-based learning,^{19,41,43} didactic lectures,^{17,19,39,43,46} workshops,³⁹ shadowing,³⁸ TBL,^{35,41,46} case-based presentations or learning,^{41,46} peer teaching,^{36,45} clinical setting activities,^{33,34,37,40,42,44,47} and mock clinical setting activities.²⁰ The literature indicates that combinations of IPE activities that encourage immersive, interactive, and reflective learning are most beneficial. The use of simulation-based learning, e-learning, and problem-based learning show the most popularity, but case-based learning, collaborative inquiry, appreciative inquiry, observation-based learning, experiential learning, reflective learning, and continuous quality improvement are all effective and further enhanced with technology use.^{56,61}

The third identified research question sought to determine the forms of evaluation used in IPE interventions delivered to MSK healthcare students. All 18 studies in this scoping review administered evaluations of some form of the IPE intervention. A systematic review done on the assessment tools in prelicensure interprofessional education reported a variety of methods that were used to evaluate the change following an IPE intervention.⁶² Several studies in this scoping review used a posttest evaluation alone^{17,20,33,40,43,45-47} rather than a pre-and post-test evaluation together.^{19,34-36,39,41,42,44} Students have indicated that the pretest evaluation better prepared them for the upcoming intervention by filling in gaps in previous work and increasing focus.⁶³ Most of the included studies evaluated student perception, attitudes, and beliefs^{17,19,33,34,36,37,40,41,44,45,47} followed by the evaluation of the acquisition of knowledge.^{17,20,36,39,42,44,45,47} With the mounting importance of IPE where universities are advised to incorporate IPE, student readiness and perception are fundamental aspects that must be evaluated.⁶⁴ Other systematic reviews also found that most studies focus on assessing students' knowledge acquisition concerning other professions, using pre- and post-evaluations.^{61,62} The included studies were noted to evaluate patient benefit,^{33,47} student skills development,^{36,39} and the IPE intervention in itself.^{39,45,46} Other reviews highlight that while almost all studies evaluated student perceptions and knowledge, there is a distinct lack of evaluation of the effectiveness of the IPE activities (regarding approaches to teaching and learning)^{50,61} and this is corroborated by this current scoping review where only 3 studies evaluated the effectiveness of their intervention.^{39,45,46}

In addition to addressing the 3 outlined research questions, the analysis of this scoping review's findings identified 5 principal themes concerning MSK IPE: benefits, barriers, interventions/strategies, evaluations, and overall findings. Since

interventions/strategies and evaluations were previously discussed within the framework of the research questions, the subsequent discussion will focus on the benefits, barriers, and overarching findings related to MSK IPE. It has been noted that student knowledge acquisition, related to the knowledge of other professions, is an important facet of any IPE intervention.⁶¹ The findings of our scoping review noted the appreciation for professional legitimacy through the acquisition of knowledge as a benefit. Further to this, the acquired knowledge has the potential to provide patient benefit and provide students with strengthening core common skills for effective IPE experiences. IPE has been reported by students in other studies to use teamwork as an approach to improve patient outcomes and build confidence and communication skills to facilitate teamwork.⁶⁵

Time constraints emerged as a significant barrier to successful IPE, a recurring issue noted in other studies.^{66,67} Adequate preparation and planning of IPE interventions were also highlighted as crucial factors, essential for fostering effective student engagement and learning.⁵⁵ Furthermore, the literature notes the importance of tailoring IPE activities to align with the participating students' backgrounds, including their academic year and field of study, as well as the mix of professions involved.⁵² The effectiveness of IPE interventions is contingent upon meticulous scheduling, funding, and logistical planning, which were identified as additional barriers in this scoping review.⁶⁸

The findings emphasize addressing stereotypes in IPE, promoting collaboration and respecting diverse perspectives.⁶⁹ Participants noted the benefits of multidisciplinary teams in enhancing patient care, reflecting positive attitudes.^{66,70} Immediate feedback and team-based learning were valued by students, aiding IPE outcomes and self-reflection.⁵⁵ Challenges like poor planning and time constraints were barriers, as previously discussed. Recommendations for integrating IPE were positive, reflecting a commitment to advancing healthcare education.⁷¹

Limitations

This scoping review followed a predefined protocol, peer-reviewed for transparency and rigor,²⁷ using Arksey and O'Malley's framework.²² Search terms were developed by experienced researchers and a librarian and tested beforehand. Four databases were systematically searched without date restrictions. Screening processes were validated by 2 reviewers, adjustments were made as needed. Mendeley and ATLAS Ti facilitated data management and analysis. Despite efforts, some studies may have been missed; the search string included only 7 terms potentially missing other relevant terms. Expanding databases and including non-English studies could yield more results. Quality appraisal of studies was not conducted, potentially affecting interpretations. The scope and implementation of competency-based IPE within the context of this review were not explored. Additionally, clarity is needed on the long-term impact of undergraduate IPE on graduate interprofessional practice.⁷² This necessitates developing, implementing, and evaluating comprehensive IPE interventions that cater to a broader range of MSK health profession students.

CONCLUSION

This scoping review appraised IPE literature focusing on MSK health professions students, which highlighted a bias toward medical and physiotherapy disciplines over other MSK health disciplines namely chiropractors, podiatrists, biokineticists, and osteopaths. It also reveals a lack of MSK-specific content in current IPE interventions, with more emphasis on broader healthcare topics. This gap limits guidance for integrating IPE into MSK Health Sciences curricula. Although IPE advances in other fields, its application in musculoskeletal contexts is underexplored, amid rising MSK disease burdens. Despite limited direct inclusion, this review identifies relevant IPE interventions for MSK-specific settings.

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Author Contributions

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