

Leadership Training in Graduate Medical Education: A Systematic Review

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ABSTRACT

Background Leadership is a critical component of physician competence, yet the best approaches for developing leadership skills for physicians in training remain undefined.

Objective We systematically reviewed the literature on existing leadership curricula in graduate medical education (GME) to inform leadership program development.

Methods Using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, we searched MEDLINE, ERIC, EMBASE, and MedEdPORTAL through October 2015 using search terms to capture GME leadership curricula. Abstracts were reviewed for relevance, and included studies were retrieved for full-text analysis. Article quality was assessed using the Best Evidence in Medical Education (BEME) index.

Results A total of 3413 articles met the search criteria, and 52 were included in the analysis. Article quality was low, with 21% (11 of 52) having a BEME score of 4 or 5. Primary care specialties were the most represented (58%, 30 of 52). The majority of programs were open to all residents (81%, 42 of 52). Projects and use of mentors or coaches were components of 46% and 48% of curricula, respectively. Only 40% (21 of 52) were longitudinal throughout training. The most frequent pedagogic methods were lectures, small group activities, and cases. Common topics included teamwork, leadership models, and change management. Evaluation focused on learner satisfaction and self-assessed knowledge. Longitudinal programs were more likely to be successful.

Conclusions GME leadership curricula are heterogeneous and limited in effectiveness. Small group teaching, project-based learning, mentoring, and coaching were more frequently used in higher-quality studies.

Introduction

There have been numerous calls to increase leadership development for physicians in training.^{1–3} Observational data have suggested that patient outcomes are improved with physician leadership.⁴ Some evidence also suggested residents are not prepared for informal or formal leadership roles following graduation.^{1,5} Without formal training, physician leadership development can occur through “accidental leadership.”^{1,6,7}

The Accreditation Council for Graduate Medical Education (ACGME) identified practice-based learning and improvement, interpersonal and communication skills, and systems-based practice as core competencies, all of which contain elements of leadership competencies.⁸ The CanMEDS framework used by the Royal College of Physicians and Surgeons of Canada renamed the role of “manager” to “leader.”⁹ The Academy of Medical Royal Colleges

developed a Medical Leadership Competency Framework (MLCF) composed of 5 categories.¹⁰ These examples illustrate the support of graduate medical education (GME) accrediting bodies for leadership training for residents.

There are numerous resources for leadership development,^{11,12} but the literature specific to undergraduate medical education and GME is limited.^{13,14} Frich et al¹⁴ identified 45 physician leadership programs, including 26 aimed at individuals in GME. They reported an impact on knowledge, but few studies explored behaviors or higher-level outcomes, and noted deficits in interprofessional and experiential learning methods. Our review updates and expands the work of Frich et al and aims to identify common elements, best practices, and current gaps in GME leadership curricula.

Methods

Literature Search

We conducted a systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards and Association for Medical Education in Europe (AMEE) Guide 94.^{15,16}

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Editor's Note: The online version of this article contains a table of the overview and outcomes of graduate medical education leadership curricula.

Three databases were searched by a professional medical librarian (S.C.) in August 2014 for relevant English-language studies: MEDLINE, ERIC, and EMBASE. MedEdPORTAL was searched for relevant curricula. Literature search strategies used a combination of subject headings and key words relating to leadership, training, and GME. An updated search was completed in October 2015. Reference lists of articles selected for full-text review were hand-searched for additional articles.

Eligibility Criteria

Eligible manuscripts had to be full-length, peer-reviewed publications or MedEdPORTAL resources outlining programs to teach leadership in GME. As multiple definitions of leadership exist, broad inclusion criteria were used to maximize examples of leadership curricula. Articles were excluded if they solely addressed professionalism or teamwork in a particular setting (eg, running codes or operating room teamwork). Due to our interest in generalizable leadership curricula, we excluded curricula unique to specific settings.

Article Review Process

A total of 3413 abstracts were independently reviewed by 2 authors (B.S. and J.D.H.; see the FIGURE). Discordant abstract decisions were reconciled by the reviewers. We retrieved 201 articles for full-text review, and we deemed 52 eligible for inclusion ($\kappa = 0.921$, 95% confidence interval 0.853–0.989).

Two reviewers (B.S. and J.D.H.) independently extracted data from the 52 articles^{7,17–67} using a standard data collection form that included specialty, training setting, trainee level, curriculum length, methods of instruction, use of mentors or coaches, experiential projects, educational theory, and MLCF competencies (demonstrating personal qualities, working with others, managing services, improving services, and setting direction).¹⁰ The quality of each article was scored from 1 (no clear conclusions) to 5 (results are unequivocal) based on Best Evidence in Medical Education (BEME) Guide No. 13.⁶⁸ Modified Kirkpatrick outcome levels (TABLE 1) were used to determine program effectiveness.^{69,70} Disagreement was uncommon, and it was reconciled using joint discussion with a third party (A.B.).

Data Analysis

Three authors (B.S., A.B., and J.D.H.) reviewed the data and determined frequencies for the specific curricular components. We independently identified common elements of leadership curricula and their

evaluations, and we summarized them through a collaborative process, using consensus to arbitrate areas of disagreement.

Results

Program Descriptions

Of the 52 publications between 1991 and 2015, 34 (65%) were published in the last 5 years.^{7,17–67} Key findings are presented in TABLE 1, with specific characteristics and overview findings presented in TABLES 2 and 3 (and online supplemental material), respectively. Only 11 studies (21%) were deemed to have a BEME quality score 4 or 5. A majority (58%, 30 of 52) included primary care programs (family medicine, internal medicine, pediatrics, psychiatry); surgical (35%, 18 of 52) and subspecialty (33%, 17 of 52) programs were represented less frequently. Only 7 of 52 programs (13%) included multiple disciplines,^{7,20,31,33,40,47,65} and 1 study was interprofessional.³⁸ Eight curricula (15%) were designed solely for chief residents.^{21,28,29,47,49,50,59,65}

The majority of curricula reported using classroom-based learning (83%, 43 of 52) and small groups (69%, 36 of 52) to deliver the educational content. Of the 52 programs, 44 (85%) identified faculty as teachers, and 29 (56%) used outside consultants. Program length varied from isolated experiences (23%, 12 of 52) to serial lessons over a defined period (37%, 19 of 52) to longitudinal programs (40%, 21 of 52). Three programs (6%) required an extension in training.^{7,22,33} Teamwork and models of leadership were the most common content (TABLE 1).

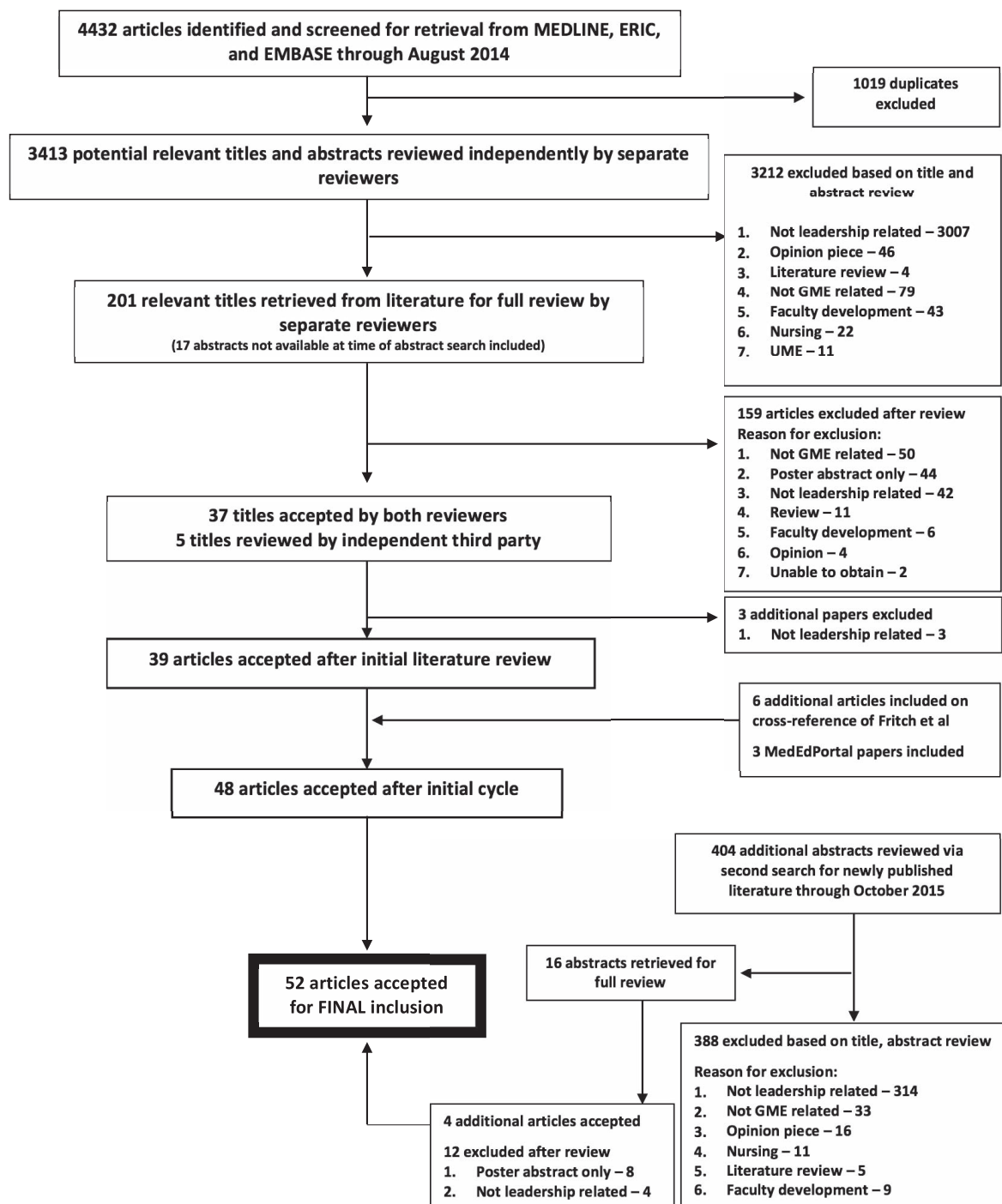
Learning Theory and Instructional Methods

The learning theory to design the curricula was reported in 7 articles (13%),^{19,28,39,42,48,56,64} and 51 (98%) identified the pedagogic approach. The majority of leadership development programs used 3 or more strategies. This included 24 programs (46%) that described a project-based component.

Assessment Methods and Outcomes

Multiple assessment methods were used (TABLES 1 and 3), with survey-based methods being the most common (postcurriculum survey in 20 [38%]; pre/post survey in 16 [31%]). Five studies (10%) used pretests and posttests to assess knowledge. Mixed and qualitative methods were used in 9 studies (17%) and 6 studies (12%), respectively. Only 1 study used a control group to assess effectiveness.

Kirkpatrick effectiveness scores ranged from 1 to 3A, with 15 of 52 (29%) reporting level 4. A total of



FIGURE

Study Selection and Article Inclusion for Systematic Review of Graduate Medical Education Leadership Curricula

28 articles (54%) reported learner satisfaction and 26 (50%) reported a subjective increase in knowledge. Objective evidence of learner knowledge and behavior change was reported in 13% (7 of 52) and 15% (8 of 52) of articles, respectively. The majority of Kirkpatrick level 4 scores were related to project completion.

Discussion

Interest in formalized GME leadership curricula appears to be expanding, as our study found that 65% of articles were published after 2010. The majority of publications were from primary care specialties, and a variety of teaching modalities

TABLE 1

Graduate Medical Education Leadership Curriculum Characteristics

Characteristic	n (%)
Content	
Teamwork	36 (69)
Models of leadership	35 (67)
Quality improvement	25 (48)
Conflict resolution	22 (42)
Feedback	17 (33)
Communication	16 (31)
Negotiation	15 (29)
Emotional intelligence	11 (21)
Delegation	10 (19)
Business of medicine	15 (19)
Time management	9 (17)
Developing others	8 (15)
Ethics/professionalism	8 (15)
Running a meeting	8 (15)
Not specified	2 (4)
Length	
Longitudinal	21 (40)
Serial	19 (37)
Isolated	12 (23)
Quality of evidence	
1: No clear conclusions	7 (13)
2: Results ambiguous	11 (21)
3: Conclusions can probably be based on results	23 (44)
4: Results clear and very likely true	9 (17)
5: Unequivocal results	2 (4)
Teaching method	
Didactic	46 (88)
Small groups	39 (75)
Case based	21 (40)
Role play	13 (25)
Reflective writing	9 (17)
Self-assessments	9 (17)
360-degree evaluations	6 (12)
Video review	6 (12)
Online learning	2 (4)
Training specialty	
Primary care	30 (58)
Surgery	18 (35)
Medical subspecialty	17 (33)
Not specified	1 (2)
Trainee level	
Resident	42 (81)
Chief resident	8 (15)
Intern	7 (13)
Fellow	3 (6)

TABLE 1

continued

Characteristic	n (%)
Training setting	
Classroom	43 (83)
Small group	36 (69)
Other	28 (54)
Project based	24 (46)
Mentors or coaches	25 (48)
Assessment method	
Postsurvey only	20 (38)
Pre/post survey	16 (31)
Mixed methods	9 (17)
Qualitative	6 (12)
Pretest-posttest	5 (10)
Not specified	2 (4)
Kirkpatrick level outcome	
Level 1: learner satisfaction	28 (54)
Level 2A: knowledge (subjective)	26 (50)
Level 2B: knowledge (objective)	7 (13)
Level 3A: behavior change (subjective)	19 (37)
Level 3B: behavior change (objective)	8 (15)
Level 4A: system change (subjective)	4 (8)
Level 4B: system change (objective)	11 (21)
Not specified	1 (2)
Medical Leadership Competency Framework	
Managing services	49 (94)
Working with others	48 (93)
Demonstrating personal qualities	41 (79)
Improving services	38 (72)
Setting direction	26 (50)

(lectures, conferences, and projects) were used. Curriculum evaluation was limited for most studies. The overall low quality of the articles as indicated by the BEME scores makes the identification of program elements that should be used in future curricula challenging. Available program resources and contexts, rather than applied theoretical constructs, appear to dominate the design and content of leadership curricula in residency.^{1,12} Based on our analysis, we provide insights for developing and evaluating future curricula (TABLE 4).

Specialty

Most GME leadership curricula were published by primary care specialties (TABLE 2). Surgical specialties and subspecialties had fewer articles, despite calls from leaders in the surgical community for leadership training.⁷¹ Pettit et al⁵⁵ demonstrated improved

neurological surgery resident knowledge of leadership and an appreciation that leadership training was beneficial to developing physician leaders. A recent article examining the impact of leadership on adverse event reporting further highlighted the need for surgeon leadership to improve patient safety.⁷²

Few programs reported interdisciplinary or interprofessional training, which is consistent with the report by Frich et al.^{7,20,31,33,38,40,47,65} Interprofessional education may improve collaboration and team-based care, but it has yet to make it into leadership curricula.⁷³ Frich et al¹⁴ suggested that programs avoid multidisciplinary curricula to “foster a nonthreatening participatory and exploratory environment.” GME leaders should consider how multiple professions could participate in leadership development to prevent redundant training and facilitate interprofessional relationships.

Teaching Setting and Methods

Small group teaching, mentoring, coaching, and project work appear to be the most effective approaches for leadership training, and small group teaching was the favored teaching method for internal medicine residents.⁷⁴ Multiple modalities were used in studies with the highest effectiveness scores, consistent with the finding from Frich et al¹⁴ that the majority of programs used 2 or more methods. Steinert et al¹² recommended using a variety of teaching methods, including experiential learning, reflective practice, projects, mentoring, and coaching, for teaching faculty leadership, and they highlighted that many programs attempted to match methods with objectives. Ultimately, methods should be selected based on desired educational outcome, available resources, and learner preferences.

Steinert et al¹² also emphasized the importance of the adult learning theory in developing leadership curricula, yet only a minority of studies reported the learning theory used in program design. The learning theory could mold the curriculum in a pedagogically rigorous manner, allowing learners to practice their learning in the workplace.¹²

Utilizing a leadership framework, such as the MLCF, which starts with personal qualities and moves to leadership that affects the system,¹⁰ may assist with curriculum development. Learning about oneself is an important component of leadership development,^{1,12} and it was present in 41 (79%) of the articles in this review.

Improving personal leadership traits can be accomplished through reflective writing, self-assessments, and 360-degree evaluations.^{1,12} Despite the importance of these methods for leadership development,

they were rarely used, and effective and standardized tools were lacking or expensive.

Online learning was reported in only 2 articles (4%) and may be an area of growing focus.^{12,22,58} Advantages of online training include asynchronous use, ease of assessment, better standardization, and scalability, yet online learning needs to be balanced with group discussion and reflection.

Program Content

Reported content of leadership curricula was consistent with the work of Frich et al¹⁴ (TABLE 1). An article from emergency medicine reported on 59 leadership competencies,⁷⁵ and a challenge for programs may be distilling a manageable list of core topics that cover key leadership competencies. Several programs used leadership training to augment ongoing clinical activities, such as quality improvement, resident-as-teacher programs, or running a team.

Program Length and Timing

While the optimum time to introduce leadership training was not addressed in the studies included, our review demonstrates that longitudinal or serial sessions are more effective than a single training event. Learners reported satisfaction with experiential learning opportunities that empowered them to apply leadership skills.^{24,29,45,47,65} Examples include team management, leading peers, small group facilitation, and addressing topics such as conflict resolution, feedback, managerial skills, and leadership styles.^{45,49} Synchronizing leadership education with these experiences is consistent with adult learning theory.^{12,76}

Residency programs are well-suited for longitudinal curricula and afford an opportunity to practice skills. Training for interns may focus on personal and interpersonal skills, while programs for more senior trainees may be geared toward team building and system change.^{7,45,46} Change management, negotiation, and creating a vision could be taught when residents are conducting quality improvement projects. Many longitudinal leadership programs combine didactic or in-person learning with longitudinal projects.¹²

Projects as Learning Method

In our review, 46% of curricula used projects, comparable to the findings by Frich et al.¹⁴ Project learning was more prevalent in high-quality studies, allowing trainees to apply leadership skills, and it was noted to be a “powerful motivational tool that enhanced accountability.”¹² Quality improvement projects for trainees can be augmented with didactics,

TABLE 2
General Characteristics of Graduate Medical Education Leadership Curriculum

Author, y	Training Setting	Training Specialty ^a	Trainee Level	Instructors	Program Length	Teaching Methods ^b	Learning Theory	Project Based	Mentors/ Coaches	Quality of Evidence ^c
Ackerly et al, ⁷ 2011	C, O	1, 2, 3	Residents ^d	Faculty, consultants	L ^e	1, 2	No	Yes	Yes	1
Awad et al, ¹⁷ 2004	C	3	Residents	Faculty	Se	NS	No	No	No	3
Babitch, ¹⁸ 2006	C	1	Residents	Faculty, consultants	L	1	No	No	No	3
Bearman et al, ¹⁹ 2012	S, O	3	Residents	Faculty	I	1, 2, 5, 6, 8, 9	Yes	No	No	2
Bhatia et al, ²⁰ 2015	C, S, O	1, 2, 3	Residents	Faculty, consultants	Se	1, 2, 3, 6	No	No	No	3
Biese et al, ²¹ 2011	O	2	CR	Faculty	L		No	No	No	3
Bircher, ²² 2013	C, O	1	Residents	Faculty	L ^e	1, 4	No	Yes	Yes	3
Block et al, ²³ 2007	C	1	Residents	Faculty, consultants	I	1, 2, 3, 5, 8	No	No	No	3
Blumenthal et al, ²⁴ 2014	C, S, O	1	Residents	Faculty	Se	1, 2, 3, 5, 6	No	No	No	3
Brandon and Mullan, ²⁵ 2013	C, O	2	Residents, fellows	Faculty, consultants	Se	1, 2, 3	No	No	No	4
Dickey et al, ²⁶ 2014	C, S, O	1	Residents	Faculty, consultants	L	1, 2, 3, 6	No	Yes	Yes	1
Donnelly, ²⁷ 2015	C, O	2	Residents	Consultants	L	1	No	Yes	Yes	1
Doughty et al, ²⁹ 1991	C, S	1	CR	Consultants	I	1, 3, 6, 8	No	No	No	2
Doughty et al, ²⁸ 2010	C, S, O	1	CR	NS	I	1, 3	Yes	No	No	4
Edler et al, ³⁰ 2010	O	3	Residents	Faculty	Se	1, 7	No	No	Yes	3
Ellison et al, ³¹ 2012	C, S, O	1, 2, 3	Residents	Faculty	L	1, 3	No	Yes	No	2
Eubank et al, ³² 2012	C, S, O	1	Residents	Faculty	L	1, 3, 7, 8, 9	No	Yes	Yes	2
Foster et al, ³³ 2008	C, S, O	1, 2, 3	Residents	Faculty	L ^e	1, 3, 7, 9	No	Yes	Yes	4
Frugue et al, ³⁴ 2010	S	2	Fellows	Faculty	L	3	No	No	No	3
Gurrera et al, ³⁵ 2014	C, S, O	2	Residents	Faculty	Se	1, 3	No	Yes	Yes	3
Hadley et al, ³⁶ 2014	S, O	NS	Residents ^f	Consultants	L	3	No	Yes	Yes	4
Hanna et al, ³⁷ 2012	C, S	3	Residents	Faculty, consultants	I	1, 3, 6	No	No	No	3
Hemmer et al, ³⁸ 2007	C, S	2	Residents ^g	Faculty, consultants	Se	1, 2, 3	No	Yes	No	2
Hultman et al, ³⁹ 2013	C, S	3	Residents, interns	Faculty, consultants	Se	1, 3	Yes	No	No	4
Karpinski et al, ⁴⁰ 2015	C, S, O	1, 2, 3	Residents, fellows	Faculty, consultants	L	1, 2, 3, 8	No	Yes	Yes	3
Kasuya and Nip, ⁴¹ 2011	C, S	1	Interns	Faculty	I	1, 2, 3, 6	No	No	No	3
Kohlwies et al, ⁴² 2011	C, O	1	Residents	Faculty	L	1, 3	Yes	Yes	Yes	3
Kolade et al, ⁴³ 2014	C, O	1	Residents	Faculty	Se	1	No	No	Yes	3
Kuo et al, ⁴⁴ 2010	C, S, O	1	Residents, interns	Faculty	L	1, 2, 3, 6, 7, 8	No	Yes	Yes	4
Lee et al, ⁴⁵ 2004	S	1	Residents	NS	I	2, 3, 6, 7	No	No	No	3

TABLE 2
General Characteristics of Graduate Medical Education Leadership Curriculum (continued)

Author, y	Training Setting	Training Specialty ^a	Trainee Level	Instructors	Program Length	Teaching Methods ^b	Learning Theory	Project Based	Mentors/ Coaches	Quality of Evidence ^c
Lee et al, ⁴⁶ 2012	S	3	Residents	Faculty	Se	1	No	No	Yes	3
Levine et al, ⁴⁷ 2008	C, S, O	1, 2, 3	CR	Faculty, consultants	I	1, 2, 3	No	Yes	Yes	5
LoPresti et al, ⁴⁸ 2009	C, S	1	Residents	Faculty	Se	1, 3	Yes	Yes	No	4
Luciano et al, ⁴⁹ 2013	C, O	1	CR	Faculty, consultants	L	1, 3	No	No	No	1
Mygdal et al, ⁵⁰ 1991	C, S	1	CR	Faculty, consultants	I	1, 3	No	No	No	3
Paller et al, ⁵¹ 2000	C, S, O	1	Residents	Faculty consultants	L	1, 2, 3	No	Yes	Yes	2
Parvizi et al, ⁵² 2013	C, S, O	3	Residents	Consultants	L	1, 3, 8, 9	No	Yes	Yes	2
Patterson et al, ⁵³ 2013	S, O	1	Residents	Faculty	L	7	No	Yes	Yes	2
Pearson et al, ⁵⁴ 1994	C, S	1	Residents	Faculty, consultants	L	1, 2, 3, 5, 6	No	Yes	Yes	4
Pettit et al, ⁵⁵ 2011	C, S	3	Residents	Faculty, consultants	Se	1, 2, 3, 5, 7, 8	No	No	Yes	3
Runnacles et al, ⁵⁶ 2013	C, O	1	Residents	Faculty, consultants	Se	1, 8	Yes	Yes	Yes	4
Ruston and Tavabie, ⁵⁷ 2010	C, S	1	Residents, interns	Faculty	Se	1, 3	No	Yes	No	5
Schulz et al, ⁵⁸ 2013	S, O	3	Residents	Faculty, consultants	L	1, 3, 4	No	No	Yes	3
Schwartz et al, ⁵⁹ 2014	C, S	2	CR	Faculty, consultants	I	1, 3, 9	No	No	No	3
Sims and Darcy, ⁶⁰ 1997	C, S	2	Residents, interns	Faculty	L	1, 3	No	Yes	Yes	1
Steiner et al, ⁶¹ 2004	C, S	2	Residents, interns	Faculty, consultants	Se	1, 2, 3	No	No	Yes	2
Steinhardt, ⁶² 2015	C	3	Residents	Faculty	I	1, 2, 3, 6, 7	No	No	No	2
Steriopoulos et al, ⁶³ 2009	C, S	2	Residents	Faculty, consultants	Se	1, 2, 3, 7	No	No	No	3
Stoller et al, ⁶⁴ 2004	C, O	1	Interns	Faculty	I	1, 3, 6, 9	Yes	No	No	3
Welbourne et al, ⁶⁵ 2012	C	1, 2, 3	CR	Consultants	Se	1, 2	No	Yes	No	1
Wichman et al, ⁶⁶ 2009	C, S	3	Residents	Faculty, consultants	Se	1, 3	No	Yes	Yes	2
Wipf et al, ⁶⁷ 1995	C, S	1	Residents	Faculty	Se	1, 2, 3, 5, 6	No	No	No	1

Abbreviations: C, classroom; O, other; L, longitudinal (duration of training); Se, serial over multiple days within a period of training; NS, not specified; S, small group; I, isolated to 1 day; CR, chief residents.

^a Training specialty: 1, primary care (family medicine, internal medicine, pediatrics, psychiatry); 2, subspecialties; 3, surgery (including surgical subspecialties).

^b Teaching methods: 1, didactic; 2, case based; 3, small groups; 4, online learning; 5, video review; 6, role play; 7, reflective writing; 8, self-assessments; 9, 360-degree evaluations.

^c Quality of evidence: 1, no clear conclusions; 2, results ambiguous but may indicate trend; 3, conclusions can probably be based on results; 4, results are clear and very likely to be true; 5, unequivocal.

^d Requires prior graduate management training (master of business administration or master of health administration).

^e Requires additional time in training beyond traditional programs.

^f Included nonmedical trainees.

^g Interprofessional (ie, included other health care professionals besides physicians).

TABLE 3
Overview and Outcomes of Graduate Medical Education Leadership Curricula^a

Source, y	Curriculum Overview	MLCF Competencies ^b	Learning Outcomes Kirkpatrick Score	Content ^c	Assessment	Key Findings
Reviewed articles with BEME level 5 quality of evidence—unequivocal						
Levine et al, ⁴⁷ 2008	Chief residents (from medical and surgical disciplines) attend 2-day off-site immersion training to increase knowledge of geriatrics to improve geriatric teaching and enhance leadership skills. Chief residents develop project action plans to be completed during their chief resident years.	1, 2, 3, 4, 5	2A, 2B, 3A, 4B	1, 2, 3	Mixed methods	Qualitative and quantitative data were collected through preintervention and postintervention knowledge tests and surveys. Interviews were conducted at 6 mo after the program. A survey was sent at 12 mo after the program. N = 47 over 3 years. Pre-post confidence in knowledge and teaching geriatrics topics increased ($P < .015$). For 2 of 3 years, pre-post knowledge increased significantly ($P < .001$). Some participants reported enhanced conflict resolution skills (n = 14) and improved teaching and leadership skills (n = 9).
Ruston and Tavabie, ⁵⁷ 2010	General practice specialty trainees undergo integrated training placement, during which they spend 2 days a week in a primary care trust over 4 mo and lead a project for health improvement.	1, 2, 3, 4, 5	2A, 2B, 3B	1, 4, 5, 6, 8, 10, 11	Qualitative	Three trainees were selected for integrated training placement. Sources of data included face-to-face and telephone interviews with trainees and staff, diaries, and observation. All respondents reported the integrated training placement as valuable, acquiring skills, including problem solving, time management, networking, communication, and different styles of leadership.
Reviewed articles with BEME level 4 quality of evidence—results are clear and very likely to be true						
Brandon and Mullan, ²⁵ 2013	Radiology residents in year-long curriculum. Series of lectures with case-based examples. Seven 90-min modules presented during noon report or existing academic time spread over the course of the year. Pretest at the start of the class to assess preexisting knowledge. Each session then had a lecture and a case-based discussion and ended with postclass test.	2, 3, 4	2B	2, 7, 11, 12	Pretest-posttest	Approximately 15 residents participated per session. There was a statistically significant increase in knowledge and self-assessment scores for all modules. Potential barriers to implementation were noted to be need to allocate specific protected time for the training and need for faculty to be able to give the training. Only 1 faculty member did the majority of training in these sessions.

TABLE 3
Overview and Outcomes of Graduate Medical Education Leadership Curricula^a (continued)

Source, y	Curriculum Overview	MLCF Competencies ^b	Learning Outcomes Kirkpatrick Score	Content ^c	Assessment	Key Findings
Doughty et al, ²⁸ 2010	Chief resident training program for residents in United States and Canada. A total of 50 residents each year take part in a 3- to 4-day experiential course on leadership styles, teamwork, conflict resolution, feedback, health systems, and working with administrators.	1, 2, 3, 4, 5	1, 2A, 3A, 3B	1, 2, 3, 4, 5, 6, 8, 9, 10, 11	Postsurvey	Retrospective survey of 1124 participants between 1998 and 2003. Of participants, 96% were satisfied with program content, 96% reported it was a significant experience for them, 92% reported a positive impact of their chief year, and 75% reported positive impact beyond chief year. Ability to give feedback (59%) and ability to manage conflict (57%) were reported as having positive impact subsequent to the course.
Foster et al, ³³ 2008	A combined leadership preventive medicine 2-y training program (adds to other GME specialty training). Includes MPH degree and leadership coursework followed by developing and implementing a change initiative/project with faculty.	1, 2, 3, 4, 5	4B	11	Qualitative	12 residents completed training in the leadership preventive medicine program. Multiple projects were implemented to improve the quality, safety, and efficiency of care. Examples include: improving early antibiotic initiation for patients with pneumonia, improving hand hygiene compliance rates, and reducing code blues by deploying an early response team.
Hadley et al, ³⁶ 2014	Project-based curriculum focused on patient care and safety. Management trainees and second-year foundation physicians work on a project over 6 to 9 mo, supervised by a mentor. Expected workload 1 to 2 h/wk.	1, 2, 3, 4	1, 2A, 3A, 4A	1, 5, 11	Mixed methods	The foundation year physicians reported improvements in self-confidence, teamwork, developing a business case, and project management.
Hultman et al, ³⁹ 2013	6-wk, 12-h course designed to improve professionalism among providers in plastic surgery (physicians, nurses, and students). Participants took part in lectures, journal club, small groups, and book review.	1, 2, 3, 4	1, 2B, 3B, 4B	1, 6, 13	Pretest-posttest	Postcourse survey demonstrated 56% of participants felt the course was a "good use of my time," and 74% reported the course would "help me be a better professional." Sentinel events declined from 13 to 3 in the division, and patient complaints decreased from 14 to 8. Example professionalism pretest-posttest is included in article.

TABLE 3
Overview and Outcomes of Graduate Medical Education Leadership Curricula^a (continued)

Source, y	Curriculum Overview	MLCF Competencies ^b	Learning Outcomes Kirkpatrick Score	Content ^c	Assessment	Key Findings
Kuo et al, ⁴⁴ 2010	PLUS program developed in 2004. Weaved leadership training into resident program with topics such as personal leadership development, team building, negotiation, and conflict management. Annual PLUS rotation and periodic half-day seminars. Must complete a childhood advocacy project.	1, 2, 3, 4, 5	1, 2A, 4B	1, 2, 3, 4, 7	Presurvey/ postsurvey	Survey on scale of 1 to 4, with 4 being significant impact, demonstrated a positive impact on leadership skills (3.4) and impact on clinical/educational skills (3.18). Nine PLUS residents received grants to complete their projects. A total of 9 of 28 graduates are in positions of leadership. There were 13 program-level awards and 3 national awards for PLUS residents. There were 6 publications and 9 invited presentations.
LoPresti et al, ⁴⁸ 2009	Four family medicine programs developed a simulated curriculum to enhance practice management. One residency took part in a new curriculum of 20 modules (1 h of lecture and 2 h of project-based work).	2, 3, 4, 5	2A, 2B	6, 7, 11, 12	Pretest-posttest; comparison group	Attendance at sessions ranged from 40% to 80% (mean 66%). Residents in intervention group scored higher on posttest than their pretest, and higher than the comparison group.
Pearson et al, ⁵⁴ 1994	Leadership and management course taught to PGY-2/PGY-3 medicine residents. Given in 12 weekly sessions in ambulatory blocks. Teaching methods included self-assessment, case-based discussions.	1, 2, 3, 4, 5	1, 2A, 3A	1, 2, 3, 6, 8, 9, 11, 14	Postsurvey	Postsurvey and oral assessment of each resident. Overall satisfaction with content and delivery has an average of 6 on a Likert scale of 1–7. Feedback from graduates suggests the materials are relevant and helpful in the subsequent positions.
Runnacles et al, ⁵⁶ 2013	Residents learn improvement methodologies during longitudinal workshops and work on improvement projects within their department under guidance of a senior resident appointed as a leadership fellow.	2, 3, 4, 5	1, 2A, 4B	6, 11	Presurvey/ postsurvey	Postintervention surveys of participants report improved skills and attitudes toward quality improvement and leadership. Projects have improved aspects of the organizations aims for “no waste, no waits, and zero harm.”

Abbreviations: MLCF, Medical Leadership Competency Framework; BEWE, Best Evidence in Medical Education; GME, graduate medical education; MPH, masters of public health; PLUS, Pediatric leadership for the underserved program; PGY, postgraduate year.

^a Specific characteristics of reviewed curricula that were BEWE levels 1–3 quality of evidence are included in the online supplemental material.

^b MLCF competencies: 1, demonstrating personal qualities; 2, working with others; 3, managing others; 4, improving services; and 5, setting direction.

^c Content: 1, teamwork; 2, conflict resolution; 3, feedback; 4, time management; 5, communication; 6, models of leadership; 7, negotiation; 8, delegation; 9, running a meeting; 10, emotional intelligence; 11, quality improvement; 12, business of medicine; 13, ethics/professionalism; and 14, developing others.

TABLE 4

Recommendations for Leadership Curricula Development and Reporting Criteria

Curriculum Elements	Best Practices	Examples to Report
Leadership model or framework	Training in managing others, self-reflection/regulation, improving services, and setting direction ^{25,28,33,44,47,48,54,56,57}	PITO, MLCF competencies
Educational theory	Experiential learning: practice learned content in the workplace ^{39,48,56}	Adult learning theory or workplace learning theory
Length of program and time of day	Training over multiple sessions ^{25,39,48,56,57} or longitudinal exposure over the entirety of training ^{33,36,56,57}	Regular time, weekly or monthly
Use of multiple teaching methods	Didactic lectures with small groups and case-based ^{25,28,33,36,39,44,47,48,54,57}	Lecture, case-based, small group discussions, role play, reflective writing, self-assessment
Faculty	Medical faculty, given ease of access ^{33,44,48,57} Outside consultants add additional expertise ^{25,39,47,54,56}	Physician, nonphysician, local, guest, consultant, university-associated (eg, business school professor)
Faculty development	...	Describe how faculty were trained to teach the content
Interprofessional and interdisciplinary participants	Management, team-based projects, and case studies with multiple professions, using real-world scenarios ³⁸	Define spectrum of member professions unique to multidisciplinary team (nurse, physician, pharmacy, etc), level of learner (eg, resident with year of training), and specialty
Mentors and coaches	Provide explicit access to leadership mentors ^{33,36,44,47,54,56}	Report how faculty were identified and their role in the program
Project-based	Projects with real problems ideally related to the quality and safety of patient care (eg, time to initiation of antibiotics in pneumonia) ³³	Descriptions should be explicit, include outcomes, and describe how leadership was demonstrated during projects
Learner assessment	Assess impact after the training to determine knowledge gained, changes in behavior, and secondary effects ^{33,39,44,47,56}	Pre-post surveys and tests, peer observations, 360-degree evaluation, qualitative inquiry, projects initiated, leadership roles filled
Programmatic evaluation	Examine impact at multiple Kirkpatrick levels and longitudinally ^{33,47,48,57}	Use Kirkpatrick levels and consider reporting any key lessons learned, consider qualitative methods

Abbreviations: PITO, personal, interpersonal, team, organizational; MLCF, Medical Leadership Competency Framework.

reflective writing, and small group discussions, and can afford opportunities to work in multidisciplinary and interprofessional teams.^{1,12,14}

Mentoring

Mentorship was more commonly found in higher-quality studies, and it capitalizes on adult learning theory, allowing for formative feedback to learners. Many studies paired mentoring with projects to help facilitate completion, along with explicitly teaching leadership principles.^{7,22,26,27,32,33,35,36,40,42,44,47,51–54,56,60,66} Mentorship also provided opportunities for relationships to continue after the formal curriculum ended.¹ Despite the appeal of mentoring, the

availability of adequately trained faculty may be a challenge for training programs.¹²

Faculty

Few studies have addressed the faculty in leadership programs. Our review showed that program directors, departmental leaders, and hospital leaders comprised the majority of faculty. Many sessions used small group discussion. Thus, in addition to content expertise, facilitation skills are a desired competency for faculty. External consultants were used in the majority of programs, and they may provide greater depth to a program. For universities that have leadership programs outside of medicine, there may be opportunities to expand these programs to teaching leadership to trainees.

Quality of Evidence and Outcomes

The overall low quality of studies was due to 2 major factors: (1) insufficient details about curricular design, and (2) low-level outcomes assessments, with most outcomes limited to learner satisfaction and self-reported knowledge.

While surveys and knowledge assessments are easy to obtain and may be useful in program feedback, these approaches fail to capture the full effectiveness of leadership programs. More comprehensive data (eg, evaluations from supervisors and peers) could better define Kirkpatrick levels 3B, 4A, and 4B. When examining the effect on systems, it is not clear that simply completing a project should be classified as level 4 effectiveness. This has a short-term effect on the system, but it may overestimate the effectiveness of the leadership program.

The timing of the program evaluation may be important for assessing effectiveness, with programs moving beyond immediate evaluation and examining longer-term outcomes to assess whether training has a lasting impact, as leadership skills may not be fully utilized until after residency. The lack of follow-up on leadership projects limits the ability to assess program effectiveness.¹² Assessments should include immediate, intermediate, and long-term data to better understand effectiveness.⁷⁷

Qualitative methods provide insights into leadership experiences through the capture of narratives,⁷⁷ yet they were used in program evaluation in only 12% of articles in this review. Qualitative approaches facilitate understanding the complexity and nuances of leadership development, and they describe the meaning and significance of leadership development from learners' perspectives.^{12,77}

This review has limitations. We did not capture unpublished leadership curricula, and we did not search the ABI/INFORM collection, where additional studies may have been published.^{13,14}

Conclusion

Gaps exist in understanding the best ways to teach leadership and the value of leadership training. The overall quality of reported leadership curricula is low. However, the available evidence suggests that small group teaching, project-based learning, mentoring, and coaching are valuable components of leadership curricula. Longitudinal leadership curricula are more likely to be successful. Enhanced reporting of curricula design and examining higher-level educational outcomes would allow for more rigorous assessment of the value of leadership programs.

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