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Review Article

Research on the Application of Interprofessional Education in Patient Safety Education

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Abstract: This review of research from 2010 to 2025 shows that while interprofessional education (IPE) effectively reshapes how students approach patient safety—boosting both their collaborative attitudes and communication skills—it still struggles to bridge the gap between the classroom and the bedside. While models like high-fidelity simulation show promise, there is a distinct lack of hard evidence linking this training to actual changes in clinical behavior or improved patient health. Moving forward, the field needs to overcome practical hurdles like scheduling conflicts and rigid medical hierarchies by shifting focus from student feedback to real-world clinical outcomes, eventually folding IPE into a more standardized, integrated medical curriculum.

Keywords: Interprofessional Education; Patient Safety; Medical Education; Clinical Practical Training; Systematic Review

1. Introduction

1.1. Patient Safety: From Individual Error to System Defect

Patient safety is a core issue in modern healthcare quality management. The landmark report To Err Is Human, released by the Institute of Medicine in 1999, pointed out that tens of thousands of deaths occur annually in the United States due to medical errors, emphasizing the systemic nature of medical harm [1]. Subsequent research has further shown that most medical errors stem from system process defects rather than a lack of individual ability. The "Swiss Cheese Model" proposed by James Reason reveals the mechanism of error occurrence from a system engineering perspective, highlighting the cumulative effect of multi-layer defense failures. This theory has driven the paradigm shift of patient safety from "attributing to individuals" to "optimizing systems" [2]. However, traditional medical education has long adopted a "siloed" cultivation model, where students from different professions lack early collaborative training, which is considered one of the important roots affecting clinical team communication efficiency and patient safety [3].

1.2. Interprofessional Education: Concept and Development

Interprofessional education (IPE) is defined 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" [4]. The World Health Organization (WHO) explicitly stated in the 2010 Framework for Action on Interprofessional Education and Collaborative Practice that IPE is a key strategy for building efficient healthcare teams [3]. Studies have shown that IPE can improve the quality of communication among healthcare personnel, enhance team trust, and reduce the risk of medical errors to a certain extent [5].

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1.3. The Internal Relationship Between IPE and Patient Safety

Patient safety essentially depends on interprofessional collaboration. Whether it is medication management, perioperative communication, or critical value reporting, all involve information interaction between multiple professions. Communication failures have been proven to be one of the primary causes of adverse events [6]. IPE directly impacts patient safety by enhancing the following core competencies: role recognition and responsibility definition, team communication (such as the SBAR model), and conflict management and decision-making synergy. Therefore, this study systematically analyzes the action mechanism of IPE in patient safety education based on the logical chain of "educational intervention—competency enhancement—behavioral change—patient outcomes."

1.4. Limitations of Previous Reviews and the Innovation of This Study

Previous systematic reviews have mostly focused on the impact of IPE on learning attitudes, while lacking in-depth analysis of how it transforms into actual clinical behavior. For example, the Cochrane review by Scott Reeves et al. pointed out that evidence for IPE's impact on clinical outcomes remains limited [7]. The innovation of this study lies in: focusing on the vertical field of "patient safety," emphasizing the "clinical practical training" context, and constructing an integrated IPE-PS analysis framework.

2. Research Methods

2.1. Search Strategy

This study follows the PRISMA 2020 guidelines [8]. The following databases were systematically searched: PubMed, Web of Science, CINAHL, ERIC, CNKI, and Wanfang. The search time range was from January 2010 to December 2025. Example of English search strategy: ("interprofessional education" OR "IPE") AND ("patient safety" OR "medical error" OR "safety culture").

2.2. Inclusion and Exclusion Criteria

Inclusion criteria: P: Medical and related professional students or healthcare personnel. I: IPE intervention (participation of ≥2 professions). C: Routine teaching or no control. O: Patient safety-related outcomes. S: RCT, quasi-experimental, or mixed-methods studies. Exclusion criteria: Single-profession studies. No patient safety content. Editorials or full text unavailable.

2.3. Data Extraction and Quality Appraisal

Two researchers independently screened and extracted the data. Quality appraisal was conducted using the Joanna Briggs Institute (JBI) tools [9]. Educational effects were stratified according to the revised Kirkpatrick model: Level 1: Reaction, Level 2: Learning, Level 3: Behavior, Level 4: Results.

3. Results

3.1. Research Overview

Through a systematic review of the included studies, it can be found that the development of interprofessional education in the field of patient safety (IPE-PS) presents obvious stage-wise evolutionary characteristics. Since 2010, the number of relevant studies has continued to grow, a trend that became particularly significant after 2020,

likely related to the sharp increase in the demand for interprofessional collaboration capabilities against the backdrop of global public health events [10].

Regarding geographical distribution, existing research is mainly concentrated in developed countries in Europe and America, especially the United States, Canada, the United Kingdom, and Australia. These countries have a significant first-mover advantage in the construction of IPE curriculum systems due to the early inclusion of interprofessional collaboration in medical education certification standards (such as the ACGME and CanMEDS frameworks) [11]. In contrast, research in developing countries like China started later. Although the number of publications has grown rapidly in recent years, they are still mainly focused on the field of nursing education, and research on deep multi-disciplinary integration is still in the exploratory stage.

In terms of research design, quantitative research dominates, with quasi-experimental designs (one-group pre- and post-test) being the most common, while the proportion of randomized controlled trials (RCTs) is relatively low, which is related to the ethical and operational complexity of educational intervention research [4]. In recent years, mixed-methods studies have gradually increased; by integrating quantitative results with qualitative interviews, they can more deeply reveal the experience and cognitive transformation process of learners during interprofessional interactions [12].

3.2. Theoretical Basis: Mechanisms of Action for IPE-PS Courses

The effectiveness of IPE-PS courses is established on the cross-support of various educational and sociological theories. Shared Mental Models are considered the core mechanism for promoting efficient team collaboration, emphasizing that through joint training, team members form a consistent perception of task understanding, role division, and risk prediction, thereby achieving efficient synergy in complex clinical situations [13]. Additionally, Situated Learning Theory points out that knowledge acquisition depends on real or high-fidelity practical situations. By placing learners in simulated or real clinical environments, IPE can promote the gradual internalization of patient safety norms through the process of "legitimate peripheral participation" [14]. Social Capital Theory explains the mechanism of IPE from the perspective of relationship networks. Through interprofessional interaction, learners can establish trust and collaboration networks, thereby reducing communication costs and improving team performance [15]. Meanwhile, Transformative Learning Theory emphasizes that through reflection and critical dialogue, learners can break through the cognitive limitations of their original professional identity and reconstruct their understanding of other professions, a process that is significant for breaking down stereotypes in the medical hierarchical structure [16].

3.3. Curriculum Models: From Simulation to Clinical Practice

Current IPE-PS teaching models show a diversified development trend, mainly including high-fidelity simulation (HFS), Team-Based Learning (TBL), case-based workshops, clinical embedded teaching, and online/hybrid teaching. High-fidelity simulation is considered one of the teaching strategies with the most sufficient evidence; by constructing highly realistic clinical crisis scenarios (such as postoperative shock, acute allergic reactions, etc.), it significantly enhances learners' team communication skills and crisis resource management capabilities [17]. Especially in the training of the SBAR communication model, simulation teaching shows good consistency in effects. Team-Based Learning (TBL) and case-based workshops are widely used in patient safety knowledge teaching (such as medication safety and root cause analysis) due to their low cost and ease of promotion. Studies indicate that these teaching methods can significantly improve learners' systems thinking and problem-solving abilities [18]. Clinical embedded

IPE is considered a key path to achieving "transformation from knowledge to behavior." By conducting interprofessional rounds and case discussions in a real clinical environment, learners can directly participate in complex medical decision-making processes, thereby enhancing their actual collaborative abilities [19]. Furthermore, online and hybrid IPE developed rapidly in the post-pandemic era, significantly enhancing educational accessibility and flexibility. However, existing research points out that this model still has certain limitations in non-verbal communication and team emotional connection [20].

3.4. Evaluation System and Implementation Challenges

IPE teaching effects are typically evaluated based on the revised Kirkpatrick model, including reaction (Level 1), knowledge and attitudes (Level 2), behavioral change (Level 3), and patient outcomes (Level 4). Currently, most studies are concentrated at Levels 1–2. Commonly used tools include the Readiness for Interprofessional Learning Scale (RIPLS) and the Safety Attitudes Questionnaire (SAQ), which have good reliability and validity in assessing changes in learner attitudes [21, 22]. However, there is still a significant evidence gap in the transformation from attitude improvement to behavioral change. Few existing studies have been able to directly prove the impact of IPE interventions on clinical behavior (such as communication quality, error reporting) or patient outcomes (such as the incidence of adverse events) [4]. At the implementation level, the promotion of IPE faces multiple structural barriers. First, inconsistent scheduling across different professional curricula makes it difficult to conduct interprofessional courses regularly. Second, faculty members with interprofessional teaching capabilities are relatively scarce. Additionally, the traditional hierarchical culture within the medical system still restricts the implementation of equal collaboration concepts to a certain extent [23].

3.5. Current Status and Reflection of Domestic Research

China's IPE-PS research is in a critical stage of transition from a single profession to multi-disciplinary integration. Existing research mostly adopts small-sample quasi-experimental designs, primarily focusing on the short-term impact of teaching interventions on learning attitudes, with insufficient evidence regarding long-term behavioral transformation and clinical outcomes. In terms of teaching models, domestic research is mainly concentrated on TBL and case-based teaching, and the systematic exploration of high-fidelity simulation and clinical embedded IPE is still relatively limited, which restricts the in-depth expansion of teaching effects. Furthermore, current domestic research lacks breadth in the participation of professions; key professions such as pharmacy, rehabilitation medicine, and medical laboratory science have low participation rates, making it difficult to fully reflect the real clinical collaboration ecology. Notably, existing evaluation tools are mostly translated versions of foreign scales (such as RIPLS, SAQ). Although preliminary reliability and validity testing has been conducted, there are still limitations in cultural adaptability, and there is a lack of localized evaluation tools developed based on the characteristics of the Chinese healthcare system [22]. Therefore, future research needs to be further deepened in theoretical construction, multi-professional integration, and localized tool development to enhance the international influence and practical transformation value of China's IPE-PS research.

4. Discussion

4.1. Summary of Main Findings

This review systematically identified five core teaching models (HFS, TBL, case-based workshops, clinical embedded teaching, and online learning) in the current IPE-PS field, summarized key theoretical foundations such as Shared Mental Models and situated learning, and further integrated an evaluation system covering the dimensions of attitude, knowledge, and behavior. The results indicate that existing evidence consistently supports the significant effect of IPE in improving learners' interprofessional collaboration attitudes and enhancing patient safety awareness (Kirkpatrick Level 1–2) [10, 11]. However, this positive impact shows a significant decay when transforming to higher levels, meaning that evidence at the levels of behavioral change (Level 3) and patient outcomes (Level 4) remains limited. This phenomenon is consistent with previous systematic review results, suggesting a "translation gap" still exists between educational intervention and clinical practice [4]. From an educational mechanism perspective, this break may stem from the ecological difference between the learning context and the real clinical environment. Although high-fidelity simulation can effectively improve skill mastery, its role in promoting behavior migration in real complex systems remains limited [17]. Therefore, how to achieve an effective transition from "simulated competency" to "clinical competency" has become a key issue in current IPE-PS research.

4.2. Dialogue with Previous Reviews

This study has conducted important expansions based on existing evidence. Compared with the review by Aamir H. Guraya et al. (2018) on the overall effects of IPE [24], this study included the latest evidence on virtual simulation and remote collaboration teaching from the past five years, revealing the evolution trend of IPE teaching models in the context of digital transformation. Meanwhile, the results of this study are highly consistent with the interprofessional education action framework proposed by the World Health Organization, further validating its theoretical hypothesis that "collaborative learning promotes health outcomes" [4]. Unlike the Cochrane review by Scott Reeves et al. (2017), which mainly focused on the macro impact of IPE on clinical outcomes [4], this study further refined the micro-level implementation path of IPE in teaching by focusing on the specific vertical field of "patient safety," particularly emphasizing the key role of clinical practical training in competency transformation. This "macro to micro" analytical path helps to compensate for the deficiencies in teaching design found in previous studies.

4.3. Theoretical Contributions and Practical Implications

At the theoretical level, this study proposes an "IPE-PS integration framework," emphasizing interprofessional education as a "strategy" for enhancing patient safety competency, while treating patient safety outcomes as the "goal (outcome)" of IPE effectiveness evaluation. This framework breaks through the previous limitation of separate analysis of teaching methods and clinical results, helping to construct a more systematic medical education research paradigm. Additionally, this study identifies a key "black box" in current IPE research—namely, the psychological and social mechanisms from educational intervention to competency internalization remain unclear. Existing research indicates that the formation of interprofessional identity and the establishment of team trust play a mediating role in behavioral transformation, but the relevant mechanisms still lack systematic validation [25]. At the practical level, this study offers the following suggestions: Curriculum design level: It is recommended to adopt a "spiral curriculum structure," introducing IPE modules progressively at different stages of training to promote the continuous reinforcement and migration of abilities. Institutional level: Educational managers should break down administrative barriers between

disciplines through credit integration and collaborative course design, a point validated by various international experiences [11]. Clinical teaching level: Embedding IPE evaluation into daily clinical practice [such as rounds and case discussions] helps achieve the deep integration of teaching and medical services, thereby promoting actual behavioral change [26].

4.4. Research Limitations

This review has several limitations. First, the literature search was limited to Chinese and English databases, potentially omitting important research or grey literature from non-English speaking countries. Second, due to the tendency for positive results to be more easily published in medical education research, this study may be subject to publication bias. Furthermore, the included studies exhibit significant heterogeneity in terms of intervention form, duration, participating professions, and evaluation indicators, which limits the feasibility of conducting a meta-analysis. Similar issues have also been reported in related Cochrane Collaboration reviews. Finally, most studies lack long-term follow-up data, leaving the assessment of the long-term effects of IPE interventions with uncertainty, which is a common methodological challenge in the current field.

4.5. Future Research Directions

Based on the findings of this review, future IPE-PS research can proceed in the following areas: (1) Mechanism level: Adopt qualitative methods such as phenomenology or grounded theory to deeply explore the cognitive reconstruction process of learners during interprofessional interactions, thereby revealing the internal mechanism of how IPE affects patient safety behavior [27]. (2) Longitudinal studies: Conduct long-term follow-up studies from medical school education to the clinical practice stage to assess the sustained impact of IPE interventions on actual clinical behavior [28]. (3) Endpoint indicators: Design complex intervention studies to explore the direct impact of IPE on patient outcomes (such as error rates and readmission rates) to respond to the current problem of insufficient evidence [29]. (4) Evaluation tools: Develop a multi-dimensional evaluation system that possesses reliability, validity, and clinical applicability, particularly strengthening the use of objective behavioral observation and patient-reported outcomes (PROMs). (5) Localized research: Within the context of the Chinese healthcare system, explore IPE implementation paths that adapt to the characteristics of hierarchical structures and resource distribution, enhancing the context-suitability and international influence of the research. (6) Technical fusion: Combine virtual reality (VR), augmented reality (AR), and artificial intelligence technologies to construct high-risk collaborative training environments to improve teaching efficiency and reduce costs [30]. (7) Faculty development: Systematically construct an interprofessional education faculty training system to enhance teachers' comprehensive abilities in team guidance, situational simulation, and feedback evaluation, which is considered one of the key guarantee factors for the successful implementation of IPE (19).

5. Conclusion

The deep integration of interprofessional education and patient safety education is the core path to addressing the complexity of modern medical systems and cultivating collaborative, practice-oriented talents. This review confirms that diversified curriculum models such as high-fidelity simulation and team-based learning can significantly optimize students' readiness for collaboration and safety culture awareness, but there remains an evidence gap in the attribution analysis of behavioral transformation and clinical endpoint indicators. Current research is still hindered by realistic challenges such

as discipline institutional barriers, limited evaluation methods, and vague theoretical transformation mechanisms. Future efforts should be dedicated to constructing a longitudinal, empirical research system, developing multi-dimensional evaluation tools that fit the local context, and promoting the transition of interprofessional education from fragmented pilot programs to a standardized medical training system through policy guidance.

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