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Describing the evidence linking interprofessional education interventions to improving the delivery of safe and effective patient care: a scoping review

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ABSTRACT

Empirical evidence indicates that collaborative interprofessional practice leads to positive health outcomes. Further, there is an abundance of evidence examining student and/or faculty perceptions of learning or satisfaction about the interprofessional education (IPE) learning experience. However, there is a dearth of research linking IPE interventions to patient outcomes. The objective of this scoping review was to describe and summarize the evidence linking IPE interventions to the delivery of effective patient care. A three-step search strategy was utilized for this review with articles that met the following criteria: publications dated 2015–2020 using qualitative, quantitative or mixed methods; the inclusion of healthcare professionals, students, or practitioners who had experienced IPE or training that included at least two collaborators within coursework or other professional education; and at least one of ten Centers for Medicare & Medicaid Services quality measures (length of stay, medication errors, medical errors, patient satisfaction scores, medication adherence, patient and caregiver education, hospice usage, mortality, infection rates, and readmission rates). Overall, n=94 articles were identified, providing overwhelming evidence supporting a positive relationship between IPE interventions and several key quality health measures including length of stay, medical errors, patient satisfaction, patient or caregiver education, and mortality. Findings from this scoping review suggest a critical need for the development, implementation, and evaluation of IPE interventions to improve patient outcomes.

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Introduction

Rapid growth of new knowledge and the rate of information expansion in patient care contributes to the evolving complexity of modern healthcare. This is a driving force behind the need to build effective team-based collaborative care models (Mitchell et al., 2012). Ample research demonstrates that interprofessional collaboration (IPC) also known as team-based care, leads to positive health outcomes (Grumbach & Bodenheimer, 2004; Lemieux-Charles & McGuire, 2006; Mickan, 2005; Oandasan et al., 2006; Veet et al., 2020). Team-based care improves patient satisfaction (Will et al., 2019) improves satisfaction while reducing cost in the hospice setting (Hughes et al., 1992), reduce mechanical complications for hospitalized patients on total parenteral nutrition (Naylor et al., 2004), reduces mortality in heart failure (Holland et al., 2005; McAlister et al., 2004), and positively impacts numerous clinical outcomes in the critical care setting (Donovan et al., 2018) To better prepare the workforce for collaborative care, healthcare education must engage learners from different health disciplines through interprofessional education (IPE) to instill the required skills to perform as an effective member of a healthcare team. To bridge the gap between practice needs and healthcare education, the World Health Organization (WHO) provided a framework in a 2010 seminal publication (World Health Organization, 2010). The WHO promoted the need for interprofessional education and defined it as: "interprofessional education occurs when two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes" (World Health Organization, 2010). It is important to distinguish IPC from IPE interventions: IPE necessarily involves an educational component (e.g., seminars, workshops), whereas IPC may take the form of practice-based (e.g., multidisciplinary rounding) or organizational-based interventions (e.g., policies) (Reeves et al., 2011)

While there is an abundance of literature supporting the value and benefit of IPE, much of the evidence focuses on the

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impact of IPE on teamwork, communication skills, attitudes, and understanding, with little focus on clinical outcomes (Brandt et al., 2014; Thistlethwaite et al., 2010). Realizing the goal of IPE is to help prepare future and current health professionals for team-based care and improved quality of care (World Health Organization, 2010), evidence linking the two is crucial. Therefore, the purpose of this scoping review was to describe and summarize the evidence linking IPE interventions to improving the delivery of safe and effective patient care. The goal was to strengthen the evidence base for IPE and collaborative practice and to enhance interprofessional research and scholarship.

Methods

No systematic or scoping reviews on the topic were identified in a search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews (CDSR), and the Joanna Briggs Institute (JBI) Evidence Synthesis.

Protocol

The project was sponsored by the Interprofessional Education Collaborative (IPEC) in collaboration with the Association of Academic Health Sciences Libraries (AAHSL) and Rutgers University. The study team (the authors) were identified following a national call for volunteers in the U.S. and included a health science librarian (Y. Z.). The protocol was developed in accordance with the JBI template. It was posted in the *Scoping Review: Interprofessional Education Collaborative* research guide at the Rutgers University Libraries (Rutgers University Libraries, 2022). A link to the protocol in PDF is also included on the scoping review project webpage on the IPEC website (Interprofessional Education Collaborative IPEC, 2022a). The protocol was registered in the Open Science Framework (Interprofessional Education Collaborative IPEC, 2022b).

Eligibility criteria

The inclusion criteria were: 1) studies written in English, 2) publication dates between 2015–2020. Because scoping reviews are a preliminary assessment of potential size and scope of available research literature, we chose this 5 year period to provide a reasonable assessment of recent literature in the field); 3) studies using qualitative, quantitative, or mixed methods, 4) studies including healthcare professionals, students, or practitioners who have experienced IPE or training, 5) all types of interventions that target any type of health or social care professionals, 6) the interprofessional intervention or collaboration must be between two or more collaborating professions, 7) the IPE exposure must have been included within coursework or other professional education (including, e.g., volunteer based learning), and 8) measures of direct patient outcomes. The definition of "direct patient outcomes" were chosen based on the U.S. Centers for Medicare & Medicaid Services (CMS) definition of Quality Measures to quantify healthcare processes, outcomes, patient perceptions, and organizational structure and/or systems that are associated with the ability to provide high-quality healthcare and/or that relate to one or more quality goals for healthcare (Centers for Medicare & Medicaid Services, 2022). Outcomes included: length of stay, medication errors, medical errors, patient satisfaction scores, medication adherence, patient and caregiver education, hospice use, mortality, infection rates, or readmission rates.

Search strategy

The search strategy aimed to find both published and unpublished studies. A three-step search strategy was utilized in this review. An initial limited search of MEDLINE (Ovid) was undertaken followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe each article. A second search using all identified keywords and index terms was then conducted across all included databases. Thirdly, the reference lists of all identified reports and articles were searched for additional studies. MEDLINE (Ovid), CINAHL (EBSCO), Cochrane Database of Systematic Reviews (Wiley-Blackwell), Scopus (Elsevier), Web of Science (Thompson Reuters), Joanna Briggs JBI EBP Database, and Dissertations & Theses (ProQuest) and unpublished studies were included using the three-step search strategy. The Embase database was not searched due to the authors' inability to obtain an institutional subscription. The search for unpublished studies included ProQuest Dissertation and Theses database; Google Scholar; and websites including UK Centre for the Advancement of Interprofessional Education, Canadian Interprofessional Health Collaborative, and the Interprofessional Education Collaborative. The references of all identified reports and articles were searched for additional studies. When a search returned a relevant literature review or meta-analysis, the reference section was reviewed to check for other applicable studies. Additional hand searches were carried out on the primary authors of relevant articles. Keywords used for searching included: interprofessional education, interdisciplinary, multi-occupational, multi-discipline, patient safety, patient outcomes, length of stay, and health quality indicators. The search strategy is shown in Online Supplement S1.

Study selection

The search strategy was conducted in a blinded fashion. Following the search, all identified citations ($n = 4{,}565$) were collated and uploaded into EndNote X9 (Clarivate Analytics, PA, USA) and duplicates were removed ($n = 329$). Using the eligibility criteria, the remaining references ($n = 4{,}295$) were evenly screened at the title and abstract level by eight reviewers in four pairs. Seven reviewers screened the titles and abstracts using EndNote 20, with one reviewer using Rayyan (Ouzzani et al., 2016), a free collaborative literature review web-tool. The undecided references ($n = 790$) were resolved by discussion and crosschecking by eight reviewers in four pairs. After title and abstract screening, there were 188 references included for full text evaluation. The full texts of potentially eligible studies were retrieved. The same four pairs of reviewers were assigned to assess them in detail against the eligibility criteria; however, one reviewer had to withdraw, and another one

resigned after reviewing the assigned full text articles. The remaining six reviewers completed the full text evaluation. Seventy-nine articles were selected for analysis. Before these studies were synthesized, an updated search was performed in PubMed in December 2021 for any newly published, relevant studies. The updated search yielded 991 references. The titles and abstracts were screened by two reviewers independently in Rayyan. These reviewers also assessed 35 potential eligible articles for inclusion. As a result, 15 additional studies were included in the final set of 94 selected studies for synthesis.

Data extraction

Data was extracted from the selected studies by six reviewers in three pairs (JC & TC in Pair 1, CO & RT in Pair 2, and JH & VU in Pair 3) using a standardized data collection template and data dictionary and input into a Microsoft Excel database. The database was cleaned by one author (JC), and discrepancies were resolved by discussion with the relevant pairs of authors.

Results

The flow chart for studies included in the review is shown in Figure 1. The characteristics of included studies are available in Online Supplement S2.

Study characteristics

The characteristics of the included studies are summarized in Table 1. Most of the studies conducted within North America were conducted within the United States ($n = 63$). The study interventions were too heterogenous to allow for categorization. The before-and-after study design (also called a pre-post study) was used by the majority of studies (66%), while only $n = 10$ randomized clinical trials were identified (Adekpedjou et al., 2020; Bonderski et al., 2018; Borenstein et al., 2016; Connolly et al., 2015; Fortin et al., 2021; Fransen et al., 2017; Lo et al., 2021; Sagahutu et al., 2020; van de Ven et al., 2017; Walker et al., 2016). The most commonly involved health profession was medicine (87%), followed by nursing (82%). The mean (±SD) number of healthcare professions

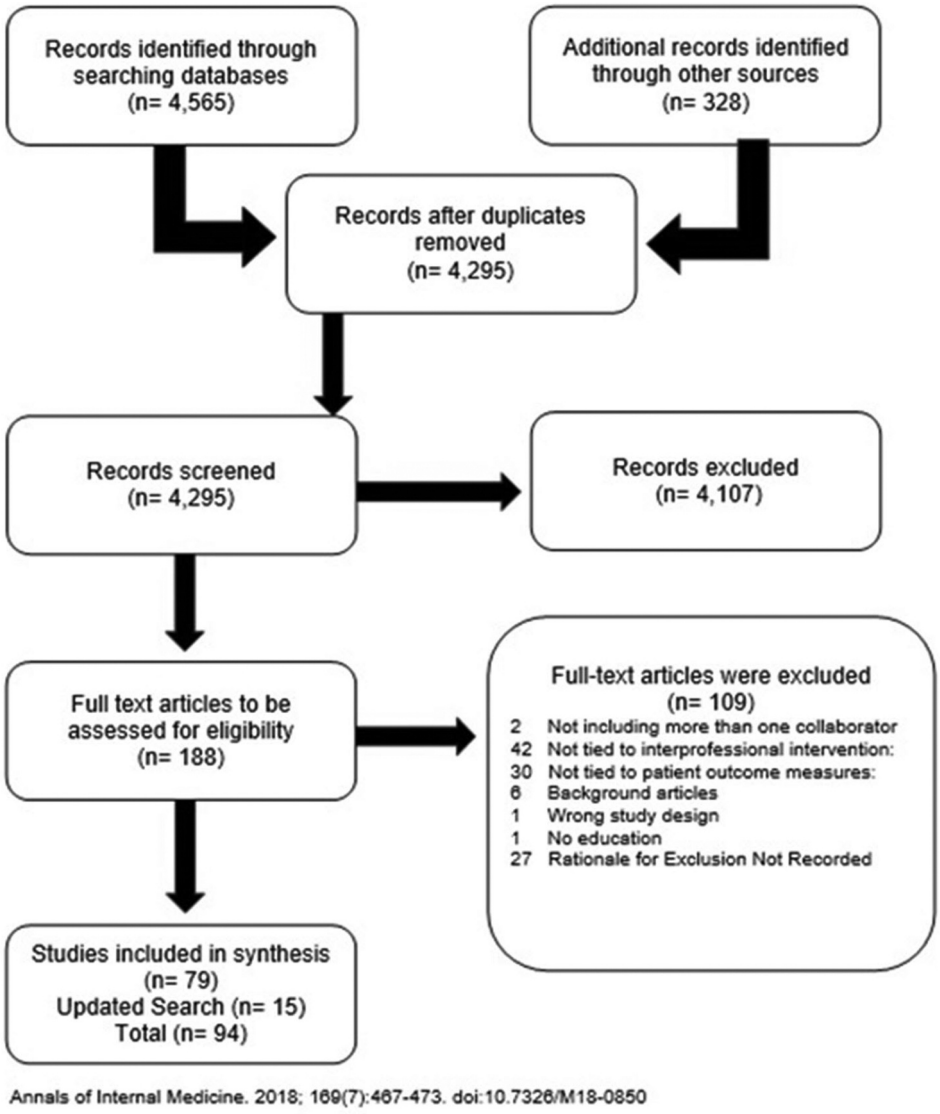

Figure 1. Flow chart of study selection based on PRISMA extension for scoping reviews (PRISMA-ScR).

Table 1. Study characteristics.

Variable	n (%)
Year	
2015	13 (14)
2016	15 (16)
2017	14 (15)
2018	19 (20)
2019	10 (11)
2020	13 (14)
2021	10 (11)
Geographical location	
North America	69 (73)
Europe	12 (13)
Africa	5 (5)
Asia	4 (4)
Australia	4 (4)
South America	0
Study design	
Before-and-after study	62 (66)
Randomized controlled trial	10 (11)
Descriptive cross-sectional study	8 (8)
Non-randomized controlled trial	6 (6)
Retrospective cohort	4 (4)
Interrupted time series study	3 (3)
Case report	1 (1)
Profession	
Medicine	82 (87)
Nursing	77 (82)
Pharmacy	40 (43)
Social work	26 (28)
Physical therapy or physiotherapist	18 (19)
Respiratory therapy	15 (16)
Dietitian or nutritionist	13 (14)
Psychology	12 (13)
Occupational therapy	11 (12)
Midwifery	7 (7)
Other*	58 (62)
Training	
Professionals	64 (68)
Students	14 (15)
Students and professionals	16 (17)
Number of professionals involved	
1–100	22 (23)
101–200	7 (7)
201–300	6 (6)
301 or more	8 (9)
Unknown	51 (54)
Number of patients involved	
1–100	20 (21)
101–200	7 (7)
201–300	12 (13)
301 or more	35 (37)
Unknown	20 (21)
Setting	
Inpatient	42 (45)
Outpatient	30 (32)
Emergency	8 (9)
Hospice or long-term care	3 (3)
Other	8 (9)
More than 1 of the above	3 (3)

*Note, some selected articles included an "other category" of health professionals who engaged in the IPE intervention.

represented in each study was 4±2. Most studies (68%) only involved healthcare professionals. [10] Most studies involved interprofessional education between post-graduate professionals (68%). There were generally less than 100 professionals involved in the interprofessional educational interventions in each study (23%), though there was a lack of clear reporting in many of the studies (54%). Most published studies included patient outcomes impacting large numbers of patients (301 or more, 37%), while a sizable portion of studies (21%) included outcomes for less than 100 patients. The most common healthcare settings involved were the inpatient (45%) and outpatient/ambulatory care (32%) settings.

Quality health measures

The outcomes of the quality health measures are reported in Table 2.The most commonly reported outcome was length of stay ($n = 27$), followed by medical errors ($n = 22$). The mean (±SD) number of outcomes measured in each study was 2±1, with a maximum of 5 and minimum of 1. Most of the outcomes were positive, with the exception of mortality (50% positive vs. 50% no change) and readmission rate (33% positive vs. 67% no change). Ten studies (10/94, 11%) did not find any positive changes in the quality health measures assessed (Atkinson, 2018; Boet et al., 2020; Connolly et al., 2015; Eckstrom et al., 2016; Flentje et al., 2020; Fransen et al., 2017; Hallin et al., 2018; Kent et al., 2016; Morgan et al., 2015; Murphy et al., 2018).

Two studies (Borckardt et al., 2020; Murphy et al., 2018) noted a negative outcome for length of stay and medical errors, respectively. In their before-and-after study of a simulation-based multidisciplinary trauma team training program (Murphy et al., 2018), found a modest increase in the emergency department length of stay from a median (IQR) 4.88 (2.03–8.05) hours to 7.17 (2.88–14.17) hours ($p < .001$), despite a decrease in emergency department to critical operation time from 2.63 (1.23–5.12) hours to 0.55 (0.22–1.27) ($p < .001$). The interrupted time series study by (Borckardt et al., 2020) found an increase in the mean (±SD) number of cases associated with complications on their Women's Health Unit before and after implementation of a proprietary interprofessional training program (39.44± 6.19 vs. 51.54±8.96, $p = .05$), despite also noting benefits in mortality and length of stay.

The identity and characteristics of the five quality measures with the most studies are given below.

Length of stay

This review identified 27 studies (Anderson et al., 2018; Angel et al., 2016; Babine et al., 2018; Bekmezian et al., 2015; Blouin-Delisle et al., 2020; Bonalumi et al., 2017; Borckardt et al., 2020; Borenstein et al., 2016; Broom et al., 2019; Christensen et al., 2016; Connolly et al., 2015; Constantine, 2016; Corcoran et al., 2017; Dennis et al., 2016; Dodds et al., 2019; Ersson et al., 2018; Hallin et al., 2018; Larson et al., 2018; Morgan et al., 2015; Murphy et al., 2018; Patton et al., 2015; Peralta et al., 2020; Siddle et al., 2018; Theilen et al., 2017; Urisman et al., 2018; Wickersham et al., 2021; Wyer et al., 2016) that measured the impact on length of stay. The 18 studies that decreased length of stay (Anderson et al., 2018; Angel et al., 2016; Babine et al., 2018; Blouin-Delisle et al., 2020; Borckardt et al., 2020; Borenstein et al., 2016; Christensen et al., 2016; Constantine, 2016; Corcoran et al., 2017; Dennis et al., 2016; Dodds et al., 2019; Ersson et al., 2018; Larson et al., 2018; Patton et al., 2015; Peralta et al., 2020; Siddle et al., 2018; Theilen et al., 2017; Urisman et al., 2018) spanned all professions except

Table 2. Quality health measures.

Measure	Studies	Outcomes (% of Studies)		
		Positive	No Change	Negative
Length of stay	27	18 (67)	8 (30)	1 (4)
Medical errors	22	17 (77)	4 (18)	1 (5)
Patient satisfaction	21	20 (95)	1 (5)	0
Patient or caregiver education	21	20 (95)	1 (5)	0
Mortality	20	10 (50)	10 (50)	0
Readmission rate	18	6 (33)	12 (67)	0
Medication errors	8	8 (100)	0	0
Medication adherence	8	8 (100)	0	0
Infection rate	5	3 (60)	2 (40)	0
Hospice use	1	1 (100)	0	0

Length of stay included department-specific length of stay (e.g. intensive care unit length of stay). Medical errors included, e.g., misdiagnosis, delayed time to diagnosis, and complications from procedures. Patient satisfaction was not limited to the use of formal patient satisfaction instruments. For the outcome of patient or caregiver education, knowledge/impact of education must be assessed; delivery of medication as a process outcome was not counted as a direct patient outcome. Medication errors included, e.g., errors in medication reconciliation, adverse effects, and suboptimal treatment selection. Hospice use reflected appropriateness of hospice use.

midwifery. All studies were limited to professionals only, except for one (Urisman et al., 2018) that involved both students and professionals.

Medical errors

This review identified 22 studies (Anderson et al., 2018; Angel et al., 2016; Babine et al., 2018; Borckardt et al., 2020; Borenstein et al., 2016; Braddock et al., 2015; Chang et al., 2019; Ching et al., 2016; Clapp, 2015; Cropper et al., 2018; Egenberg et al., 2017; Flentje et al., 2020; McQuaid-Bascon et al., 2018; Sagahutu et al., 2020; Sauter et al., 2016; Schentrup et al., 2019; Theilen et al., 2017; Tuuri et al., 2016; van de Ven et al., 2017; Walker et al., 2016; Yamada et al., 2016; Zorek et al., 2015) that measured the impact on medical errors. The 17 studies that decreased medical errors (Anderson et al., 2018; Babine et al., 2018; Braddock et al., 2015; Ching et al., 2016; Clapp, 2015; Cropper et al., 2018; Egenberg et al., 2017; McQuaid-Bascon et al., 2018; Sagahutu et al., 2020; Sauter et al., 2016; Schentrup et al., 2019; Theilen et al., 2017; Tuuri et al., 2016; van de Ven et al., 2017; Walker et al., 2016; Yamada et al., 2016; Zorek et al., 2015) spanned all professions. All studies were limited to professionals only, except for two (Walker et al., 2016; Zorek et al., 2015) that involved both students and professionals.

Patient satisfaction

This review identified 21 studies (Atkinson, 2018; Bamberger et al., 2017; Beaudreau et al., 2022; Block et al., 2021; Bonalumi et al., 2017; Bonderski et al., 2018; Buregyeya et al., 2021; Cao & Hull, 2021; Coleman et al., 2017; Fortin et al., 2021; Howell et al., 2022; Lawrence et al., 2015; Lee et al., 2021; Ploylearmsang et al., 2021; Robinson-Dooley & Nichols, 2016; Schussel et al., 2019; Shirey et al., 2021; Shrader et al., 2018, 2019; Truijens et al., 2015; Zorek et al., 2015) that measured the impact on patient satisfaction. All of the studies increased patient satisfaction, with the exception of one (Atkinson, 2018) that had no impact, and all professions were represented. The studies were about evenly divided between including students only (7/21, 33%), professionals only (8/21, 38%), or both (6/21, 29%).

Patient or caregiver education

This review identified 21 studies (Adekpedjou et al., 2020; Coleman et al., 2017; Constantine, 2016; Greenberg et al., 2020; Lee et al., 2021; Lo et al., 2021; Mozer et al., 2021; Myers Virtue et al., 2018; Nagelkerk et al., 2018, 2018; Philips et al., 2021; Schussel et al., 2019; Shrader et al., 2018; Simone et al., 2017; Straub & Bode, 2019; Tedesco et al., 2017; Truijens et al., 2015; Urisman et al., 2018; Weng et al., 2017; Wickersham et al., 2021; Yamada et al., 2016) that measured the impact on patient or caregiver education. All the studies improved patient or caregiver education, except for one (Constantine, 2016) that had no impact, and all professions were represented. The studies were about evenly divided between including students only (6/21, 29%), professionals only (7/21, 33%), or both (8/21, 38%).

Mortality

This review identified 20 studies (Borenstein et al., 2016, Connolly et al., 2015, (Fransen et al., 2017)- (Beaudreau et al., 2022; Boet et al., 2020; Bohnenkamp, 2020; Borckardt et al., 2020; Braddock et al., 2015; Broom et al., 2019; Chang et al., 2019; Christensen et al., 2016; Davis et al., 2015; Dennis et al., 2016; Egenberg et al., 2017; Ersson et al., 2018; Hallin et al., 2018; Lo et al., 2021; Murphy et al., 2018; Tedesco et al., 2017; Theilen et al., 2017; Urisman et al., 2018; Walker et al., 2016; Wickersham et al., 2021; Wyer et al., 2016)) that measured the impact on mortality. While none of the studies worsened mortality, 50% improved mortality (Beaudreau et al., 2022; Bohnenkamp, 2020; Borckardt et al., 2020; Braddock et al., 2015; Chang et al., 2019; Davis et al., 2015; Ersson et al., 2018; Jakobsen et al., 2021; Tedesco et al., 2017; Theilen et al., 2017; Walker et al., 2016). All professions were represented with the exception of dietitians or nutritionists

and occupational therapists. All studies were limited to professionals only, with the exception of one that involved students only (Hallin et al., 2018) and one that included students and professionals (Walker et al., 2016).

Discussion

This scoping review describes the relationship between IPE and patient outcomes. Specifically, findings from this study point to evidence to support the role of IPE positively impacting several key quality health measures (length of stay, medical errors, patient satisfaction, patient or caregiver education, and mortality).

Most of the studies reported a positive impact on clinical outcomes, and several studies reported improvement in more than one quality health measure of interest. This highlights the multifaceted impact of IPE interventions. However, as 4/10 quality health measures assessed had < 10 studies each (medication errors, medication adherence, infection rate, and hospice use), there is a need to further assess the impact of IPE interventions on these underrepresented outcomes.

It is interesting to contrast the results of this review with a 2017 Cochrane systematic review of IPC interventions, which found limited evidence for a direct impact on patient health outcomes (Reeves et al., 2017). However, their review of $n = 9$ studies was limited to randomized controlled trials (none of which were included in our review, as they did not involve an educational component and were therefore not IPE interventions). It is unknown how interventions providing IPE compare to those focusing on IPC, and the two approaches may overlap and synergize. For example, an IPE intervention seeking to improve adherence to evidence-based guidelines may benefit by adopting multidisciplinary rounding. However, we did not document the use of IPC interventions alongside IPE interventions in this review.

Of the top five quality measures with the greatest number of studies, mortality was the only outcome without majority support. This may be due to the inherent attractiveness of mortality as an important patient-centered outcome, perhaps reflecting an overly ambitious attempt to demonstrate the impact of an IPE intervention. It is important to note that we did not distinguish between all-cause mortality and disease-specific mortality, which introduces heterogeneity into this outcome (Jakobsen et al., 2021).

Interestingly, there were more studies that did not have an impact on readmission rate compared to those that had a favorable impact. This may be attributable to the attractiveness of readmission rate as a direct patient outcome, due to both ease of measurement and important financial implications. While this review did not attempt to grade the validity of studies or document whether a priori power was calculated and/or met, IPE studies should be mindful not to attempt to measure outcomes for which they are underpowered or not otherwise designed to evaluate.

Professionals were overwhelmingly involved in comparison to students. This may be due to the lack of professional responsibilities demanded of students, with a corresponding lack of ability to directly impact objective outcomes like mortality and length of stay, leading investigators to assess more subjective and accessible outcomes. The final result is that students were underrepresented as a whole. It is also notable that there were no studies assessing the impact of IPE delivered as part of a pre-licensure curriculum and following students' post-graduation to determine the impact that these experiences had on students' ability to provide evidence-based, collaborative care. Despite these results, there is limited evidence to suggest that health profession graduates who were exposed to IPE perceived better preparation for team-based collaborative practice. Future studies should consider exploring curricular IPE interventions and patient outcomes effectuated by graduates as this could become a potential recruitment tool.

Findings from this scoping review also highlighted that many of the IPE interventions occurred in North America (73%) and there is the possibility that due to differing healthcare systems outside of North America, results for any of the key measures could be different. Given the dominance of physicians and nurses in addition to the recent calls for interprofessional care in North America, it is not surprising that medicine and nursing were highly represented in IPE interventions (87% and 82%). Further, this was expected due to the quality health measures assessed for this scoping review. The disciplines of pharmacy and social work followed, after medicine and nursing, with significant underrepresentation from other disciplines (physical therapy, dietetics, respiratory therapy, occupational therapy, psychology, and midwifery). This represents an opportunity to better understand the impact of IPE collaborations with these underrepresented professions, and future research should explore novel partnerships.

Limitations

There are several limitations worth noting. We did not assess the reproducibility, quality, or rigor of studies, nor did we assess the cost or feasibility of interventions. While most clinical outcomes were positive, we did not assess for publication bias. Finally, we did not categorize the IPE interventions as they were too heterogeneous. Despite the limitations, a strength of this scoping review was that paired reviewers, representing a diverse, interdisciplinary group, were used to reduce the risk of bias. Forthcoming research will examine the process of conducting this review using interprofessional researchers.

Conclusions

To improve the quality of patient care, healthcare professionals must not only work together as a team but learn together as a team. Future IPE researcher should include the use of standardized, reproducible interventions that can be generalized to outside institutions; specify the number and specific roles each discipline played in the IPE and with patient outcomes; and explore the relative impact and importance of IPC on IPE interventions and consider utilizing both when designing interprofessional interventions.

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Virginia Uhley is an Associate Professor in the Department of Foundational Medical Studies and in the Department of Family Medicine and Community Health.

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