A Systematic Review of Pain Management Education in Graduate Medical Education

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ABSTRACT

Background Despite the importance of pain management across specialties and the effect of poor management on patients, many physicians are uncomfortable managing pain. This may be related, in part, to deficits in graduate medical education (GME).

Objective We sought to evaluate the methodological rigor of and summarize findings from literature on GME interventions targeting acute and chronic non-cancer pain management.

Methods We conducted a systematic review by searching PubMed, MedEdPORTAL, and ERIC (Education Resources Information Center) to identify studies published before March 2019 that had a focus on non-cancer pain management, majority of GME learners, defined educational intervention, and reported outcome. Quality of design was assessed with the Medical Education Research Study Quality Instrument (MERSQI) and Newcastle-Ottawa Scale–Education (NOS-E). One author summarized educational foci and methods.

Results The original search yielded 6149 studies; 26 met inclusion criteria. Mean MERSQI score was 11.6 (SD 2.29) of a maximum 18; mean NOS-E score was 2.60 (SD 1.22) out of 6. Most studies employed a single group, pretest-posttest design (n=16, 64%). Outcomes varied: 6 (24%) evaluated reactions (Kirkpatrick level 1), 12 (48%) evaluated learner knowledge (level 2), 5 (20%) evaluated behavior (level 3), and 2 (8%) evaluated patient outcomes (level 4). Interventions commonly focused on chronic pain (n=18, 69%) and employed traditional lectures (n=16, 62%) and case-based learning (n=14, 54%).

Conclusions Pain management education research in GME largely evaluated chronic pain management interventions by assessing learner reactions or knowledge at single sites.

Introduction

One of the few pathologies shared among most medical specialties is pain: 20% to 50% of primary care patients present to clinic with chronic non-cancer pain,[1,2] 40% to 60% of emergency department visits are due to a pain-related chief complaint,[3,4] and at least 80% of surgical patients have some degree of postoperative pain.[5,6] Poor control of these painful syndromes is associated with poor patient outcomes, high morbidity, and increased costs to society.[7-9] However, despite the clear importance of effectively managing pain, physician knowledge and comfort around pain management is alarmingly low.[10,11]

Acute and chronic non-cancer pain management requires unique approaches that balance benefits of analgesia with potential risks, including opioid use disorder.[12] One of the most highlighted issues of the last decade is the opioid epidemic, which is primarily a concern regarding opioid use disorder in patients without cancer pain.[13,14] One cited contributing factor to the opioid epidemic is physician overprescription,[15,16] which may, in part, be addressed through physician education.[17,18] In recognition of the connection between undereducation, poor management, and overprescription, states have begun to mandate additional training in pain management as part of licensing requirements.[19] In spite of these measures, a recent review of pain education in medical schools noted that US schools dedicate a median of only 9 hours to pain management, which has been critiqued as insufficient for addressing societal needs.[20,21] Within graduate medical education (GME) programs, residents have reported feeling uncomfortable and unprepared to manage pain, at least partially due to undereducation.[22-24]

In this study, we sought to examine pain management education within GME programs. Specifically, we aimed to (1) evaluate and appraise the literature on acute and chronic non-cancer pain management education as it currently exists in GME programs through an analysis of methodology and educational outcomes, and (2) summarize the educational methods and foci described in said literature.

Methods

Because the goal of our review was to assess and summarize research on pain management education

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Editor's Note: The online version of this article contains the protocol template and data extraction tools used in the study.

in GME, we chose a systematic review, as this design allows for systematic identification and evaluation of all available literature. This study was executed in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[25]

Literature Search

We searched PubMed, MedEdPORTAL, and ERIC (Education Resources Information Center) using variable terms to identify English-language articles published online before March 2019 that focused on educational interventions around acute and chronic pain management in GME. Our search terms included iterations and synonyms of our population (eg, residents, fellows, interns); intervention (eg, education, curricula, didactic); and topic (eg, pain management, opioids, analgesia). While the Population, Intervention, Comparison, Outcome (PICO) framework is commonly employed to structure a search strategy, we did not target a specific comparison group or outcome in order to keep our search as broad as possible. See the online supplementary data for full study protocol, including complete search terms.

Eligibility

In order to meet inclusion criteria for our review, studies had to have:

1. A majority focus on non-cancer pain management education, defined as an intervention that focused ≥50% of time or content (as gathered from the studies) on pain management physiology, pharmacology, prescribing habits, or patient communication strategies.
2. A learner base that was composed of a majority of GME learners, defined as a learner base with ≥50% medical residents and/or fellows.
3. A structured, formal, educational intervention defined as a didactic session, group discussion, simulation, online module, written instruction, or tool.
4. A reported outcome, defined as any structured evaluation of the implemented intervention.

Given the heterogeneity of educational studies targeting pain management, inclusion criteria were designed to allow for the broadest search possible. We chose to include only articles with outcomes in order to target interventions that had been implemented and studied as opposed to interventions that had only been crafted or proposed. Articles were excluded if they had a primary focus on cancer-related, end-of-life, or hospice pain management, as these categories of pain management weigh the risks of opioid use and opioid use disorder differently than in acute and chronic non-cancer pain management. We also excluded articles primarily focused on interventional and procedural analgesic techniques or substance use disorders as these fell outside the aims of the paper. Other reasons for exclusions were non-English-language articles, opinion pieces, and non-peer-reviewed literature.

Study Selection

Two study authors (Z.M., K.T.) independently reviewed all titles and abstracts and saved relevant studies using Zotero version 5.0.87 (Corporation for Digital Scholarship, Vienna, Virginia). In cases of disagreement, the full text was independently reviewed by both authors and reconsidered for inclusion. If the 2 authors continued to disagree, the full text was rereviewed, the article discussed, and consensus agreement was reached based on the predetermined inclusion/exclusion criteria. In cases of continued disagreement, a third and more senior author (A.P.) served as an arbitrator.

Data Collection

Study data were managed using REDCap version 9.5.24 hosted at the University of Chicago (Vanderbilt University, Nashville, Tennessee). We created a data extraction form (online supplementary data) that allowed for analysis based on the BEME (Best Evidence Medical Education) Collaboration[26]; this was piloted with 10 articles before use. Data extracted from the articles consisted of 3 domains: (1) Journal (name, Journal Citation Reports Impact Factor, SCImago Journal Rank); (2) Study characteristics (publication year, number, name, and location of participating institution[s]); and (3) Participant characteristics (number, level of training, and medical specialty).

One author (Z.M.) with expertise in medical education also collected educational characteristics of the included studies by examining methods, images, tables, and appendices. These data were then categorized by method and educational focus (online supplementary data). Given the nuances of this content, only the reviewer with a strong understanding of educational methods conducted this aspect of the review.

We assessed methodological quality using 2 separate instruments: the Medical Education Research Study Quality Instrument (MERSQI) and the Newcastle-Ottawa Scale–Education (NOS-E).

The MERSQI was designed to "measure the [methodological] quality of experimental, quasi-experimental, and observational studies."[27] The MERSQI is composed of 10 items reflecting 6 domains of research quality (study design, sampling, type of data, validity, data analysis, outcomes); it has demonstrated criterion validity as well as high inter- and intra-rater reliability across items.[28]

The NOS-E was developed for "use in a meta-analysis of Internet-based education for health professionals" by modifying the Newcastle-Ottawa Scale, an instrument developed to assess the quality of comparative nonrandomized studies included in meta-analyses.[29,30] The NOS-E evaluates 5 items: representativeness of the intervention group, selection of the comparison group, comparability of the groups, study retention, and blinding. NOS-E authors demonstrated high inter-rater reliability and as well as correlation with MERSQI scores.[29]

The MERSQI and NOS-E are both designed to score methodological quality. The MERSQI, however, is slightly more objective and focuses on design, whereas the NOS-E focuses on procedure. The present study follows the suggestion by Cook et al that these tools should serve to complement one another in analysis of methodology.[29]

Data Analysis

Two authors (Z.M., K.T.) independently scored each article using both the MERSQI and the NOS-E; these scores were used to calculate an initial intraclass correlation coefficient (ICC) between the 2 raters to evaluate reliability. Disagreements were resolved by consensus. Descriptive statistics, total scores, and subscale scores of the MERSQI and NOS-E were calculated using Excel version 16.16.21 (Microsoft Corp, Redmond, Washington) and R version 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

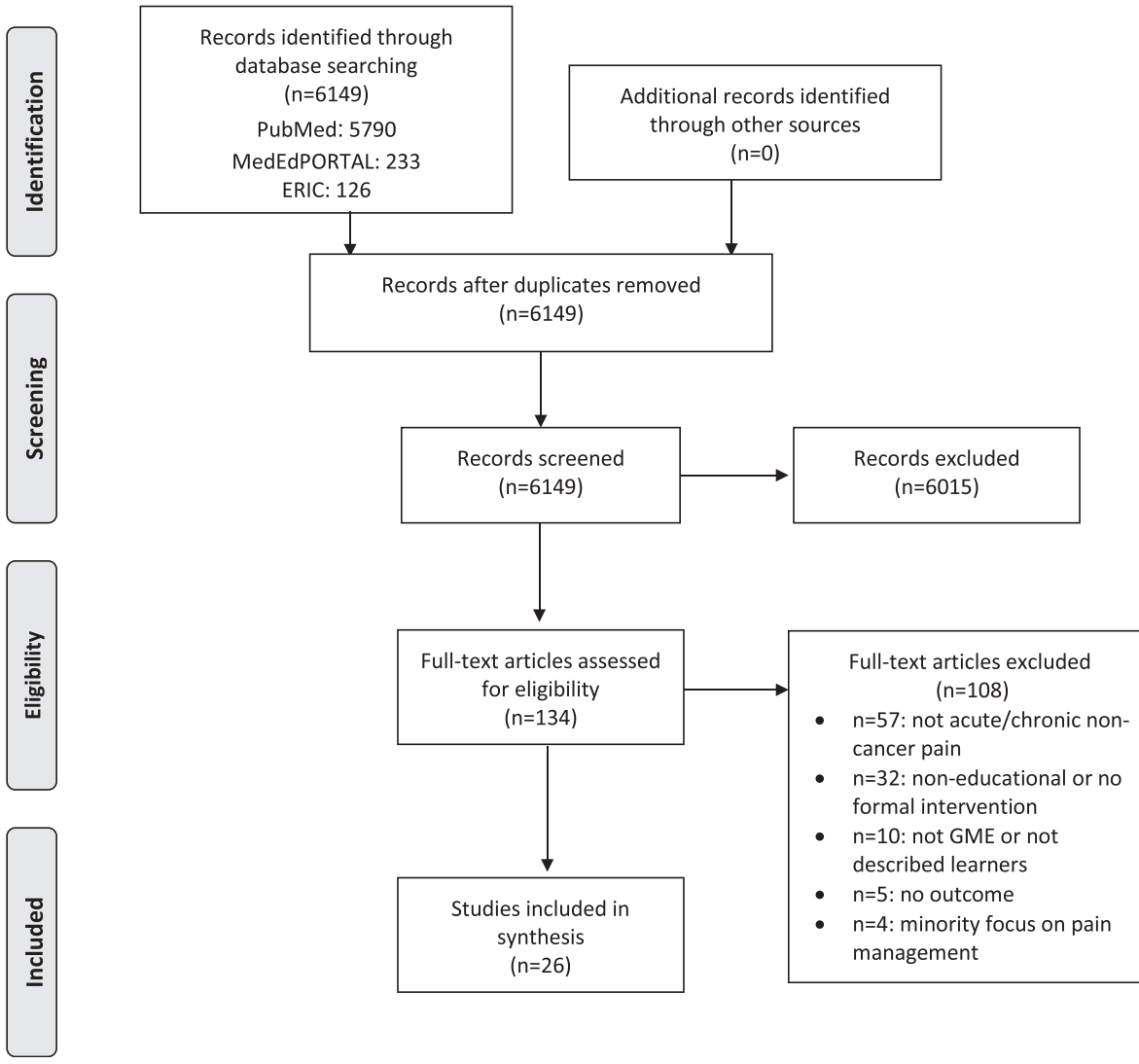
Results

The initial query yielded 6149 articles. Following our prespecified review process, we refined the search to 134 articles. These 134 articles were reviewed in full and resulted in 26 articles that met inclusion criteria (FIGURE).[31-56] A senior author (A.P.) served as an arbitrator to determine inclusion eligibility for 6 articles in the final stage of review.

Included articles were published between 1996 and 2019; 24 studies (92%) were published after 2000 and 17 (65%) published after 2009 (TABLE 1). One included study was published as a presentation given at a national conference.[45] The rest were published in journals that ranged from regional to international and were related to GME, pain, and various specialties. The mean journal impact factor was 2.61 (SD 1.31) and the mean SCImago Journal Rank was 0.96 (SD 0.52). The most commonly represented fields were internal medicine (n=17, 65%), family medicine (n=4, 15%), pediatrics (n=4, 15%), surgical subspecialties (n=4, 15%), emergency medicine (n=3, 12%), and anesthesia (n=3, 12%). The majority of scholarship came from within the United States (n=24, 92%) and from institutions with a university affiliation (n=23, 88%). While our search terms were intended to capture all interventions within GME, we found only one study that included fellows.[48] Only 2 papers (8%) described interventions delivered to faculty as well as residents.[39,43]

Our review examined articles that described educational interventions directed toward acute and/or chronic non-cancer pain management. The majority (n=15, 58%) of included studies were focused solely on chronic pain management. Seven (27%) focused on acute pain and 3 (12%) had educational elements of both. There was one study (4%) that did not specify whether their education was directed toward acute or chronic pain management. Intervention lengths were highly variable across studies: the shortest intervention was a single 30-minute lecture, while the longest intervention was spread out over 1.5 years. The minority (n=7, 27%) took place over 1 month or longer. The most common educational methods were traditional lectures (n=16, 62%) and case-based learning (n=14, 54%). Four studies (15%) included use of pocket cards, and 3 studies (12%) provided a general resource kit. Four studies (17%) used standardized patients or OSCEs in their intervention; 3 (13%) incorporated small group learning. The majority (n=16, 62%) of studies implemented multiple methods.

The mean consensus MERSQI score was 11.6 (SD 2.33) out of a maximum of 18 (TABLE 2). Reliability for MERSQI scores was high (ICC=0.94, 95% CI 0.87-0.97). The most prevalent study design was a single group, pretest-posttest design (n=16, 64%). The majority of studies sampled from single institutions (n=21, 84%). Forty-eight percent (n=12) of articles had response rates greater than 75%. Some articles included content validity evidence for their evaluation instrument (n=12, 48%); however, few included internal structure (n=5, 20%) or relationships to other variables (n=3, 12%). Data analysis was appropriate in nearly all studies (n=24, 97%) and went beyond simple descriptive analyses in most (n=21, 84%). The most common study outcomes were post-intervention test scores, which evaluated effects of the intervention on learner knowledge (n=12, 48%), and post-intervention surveys, which



FIGURE

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram

Note: PRISMA flow diagram of article search and selection process in a systematic review of the literature on pain management educational interventions in graduate medical education settings published through March 2019.[25]

examined learner satisfaction, perceptions, and/or attitudes (n=6, 24%). Five studies (20%) evaluated learner behaviors; most of these looked at changes in resident prescribing behavior. Only 2 studies (8%) evaluated patient or health care–centered outcomes; both tracked changes in patient pain scores before and after their interventions.

The mean consensus NOS-E score was 2.60 (SD 1.22) out of a maximum of 6 (TABLE 3); reviewers had an ICC of 0.93 (95% CI 0.83-0.97). The NOS-E representativeness domain is similar to the response rate domain of the MERSQI; as expected, the findings here are similar to the MERSQI with the majority (n=15, 60%) of studies having an intervention group that was very or somewhat representative of the average learner in the community. Few studies (n=4, 16%) had a comparison group from the same community of participants; the majority did not have a separate comparison group (n=19, 76%). Studies largely had retention rates that were unlikely to introduce bias per NOS-E definitions (n=21, 84%). The outcomes domain of the NOS-E is solely concerned with blinding; the majority of outcomes assessments were blinded (n=18, 72%). We were unable to calculate MERSQI and NOS-E scores for one included paper because it was published without sufficient detail (TABLE 4).[34]

TABLE 1
Characteristics of Studies in a Systematic Review of Pain Management Education in Graduate Medical Education (n=26)

Author	Impact Factor	Year	Country	Learners, N	Specialty	Educational Methods	Reported Outcomes	Length of Intervention	Acute/ Chronic
Kumar[31]	3.091	1996	US	22	IM	Lecture	Knowledge test	1 month	Both
Jones[32]	1.207	1999	US	. . .	EM	Lecture	Patient pain scores	4 hours	Acute
Ury[33]	4.005	2002	US	Unknown	IM	CBL	Inpatient opioid administration	1.5 years	Chronic
Brown[34]	NA	2007	US	. . .	Unlisted	Lecture	Learner satisfaction	1 lecture	Chronic
Chen[35]	5.424	2007	US	43	IM, FM, Geriatrics	Lecture, SP, SG	Knowledge test SP examination score Learner satisfaction	1-day workshop	Chronic
Roth[36]	2.782	2008	US	72	IM, Peds	CBL, SP, SG, observation of encounter	Learner attitudes/beliefs	4-hour workshop	Chronic
Scott[37]	1.53	2008	US	65	IM	Lecture, CBL, SG, pocket cards	Learner attitudes/beliefs Knowledge test	1 year	NA
Gunderson[38]	2.986	2009	US	50	IM	CBL	Learner attitudes/beliefs	2 hours	Chronic
Yanni[39]	2.782	2009	US	439	IM, FM, Peds, Anes, Psych, Subspecialties, Neuro	Online modules, CBL, resource kit	Learner satisfaction Knowledge test	1-2 months	Chronic
Elhwaris[40]	4.859	2010	US	28	IM	Lecture, CBL, role-play	Knowledge test Learner satisfaction	1 month	Chronic
Saroyan[41]	NA	2010	US	60	Peds, Anes, Subspecialties	Lecture, pocket cards	Knowledge test Learner satisfaction	1 lecture	Acute
Sullivan[42]	3.209	2010	US	215	IM	Online module, CBL	Learner attitudes/beliefs Knowledge test	2 hours	Chronic
Gugelmann[43]	1.29	2013	US	. . .	EM	Lecture, CBL, EMR aid, journal club	ED discharge opioid prescriptions	8-11 months	Acute
Akce[44]	NA	2014	US	58	IM	CBL, EMR aid, pocket cards	Patient pain scores	1 month	Both
Horber[45]	NA	2014	US	59	IM, EM, FM, OB/GYN, Peds, Other	SP	Learner satisfaction Learner attitudes/beliefs	2 hours	Both
Smith[46]	0.724	2014	US	24	FM	Lecture, CBL, observation of encounter	Learner attitudes/beliefs	NA	Chronic
Alford[47]	NA	2016	US	39	IM	Lecture, SP	Knowledge test Learner attitudes/beliefs	1 hour ± 4.5-hour OSCE	Chronic
Lester[48]	NA	2016	US	65	Unlisted	Lecture, CBL, pocket cards, resource kit	Learner attitudes/beliefs Knowledge test	30-minute lecture	Acute

TABLE 1
Characteristics of Studies in a Systematic Review of Pain Management Education in Graduate Medical Education (n=26) (continued)

Author	Impact Factor	Year	Country	Learners, N	Specialty	Educational Methods	Reported Outcomes	Length of Intervention	Acute/ Chronic
Regunath[49]	0.06	2016	US	49	IM	Lecture	Learner attitudes/beliefs	1 week	Chronic
Bakshi[50]	NA	2017	India	38	Anes	CBL, readings	Learner attitudes/beliefs Knowledge test Learner satisfaction	3 months	Acute
Holliday[51]	2.782	2017	Australia	47	IM	CBL, readings, resource kit	Learner attitudes/beliefs Vignette responses	1-day workshop	Chronic
Ruff[52]	2.986	2017	US	91	IM	Lecture, role-play, observation of patient encounter	Learner attitudes/beliefs	1 week	Chronic
Jacobs[53]	2.782	2018	US	143	IM	CBL	Learner attitudes/beliefs Knowledge test Physical examination and diagnosis documentation	1 hour	Chronic
Nooromid[54]	2.403	2018	US	30	Surgery, Subspecialties	Lecture	Vignette responses Learner satisfaction	30 minutes	Acute
Vettese[55]	NA	2018	US	63	IM	Lecture, role-play	Learner attitudes/beliefs Knowledge test Clinical UDS use	3-hour workshop + 1-hour lecture	Chronic
Chiu[56]	2.141	2019	US	31	Surgery, Subspecialties	Lecture	Learner attitudes/beliefs Opioid prescription	1 lecture	Acute
Summary Statistics	**Mean 2.72 (1.31)**		**US: 24 (92%) Other: 2 (8%)**	**Mean 63.4 (43.4)**	**IM: 17 (65%) FM: 4 (15%) Peds: 4 (15%) Subspecialty: 4 (15%) EM: 3 (12%) Anes: 3 (12%) Surgery: 2 (8%)**	**Lecture: 16 (62%) CBL: 14 (54%) SP: 4 (17%) Pocket card: 4 (15%) SG: 3 (13%) Resource kit: 3 (12%) Role-play: 3 (12%) Observation: 3 (12%) Readings: 2 (8%) Online modules: 2 (8%) EMR aid: 2 (8%)**	**Kirkpatrick levels: Attitudes, beliefs: 6 (24%) Knowledge: 12 (48%) Learner behavior: 5 (20%) Patient outcomes: 2 (8%)**		**Chronic: 15 (58%) Acute: 7 (27%) Both: 3 (12%)**

Abbreviations: US, United States; IM, internal medicine; EM, emergency medicine; CBL, case-based learning, NA, not available; FM, family medicine; SP, standardized patient; SG, small group; Peds, pediatrics; Anes, anesthesia; Psych, psychiatry; Neuro, neurology; EMR, electronic medical record; ED, emergency department; OB/GYN, obstetrics and gynecology; UDS, Uniform Data System.

TABLE 2
Medical Education Research Study Quality Instrument (MERSQI) Results and Breakdown (n=25)

MERSQI Domain	Response Item (Points)	No. of Studies (%)
Study design (SD)	Single group cross-sectional or single group post-test only (1)	3 (12)
	Single group pre- and post-test (1.5)	16 (64)
	Nonrandomized, 2 group (2)	5 (20)
	Randomized controlled trial (3)	1 (4)
Sampling: Institutions (I)	1 institution (0.5)	21 (84)
	2 institutions (1)	1 (4)
	3 or more (1.5)	3 (12)
Sampling: Response rate (RR)	NA (—)	5 (20)
	<50% or not reported (0.5)	4 (16)
	50%–74% (1)	4 (16)
	>75% (1.5)	12 (48)
Type of data (TD)	Assessment by study participant (1)	7 (28)
	Objective (3)	18 (72)
Validity evidence for instrument	NA (—)	5 (20)
Content (C)	Not present (0)	8 (32)
	Present (1)	12 (48)
Internal structure (IS)	Not present (0)	15 (60)
	Present (1)	5 (20)
Relationship to other variables (ROV)	Not present (0)	17 (68)
	Present (1)	3 (12)
Data analysis: Sophistication (S)	Descriptive analysis (1)	4 (16)
	Beyond descriptive (2)	21 (84)
Data analysis: Appropriateness (A)	Inappropriate (0)	1 (3)
	Appropriate (1)	24 (97)
Outcome (OC)	Satisfactions, attitudes, perceptions, opinions, general facts (1)	6 (24)
	Knowledge, skills (1.5)	12 (48)
	Behaviors (2)	5 (20)
	Patient/health care outcome (3)	2 (8)

TABLE 3
Newcastle-Ottawa Scale–Education (NOS-E) Results and Breakdown (n=25)

NOS-E Domain	Response Item (Points)	No. of Studies (%)
Representativeness of intervention group (RIG)	Not representative (0)	10 (40)
	Very or somewhat representative of the average learner in the community (1)	15 (60)
Selection of comparison group (SCG)	No separate comparison group or comparison drawn from different community (0)	21 (84)
	Drawn from same community (1)	4 (16)
Comparability of comparison group (CCG) Nonrandomized (n=5) Randomized (n=1)	No separate comparison group (0)	19 (76)
	Controlled for 1 subject characteristic (1)	5 (20)
	Controlled for 2 or more subject characteristics (2)	0 (0)
	Allocation not concealed (1)	0 (0)
	Allocation concealed (2)	1 (4)
Study retention (SR)	Poor retention could introduce bias (0)	4 (16)
	Retention unlikely to introduce bias (1)	21 (84)
Blinding of assessment (BA)	Outcome assessment not blinded (0)	7 (28)
	Outcome assessment blinded (1)	18 (72)

TABLE 4
Medical Education Research Study Quality Instrument (MERSQI) and Newcastle-Ottawa Scale–Education (NOS-E) Breakdown by Article (n=25)

Author	MERSQI Domains											NOS-E Domains					
	SD	Sampling		TD	Validity Evidence			Data Analysis		OC	MERSQI Total	RIG	SCG	CCG	SR	BA	NOS-E Total
		I	RR		C	IS	ROV	S	A								
Akce[44]	1.5	0.5	-	3	-	-	-	1	2	3	**14.7**	1	0	0	1	1	**3**
Alford[47]	2	0.5	1.5	1	1	1	1	1	2	1.5	**12.5**	0	1	1	1	0	**3**
Bakshi[50]	1.5	0.5	1.5	3	1	0	0	1	2	1.5	**12**	1	0	0	1	1	**3**
Chen[35]	1.5	0.5	1.5	3	1	0	0	1	2	1.5	**12**	0	0	0	1	1	**2**
Chiu[56]	2	0.5	-	3	-	-	-	1	2	2	**14**	1	1	1	1	1	**5**
Elhwairis[40]	1.5	0.5	1.5	3	0	0	0	1	1	1.5	**10**	1	0	0	1	1	**3**
Gugelmann[43]	1.5	1	-	3	-	-	-	1	2	2	**14**	1	0	0	1	1	**3**
Gunderson[38]	1.5	0.5	1.5	1	0	0	0	1	2	1	**8.5**	1	0	0	1	0	**2**
Holliday[51]	1.5	0.5	1.5	3	1	0	0	1	2	1.5	**12**	1	0	0	1	1	**3**
Horber[45]	1	1.5	1.5	1	0	0	0	1	1	1	**8**	1	0	0	1	0	**2**
Jacobs[53]	2	0.5	0.5	3	1	0	0	1	2	2	**12**	1	1	1	1	1	**5**
Jones[32]	2	0.5	-	3	-	-	-	1	2	3	**15.3**	1	0	1	1	1	**4**
Kumar[31]	1.5	0.5	1	3	0	0	0	1	2	1.5	**10.5**	0	0	0	1	1	**2**
Lester[48]	1	0.5	1	3	0	0	0	0	1	1.5	**8**	0	0	0	0	1	**1**
Nooromid[54]	1.5	0.5	0.5	3	0	0	0	1	2	1.5	**10**	1	0	0	0	1	**2**
Regunath[49]	1.5	0.5	1.5	1	0	1	0	1	1	1	**8.5**	1	0	0	1	0	**2**
Roth[36]	1.5	0.5	1.5	1	1	1	0	1	2	1	**10.5**	1	0	0	1	0	**2**
Ruff[52]	0.5	0.5	0.5	1	1	0	0	1	2	1	**8.5**	1	0	0	0	0	**1**
Saroyan[41]	1.5	0.5	1	3	1	0	1	1	2	1.5	**12.5**	0	0	0	0	1	**1**
Scott[37]	1.5	0.5	1.5	3	1	0	0	1	2	1.5	**12**	0	0	0	1	1	**2**
Smith[46]	1	0.5	1	1	1	0	0	1	2	1	**8.5**	0	0	0	1	0	**1**
Sullivan[42]	3	1.5	1.5	3	1	1	0	1	2	1.5	**15.5**	0	1	2	1	1	**5**
Ury[33]	2	0.5	-	3	-	-	-	1	2	2	**14.0**	1	0	1	1	1	**4**
Vettese[55]	1.5	0.5	1.5	3	0	0	0	1	2	2	**11.5**	0	0	0	1	1	**2**
Yanni[39]	1.5	1.5	0.5	3	1	1	1	1	2	1.5	**14**	0	0	0	1	1	**2**

Abbreviations: SD, study design; I, institutions; RR, response rate; TD, type of data; C, content; IS, internal structure; ROV, relationship to other variables; S, sophistication; A, appropriateness; OC, outcome; RIG, representativeness of intervention group; SCG, selection of comparison group; CCG, comparability of comparison group; SR, study retention; BA, blinding of assessment.

Discussion

In this systematic review of acute and chronic noncancer pain management education within GME, we found room for improvement largely related to study design and methodology. Most studies were conducted at a single site and assessed their interventions using outcomes at low Kirkpatrick levels.[57] We also noted a preponderance of brief educational interventions mostly focused on chronic pain management.

As Cook and Reed suggest, insight into study quality can be attained by examining MERSQI and NOS-E domain scores.[29] Specific domains of weakness noted were design, sampling, use of validity evidence, and outcomes. The majority of papers included in this review used a single group, pretest-posttest design. Only Sullivan et al used a multicenter randomized control design and resultingly had the highest total MERQSI score.[42] Multi-institutional studies, though logistically harder, would strengthen study results. One way to ease the burden of performing multi-institutional studies is through the creation of collaborative research groups. One successful example of this is the Emergency Medicine Education Research Alliance, a network of researchers that collaborate to produce high-quality, multi-institutional research.[58]

The outcomes domain of the MERSQI ties directly to Kirkpatrick's hierarchy for evaluation; the majority of the included studies assessed either learner

reactions (level 1) or knowledge (level 2), but rarely learner behavior (level 3) or patient/health care outcomes (level 4).[57] While this is an important finding and critique, it is not uncommon in the field of medical education; other reviews of education from various fields have made similar observations.[59-62] Some have posited that these restricted outcomes measures are due to a lack of external funding for medical education research[27]; however, others argue that medical education researchers have the responsibility to aggressively pursue funding in order to evaluate high-level outcomes and push the field forward.[63] It should be noted that, while higher Kirkpatrick's levels may seem inherently better as outcomes, low-level outcomes are still appropriate and useful in many contexts (ie, program evaluation, novel interventions).[64]

Despite our inclusive search for both acute and chronic non-cancer pain management education, we found few interventions that focused on acute pain. While this undoubtedly reflects the urgency to address opioid utilization for chronic pain conditions, we feel that acute pain management education is equally important for patients and clinicians, especially in light of recent literature suggesting the mismanagement of acute pain may lead to long-term dependence and poor outcomes.[15,65-69] While it was outside the scope of our review, we did note that a number of articles were excluded due to a focus on cancer-related pain or end-of-life care. Some principles of acute pain management may have been included in these articles.

The educational methods described in articles included in this review are encouraging. In choosing educational methods, Thomas et al offers 3 guidelines: (1) maintain congruence between objective and methods; (2) use multiple methods; and (3) choose methods that are feasible in terms of resources.[70] Most included papers focused on cognitive objectives (ie, build the knowledge base of learners). Lectures and case-based learning, which were the most commonly employed educational methods, are well-suited to address these objectives.[70] However, there are certainly behavioral and communicative aspects to pain management which are best targeted by supervised clinical experiences, role-playing, and the use of standardized patients[70]; these methods were employed by just 7 (29%) studies.

The timeline of the studies in this review are also of interest. While analgesia has always been an important aspect of patient care, pedagogical interest in this topic seems to have increased recently as a majority of papers included in our analysis were published after 2009. While this may be due to a number of factors, a key contributing factor may be the opioid epidemic: in the late 2000s, literature questioning the role of opioids in pain control began emerging and Purdue Pharma plead guilty to misbranding OxyContin.[71,72] Another possible explanation for the recent surge in publications is the increasing emphasis on evidence-based medical education. Lim and Golub noted that the number of systematic reviews within GME increased from 2 between 1966 and 1974 to 373 between 1995 and 2004.[73] While medical education research has existed for some time, over the last decades this field has been experiencing what one author called a "renaissance;" the growing literature on pain management education might be due in part to this evolution.[74]

The geographic distribution of included studies in our review is also interesting. Medical education research is largely concentrated in Europe, North America, and Australia; however, we found only 2 non-US studies.[75] This may be related to the mentioned opioid epidemic concentrated in the United States, but it may also reflect a limitation of our search strategy in that we neglected to include a large open access database run by the Association for Medical Education in Europe called MedEdPublish.

This study has several additional limitations. First, our literature search was limited to 3 databases. Though this permitted an extensive review, future studies could include additional databases and specifically should be inclusive of non-US-based databases. Further, our use of quantitative tools (ie, MERSQI, NOS-E) to assess methodological quality could have overlooked notable qualitative characteristics of study methods. However, we did not explicitly exclude qualitative work, and none of the articles included in our review were purely qualitative. There were a few papers that described curricular innovations and needs assessments in regard to pain management education, neither of which were included here but may offer insight into the state of pain management education.

Given the severity of the problem of undereducation around pain management, the ongoing opioid epidemic, and increased focus in methodologically sound medical education research, we call for more robust studies that might guide field-specific education. While the present study summarized educational methods, future work could evaluate which methods most effectively improve acute and chronic non-cancer pain management in GME. Additionally, future research on pain management in GME should strive to use more rigorous design, multi-institutional and/or interdepartmental sampling, and to target outcomes related to learner behavior or patient outcomes.

Conclusions

In this systematic review of acute and chronic noncancer pain management education in GME, we found that a majority of studies evaluated chronic pain management educational interventions at single sites through an assessment of learner reactions or knowledge. Notably, despite pain management being a pervasive issue that is not restricted to internal medicine, there were few interventions from other fields.

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