Original Research Paper

Exploring the role of leadership education in undergraduate medicine: a scoping review

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Abstract

Background: Leadership is increasingly recognized as a core competency in medical education, central to the CanMEDS framework and vital for patient safety, interprofessional collaboration, and healthcare innovation. Despite this awareness, undergraduate medical curricula traditionally underemphasize leadership training, leaving students underprepared for the complex non-clinical demands of modern healthcare. **Purpose:** This scoping review explores the role, design, and impact of leadership education in undergraduate medical education. The objective was to synthesize current initiatives, assess their effectiveness, and identify gaps and opportunities for strengthening student leadership development. **Methods:** A scoping review following the JBI methodology and reported in accordance with the PRISMA-ScR checklist was conducted. A comprehensive search of PubMed/MEDLINE was performed in May 2025 for English studies published from 2015–2025. Two reviewers independently screened titles, abstracts, and full texts using Covidence, with discrepancies resolved by consensus. Data were charted using a standardized spreadsheet capturing study design, population, intervention characteristics, and outcomes. Findings were synthesized thematically. **Results:** Of the 23 included studies, quantitative (35% [n=8]) and mixed-methods (30% [n=7]) designs predominated; qualitative studies accounted for 17% (n=4) and opinion pieces/commentaries for 13% (n=3). Most studies were conducted in the United States (43% [n=10]). Workshops or simulations were the most common intervention type (43% [n=10]), followed by curricular programs (22% [n=5]) and extracurricular initiatives (22% [n=5]). Across studies, outcomes were primarily short-term and self-reported (e.g., confidence/self-efficacy, leadership identity, and perceived skill gains), with limited objective assessment or longitudinal follow-up. Leadership frameworks (e.g., CanMEDS, MLCF, LID) were applied inconsistently. **Conclusions:** Undergraduate leadership development is a diverse but fragmented process; more coherent, longitudinal, competency-based integration and stronger evaluation approaches are needed.

Keywords: Leadership Education, undergraduate medical education, Leadership

Date submitted: 22-September-2025

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Citation: Sadeghighazichaki P, Golkar A, and Abdulla A. Exploring the role of leadership education in undergraduate medicine: a scoping review. Educ Health 2026;39:71-80

Online access: www.educationforhealthjournal.org
DOI: 10.62694/efh.2026.468

Published by The Network: Towards Unity for Health

Introduction

Medical school is a formative and challenging period that shapes students into future clinicians while fostering personal and professional growth. In this environment, learners are expected to adapt to rapidly changing clinical and societal contexts while acquiring the breadth of knowledge required to practice medicine competently. The CanMEDS framework identifies the multiple roles of a physician, including communicator, collaborator, leader, health advocate, scholar, and professional, underscoring that clinical expertise must be accompanied by a broad set of leadership competencies.[1] Although some leadership traits may be present before entry into medicine, the ability to lead requires intentional development and practice over time.[2]

By default, physicians are often placed in leadership roles, guiding patients, coordinating multidisciplinary teams, and mentoring trainees.[3] However, medical students frequently report a lack of confidence and preparation to assume leadership responsibilities in clinical settings, partly due to limited formal education and structured opportunities.[3,4] Moreover, factors such as the hidden curriculum and persistent gender disparities in leadership trajectories highlight inequities that leadership education must address.[5,6]

Leadership is not merely desirable but essential in modern healthcare. Evidence links strong physician leadership to better patient outcomes, improved team performance, and enhanced system efficiency.[2,7] Conversely, leadership deficits are associated with safety incidents, communication breakdowns, and poor organizational culture. The 2010 Lancet Commission called for transformational reforms in health professional education, highlighting leadership and interprofessional collaboration as critical competencies to meet 21st-century health system needs.[1]

In response, medical schools have implemented diverse leadership initiatives, ranging from short workshops and electives to longitudinal, competency-based programs.[8] However, these efforts remain fragmented and inconsistently evaluated, with no clear consensus on the optimal design, timing, or assessment of leadership curricula.[3,4] A contemporary synthesis of the evidence is needed to guide curriculum developers, inform accreditation standards, and ensure that graduates are prepared for the leadership challenges they will inevitably face.

This scoping review addresses this gap by systematically mapping recent literature on leadership education in undergraduate medical programs. We describe the prevalence and characteristics of interventions, summarize reported outcomes, and identify gaps and opportunities to strengthen leadership development during this crucial stage of medical training.

Building on earlier systematic reviews of leadership training in medical education[3,8] this scoping review provides a contemporary update (January 2015–May 2025), maps interventions across global undergraduate contexts, and adds a thematic synthesis of how programs are designed, implemented, and evaluated.

For consistency, we use the term "leadership development" as an umbrella descriptor encompassing leadership education and training initiatives.

Methods

Protocol and Reporting

This scoping review followed the Joanna Briggs Institute (JBI) methodology for scoping reviews and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.[34] The review process consisted of five stages: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) data charting, and (5) collating, summarizing, and reporting results — as described in Arksey and O'Malley's scoping review framework.[32]

Research Question

The review addresses the question: *"What leadership education initiatives have been described in undergraduate medical education, and what outcomes, impacts, and gaps have been reported?"*

Search Strategy

A comprehensive literature search was conducted in May 2025. The primary database searched was PubMed/MEDLINE. The search was restricted to articles published in **English** between January 2015 and May 2025 to capture initiatives reflecting contemporary competency frameworks such as CanMEDS 2015. The search strategy used was:

(((leadership [MeSH Terms]) OR ("leadership training" OR "leadership curriculum" OR "leadership education")) AND ((undergraduate medical education [MeSH Terms]) OR ("medical students" OR "undergraduate medical education"))) AND (teaching methods[MeSH Terms]))

Reference lists of included studies were hand-searched to identify additional relevant publications. Although this review primarily focused on PubMed, this limitation and its implications are acknowledged in the Discussion.

Eligibility Criteria

Studies were eligible for inclusion if they met the following criteria:

- **Population:** Undergraduate medical students in pre-clerkship or clerkship stages.

- **Concept:** Leadership education interventions (formal curricula, workshops, simulation, longitudinal programs, electives).
- **Context:** Undergraduate medical education settings worldwide.
- **Outcomes:** Reported leadership-related outcomes, including skill development, confidence, professional identity formation, career outcomes, team performance, quality improvement participation, or longitudinal impact.
- **Types of Evidence:** Empirical research (quantitative, qualitative, or mixed methods) published in peer-reviewed journals.

Exclusion criteria included:

- Non-English language studies.
- Studies focused solely on postgraduate or non-medical student populations.
- Papers addressing non-leadership curricula or not reporting leadership-related outcomes.

Study Selection

Search results were imported into **Covidence** for screening. Two reviewers independently screened titles and abstracts, followed by full-text review of potentially eligible articles. Discrepancies were resolved by discussion or, when necessary, by a third reviewer. A **PRISMA-ScR flow diagram (Figure 1)** summarizes the selection process.

Data Charting

A standardized data extraction form was developed a priori. Extracted variables included:

- Author(s) and year of publication
- Country and setting
- Study design and methodology
- Learner population and sample size
- Intervention characteristics (duration, delivery method, framework used)
- Outcomes measured and key findings

Data extraction was performed independently by two reviewers, with discrepancies resolved through consensus.

Data Analysis and Synthesis

A thematic synthesis was conducted following Braun & Clarke's six-phase approach.[33] A preliminary coding framework was developed a priori from the data charting fields and was refined iteratively during analysis (**Table 1**). Codes were generated inductively from included studies, grouped into descriptive categories, and consolidated into analytic themes through repeated team review and discussion. Trustworthiness was enhanced through structured coding meetings and maintenance of an audit trail documenting coding decisions and theme refinement.

Results

Study Selection

The PubMed/MEDLINE search identified 40 records. Following title/abstract screening, 8 records were excluded for not meeting eligibility criteria, leaving 32 reports sought for retrieval (0 not retrieved). Full-text assessment excluded 9 articles (wrong outcomes, n=6; wrong population, n=1; wrong intervention, n=2). Hand-searching reference lists did not identify additional eligible studies. In total, 23 studies were included (**Figure 1**).

Study Characteristics

Our search yielded 40 unique records, from which 23 full-text articles were included in the final analysis (**Table 2**). The majority of included studies employed quantitative methods (n=8, 35%) or mixed methods approaches (n=7, 30%). Qualitative studies (n=4, 17%), opinion pieces/commentaries (n=3, 13%), and surveys (n=1, 4%) were less commonly represented. Most studies originated from the United States (n=10, 43%), with additional representation from England (n=3, 13%) and Germany (n=3, 13%), as well as Iran, Thailand, Norway, Australia, Scotland, Pakistan, and Canada (each n=1, 4%). Publication years ranged from 2015 to 2025, with the highest concentration of articles published in 2018 (n=6, 26%). Study characteristics are summarized in (**Table 3).**

Incorporation of Leadership Frameworks

Many studies either explicitly utilized leadership frameworks as a means of leadership education or

Table 1: Scoping review coding framework for thematic analysis

Coding Categories	Subcategory Coding
Leadership Framework Utilized	1. Explicit leadership framework mentioned 2. Implicit or partial framework usage 3. No explicit framework used
Teaching Methods Employed	1. Simulation-based learning 2. Problem-based and case-based learning 3. Experiential and active learning 4. Mentorship and coaching 5. Didactic and lecture-based methods 6. Reflection and feedback methods 7. Technology-enhanced learning
Assessment Methods Employed	1. Survey-based assessment 2. Reflection-based assessment 3. Behavioural observation assessment 4. Knowledge-based testing 5. Project and portfolio assessment 6. Focus groups and qualitative methods 7. Peer assessment methods 8. No assessment methods
Themes for Analysis	1. The imperative for leadership education in modern medicine 2. Effectiveness of leadership education interventions 3. Critical competencies for medical leadership 4. Optimal education approaches 5. Implementation challenges and solutions 6. Optimal program characteristics 7. Outcomes and impact measurement 8. Future directions and recommendations

Figure 1: PRISMA flow diagram for scoping review and inclusion and exclusion.

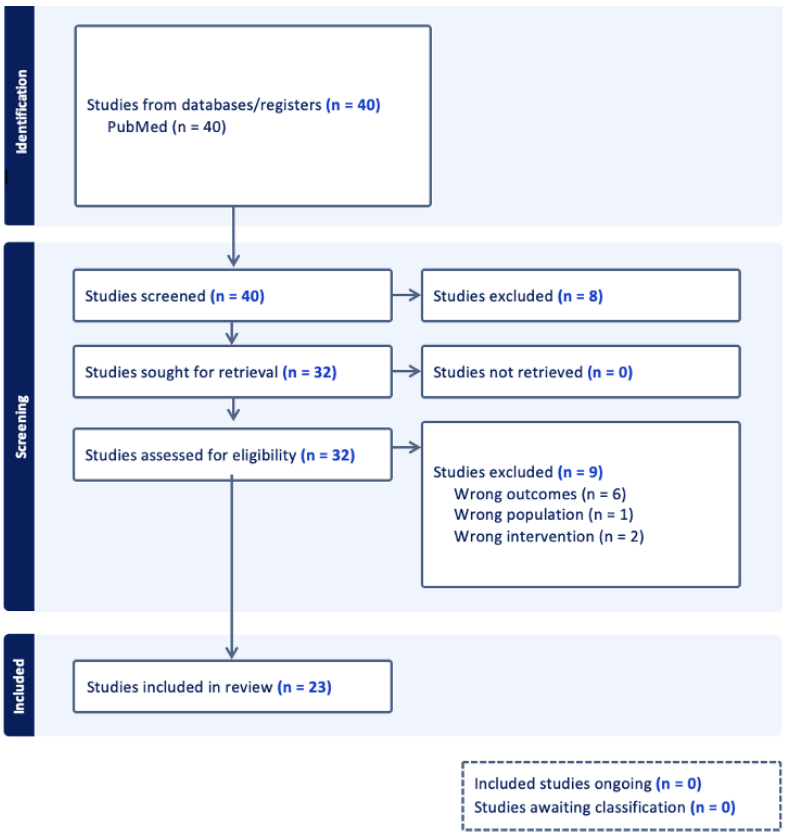

Table 2: Included studies' publication information, study design, and study characteristics

Paper Number	Paper Title	Publication Year	Journal	Study Design	Sample Size / Participants	Level of Learners (e.g., pre-clerkship, clerkship)	Setting (e.g., classroom, clinical, extracurricular)	Type of Intervention (e.g., curriculum, workshop, elective)
1	A first-year leadership programme for medical students.	2019	*The Clinical Teacher*	Mixed Method	71	Pre-clerkship	Extracurricular	Curriculum
2	A simulated night shift in the emergency room increases students' self-efficacy independent of role taking over during simulation.	2016	*BioMed Central Medical Education*	Quantitative	18	Clerkship	Clinical	Workshop/Simul-ation
3	Assessing curriculum effectiveness: a survey of Uniformed Services University medical school graduates.	2015	*Military Medicine*	Survey	1189	Medical graduates	Extracurricular	Other
4	Assessment of medical students' leadership traits in a problem/case-based learning program.	2018	*Medical Education Online*	Quantitative	84	Pre-clerkship	Mixed	Curriculum
5	Challenges in Translation: Lessons from Using Business Pedagogy to Teach Leadership in Undergraduate Medicine.	2017	*Teaching and Learning in Medicine*	Qualitative	62	Pre-clerkship	Classroom	Course
6	Comparison of knowledge and confidence between medical students as leaders and followers in simulated resuscitation.	2020	*International Journal of Medical Education*	Quantitative	139	Clerkship	Clinical	Workshop/Simul-ation
7	Developing non-technical ward-round skills.	2015	*The Clinical Teacher*	Qualitative	206	Clerkship	Mixed	Workshop/Simul-ation
8	Examining participant perceptions of an interprofessional simulation-based trauma team training for medical and nursing students.	2018	*Journal of Interprofess-ional Care*	Mixed Method	310	Both	Mixed	Workshop/Simul-ation
9	Experiential learning, leadership, medical students and the army.	2015	*Education for Primary Care*	Qualitative	-	Pre-clerkship	Mixed	Workshop/Simul-ation
10	Innovation and entrepreneurship programs in US medical education: a landscape review and thematic analysis.	2017	*Medical Education Online*	Mixed Method	62	Both	Mixed	Workshop/Simul-ation
11	Leadership and academic medicine: preparing medical students and residents to be effective leaders for the 21st century.	2018	*MedEdPortal*	Mixed Method	85	Not specified	Classroom	Workshop/Simul-ation
12	Leadership identity development through reflection and feedback in team-based learning medical student teams.	2018	*Teaching and Learning in Medicine: An International Journal*	Quantitative	110	Pre-clerkship	Not specified	Other
13	Learners as leaders: a global groundswell of students leading choosing wisely initiatives in medical education.	2019	*Academic Medicine*	Opinion piece/comm-entary	-	Not specified	Not specified	Other
14	Maximising the fourth year of medical school.	2016	*The Clinical Teacher*	Opinion piece/comm-entary	-	Not specified	Not specified	None
15	Non-traditional skills in undergraduate medical education — the development of a teaching programme.	2018	*Scottish Medical Journal*	Quantitative	50	Clerkship	Not specified	None
16	On the road to becoming a responsible leader: A simulation-based training approach for final year medical students.	2017	*GMS Journal for Medical Education*	Quantitative	37	Clerkship	Mixed	Workshop/Simul-ation
17	Operationalizing a 3-year standalone, accelerated medical school curriculum to nurture physicians to become primary care and health system leaders.	2024	*Medical Education Online*	Opinion piece/comm-entary	45	Both	Mixed	Curriculum
18	Promoting leadership and teamwork development through Escape Rooms.	2018	*Medical Education*	Qualitative	26	Both	Extracurricular	Workshop/Simul-ation
19	Reciprocal benefit to senior and junior peers: An outcome of a pilot research workshop at medical university.	2015	*Journal of Pakistan Medical Association*	Quantitative	20	Both	Extracurricular	Workshop/Simul-ation
20	Student leadership development initiative: a pilot for a sustainable, replicable model for incorporating leadership into medical education.	2019	*Wisconsin Medical Journal*	Mixed Method	58	Both	Extracurricular	Other
21	Surgeons' participation in the development of collaboration and management competencies in undergraduate medical education.	2020	*PLOS ONE*	Quantitative	8	Not specified	Classroom	Other
22	The health innovations scholars' program: a model for accelerating preclinical medical students' mastery of skills for leading improvement of clinical systems.	2016	*American Journal of Medical Quality*	Mixed Method	6	Pre-clerkship	Clinical	Curriculum
23	Uncover it, students would learn leadership from Team-Based Learning (TBL): The effect of guided reflection and feedback.	2017	*Medical Teacher*	Mixed Method	206	Pre-clerkship	Classroom	Curriculum

implicitly included it. Overall of the 23 papers included, 7 papers (35%) used frameworks explicitly.[9–15] 4 papers had partial references to leadership frameworks but these were not explicitly outlined.[16–19] The remaining 12 papers did not discuss leadership frameworks.[20–31] The leadership frameworks referred to included the CanMEDs, Medical Leadership Competency Framework (MLCF), Leadership Identity Development (LID) Model, Leadership Traits Questionnaire (LTQ), Accreditation Council for Graduate Medical Education (ACGME) Competencies Framework, and an Institutional-Specific Framework. The studies with implicit references to leadership frameworks referred to Kirkpatrick's Evaluation Model, Experiential Learning Theory, and business leadership concepts.

Curricula Characteristics

Across the 23 included studies, the level of learners targeted by leadership education initiatives varied. Pre-clerkship students were the most frequently engaged (n = 7, 30%), followed by programs spanning both pre-clerkship and clerkship years (n = 6, 26%). Fewer initiatives focused exclusively on clerkship students (n = 5, 22%) or medical graduates (n = 1, 4%), while several did not specify the level of learner (n = 4, 17%) (see **Table 4**).

Leadership training was delivered in diverse settings, most commonly in mixed environments combining classroom, clinical, and/or extracurricular contexts (n = 7, 30%). Standalone extracurricular programs accounted for nearly a quarter of studies (n = 5, 22%), while interventions delivered solely in the classroom (n = 4, 17%) or clinical setting (n = 3, 13%) were less frequent. In four studies (17%), the setting was not specified.

With respect to intervention type, workshops or simulations were most prevalent (n = 10, 43%), followed by structured curricula (n = 5, 22%) and other modalities such as electives or leadership-focused projects (n = 5, 22%). Collectively, these

Table 3: Study Characteristics

Study characteristic	No. (%) of studies. (n=23)
Study type	
Mixed Method	7 (30%)
Quantitative	8 (35%)
Qualitative	4 (17%)
Opinion piece/commentary	3 (13%)
Survey	1 (4%)
Study location	
United States	10 (43%)
England	3 (13%)
Germany	3 (13%)
Iran	1 (4%)
Thailand	1 (4%)
Norway	1 (4%)
Australia	1 (4%)
Scotland	1 (4%)
Pakistan	1 (4%)
Canada	1 (4%)
Year of publication	
2015	4 (17%)
2016	3 (13%)
2017	4 (17%)
2018	6 (26%)
2019	3 (13%)
2020	2 (9%)
2024	1 (4%)

findings highlight the breadth of approaches to leadership training, though they also underscore variability in learner level, educational setting, and intervention design.

Thematic Findings

Theme 1: The Imperative for Leadership Education in Modern Medicine

Modern healthcare requires physicians to be both clinical experts and system leaders, managing change, interprofessional collaboration, cost pressures, and equity challenges.[9,16,25,31] Leadership competencies are essential for value-based care, quality improvement, and population health initiatives that extend beyond traditional clinical training.[25,31] Yet, a persistent gap remains between what medical schools teach and the skills new physicians need.[25,28] Many junior doctors report feeling unprepared for leadership responsibilities, contributing to stress and attrition from training programs.[9,28] Historically, leadership was seen as an outcome of technical expertise rather than a teachable skill.[13] Evidence now supports integrating leadership education early to align training with real-world demands and reduce patient safety risks.[16,19,23,31] Deficiencies in non-technical skills correlate with longer hospital stays, morbidity, and mortality, whereas programs that emphasize teamwork and communication improve outcomes and confidence.[19,23]

Theme 2: Effectiveness of Leadership Education Interventions

Structured interventions effectively build leadership competencies. Simulation-based programs significantly improved communication, perspective-taking, and conflict resolution, with 43% of participants demonstrating sustained behavioral change 12–18 months later.[13] Programs like HISP produced measurable gains in leadership (18.4%), quality and safety (14.7%), and health systems knowledge (21.2%) and generated "spread events" where students initiated quality improvement projects at their home institutions.[31] Leadership training also strengthens identity formation: structured reflection advanced students through developmental stages,[12] and initiatives such as Student Leadership Development Initiative (SLDI) left 78% of participants feeling prepared to lead teams and 93% reporting new improvement strategies.[14]

Theme 3: Critical Competencies for Medical Leadership

Seven non-technical skill domains including situational awareness, decision-making, communication, teamwork, leadership, stress management, and task management are crucial for safe, efficient care.[19] Simulation-based training improved students' insight into ward challenges and empathy for patients and teams.[19] Interprofessional training allowed learners from multiple professions to practice collaborative leadership, improving confidence, stress management, and situational awareness.[13,22] Programs that emphasize systems thinking and innovation help graduates function as "health system change agents", improve discharge processes, and foster ongoing institutional innovation.[18,24,31]

Theme 4: Optimal Educational Approaches

Experiential learning consistently outperforms didactic teaching for leadership development.[16,23,29] Programs such as military-style team challenges and escape rooms enhanced communication, teamwork, and self-awareness, with students preferring these hands-on approaches over lectures. Mentorship and small-group sessions with physician leaders provided career guidance and modeled empathy and motivation, inspiring students to pursue further leadership opportunities.[14] Structured reflection and multi-source feedback advanced professional identity development, improved self-awareness, and reinforced leadership behaviors.[9,12,32]

Theme 5: Implementation Challenges and Solutions

Major barriers include packed curricula, student skepticism, and difficulty aligning early training with clinical priorities.[16,28,32] Programs were most successful when they clearly linked leadership concepts to clinical relevance and patient outcomes.[18] Business-school pedagogy often failed when applied directly; effective curricula required healthcare-specific cases and facilitators familiar with medical culture.[33] Faculty development is critical, as skilled instructors and simulation resources are needed for meaningful training.[13] Student buy-in improves when the purpose of leadership training is explicit and timed to coincide with clinical experiences.[9,16,33]

Theme 6: Optimal Program Characteristics

Best practices include early introduction with longitudinal reinforcement, mission-aligned curricula, and alignment with competency frameworks such as CanMEDS or ACGME.[10,13–15] Multi-modal assessment combining self-, peer-, and faculty evaluations more accurately measures growth.[11] Student-led initiatives like STARS demonstrate global scalability and the benefits of peer-assisted learning.[26,30]

Theme 7: Outcomes and Impact Measurement

Leadership education improves knowledge, confidence, problem-solving, and self-awareness, all directly linked to patient safety.[20,23,31] These skills are retained when applied through experiential learning, as shown by sustained positive behaviors after training.[31] Programs also enhance team functioning, reduce errors, and improve organizational outcomes by teaching students to leverage team member strengths and maintain situational awareness.[22,31,36] Nearly half of participants in leadership programs report career influence, shaping future professional development and choice of roles.[14]

Theme 8: Future Directions and Recommendations
Future efforts should embed leadership training systematically throughout undergraduate education, with repeated, competency-based exposure.[9,13] Interprofessional and collaborative models should mirror real-world team dynamics and reduce hierarchies.[12] Innovation and entrepreneurship content will prepare students to lead technological and systemic change.[24] Finally, globally scalable, adaptable frameworks such as STARS can standardize leadership training across diverse contexts, ensuring equitable preparation for all medical graduates.[26]

Discussion

This scoping review synthesizes contemporary undergraduate leadership development initiatives (2015–2025) and, through thematic synthesis, identifies common approaches, reported outcomes, and persistent gaps. While most programs reported positive learner-level outcomes, the evidence base remains heterogeneous in design, content, and evaluation.

A central finding is the fragmentation of leadership models and frameworks used across programs. Although some initiatives aligned with established frameworks (e.g., CanMEDS, MLCF, Leadership Identity Development), many did not specify an organizing model, limiting comparability and complicating curriculum design. One pragmatic pathway toward coherence is to define a minimum set of priority leadership competencies for undergraduate medicine and map local curricula to these shared domains, allowing contextual flexibility while improving alignment and assessment.

Across studies, evaluation most often relied on short-term self-report measures (e.g., confidence, self-efficacy, or perceived skill gains), with few objective assessments or longitudinal follow-up. Future work would be strengthened by using observable performance-based assessments where feasible (e.g., simulated or workplace-based team leadership tasks), multi-source feedback, and follow-up designs that examine sustained behaviors and downstream educational or clinical impacts. Applying structured evaluation frameworks (e.g., Kirkpatrick's levels)[35] may also support more consistent reporting and comparison across programs.

The geographic distribution of evidence was concentrated in North America and Europe, with limited representation from low- and middle-income countries. This matters because feasibility and scalability of leadership development often depend on faculty availability, protected time, and access to simulation or interprofessional programming. Resource-sparing strategies such as near-peer facilitation, integration with existing quality improvement or community health activities, and modular curricula may be particularly relevant for broader global implementation.

Based on the included literature, practical recommendations can be made more specific:
1. Prioritize competency domains commonly reported across programs (communication, teamwork, conflict management, systems thinking, and quality improvement)
2. Integrate leadership development longitudinally within existing courses and clinical placements, rather than as standalone electives
3. Invest in faculty development (e.g., train-the-trainer, shared teaching materials, and feedback coaching)
4. Pair curricula with an explicit assessment plan that aligns outcomes to targeted competencies.

Limitations of this review include restriction to PubMed/MEDLINE and English-language publications, which may underrepresent leadership development work published in education or social science journals. Although reference list hand-searching was performed, no additional eligible studies were identified beyond database results. These constraints should be considered when interpreting the breadth and global representativeness of the findings.

Conclusion

This review highlights the urgent need to embed leadership education systematically across undergraduate medical curricula. Evidence consistently supports early, longitudinal, and competency-based approaches that prioritize

experiential learning, structured reflection, interprofessional collaboration, and authentic quality improvement projects. As healthcare systems shift toward team-based, value-driven models, cultivating physician-leaders is no longer optional but essential for improving patient outcomes and driving system transformation.

Rather than treating leadership as an innate trait or a byproduct of clinical experience, medical education must deliberately develop these skills as a core across the board professional competency. Institutions that adopt integrated, evidence-informed leadership curricula will not only better prepare graduates for the leadership challenges they will face but also contribute to building a more resilient, innovative, and patient-centered health system. Future research should focus on evaluating the long-term impact of these interventions on clinical performance, team outcomes, and health system improvement.

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