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Problem-based and related learning approaches in family medicine residency: a scoping review of four countries

Megan Clemens,[1] Josheil Kaur Boparai,[1] Russell Dawe,[1] Susan Avery[1]

[1]Faculty of Medicine, Memorial University of Newfoundland, Newfoundland, Canada

Correspondence to: Megan Clemens, Faculty of Medicine, Memorial University of Newfoundland, 300 Prince Phillip Dr., St. John's, NL A1B 3V6; email: Megan.clemens@mun.ca;

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Abstract

Background: Postgraduate medical education (PGME) bridges the transition from medical school to independent practice. Problem-based learning (PBL), widely used in undergraduate medical education, has emerged as a promising alternative to traditional lectures in PGME. However, its impact on family medicine training remains unclear.

Objective: In this scoping review, we describe the use of PBL in family medicine PGME programs and examine its educational and healthcare-related outcomes.

Methods: Using Arksey and O'Malley's methodological framework, we conducted a scoping review of PubMed, Embase, PsycINFO, ERIC, Web of Science, and ProQuest in January 2025. Two reviewers independently screened articles, extracting and synthesizing data according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).

Results: Twelve studies met inclusion criteria, illustrating diverse PBL delivery methods in family medicine PGME. Programs integrated PBL as standalone sessions, an adjunct, or blended with traditional methods. Learning groups often included mixed specialties (e.g., family medicine and internal medicine) and varied learner levels (e.g., residents and attending physicians). Most studies reported high learner satisfaction and improved perceptions of topics; however, objective assessments of knowledge, pre- and post-PBL, showed no significant improvement. Limited data on behavior and patient outcomes suggested potential benefits.

Conclusion: PBL in family medicine PGME appears to enhance engagement and satisfaction but shows mixed educational outcomes. Further research is needed to determine its optimal role in training.

Résumé

Résumé français à venir.

Introduction

Postgraduate medical education (PGME) encompasses training that follows medical school, including internships, residencies, and fellowships. PGME learners engage in both clinical work and structured educational activities. While their learning needs vary, traditional methods, such as lectures, including large group grand rounds and academic half-day lectures, remain common.[1] However, the passive learning that results from lectures may not fully achieve PGME goals, such as developing clinical reasoning, problem-solving skills, and knowledge retention.[2,3]

Problem-based learning (PBL) has emerged as a potential alternative or complement to traditional large group sessions. PBL, initially introduced by Dr. Howard Barrows in the 1970s at McMaster University for undergraduate medical education (UGME), is a process where learners address a clinical problem, generate and answer questions as they progress, and ultimately synthesize a solution.[4] Although PBL was not originally grounded in formal learning theory, subsequent scholarship has linked it to educational theories that help explain its processes and outcomes.[4] Over the past 50 years, PBL has become widespread in UGME and many other programs across North America globally crossing diverse cultural and educational contexts.[5] PBL's growing popularity stems from its association with substantial increased learner satisfaction and marginal long-term knowledge retention compared to lectures.[6,7]

PBL may suit PGME because it emphasizes active, clinically relevant learning.[8] Unlike UGME, PGME curricula are less exam-focused, making the memorization of facts less relevant.[9] These distinctions suggest that PGME programs may be equally or even more well-suited to using PBL for their academic learning. However, the flexibility and limited learning hours in PGME raise concerns about PBL's practicality.[9] This is particularly true for family medicine programs, which can be as short as two years.[10] Given the limited research on PBL in PGME,[7] especially in family medicine, further research is needed to understand its use and outcomes in this context.

The primary purpose of this scoping review is to examine how PBL is used in family medicine PGME programs. Where available, we also summarize the educational and healthcare outcomes associated with these interventions. The insights gained may help PGME programs implement or refine PBL approaches.

Methods

We conducted this scoping review using Arksey and O'Malley's methodological framework.[11] The six steps involved creating a research question, identifying relevant studies, selecting eligible studies, charting the data, and collating, summarizing, and reporting the results; the sixth, optional step involved stakeholder consultation.[12] Additionally, we followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines.[13]

Step 1: Identifying a research question

We posed the research question: How do PGME family medicine programs use PBL to deliver their curricula, and what are the reported associated learner and healthcare system outcomes?

Steps 2 and 3: Identifying relevant studies and selecting eligible studies

One author (M.C.) conducted a comprehensive search for studies that included three concepts: PBL, PGME, and family medicine. M.C. collected literature published in English from six databases: PubMed, Embase, PsycINFO, ERIC, Web of Science, and ProQuest Dissertations and Theses Global. Each database was searched from inception to January 7, 2025. The complete search strategy, developed in consultation with a research librarian, is presented in Appendix A.

We included English-language studies published in Canada, the United States, Australia, or the United Kingdom. We restricted the search to these regions due to their comparable family medicine training and accreditation standards.[14] We excluded studies that focused exclusively on UGME or post-PGME training (i.e., continuing professional development). Similarly, we excluded studies focusing solely on non-family medicine disciplines, as these did not address the shorter training duration and unique training needs of family medicine learners. We included studies that structured training around PBL or similar methods that focused on a problem or case, such as flipped classrooms, case-based learning, or team-based learning. We excluded studies based on lectures, seminars, experiential learning, simulations, or role-playing if they did not meet the prerequisite of being grounded in a specific problem. Only synchronous formats involving multiple learners, including in-person, virtual, or hybrid formats, were eligible for consideration. Synchronous training allows for real-time interaction and problem-solving among students, which are essential features of PBL.[15] These elements are more challenging to achieve in

asynchronous formats,[16] and as such, this review focused on synchronous delivery to better capture the dynamics and educational impact of PBL environments. The accepted studies provided sufficient descriptions of the PBL design, regardless of whether they reported the outcomes of their PBL methodology.

Two authors (M.C. and J.K.B.) independently screened studies for eligibility. Initially, they independently reviewed the titles and abstracts of the articles. Discussion and consensus between both authors (M.C. and J.K.B.) were used to resolve discrepancies. If consensus could not be reached, R.D. or S.A. were available for resolution; however, all conflicts were resolved through discussion without the need for escalation. Upon completing title/abstract screening, M.C. and J.K.B. independently reviewed the full-text articles using the same approach for any conflict resolution. Although we did not calculate a formal inter-rater reliability statistic, the use of independent screening followed by conflict resolution for any discrepancies is consistent with best practices in scoping review methodology.[13]

Step 4 and 5: Charting the data and collating, summarizing, and reporting the results

The lead author (M.C.) developed a standardized data charting form using Covidence (Appendix B). In accordance with the PRISMA-ScR guidelines[13] and Arksey & O'Malley methodological framework,[11] M.C. and J.K.B. extracted key study characteristics, including methods, participants, intervention, presence or absence of a comparison group, and outcomes, using Covidence. M.C. developed the extraction form based on the review objectives, including adapted Kirkpatrick Model levels and characteristics relevant to similar published scoping reviews, and iteratively refined during the data extraction process. We divided the articles between M.C. and J.K.B., with each author extracting data from their assigned articles and verifying the information extracted by their counterpart to ensure accuracy. Authors R.D. and S.A. then reviewed the extracted information and further reviewed the full text of selected articles where questions arose for clarification. All authors reached a consensus on the final list of accepted articles and completed the data charting.

Step 6: Stakeholder consultation

A formal stakeholder consultation was not conducted as this step is optional in the Arksey and O'Malley methodological framework.[11] However, throughout this review, co-authors R.D. (a family medicine residency Program Director) and S.A (a family medicine residency Curriculum Director) served as stakeholders. These individuals have direct experience with and a vested interest in PBL, as faculty involved in designing and implementing PBL for family medicine residents. Their combined perspectives as educators, administrators, and clinicians informed the interpretation of findings and the contextualization of PBL within PGME.

Kirkpatrick's Model of Training Outcomes

The Kirkpatrick Model describes training program outcomes[17] and has been adapted for use in medical education.[18] The original model includes four steps; trainees' reactions to a training program (Step 1); trainees' learning (Step 2); trainees' behavioral changes resulting from learning (Step 3) and the impact of training program on targeted outcomes (e.g., reduction of costs, reduction of turnover absenteeism etc.) (Step 4).[17] The adapted Kirkpatrick Model for medical education encompasses the same four levels, with some modification: the learners' satisfaction with program content and delivery (Level 1), change in opinion about the topic (Level 2A), change in knowledge and/or skills (Level 2B), change in behavior (Level 3), and patient outcomes (Level 4) (Figure 1). The adapted Kirkpatrick Model is a valuable tool for evaluating medical education programs as it references both learner and patient outcomes.

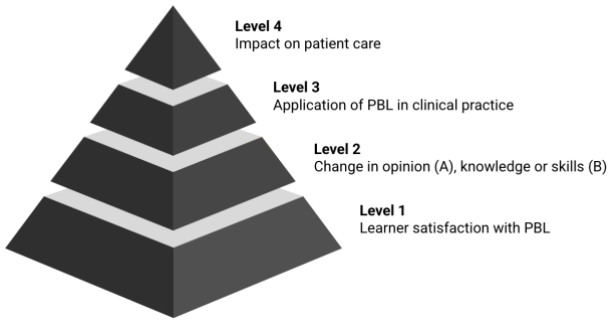

Figure 1. The adapted Kirkpatrick model has four levels to evaluate medical education program outcomes

In this scoping review, we used the adapted Kirkpatrick Model as an organizing framework to categorize the types of outcomes reported in the included studies. The inclusion criteria did not require a study to assess outcomes across all four levels. Instead, the model served to group studies by the outcomes they measured, allowing us to summarize how different types of outcomes were represented across the included studies and identify gaps for future research.

Data items

We extracted data on study identification, population details, intervention components, and outcomes. We categorized outcomes by adapted Kirkpatrick level to facilitate structured analysis (Appendix B). We simplified

partial findings from larger studies, ensuring that relevant data were included for synthesis.

Data analysis

Authors M.C. and J.K.B. reviewed the extracted data and used Braun and Clarke's six-phase thematic analysis methodology (Appendix C).[19] First, the authors re-read the extracted data, recording initial ideas for thematic codes. Next, the extracted data were systematically reviewed and manually coded. The coded and collated data were then sorted into potential themes, which were subsequently reviewed and refined. The fifth phase involved defining and naming the themes, which were then used to complete phase 6, wherein the extracted data was analyzed according to the corresponding themes. Authors R.D. and S.A. resolved any discrepancies about article inclusion.

Critical appraisal

We critically appraised the included articles using the JBI Critical Appraisal Checklist, which examined methodological rigor and reliability.[20] Either M.C. or J.K.B. appraised each article, focusing on key aspects of study design, including clarity of objectives, use of control groups, and appropriateness of statistical analysis.

Synthesis of results

Based on key variables and outcomes, including unique details about the PBL delivery and outcomes (if available), we organized the data by Kirkpatrick level. We summarized these findings both qualitatively and quantitatively to identify patterns, trends, and discrepancies.

We registered this scoping review with Open Science Framework.[21]

Results

Our search yielded 1566 articles after de-duplication. After title/abstract screening, we retained 59 articles for full-text screening. The most common exclusion reasons during full-text screening were incorrect learning type (*n* = 19), incorrect medical specialty (*n* = 10), and insufficient detail about the intervention (*n* = 7). We included 12 articles for data charting (Figure 2).

Of the included articles (Table 1), eight were from the USA, two from England, and two from Canada. Eight articles exclusively involved family medicine residents, while the remaining four included trainees from other specialties (e.g., internal medicine, pediatrics, or medicine-pediatrics) as well as family medicine. The residents involved in these training programs were from all years of training, ranging from the first to the third postgraduate year (PGY-1 to PGY-3). Most of the interventions included only PGME learners; however, four studies also included learners who were UGME learners, staff, or faculty. We classified 11 studies as quasi-experimental and one as a randomized controlled trial during critical appraisal. Despite the predominance of quasi-experimental designs, the overall methodological quality was rated as high for seven studies, moderate for one study, and low for four studies.

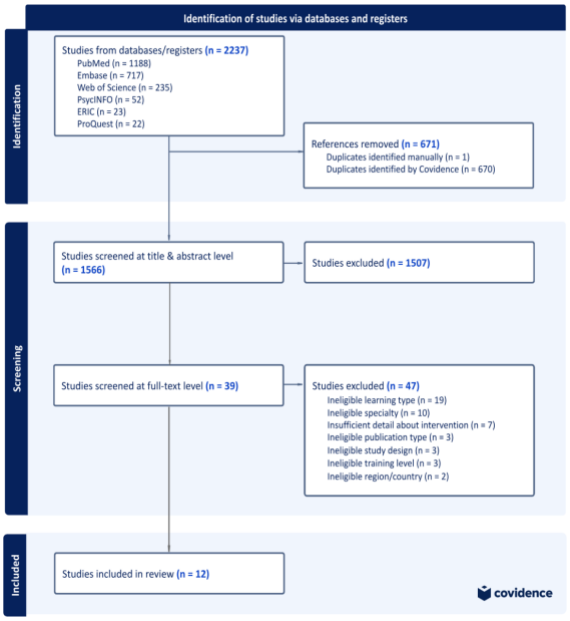

Figure 2. PRISMA flow diagram of studies identified, screened, and included for review

Since the eligibility criteria encompassed a range of methods aligned with core PBL principles such as flipped classrooms, case-based learning, and team-based learning, it is important to note that of the 12 included studies, only four[23,24,27,33] specifically examined interventions that closely adhered to classical PBL formats. Other studies incorporated PBL elements within broader educational interventions. For instance, Agrawal et al. used PBL components within an interactive workshop that included a presentation, a video demonstration, and both small- and large-group problem-based discussions.[22] Similarly, Klein et al. integrated PBL as part of a blended approach alongside journal club discussions and practice questions.[29] This variation reflects the flexible application of PBL principles within family medicine PGME curricula, highlighting the heterogeneity in implementation across studies.

Table 1. Summary of study characteristics and quality assessment

Study	Country	Population	Intervention	Comparison	Quality Assessment
Agrawal et al., 2004[22]	Canada	PGY-1 and PGY-2 FM residents	Faculty debate and large group discussion (part 1) followed by presentation and group PBL (part 2; 2 months later); topic = impact of pharmaceutical marketing	N/A	High
Benson et al., 2018[23]	United States	FM, IM, and transitional year residents	Five lecture sessions followed by one PBL session 9 months later; topic of local health disparities and diabetes-related topics	Same group of residents as the year prior, who completed lecture learning	High
Colenda et al., 2000[24]	United States	PGY-1 primary care residents, including FM, IM, medicine/pediatrics, OB/GYN, and others	PBL module on managed care organization and finances; part of a 10-module series	N/A	High
Cooper & Bartlam, 2001[25]	England	FM residents with prior experience, either in hospital or overseas	Weekly half-day course with the goal developing self-directed learners and reflective practitioners	N/A	Low
Danczak, 2012[26]	England	PGY-3 trainees in GP specialty training	Pre-work to research assigned questions, followed by "speed-dating" session where learners take on the role of examiner, examinee, or observer to answer aforementioned questions	N/A	Low
Haidet et al., 2004[27]	United States	Primary care residents, including FM, IM, and pediatrics	Assigned group problems to solve, with teacher-facilitated discussions in between each task	Residents from the same program undergoing slide-and-lecture teaching	Moderate
Holmes et al., 2012[28]	United States	PGY-1 through -3 FM residents based at a community hospital	Intervention with six components, one of which was a case-based seminar about breastfeeding as part of nursery/peds rotation	Another FM program with similar setting and patient population	High
Klein et al., 2008[29]	Canada	FM residents	Two academic half-days per month on the same medical topic, the first of which was lecture-based, with the second being small group learning including PBL	N/A	High
Philp et al., 1996[30]	United States	PGY-3 FM residents	Twice monthly conference where residents submit "difficult" patients to either be interviewed live or be verbally recounted, followed by discussion of the case and deficits in understanding	PGY-3 residents from previous years who received seminar format	Low
Raleigh et al., 2018[31]	United States	PGY-1 through -3 residents in FM from university, community, and military-based programs	Single "engaged classroom" session about management of dyspnea, including slides and a case-based active learning scenario for learners in small groups	Two other teaching models (slide-based and high-fidelity simulation) about the same topic	High
Sass & Edelsack, 2001[32]	United States	PGY-2 FM residents	Introductory lecture session followed by project assignment whereby small resident groups examined regional demographic data to theorize relationships causing patient morbidity	N/A	Low
Zimmerman et al., 1997[33]	United States	Primary care residents	Problem presentation meeting to learn the case and divide tasks amongst the group, followed by a problem resolution meeting to share gathered information and discuss in the context of the case	Small group multi-station clinical teaching scenarios (MCTS) where cases are addressed using provided reference material	High

PGY: postgraduate year; FM: family medicine; GP: general practitioner ; IM: internal medicine; OB/GYN: obstetrics and gynecology

PBL curriculum delivery

We found three distinct categories of synchronous approaches to integrating PBL into family medicine PGME curricula: 1) standalone, 2) adjunct, and 3) blended.

Standalone approaches utilize PBL as the primary instructional mode. For example, Colenda et al. implemented eight sessions exclusively based on PBL,[24] where residents engaged in small groups after reviewing preassigned materials to foster critical thinking and self-directed learning. Cooper and Bartlam described a weekly half-day course designed to accommodate the varied needs of residents with diverse levels of prior clinical experience, including international graduates and those transitioning from other careers.[25] Zimmerman et al. structured their sessions into two meetings: the first for case analysis and task assignment; the second for group discussion and synthesis.[33]

Adjunct approaches incorporate PBL into traditional curriculum delivery methods that may or may not have been previously established. For example, Klein et al. described a two-year rotating curriculum covering one topic each month across two academic half-days: the first as a large-group lecture session and the second as a small-group PBL session.[29] Benson et al. implemented a five-lecture series, followed months later by a PBL with group discussions and case-based learning.[23] Agrawal et al. paired a debate session on pharmaceutical marketing and a PBL session two months later, which discussed evidence-based practices and clinical scenarios.[22] These hybrid approaches leveraged the strengths of PBL while maintaining continuity with existing content and enhancing feasibility.

Blended approaches integrate PBL with previously established curriculum delivery methods. Philp et al. described a psychiatry conference where family medicine residents presented challenging or interesting cases with PBL supplementing these discussions.[30] Holmes et al. included a case-based seminar during an inpatient rotation, adding to insights from a lactation consultant that emphasized real-world significance.[28] Danczak featured an intervention with stations where learners rotated after a preparatory phase, incorporating PBL into problem-solving exercises.[26] Raleigh et al. featured an "engaged classroom" approach, combining slide- and case-based learning, which included scenarios and small groups to work through clinical decisions.[31] Haidet et al. interspersed teacher-led instruction within the PBL sessions after learners had the opportunity to solve the task in small groups.[27] Finally, Sass and Edelsack implemented PBL as a part of a small group project analyzing health disparities among the residents' communities.[32]

PBL curriculum outcomes

Eight studies evaluated *learner satisfaction*, corresponding to Level 1 of the adapted Kirkpatrick's Model, with each study primarily reporting high satisfaction with PBL.[24,27,30,33] The others found no significant differences or a preference for alternative methods. Faculty observers also valued PBL while assessing group dynamics, and learners generally participated equally, fostering collaboration and engagement.[26] Learners appreciated PBL's similarity to real-life medical cases and the required clinical reasoning process.[25,26] However, some concerns were raised about the initial difficulty of adapting to PBL,[32] and two studies found that PBL was not viewed as superior to common lecture-style sessions.[23,27] Specifically, Haidet et al. showed that learners demonstrated significant improvements in attitudes toward sensitivity, specificity and predictive value content ($p < 0.0001$) irrespective of whether they attended the PBL versus lecture-style delivery.[27] Another study found that multi-station clinical teaching scenarios had greater reported satisfaction than PBL, and were perceived as more valuable, although no statistical test was conducted to determine significance.[33]

Seven studies assessed *changes in learners' opinions* about the topic, corresponding to Level 2A of the adapted Kirkpatrick's Model. Four of these studies found shifts in perspective, such as the ethical appropriateness of pharmaceutical marketing ($p = 0.033$),[22] managed care's threat to the autonomy of healthcare providers (not statistically significant),[24] and the importance of under-vaccination as a national problem, with mean increases ranging from 0.9 to 1.2 points for childhood, adult, and Haemophilus influenzae type b vaccinations.[33] Other examples include learners developing more favorable attitudes and beliefs about breastfeeding ($p = 0.03$)[28] or considering patients' finances, cultural differences, and social support more often during diabetes consultations ($p > 0.05$).[23] Two studies noted no significant changes if learners held extreme pre-existing opinions, such as a negative perception of managed care[24] or a finding that diabetes education was valuable.[23] Researchers observed no significant changes in perception after the intervention in one study.[31]

Eight studies evaluated *changes in knowledge or skills,* corresponding to Level 2B of the adapted Kirkpatrick's Model. One study objectively measured knowledge before and after PBL using a 10-item multiple-choice test but found no statistically significant improvement in the mean

pre- vs. post-test (66.4% vs. 69.2% after PBL). The pass rate improved from 65% to 80%, though this difference was also not statistically significant.[24] Another study found that both PBL and multi-station clinical teaching scenarios significantly increased post-test scores (mean increase of 1.8 to 3.9 out of 10, $p < 0.01$), with quiz passing rates remaining high for both interventions. The superior method varied depending on the disease covered. Most studies have found no significant differences in knowledge gain or retention between lecture instruction and PBL when measured objectively.[23,27] However, one study reported greater knowledge following PBL ($p < 0.01$).[28] Three studies evaluated change in confidence: one reported increased self-reported confidence,[32] another found no significant change ($p > 0.05$),[22] and a third noted a 1.19% increase in comfort in managing a specific condition after PBL, which was significantly higher than lecture and simulation sessions ($p < 0.0001$).[31]

Three studies evaluated *behavior change* (subjectively measured), corresponding to Level 3 of Kirkpatrick's Model. Holmes et al. found that most participants implemented changes they had committed to three to six months after the intervention.[28] Benson et al. reported that most respondents referred patients for diabetes management self-education and assessed them for risk factors highlighted in the training. However, this was not a statistically significant change compared to the pre-intervention.[23] Agrawal et al. found a decrease in the use of pharmaceutical marketing tools post-intervention, such as a 25% drop in accepting gifts and a 17% drop in attending sponsored CME events, though this was not statistically significant ($p > 0.05$).[22]

One study evaluated *patient outcomes,* corresponding to Level 4 of adapted Kirkpatrick's Model. That study found significant differences in patients' breastfeeding rates among physicians who participated in the intervention compared to the control group. Patients whose physicians attended the intervention, which included case-based learning, showed significantly higher breastfeeding rates ($p < 0.001$) compared to learners at a similar program without this training (26% vs. 11% at 4 months and 30% vs. 9% at 6 months).[28]

Discussion

In our scoping review, we examined the utilization of PBL as a method of curriculum delivery in family medicine residency programs across the US, UK, and Canada. The studies we reviewed describe how faculty and programs actively use PBL to deliver family medicine curricula in PGME programs, and when available, the associated learner and healthcare system outcomes. Integrating PBL into PGME curricula followed three categories of approaches: standalone PBL,[24,25,33] PBL as an adjunct to traditional methods,[22,23,29] or blended PBL.[26-28,30-32]

The studies reviewed suggest high learner satisfaction with PBL (adapted Kirkpatrick Level 1), with many participants appreciating its real-life application and the collaborative nature of the learning process.[24,30,33] Students' learning approaches may explain the high learner satisfaction. Prior research suggests that learning approaches can be classified into two categories: surface and deep. Surface learning emphasizes memorizing facts without completely understanding the underlying mechanisms and principles. In contrast, deep learning involves a comprehensive understanding that allows learners to integrate new information, facilitating long-term retention.[34] At the postgraduate level, learners are likely to prioritize deep learning, which may explain their high satisfaction with PBL, as Gurpinar et al. found that students who adopted a deep learning approach were more likely to report greater satisfaction with PBL.[35] However, some learners expressed concerns about its initial difficulty and questioned its effectiveness compared to traditional methods and other non-traditional learning approaches within PGME curricula.[23,32] Learners may find PBL difficult due to the increased work it requires. Cook and Moyle demonstrated that although students appreciated PBL, it was challenging due to the active engagement it demands, requiring students to think critically and rationalize information rather than memorize it.[36] Nursing students participating in PBL reported improvements in critical thinking. However, they also noted increased effort, such as more reading and preparation before tutorials. While beneficial, this shift to active learning requires more time and effort from the learner. Given the immense volume of medical knowledge that must be mastered during medical school and residency and limited time available to learners,[37] it is understandable that some may question the effectiveness of PBL compared to other, less time-consuming methods.

Results were mixed regarding shifts in learner opinions (adapted Kirkpatrick Level 2A). While several studies have found that PBL encourages learners to engage more deeply with topics, the changes are often modest, such as bringing a topic to learners' attention[23] or emphasizing its importance.[28,33] Notably, learners with strong pre-existing opinions appeared less likely to alter their views,[23,24] suggesting that PBL may not equally benefit all participants. This points to the benefit of tailoring teaching

methods to the learners involved, if feasible, to maximize the impact of PBL. Prior research supports this notion, indicating that learner characteristics such as motivation, openness to feedback, and a growth mindset significantly influence the effectiveness of educational interventions, although these factors are themselves shaped by external and contextual influences, making the relationship complex.[38]

Evaluations of objective knowledge (adapted Kirkpatrick Level 2B) provided limited support for PBL, with knowledge improvements generally comparable to those achieved with other methods.[23,24,33] The exception to this was the studies that evaluated subjective reports of knowledge, which indicated greater perceived knowledge among participants after PBL.[28] Altogether, these findings raise some questions about PBL's effectiveness in achieving measurable improvements in knowledge acquisition and learning outcomes. However, it is essential to recognize that PGME training has broader objectives beyond knowledge, including long-term retention and fostering a motivating, student-centered learning experience,[39] which may contribute to the value of PBL.

We identified three studies assessing behavior change (adapted Kirkpatrick Level 3) and patient outcomes (adapted Level 4). For instance, several months after a PBL intervention, participants implemented several of the changes they had been taught,[28] such as more frequent referrals for at-risk patients.[23] Additionally, a study examining patient outcomes found measurable improvements, such as higher breastfeeding rates among patients of physicians who had participated in PBL.[28] As few studies assessed these outcomes, we cannot draw definitive conclusions regarding the benefit of PBL in these areas. Nonetheless, these findings suggest that PBL's real-life, scenario-based approach may facilitate the application of learned skills in clinical practice. This application aligns with Knowles' principles of adult learning, which emphasize that adult learners value relevant, practical, and immediately applicable methods.[40] Unlike traditional teaching methods, where knowledge is acquired in isolation and later applied, PBL integrates basic sciences and clinical practice, reflecting real-world complexities.[39] This relevance enhances motivation and long-term retention, as adults are more engaged when learning addresses real-life problems.[40] Additionally, PBL supports lifelong learning by fostering critical thinking, adaptability, and teamwork—skills essential for navigating the evolving healthcare landscape.[39] However, these studies did not compare how behavior changes between PBL and other teaching methods, indicating the need for further research to understand PBL's unique contribution to behavior change compared to alternative approaches.

Overall, these highlighted findings suggest the potential value of PBL in fostering engagement, shifting opinions, and promoting behavior change. However, more research is needed to fully understand the role of PBL within PGME curricula.

Strengths and limitations

This scoping review systematically mapped how PBL is currently implemented and evaluated within family medicine PGME programs. A key strength is the use of a structured search strategy across multiple databases and grey literature sources, along with duplicate screening and data extraction to enhance rigor. Applying the adapted Kirkpatrick Model provided a transparent framework for organizing heterogeneous outcomes and allowed for comparison across diverse evaluation levels.

One limitation is that the reviewed studies were not family medicine trainee exclusive; sessions also included mixed groups that combined family medicine with other disciplines (e.g., internal medicine;[23,24] obstetrics/gynecology and pediatrics[24]). This limitation is important to mention because PBL may function differently depending on the disciplinary context. Finally, while the adapted Kirkpatrick Model served as a pragmatic organizing framework, it may have underrepresented process-based benefits (e.g., enhanced teamwork, self-directed learning), particularly as many included studies prioritized outcome measures over nuanced process evaluations.

Future directions

Future studies should explore which aspects of PBL are most effective and beneficial for family medicine PGME learners. The effectiveness of PBL in PGME should be compared to traditional teaching methods before its broad implementation, given its requirement for a high faculty workload and specialized training.[42] Furthermore, the consistent use of a synchronous approach to PBL implementation across all included studies highlights the need for future research to compare these results to asynchronous environments. Asynchronous approaches have gained popularity and have been shown to foster commitment, discipline, reflection and critical thinking skills, all of which align with the core principles of PBL.[43]

Additionally, standardized and objective evaluations of PBL interventions are needed to better understand their impact on learner outcomes and patient care. Future

studies should include larger sample sizes, control groups and follow-up assessments to assess the long-term effects of PBL. Future research should investigate whether PBL is better suited for specific curricular topics, disciplines, and stages of PGME training, and compare its utility directly with other teaching methods.

Given the success of PBL in UGME, as evidenced by increased competence in social and cognitive dimensions,[44] further research should explore whether these benefits can be extended to PGME settings.

Conclusion

In this scoping review, we identified three categories of synchronous approaches to integrating PBL into family medicine residency training: 1) standalone, 2) adjunct, and 3) blended. These models were associated with improved learner engagement, attitudes, and, in some cases, changes in clinical behavior. Successful implementation depended on resident buy-in, protected time, and faculty preparedness. As family medical education evolves, PBL and related methods offer promising tools to support critical thinking and self-directed learning. Further research should compare these strategies to optimize family medicine residency training.

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Appendix A. Search strategy

Date of search: January 7, 2025

PubMed

("Education, Medical, Graduate"[Mesh] OR "post-graduate medical education"[tiab] OR "postgraduate medical education"[tiab] OR PGME[tiab] OR "medical residen*"[tiab] OR "graduate medical education"[tiab])

AND ("Problem-Based Learning"[Mesh] OR "PBL"[tiab] OR "case-based learning"[tiab] OR "CBCL"[tiab] OR "case-based collaborative learning"[tiab] OR "problem based learning"[tiab] OR "problem based"[tiab])

Embase

('postgraduate education'/exp OR residency training/exp OR 'postgraduate medical education':ab,ti OR 'pgme':ab,ti OR 'graduate medical education':ab,ti OR 'resident':ab,ti OR 'residency':ab,ti OR 'medical residen*':ab,ti)

AND (''problem based learning'/exp OR 'problem-based learning':ab,ti OR 'pbl':ab,ti OR 'case-based learning':ab,ti OR 'cbl':ab,ti OR 'case-based collaborative learning':ab,ti OR 'cbcl':ab,ti)

PsycINFO

(TI ("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR “medical residen*”) OR AB ("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR “medical residen*”))

AND (TI ("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL") OR AB ("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL"))

ERIC

(TI ("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR “medical residen*”) OR AB ("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR “medical residen*”))

AND (TI ("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL") OR AB ("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL"))

Web of Science

((TI=("postgraduate medical education" OR "pome" OR "graduate medical education" OR "resident" OR "residency" OR “medical residen*”)) OR AB=("postgraduate medical education" OR "pome" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR “medical residen*”)) AND ((TI=("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL")) OR AB=("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL"))

ProQuest

(ab("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR "medical residen*")

OR ti("postgraduate medical education" OR "PGME" OR "graduate medical education" OR "GME" OR "resident" OR "residency" OR "medical residen*"))

AND (ab("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL")

OR ti("problem-based learning" OR "PBL" OR "case-based learning" OR "CBL" OR "case-based collaborative learning" OR "CBCL"))

Appendix B. Data charting form

General information

Study ID number	
Title	
Author(s)	
Publication year	
Country in which the study was conducted	United States Canada England Ireland Other UK Australia Other

Methods

Objective of study	
Study funding sources	
Possible conflicts of interest for study authors	
Institution	
Population description	
Total number of participants	
Number of participants with available data	
Health profession(s) included as participants	Medicine (dr/resident/med student) Nursing Other
Medical training level(s) included	UGME PGME - resident PGME - fellow Staff/attending physician Other
Specialty(ies) included	Family medicine Internal medicine Emergency medicine Pediatrics Surgical Other
Describe the intervention in detail	
Development of intervention	
Learning topic	
Group size	
Group composition	
Pre-work for learners?	Yes No

	Not specified Other
Facilitator training level/profession	Resident Fellow Staff/attending physician Faculty Allied health professional Not specified Other
Facilitator background	Subject expert Not subject expert Not specified Other
How was the facilitator trained?	
Comparison group?	Yes No
If yes, describe comparison group	

Outcome

Summary of evaluation(s)	
Evaluation method(s)	Survey(s) Focus group Supervisor feedback Other
Time point(s) of evaluation	Pre-intervention During intervention Immediately post-intervention Later post-intervention Other
Describe evaluation 1	
Results of evaluation 1	
Describe evaluation 2	
Results of evaluation 2	
Describe evaluation 3+	
Results of evaluation 3+	
Evaluation of learner satisfaction (level 1)	Content Delivery Not evaluated Other
Findings of learner satisfaction (level 1)	
Evaluation of change in opinion (level 2A)	Subject/topic Not evaluated Other
Findings of change in opinion (level 2A)	
Evaluation of change in knowledge or skills (level 2B)	Subjective - knowledge Subjective - confidence

	Subjective - comfort Objective - knowledge Not evaluated Other
Findings of change in knowledge or skills (level 2B)	
Evaluation of behaviour change (level 3)	Intention to change Subjective - Behaviour has changed Objective - Behaviour has changed Not evaluated Other
Findings of behaviour change (level 3)	
Evaluation of patient outcomes (level 4)	Subjective Objective Not evaluated Other
Findings of patient outcomes (level 4)	
Analyzed subgroup differences?	Yes No Unclear
Subgroup findings, if applicable	

Appendix C. Thematic analysis summary table

Theme	Sub-Themes	Representative Studies	Kirkpatrick Level	Summary of Study Findings
PBL Curriculum Delivery	Standalone PBL	Colenda et al., (2000) Cooper and Bartlam, 2001 Zimmerman et al., (1997)	N/A	In addition to being used as a standalone approach, PBL was incorporated in traditional curriculum delivery methods such as didactic sessions, case-based learning and seminars.
	PBL as an adjunct	Klein et al., (2008) Benson et al., (2018) Agrawal et al., (2004)		
	Blended PBL	Philp et al., (1996) Holmes et al., (2012) Danczak (2012) Raleigh et al., (2018) Haidet et al., (2004) Sass and Edelsack, (2001)		
Learner Satisfaction	Real-life applicability Team-based collaboration Comparison to didactic sessions	Benson et al., (2018) Colenda et al., (2000) Cooper and Bartlam, 2001 Danczak (2012) Haidet et al., (2004) Philp et al., (1996) Sass and Edelsack, (2001) Zimmerman et al., (1997)	Level 1	Majority studies reported high satisfaction with PBL.
Changes in Learners' Opinions	Perspective Shifts Pre-existing opinions	Agrawal et al., (2004) Benson et al., (2018) Colenda et al., (2000) Holmes et al., (2012) Raleigh et al., (2018)	Level 2A	PBL was associated with changes in learners' opinions about topics in some studies but not all.
Knowledge or Skill Changes	Objective measures (e.g., pre and post-tests) Subjective measures (e.g., confidence and comfort)	Agrawal et al., (2004) Benson et al., (2018) Colenda et al., (2000) Haidet et al., (2004) Holmes et al., (2012) Raleigh et al., (2018) Sass and Edelsack et al., (2001) Zimmerman et al., (1997)	Level 2B	Objective test improvements were inconsistent. Self-reported knowledge and confidence showed some favorable results.
Behavior Change	Clinical decision-making Implementation of learned practices	Agrawal et al., (2004) Benson et al., (2018) Holmes et al., (2012)	Level 3	Learners reported applying training in clinical practice, such as increasing patient referrals or adopting breastfeeding support measures

Patient Outcomes	Improvement in patient health behaviors	Holmes et al., (2012)	Level 4	Exclusive breastfeeding rates improved among patients of physicians who had participated in a PBL-based intervention.