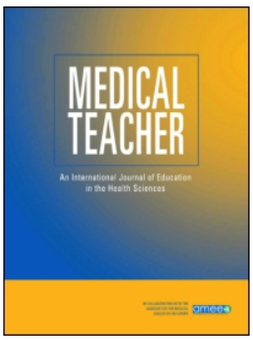

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Building capacity for education research among clinical educators in the health professions: A BEME (Best Evidence Medical Education) Systematic Review of the outcomes of interventions: BEME Guide No. 34

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BEME GUIDE

Building capacity for education research among clinical educators in the health professions: A BEME (Best Evidence Medical Education) Systematic Review of the outcomes of interventions: BEME Guide No. 34

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Abstract

Background/purpose: There is a growing desire for health professions educators to generate high-quality education research; yet, few of them encounter the training to do so. In response, health professions faculties have increasingly been devoting resources to provide members with the skills necessary for education research. The form and impact of these efforts have not been reviewed, though such a synthesis could be useful for practice. The objectives of this systematic review were to (1) identify interventions aimed at building capacity for education research among health professions clinical educators and (2) review the outcomes of these interventions.

Methodology: We developed a systematic review protocol based on our pilot scoping search. This protocol underwent peer review and was prospectively registered with the Best Evidence Medical Education Collaboration. Based on this protocol, we conducted a comprehensive search of health professions' databases and related grey literature. Systematic methods were applied: two independent reviewers completed title screening and full text review for inclusion, data extraction, and methodological quality assessment. Studies were included if they reported outcomes for interventions designed to increase capacity for health professions clinical educators to conduct education research. We conducted a qualitative synthesis of the evidence which included detailed reporting of intervention characteristics and outcomes.

Results: Our search returned 14, 149 results, 241 of which were retained after title and abstract screening, and 30 of which met inclusion criteria after full text review. Seven groups of interventions were identified, the most frequent being teaching scholars programs ($n = 10$), health professions education fellowships ($n = 3$) or master's programs ($n = 4$). The most commonly measured outcome was change related to enhanced scholarly outputs (grants, papers, abstracts, and presentations) post-intervention. Unfortunately, most of the included studies lacked detailed description of the intervention and were of low to moderate quality with post-test only design.

Discussion/conclusions: This review demonstrates that various interventions can have a positive impact on the ability of health professions clinical educators to conduct education research. We note several key elements of the interventions including: (1) protected time, (2) mentorship and/or collaboration, (3) departmental and institutional commitment and leadership, and (4) financial support. Through our analysis we describe the complexities around evaluating clinical educators' health professions research activities and the interventions used to promote education research. While improved study quality would allow more detailed understanding and evaluation of these key features, we are able to provide recommendations for potential strategies for improving participation in and quality of health professions education research based on this analysis.

Introduction

The launch of the Best Evidence Medical Education (BEME) Collaboration in 1999 marked a growing desire among health professions educators for an evidence-based approach to education practice. However, shortcomings in the quality of health professions education research have been widely reported in the literature (Lurie 2003; Shea et al. 2004). These have included weakness in methodological design (Carline 2004; Regehr 2004; Cook & Beckman 2006), single-site studies (Colliver & McGaghie 2008), inadequate description of multifactorial interventions (Colliver & McGaghie 2008), small sample sizes (Reed et al. 2007), and lack of reporting of clinically relevant outcomes (Chen et al. 2004; Whitcomb 2005). One explanation for these shortcomings is the relative

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Practice points

- Most interventions described learner satisfaction and positive behavior outcomes suggesting that many intervention types could be of benefit.
- Key elements of the interventions included: (1) protected time, (2) mentorship and/or collaboration, (3) departmental and institutional commitment and leadership, and (4) financial support.
- Many complexities were identified around evaluating clinical educators' health professions research activities and the interventions used to promote education research (e.g. high motivation to succeed regardless of intervention type).
- Recommendation and potential strategies for improving participation in and quality of health professions education research are described based on this analysis with discussion of related literature in this evolving area.

lack of research training and expertise of the health professionals who conduct education research (Huwendiek et al. 2010). In order to address these shortcomings and impact change, a critical mass of health professions leaders with expertise in education research is required. In response, departments, faculties, institutions, and other stakeholders have been increasingly devoting resources to enhance their members' education research skills and productivity. For example, the American Association of Medical Colleges (AAMC) has instituted the "medical education research certificate program" (MERC, https://www.aamc.org/members/gea/merc/), the Royal College of Physicians and Surgeons of Canada (RCPSC) has funded a "medical education research grant" (http://www.royalcollege.ca/portal/page/portal/rc/awards/grants/medical_education/meded_research_grant) to support quality research in medical education, and the Association of Medical Education in Europe (AMEE) offers a "research in essential skills in medical education course" and certificate (RESME, http://www.amee.org/conferences/amee-2014/programme/courses/research-in-essential-skills-in-medical-education).

However, despite these efforts, the results have been mixed. For example, a relatively recent international mixed-method study of experienced health professions educators identified a perception of low expertise and a need for further training in the area of education research methodology (Huwendiek et al. 2010). Further, the main challenges identified for those predominantly in the area of medical education research included a lack of academic recognition, funding, faculty development, protected time, and institutional support (Huwendiek et al. 2010). However, on the other hand, some programs that aimed to increase medical education research have demonstrated long-term benefits. For example there are reports of programs that increased academic productivity, improved successes in achieving grant funding, and resulted in promotions linked to education research (Irby & Hekelman 1997; Armstrong et al. 2003; Gruppen et al. 2003; Frohna et al. 2006; Wilkerson et al. 2006).

The task of health professions education research is carried out by a wide range of health professions educators and researchers. We have focused this review on "clinical educators" as they face a unique set of challenges and represent a large number of those participating in health professions education research. The exact definition of clinical educator varies considerably within the literature. Sherbino et al. (2014) addressed this in a mixed-method study intended to define the attributes, domains of competence, and core competencies of the related term clinician educators. On the basis of this study's findings, a clinician educator was defined as a clinician active in the health professions who applies theory to education practice, engages in education scholarship, and serves as a consultant to other health professionals on education issues. In the literature, authors use a wide variety of terms beyond clinical or clinician educator such as physician educator, pharmacist educator, and nurse educator; however, for the purpose of this review we will refer to this group of terms collectively as "clinical educators."

We further define this collective term, clinical educators, as a unique population with three important intersecting roles. The first role that the clinical educator must have is that of an academic. This implies that the position provides the impetus and in many cases the resources to conduct research. Promotion for this group is, to varying extents, is attached to research productivity, and resources such as time and training may be provided by the academic's organization. This academic responsibility for research productivity in the role of the clinical educator differentiates this group from the broader group of clinical supervisors, facilitators and teachers. The second role requirement is that of clinician. This is significant because it designates someone who has undergone significant amounts of clinical rather than research training, and because it designates someone who has competing clinical professional responsibilities and demands. It is this role that is unique to clinical educators and distinguishes them from those with a primary research designation. The third role requirement is that of educator or teacher and it is this role that designates them as personally immersed in the context and setting to which education research is applied. Thus, in summary, for the purposes of this review, a clinical educator must have academic responsibilities and incentives to publish research, must work clinically in the health professions and must have a role in health professions education. Because of the distinct challenges that this population faces, those designing interventions need to take these three intersecting roles into account when planning initiatives. There has yet to be a systematic review that focuses on the needs of this population in promoting health professions education research capacity.

Although the optimization of health professions clinical educators' abilities to conduct high-quality education research can be conceptualized in many different ways, we will approach this review through the theoretical lens of research capacity building (RCB). RCB is defined as "a process of individual and institutional development which leads to higher levels of skill and greater ability to perform useful research"

(Trostle 1992). While this definition includes faculty development as one important aspect of RCB, it also expands the definition to other broader processes and groups that can support clinical educators' research development. For example, Cook et al. (2005) provide a useful discussion of how they apply this theoretical framework to conceptualizing the overarching features of RCB within health services contexts. The key principles of RCB within this context include: development of skills and confidence, support for linkages and partnerships, development of research that is relevant to service users and has impact on practice, development of appropriate dissemination, investment in infrastructure, and building elements of sustainability and continuity. In this construct it is suggested that each principle operates at individual, team, organization and supra-organizational levels.

While there is certainly overlap between faculty development and RCB, these terms are not interchangeable. Faculty development, as explained in BEME Guide No. 8 (Steinert et al. 2006), is an organized effort to help faculty members become proficient in each of their demanding professional roles. However these efforts often focus on training programs provided to faculty members. Compared to faculty development, RCB includes these training programs but provides an explicit expansion to areas beyond teaching to aspects such as provision of funding opportunities and grants, development of support infrastructure such as offices of research and creation, and facilitation of collaborative research networks. Further, faculty development initiatives often focus on individual participants whereas RCB initiatives operate at both the individual and system level. Faculty development and RCB also differ in scope in that RCB is focused on the academic's role in research whereas faculty development initiatives can also apply to skills for other professional roles such as teaching, leadership or administrative skills. One limitation to this approach is that research skills may receive diminished visibility when "competing" with other topics of interest such as teaching or leadership skills, which may be perceived as more immediately relevant.

The RCB lens purports that enhancing clinical educators' capability to produce higher quality education research involves segments of the university beyond faculty, educational objectives beyond enhanced research skills, and interventions beyond training. An illustration of this point is provided by Zibrowski et al. (2008). They demonstrated that training in education research techniques did not enhance physicians' education scholarly outputs, whereas the provision of protected time for research did. While skills training distinctly falls within the realm of faculty development, the allocation of protected time may not. Other features of RCB that extend beyond faculty development and that commonly appear in the RCB literature are those that incorporate system level interventions such as institutional financial support, infrastructure, and sustainability as key elements (Cooke 2005; Liberato et al. 2011; Jamerson & Vermeersch 2012). For example, RCB initiatives may include the provision of financial support such as research assistant salaries or small seed grants and infrastructure support such as data analysis software or personal computers. Another important organizational intervention is the explicit inclusion of education scholarship in clinical educators' job descriptions allowing for promotion to occur on this basis.

Another way to conceptualize RCB interventions for enabling education research among clinical educators is through social cognitive career theory (SCCT). SCCT hypothesizes that "person-environment interactions form learning experiences that, in turn, influence perceived confidence in one's abilities to perform career-related tasks and activities (i.e. career self-efficacy) and the types of outcomes one expects as a consequence of given career pursuits (i.e. outcome expectations)." Bakken et al. (2006) examined the context of career development as a clinician researcher within the SCCT model and made suggestions for promoting a career as a clinician researcher. These suggestions include: (1) reduce role conflicts that result from complex environments consisting of research, family, and clinic responsibilities; (2) provide continuity of research training throughout undergraduate and postgraduate health professions training programs; (3) create a positive and rewarding mentoring culture by training mentors appropriately; (4) incorporate and evaluate interventions for self-efficacy; and (5) create positive outcomes expectations (e.g. financial support, awards, competitive salaries). Thus, the SCCT for career development of clinician researchers contains many aspects that fall solely under RCB and provides a meaningful theoretical underpinning to this framework and to our review.

Fortunately, there is a growing movement among institutions to recognize the need to support health professions education research activity, and many have been experimenting with various types of interventions aimed at supporting health professions education research. The current literature includes, but is not limited to, interventions such as: teaching scholars programs (defined as programs where participants commit to a longitudinal faculty development program around both teaching skills and education research), writing groups, small grants, health professions education offices or academies (defined as institutional infrastructure designed to support health professions teaching and education research scholarship which may include features such salary support, protected time, mentorship, etc.), and fellowship or master's programs in health professions education. While these interventions may be designed to increase capacity across several professional roles, they often include components designed to impart skills, mentorship, collaboration, infrastructure, and sustainability within the realm of education research. Despite the increasingly wide use of interventions designed to build research capacity among health professions clinical educators in the area of education research, no systematic review has been done to rigorously assess the effectiveness or key features of any of these interventions. A synthesis of the evidence in this growing field could provide direction for those in positions of leadership around faculty structure, faculty development, and resource allocation. Thus, we conducted a systematic review to examine the evidence of the effectiveness and key features of interventions in promoting health professions education research within the distinct population of clinical educators.

Objectives

The research question for this study is: what are the outcomes of interventions that aim to build capacity for education research among clinical educators in the health professions. We conducted a systematic review of the literature to assess the outcomes of interventions designed to build capacity for education research. The aim of this study is to synthesize this material to guide and inform those responsible for resource allocation and future program development in RCB for education research among health professions clinical educators.

Methods

Inclusion and exclusion criteria

Inclusion and exclusion criteria are detailed in Table 1. First, we included a population of health professions clinical educators. When we encountered studies of mixed groups of clinical educators and other participants, we only included studies where the clinical educators made up a significant majority of the group (i.e. more than 75% of the group meets our definition of clinical educators). Second, we included those clinical educators who participated in an RCB intervention designed to address their capacity to perform health professions education research. Third, we included studies that reported outcome measures related to education research skills and/or performance at an individual, faculty, or institutional level. Finally, we reported the outcomes of these interventions and categorized the studies according to the intervention type. We also categorized the outcomes according to a modified Kirkpatrick framework (Kirkpatrick & Kirkpatrick 1994): learners' reactions (level 1), learners' actual or perceived skills or knowledge (level 2), learners' behavior (level 3), or patients' health outcomes (level 4). Types of study designs included are shown in Table 1.

Search strategy

We identified relevant studies from the electronic databases listed in Table 2. The search strategy used a combination of subject headings and free-text keyword searching in order to capture the main search headings of "Faculty/Education" and "Research Capacity Building Interventions" and "Research or Scholarship." Each database search strategy was adapted to match the appropriate subject headings used by that database (if applicable). In order to not miss relevant studies, search strategies were modified as necessary to reflect content differences in health, education, and interdisciplinary databases. An example of an Ovid Medline Search is shown in Table 3 and complete search strategies for all databases are available upon request. Based on our pilot searches, we expected the overall search to be sensitive but lack precision. This is due to the fact that although the search strategy was rigorously tested against a set of relevant articles, there was an inherent lack of standardized search terms for targeted areas of interest for this review.

In addition, the reference lists of all included studies were hand searched, as were those of relevant reviews that were identified during the title screening procedure described below. We also hand-searched conference proceedings for the Association of American Medical Colleges, the Association of Medical Education in Europe, and the Canadian Conference of Medical Education from 2010 to 2012. We also conducted a separate citation search on Web of Science looking forward for studies that cite any of the included articles as well as a search of Google Scholar. The primary authors of all included studies were contacted by email to determine if they knew of any unpublished, recently published, or ongoing studies relevant to the review.

Screening and selection of studies

The titles and abstracts generated from the electronic database searches were collated in a RefWorks™ reference management database. They were then screened independently by two reviewers (RA and AF) to exclude those that did not meet the inclusion criteria or address the study question. The full texts of the remaining studies were retrieved and a pre-approved inclusion form was applied independently by two reviewers (RA and AF) to identify relevant studies. Disagreements were resolved through discussion, or with the aid of a third reviewer (AO or LH) as required.

Assessment of methodological quality

The methodological quality of included studies was evaluated independently by two reviewers (RA and LH) using the Medical Education Research Study Quality Instrument (MERSQI) (Reed et al. 2007). This instrument has been used previously in a published BEME review (de Jong et al. 2013) and was selected by our team, as it is specific to health professions education research studies and capable of measuring the quality of experimental, quasi-experimental, and observational studies. The MERSQI instrument includes 10 items, reflecting six domains of study quality including: study design, sampling, type of data (subjective or objective), validity, data analysis, and outcomes. The maximum score for each domain is three, producing a potential range of 5–18. Discrepancies were resolved through consensus or with the aid of a third reviewer (AO) as required.

Data extraction

Data were extracted and entered into an electronic data extraction form. The form was developed and piloted in a systematic review performed by two of the authors (Hartling et al. 2010) and further revised and tailored to the current review. One reviewer extracted data (AF) and to ensure accuracy and consistency a 20% sample of the articles was randomly selected for extraction by a second reviewer (RA). The data extracted by the two reviewers were compared. As classification of the Kirkpatrick level of the reported outcomes for 11 of 30 included papers was reported as unclear and as one discrepancy in determination of study design was detected on performing the 20% quality check, we subsequently decided to have a second author double check all data extraction (half done by RA, half done by

Table 1. Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Population	Physicians	Non-health professionals
	Nurses	
	Pharmacists	
	Dentists	
	Veterinarians	
	Dieticians	
	Clinical Psychologists	
	Other Allied Health Professionals	
Intervention	Fellowships	
	Bursaries	
	Certificates of education research	
	Teaching scholars programs	
	Offices of education research	
	Initiative to build or expand research networks	
	Research facilitators	
	Mentorship	
	Peer writing groups	
	Small grants	
	Research forums	
	Removal of barriers to conduct education research	
	Formal instruction	
	Master's programs relevant disciplines	
	Infrastructure support (e.g. data analysis software, personal computers, research assistant salaries)	
	Bestowal of protected time	
	Efforts to include research activity in clinical educators' job descriptions	
	Other interventions targeted specifically at research capacity building	
Outcomes	Change in patient outcomes (Kirkpatrick level 4)	
	Changes in products of scholarship (Kirkpatrick level 3):	
	Grants	
	Publications	
	Conference presentations	
	Change in behavior around scholarship (Kirkpatrick level 3):	
	Collaborations	
	Research participation	
	Change in measured or perceived knowledge or skills (e.g. knowledge acquisition scores, self-ratings of skills) (Kirkpatrick level 2)	
	Learner reaction/satisfaction (Kirkpatrick level 1)	
	Other relevant outcomes (as per text)	
Research Design	Studies which provide primary data for any of the outcomes listed above, including (but not limited to) the following designs:	Studies that do not report an outcome including:
	Randomized controlled trials	Needs assessments
	Non-randomized control trials	Prevalence studies
	Before and after studies	Opinion papers
	Interrupted time series	Commentaries
	Post-test only studies	Letters
	Qualitative or mixed method studies	Editorials
Language	English language (Morrison et al. 2009)	Articles not available in English

AO). This review of 100% of the data extraction revealed only the one discrepancy that was identified in the original 20% check. However, it did allow for resolution in the 11 of 30 studies where classification of Kirkpatrick level of outcome was initially unclear and identified 11 other studies where Kirkpatrick level was incorrectly assigned initially. No other significant discrepancies in data extraction were identified through this more detailed data extraction check.

Analysis

We conducted a qualitative synthesis of the evidence, using procedures outlined by Ogawan and Malen (1991) for synthesizing heterogeneous bodies of literature. We first divided the studies by intervention type. In order to avoid making inferences where details were not available, we classified the interventions using the terms that were provided by the authors. We then further identified the following

constructs by which we evaluated and compared studies: participant group, study design, type of outcome (according to modified Kirkpatrick framework), and quality assessment scores. Meta-analysis was not performed because of substantial heterogeneity across study design, intervention type, and due to insufficient reporting of data at the study level.

Results

Description of search results

Of 19, 149 studies identified through the search process, 30 studies met the inclusion criteria. Figure 1 (published online as Supplementary Material) shows the flow of the study review process.

Description of population

The majority of the studies were conducted in the USA (26 studies), while the remaining studies were conducted in Canada (3 studies) and Iran (1 study). The studies were conducted between 1991 and 2011 with the median year of publication 2004.

Participant groups were extremely varied. All studies included our target population of health professions clinical educators but in some cases the clinical educators were mixed with unspecified or non-clinical educators. In general, the groups consisted most frequently of physicians mixed with members of other health-care professions. Often participants were referred to generally as "clinical staff" or "medical staff" without specifying their health profession and thus we could not analyze the data by profession. Eight studies included only physician participants and one study included only nursing participants. Studies with a mix of physicians and other health professions participant groups include five studies with nurses, two studies with pharmacists, two studies with dentists, one study with veterinarians, and one study with social workers. There were also studies with a mix of clinical educators and other participants including 10 studies of clinical educators with basic scientists and three with administrators (including program directors and members of offices of medical education). No studies compared outcomes by health-care profession. Few studies indicated the level of experience of the participants precluding meaningful comparisons between studies of junior versus more experienced clinical educators.

Table 2. Included online databases.

Health-related databases	General databases
Medline (1950–present)	ERIC
EMBASE (1980–present)	SCOPUS
PSYCinfo	
CINAHAL (1937–present)	
Cochrane Library (various dates–present)	

Databases – note that all searches were limited to 1970 to current.

Description of interventions

Intervention groupings are shown in Table 4 and are summarized as follows: health professions education fellowship or master's programs (7 studies), teaching scholars programs (10 studies), health professions education writing groups (2 studies), health professions education research awards or grants (4 studies), offices or academies of health professions education (3 studies), mixed intervention (1 study), and "other" education research initiatives (3 studies). A description of each structured intervention is summarized in Tables 5–7, published online as Supplementary Material. Unfortunately, the level of detail reported about each of the structured interventions was often limited. Further, due to the heterogeneity of educational strategies used and content included in the interventions, variations in study design and quality, and paucity of comparative study designs, it was not possible to determine which intervention type had the most beneficial effect.

Table 3. Example search for Ovid Medline.

Faculty/Education	AND Research Capacity Building Interventions	AND Research or Scholarship
exp Education/ or Teaching/ or "medical education".mp. or "clinical education".mp. or "teaching".ti. OR (exp Health Personnel or exp Students, Health Professions/ or exp Faculty/ or "clinical faculty".mp. or (faculty or researcher*).ti.) AND (education or teaching).mp. ored.fs.	capacity building.mp. or Staff Development/ or exp In-service Training/ or financial support/ or research support as topic/ or exp training support/ or Financing, Organized/ or Mentors/ or peer group/ or (writing group* or peer group* or mentor* or social network*).ti,ab. or (master* adj3 medical education).mp. or (staff development or faculty development or teaching scholar*).ti,ab. or (office* adj3 education).mp. or fellowship*.ti. or Program Evaluation/ or Program Development/	Research/Publishing/ (research* or scholarship or scholarly).ti,ab.

Although many of the interventions described within our review were not explicitly grounded in an education theory, we identified common features across interventions. These included the use of multiple established instruction and assessment methods, longitudinal program design, and underpinning in an experiential learning framework. For example, teaching strategies included lectures, workshops, and small group sessions. Assessment strategies included peer review, self-reflection, project assignments, and CV analyses. All of the interventions where instruction was explicitly provided used experiential learning as the primary organizing structure of the intervention. For example, many interventions included completion of a project that ultimately demonstrated the participants' ability to produce some form of education research.

Methodology and outcomes of interventions

Tables 5–7 (published online as Supplementary Material) outline details corresponding to each study design. In summary, the majority of the studies used a post-test only design ($n = 21$) and quantitative data collection ($n = 23$). The methodological quality analysis revealed an average MERSQI score of 8.87 (range 5.5–14). The lowest scores were in the validity domain, with only one study reporting both validity and reliability of the evaluation tools used (Burdick et al. 2010). Reported study outcomes most commonly fell into Kirkpatrick level 3 ($n = 22$), followed by level 1 ($n = 15$) and level 2 ($n = 4$) (note: some studies reported more than one level of outcome). No studies reported Kirkpatrick level 4 outcomes. The most commonly reported Kirkpatrick level 3 outcomes were dissemination related behaviors such as number of grants, publications, and presentations (including abstracts and posters).

Observations regarding the key features of the interventions

Although few studies explicitly identified the key features of the interventions that were associated with positive outcomes, we have noted several commonalities. As described above, the key common features included the use of a variety of teaching and assessment strategies, the use of a longitudinal program design, and the use of an experiential learning framework. Even though the majority of the studies in our review included or focused on physician clinical educators, a broad range of health-care professions were represented including nurses, dentists, social workers, veterinarians, and pharmacists. While no studies compared outcomes by health-care profession, there was a high degree of participant satisfaction and desired behaviors across these groups suggesting widespread applicability of these intended intervention outcomes across health professions.

Focused analysis

As previously described, due to heterogeneity across study design, intervention type, and insufficient reporting of data at the study level it was not possible to provide a quantitative synthesis of all interventions. Instead we decided to take a

Table 4. Types of interventions used.

Intervention type	Studies using intervention type	Total
Health professions fellowship or master's programs	Baker and Lewis (2007) Burdick et al. (2010) Lewis and Baker (2009) Marks (1999) Searle et al. (2006) Simpson (1993) Wilkerson and Hodgson (1995)	7
Teaching scholars programs	Fidler et al. (2007) Heinrich et al. (2009) Moses et al. (2006) Moses et al. (2009) Muller and Irby (2006) O'Sullivan et al. (2006) Rosenbaum et al. (2005) Srinivasan et al. (2007) Steinert et al. (2003) Steinert and McLeod (2006)	10
Health professions education research awards or grants	Albanese et al. (1998) El-Sawi et al. (2009) Nieman and Kelliher (1991) Viggiano et al. (2000)	4
Health professions education writing groups	Cumbie et al. (2005) Steinert et al. (2008)	2
Offices in education research/academies of educators/education research groups	Beckman et al. (2009) Cooke et al. (2003) Nierenberg and Carney (2004)	3
Other health professions education research initiatives	Alizadeh et al. (2011) Armstrong et al. (2003) Simpson et al. (2006)	3
Mixed interventions	Thomas et al. (2004)	1
Total		30

separate look at the studies with higher quality design in order to identify key features associated with successful outcomes through qualitative synthesis. In our review, these stronger studies designs included those with pre- and post-design or a comparison group as opposed to post-test only design. A total of nine studies met this criterion and they evaluated the following interventions: two studies on health professions education master's or fellowships (Simpson 1993; Burdick et al. 2010), three studies on teaching scholar programs (Rosenbaum et al. 2005; O'Sullivan et al. 2006; Moses et al. 2009), one study on a medical education writing group (Steinert et al. 2008), one study on "other" health professions education research initiative (a longitudinal study where the intervention changed iteratively over the time of the study) (Simpson et al. 2006), one study on a medical education research group (Beckman et al. 2009), and one study on a grant program (El-Sawi et al. 2009). El-Sawi et al. conducted the only comparative study included in this review. We performed a focused analysis of the following dimensions: description of the intervention, outcomes reported, and main authors' conclusions. A summary of these studies can be found in Table 8, published online as Supplementary Material. The reported data in these studies did not allow for calculation of effect sizes.

Description of intervention

Detailed descriptions of each of the included nine interventions are provided in Table 8 (published online as Supplementary Material). As for the details of specific interventions, the peer writing group intervention (Steinert et al. 2008) included a faculty development workshop (plenary session, small group discussion, and instructional workbook) followed by 3 two-hour peer writing group sessions over six months with independent study time. The medical education research group (Beckman et al. 2009) met once a month for one and a half hours for a structured meeting including reviewing research proposals for departmental protected time and discussing and critiquing research initiatives within the group. The small grants program was over an 18-month period. The health professions education research fellowships or master's programs ranged from one (Simpson 1993) to two-year programs (Burdick et al. 2010). Teaching scholars programs ranged from 10 to 13 sessions over an unknown time period to three years (Rosenbaum et al. 2005; O'Sullivan et al. 2006; Moses et al. 2009). The "other" education research initiative described by Simpson et al. (2006) evolved over a 15-year period from a two-year program initially to shorter 4- to 6-week modules.

All nine of the higher quality studies included physicians either alone or with: nurses (Moses et al. 2009; Burdick et al. 2010), basic scientists (Burdick et al. 2010), undergraduate and/or post-graduate program coordinators (O'Sullivan et al. 2006; Steinert et al. 2008), or pharmacists (Moses et al. 2009). One study focused on international collaboration and included participants from 19 countries (Burdick et al. 2010); another two studies focused on post-graduate program directors and coordinators (O'Sullivan et al. 2006; Steinert et al. 2008).

As described for the larger group of studies, several commonalities existed across these studies' interventions. For example, all of these interventions included core curriculum components that covered the basics of health professions education research, and for the most part, these were delivered using a variety of teaching strategies. For example, usually a combination of lectures, workshops, small groups, peer review, and/or self-reflection would be used. In addition, most interventions included the completion of some form of education research product (with the exception of O'Sullivan 2006 and Steinert et al. 2008). These products included written reports describing institutional education innovations, abstracts, presentations, or publications.

Outcomes reported

Five of the nine studies measured participant reaction to the intervention (Simpson 1993; O'Sullivan et al. 2006; Simpson et al. 2006; Steinert et al. 2008; Moses et al. 2009; Burdick et al. 2010). In all cases, the intervention ratings were positive. Both health professions education fellowship studies also reported increases in self-reported knowledge and skills relevant to conducting health professions education research. Eight studies evaluated the effects of the intervention on education research behaviors (Simpson 1993; Rosenbaum et al. 2005; O'Sullivan et al. 2006; Simpson et al. 2006; Steinert et al. 2008; Beckman et al. 2009; El-Sawi et al. 2009; Moses et al. 2009). This included increases in abstracts, presentations, grants, and publications. Only one of these studies reported post-intervention decline in productivity (O'Sullivan et al. 2006). Three studies also evaluated the effect the intervention had on the participants' professional social network (El-Sawi et al. 2009; Moses et al. 2009; Burdick et al. 2010). For example, one used qualitative synthesis of networking themes from structured interviews (Burdick et al. 2010), one study was a comparative mixed-method study including structured interviews (El-Sawi et al. 2009), and one study used formal social network analysis (Moses et al. 2009). They all reported increases in network despite using these very different methods for evaluation (further described in Table 8). However, this did not result in statistically significant increases in productivity when it was measured through social network analysis (Moses et al. 2009).

Synthesis of common findings

Several themes were identified through review of these nine papers as important components of interventions. First, many of these studies emphasized the importance of protected time to complete education research (Simpson 1993; Rosenbaum et al. 2005; Simpson et al. 2006; Steinert et al. 2008; Beckman et al. 2009). This came through most strongly in our review of the limitations described in the discussion sections of the included studies. Here, a lack of protected time was highlighted as a limitation to: (1) recruitment and participation of both instructors and learners, (2) ability to work on course projects, and (3) writing productivity (Simpson 1993; Rosenbaum et al. 2005; Steinert et al. 2008). Second, these studies emphasized the importance of mentorship and/or collaboration in education research (Simpson et al. 2006; Steinert et al. 2008; Beckman et al. 2009; El-Sawi et al. 2009;

Moses et al. 2009; Burdick et al. 2010). For example, the results of the study by Moses et al. directly bring light to the importance of the role of collaborative social networks for success in education research and this theme recurs in the discussion section of nearly all higher quality studies. Third, several studies noted (Rosenbaum et al. 2005; Simpson et al. 2006; Beckman et al. 2009) the importance of leadership and commitment toward education research at the departmental and/or institutional level. Lastly, financial support was included as an important factor toward the development of education research (Rosenbaum et al. 2005; Simpson et al. 2006; El-Sawi et al. 2009). Examples of financial support included grant funding and stipends. Review of these papers identified funding not only as a primary source of direct support to project completion but also as a facilitator of collaboration between researchers (Simpson et al. 2006; El-Sawi et al. 2009).

Discussion

Summary of key findings

This systematic review aims to identify interventions meant to increase capacity for education research among health professions clinical educators. The results of this review are intended to provide those responsible for resource allocation and future program development in health professions education RCB with a practical summary to guide implementation of interventions within their institution. To our knowledge, this is the first systematic review that provides a synthesis on this topic.

This review suggests positive outcomes in the following domains: (1) learner satisfaction, (2) knowledge and skills required to conduct education research, and (3) behaviors such as success in publications and grants. All but one study (O'Sullivan et al. 2006) reported positive results in one or a combination of these outcomes. This suggests that any of the interventions described in this review may have had positive impact on these outcomes. As previously alluded to in the results section, due to the heterogeneity of study methodology and paucity of comparative study designs, it was not possible to determine which intervention type had the most beneficial effect. However, through our focused qualitative synthesis we did identify key features across a broad range of RCB interventions associated with success including: protected time, financial support, supportive work environment (mentorship and collaboration), and leadership and commitment toward education research at the departmental and/or institutional level.

The strength of this review lies in its use of a prospectively registered rigorous systematic review methodology that includes standard methods to avoid bias (e.g. two independent reviewers completing each stage), predetermined inclusion criteria and clear definitions of education research, health professions clinical educator, and RCB. Further the conceptual framework of RCB allowed for inclusion and evaluation of a broad range of intervention types and key features. In addition, a broad search strategy was employed to guard against missing key studies.

The single outlier study (O'Sullivan et al. 2006) that observed a decline in productivity after their teaching scholars' program hypothesized that this finding was due to a better understanding by participants of what constitutes "true education research." Thus this finding may have represented a response shift bias, and may have been overcome by the use of a retrospective pre- and post-test design.

The studies in our review did not differentiate between experienced versus inexperienced participants. However, one included study discussed an unexpected finding whereby grant applications were more likely to be submitted by senior faculty looking "to shift into new areas of interest" than by junior faculty (Nieman & Kelliher 1991). Conflicting outcomes in this regard have been noted in faculty development initiatives aimed at improving health professions education teaching (Steinert and McLeod 2006) in which some interventions had the greatest impact on inexperienced participants (Baroffio et al. 1999), while others impacted more experienced participants (Litzelman et al. 1998). Further studies addressing participant attributes such as specific health profession, self-motivation, and experience are needed.

Linking the concepts of faculty development and research capacity building

The interventions described in our review share several commonalities with those described in a BEME review of faculty development interventions aimed at improving teaching scholarship or leadership (Steinert et al. 2006, 2012). For example, most of the interventions included in our review were longitudinal designs, which is consistent with the faculty development review (Steinert et al. 2006). The potential benefits cited for longer programs include the creation of social networks and sustained involvement post intervention. However, several of the papers in our review noted problems with longer programs such as the time constraints of an extended commitment for both facilitators and participants. This highlights the need to compare the feasibility of shorter versus longer duration programs. Steinert et al. (2006) commented on the role of context in faculty development interventions and on the four conditions necessary for change to occur: (1) the person must have the desire to change, (2) knowledge of what to do, (3) a supportive work environment, and (4) rewards for change. They stipulated that the first two conditions for change could be achieved through faculty development and the second two could not; yet, they hypothesize that it may be the latter two conditions that promote change in the broader sense.

Our review builds on the foundation laid by the faculty development review by expanding on these last two conditions necessary for research activity. For example, we looked at interventions beyond traditional faculty development including those within the broader umbrella of RCB. This included interventions that incorporate changes in institutional organization and shifts in infrastructure. These key RCB features are capable of producing both a supportive work environment and rewards for education research. Our qualitative synthesis highlighted these components of

RCB as necessary for the success of structured interventions, further building on the faculty development review.

It has been suggested by Bowman et al. (2007, p. 2521) that "increasing research productivity is an institutional challenge that requires multiple complex actions over a sustained period of time." While no studies in our review specifically measured changes in institutional practice as a primary outcome, many reported closely related markers such as participants' involvement in leadership roles and development of collaborative networks. These key markers may influence future institutional change.

Our review did identify papers that evaluated the networking aspect of the RCB construct by employing social networking analysis. Social network analysis is an emerging area that describes and measures the complexities of the relationships between individuals (O'Malley & Marsden 2008). We agree with Moses et al.'s (2009, p. 76) perception that "social network mapping may be a valuable tool for visually conceptualizing the structure of the networks built through faculty development programs." The development of scholarly professional networks has been previously linked to greater productivity (Morzinski & Fisher 2002; Bland et al. 2005). This suggests that the academic socialization and the development of collegial support, in addition to the acquisition of knowledge and skills, are important components of RCB interventions and a contributing factor to their success.

The shift in philosophy toward the importance of academic support and recognition for education research that is highlighted by the RCB framework is further supported by the Canadian Association for Medical Education (CAME) position paper on Education Scholarship and its interplay with promotions guidelines and practices in Canada (Van Melle et al. 2012). It should be noted that this report focused on medical education research and used the phrase clinician educators to refer to physicians with consultative skills in medical education practice and research rather than the broader definition of clinical educators used in the current review. However, CAME made several recommendations regarding strategies to appropriately support and recognize clinical faculty involved in education research that could apply to the broader group of clinical educators working in health professions education research. These recommendations were described at national, institutional, support system, and individual levels. At the national level, they advocated for a need for common language and definitions for education research in order to distinguish education research from education administration, education leadership, and traditional research activities. At the institutional level, they identified the need for specific metrics to measure the range of products and the impact of education research. At a support system level, they recommended that those in key leadership positions have a robust understanding of the scope and importance of education research. Additionally, the need for specific mentors to provide advice to clinical faculty on how to undertake education research as a viable and successful academic career path was also recommended. Finally at the individual level they recommended that pathways and guidelines be developed for incorporating education research into the various roles of an academic clinician (e.g. clinician teachers, clinician educators, clinician leaders, research scientists). The report also recommended support for development of the skills and opportunities required to successfully engage in education research. These recommendations are all well aligned with the RCB framework and the findings of the current review.

Limitations of included studies

Despite the fact that all but one of the studies in this review report positive outcomes, we noted there are several caveats to these results. The limitations of the included studies fell into four broad categories: (1) provision of inadequate intervention detail, (2) lack of theoretical underpinning, (3) use of outcomes with questionable validity and/or meaning, and (4) lack of suitable study design for the research questions posed.

To begin with, few studies identified the particular features of the intervention that were associated with positive outcomes, making it difficult to infer why particular interventions worked. For example, detailed description regarding the participant group, response rates, statistical methods, and details of intervention duration, curricular content and teaching, and assessment strategies were often lacking. This made it difficult to accurately compare interventions and to tease out important features of the interventions. Further, the seven categories we used to classify the intervention types were based on the authors' chosen terminology. Author's labeling of the interventions may have been flawed, but lack of detailed descriptions of interventions precluded us from allocating interventions to preset categories in a consistent manner and so it was decided to use study authors' terms. In conceptualizing the framework for grouping interventions it is important to recognize that each intervention type is not necessarily mutually exclusive of another and may include features of multiple intervention types. For example, it is hard to identify the differences between what some authors called a longitudinal faculty development program and other authors called a teaching scholars' program. In addition, very few studies explicitly mention a theoretical underlying framework, again making it difficult to hypothesize regarding why their intervention may have succeeded.

The next major concern with the included studies relates to the use of outcomes with questionable validity or meaning. For example, there were high levels of learner satisfaction with all types of interventions reported. This finding is likely at risk of selection bias as the majority of the participants were volunteers and thus a motivated group of individuals that are interested in growth and development in the area of health professions education research. In fact, this selection bias may also have affected higher level outcomes such as knowledge, skills, and behaviors. It is possible that these participants were motivated enough to succeed by the dire academic consequences of failure that they may have had the same behavioral outcomes regardless of the intervention. Second, many studies defined changes in research behavior as changes in number of presentations, grants, or publications. While this increase in number of research related outputs likely represents a positive behavioral outcome, none of these studies assessed the quality or impact of these outputs. In addition, while the majority of interventions required completion of a project demonstrating

the participants' ability to produce some form of education research, more studies with long-term follow-up would be required to determine if participants' engagement in education research is sustained.

Another limitation of included studies relates to the lack of validated outcome measures, which contributed to overall low to moderate quality ratings. Only one study (Burdick et al. 2010) reported validity or reliability of the questionnaires used. Four studies used unvalidated measures to assess changes in self-perceived knowledge or skills. While not acknowledged in these studies, changes in self-perceived knowledge and skills are at risk of biased interpretation (Dunning 2004; Regehr & Eva 2006). Further these self-perceived knowledge and skill outcomes do not fit cleanly into frameworks such as Kirkpatrick where original descriptions imply external tests of knowledge and skills (Kirkpatrick & Kirkpatrick 1994). However, several studies did attempt to strengthen outcome measures with novel approaches including standardized CV analysis (a standardized method for analyzing CV's whereby data of interest is extracted using a template and analyzed to provide descriptive findings) (Morzinski & Schubot 2000; Gruppen et al. 2003) and social network analysis (Searle et al. 2006; Moses et al. 2009).

Finally, study designs were often not well aligned to the corresponding research questions. This frequently limited the ability to draw conclusions from the data even when reasonably strong study outcomes were reported. For example, nearly all studies were quasi-experimental and thus cause and effect could not be determined. Any enhanced education research productivity outcomes could be confounded if the participants had also participated in other interventions designed to increase research productivity in general. For example, participation in a public health masters' degree or a clinical investigator program would likely extend participants' productivity in education as well as clinical research. This flaw could have been overcome in several ways, such as by using a controlled study design or using a qualitative or mixed-method design that could provide depth into the details of the context and implications of the changes seen (O'Malley & Marsden 2008).

Even the nine highest quality studies presented in the focused analysis had flaws. The majority of these studies used single-group pre- and post-test design, which may overestimate effect size as noted by Cook et al. (2011). Additionally, few studies assessed the durability of the observed outcome over time. Further studies would be required to compare outcomes in the immediate and delayed post-intervention period (Cooke 2005).

Despite these concerns, it is difficult to critique the authors who have taken on this challenging area of research. Due to the complex multidimensional nature of the construct of education research, there is a high risk of confounding in most approaches to evaluation of these interventions. This makes it difficult for researchers to design what would traditionally be considered a methodologically rigorous study by any quality assessment tool. Some examples of these potential confounders include the fluidity of the identity of the clinical educator in that many faculty experience shifts in academic roles unrelated to the interventions at hand. In addition, the high level of motivation to succeed found in this population will often cause them to work above or around interventions if they find them unhelpful rather than risk academic failure.

What is "high-quality" health professions education research?

To this end, the definition of what constitutes "high-quality" health professions education research has increasingly come under debate. Yarris et al. (2013) argue that although methodological rigor forms the basis of what defines quality, focusing purely on rigor at the expense of other aspects of quality can "diminish the value of the results for the consumers." This highlights the debate between rigor and applicability/generalizability that has also been raised in clinical research arenas. Further, Cook and West (2013) have cautioned regarding the focus on outcomes based research, which is a heavily weighted component of quality assessment scales used for assessing the quality of health professions research. They warn that an over emphasis on patient outcomes (Kirkpatrick level 4) in health professions education research may be subject to five significant risks: (1) dilution of the impact of the education intervention as it is filtered through the health-care system and health-care providers, (2) inadequate sample size, (3) failure to establish a causal link, (4) potentially biased outcome selection, and (5) teaching to the test. Cook and West (2013) also offer suggestions to improve reporting of more meaningful outcomes. These include: (1) clarification of the study objective and conceptual framework before selecting outcomes; (2) consideration of the development and use of behavioral and other related outcomes; and (3) consideration of a stepwise approach in evaluating education interventions including first assessing knowledge and skills, then behaviors, and finally patient outcomes. Further, Cook and West (2013) emphasised selecting patient outcomes that result from the engagement of the whole health-care team and using advanced statistical techniques whenever there is more than one patient outcome per trainee (i.e. clustering of patients). These suggestions could help guide researchers working in the field of improving capacity for health professions education research and those planning faculty development in this area.

Limitations of the review overall

This review itself was also subject to limitations. As previously mentioned, it was limited by the fact that the majority of the studies included were of low or moderate methodological quality making it difficult to make specific inferences about the effectiveness of the interventions. We continue to support the ongoing push within health professions education literature for more rigorous study design. Another limitation relates to the use of the Kirkpatrick framework as one of the organizing structures of the review. However, the Kirkpatrick framework was only one of several conceptual frameworks employed in this review and thus did not play a dominant role. Other organizers in the analysis included intervention type, study design, and participant group. Classification of studies by Kirkpatrick levels was necessary in order to attain a MERSQI score for each study. However, not all outcomes were easily

amenable to classification within the original framework. For example, while we decided to classify self-perceived knowledge and skills as Kirkpatrick level two, we recognized that this is a modification of the original framework. Fortunately, the implications of this decision in the current review were likely small in that some studies may have been granted at maximum half an extra point in the MERSQI. Since higher quality studies were not selected based on MERSQI score but rather on study design, this likely did not alter the analyses in this review. While the MERSQI was meant to be a more specific tool for health professions education systematic reviews, we found that it was somewhat overly weighted toward the Kirkpatrick level of the outcomes. Again, this did not impact our subsequent analyses. Finally, while the search strategy was very broad in this review and required a lot of resources on our part, it allowed our team to feel confident that key papers would not be missed.

Recommendations for next steps

The breadth of interventions to improve research capacity of clinical educators described within the literature is vast, and this review provides a starting point toward developing an evidence-based approach to best practice in this field. Our review documents the growth in several of the key components of RCB including: (1) targeting and sustaining investments in a variety of RCB activities, (2) developing leadership at the faculty and institutional level, (3) creating infrastructure and recognition for education research, and (4) building collaborative networks of health professions education researchers. Now is the time to shift emphasis to the importance of studying RCB in health professions education and more specifically the evaluation of such RCB interventions. Evaluation data in the broader RCB literature are also limited as RCB has not traditionally been a focus of research and little evidence exists for effective evaluation approaches to date. Thus, it is imperative that health professions education researchers continue to work together and draw from the broader literature regarding RCB to develop higher quality evaluation techniques across local and regional research networks. For example, expansion of existing regional, national, and international collaborative groups interested in various aspects of health professions education research such as the FAIMER network, the International Competency Based Medical Education group (ICBME) and the International Clinician Educators Network (ICENet, http://icenetblog.royalcollege.ca) could allow progress to be made in this area. Importantly it has become necessary to better define other features beyond methodological rigor and high-level outcomes that contribute to high-quality education research.

Conclusions

The literature around increasing capacity for health professions education research is gaining momentum with increasing numbers of publications. While the strength of evidence remains limited by weaker study designs, we identified many complexities around evaluating clinical educators' health professions research activities and the interventions used to promote education research. However, most interventions designed to increase education research among clinical educators described a positive outcome in terms of learner satisfaction and behavior. From our qualitative synthesis of the nine highest quality included studies, we noted several themes that may represent key elements of the interventions including: protected time, mentorship and/or collaboration, departmental and institutional commitment and leadership, and financial support. Additional observed commonalities regarding the interventions included positive outcomes across a broad range of health professions as well as the use of multiple instructional and evaluation methods, longitudinal program designs, and experiential learning as organizing structures. Finally, there was increased growth in the areas of developing supportive environments and increasing recognition for health professions education research.

Implications for future research

(1) Future studies should be designed to adhere to stronger methodological standards including: detailed descriptions of the intervention such that replication is possible, planning for evaluation at the outset of the intervention, realistic and clear definitions of outcomes, reliable and valid outcome measurement tools, and better alignment between research questions and study design by employing comparative quantitative, qualitative, or mixed methodology study design to better support the strength of observed outcomes and conclusions.
(2) The elements of the intervention that led to the desired outcomes need to be better documented and evaluated.
(3) Future studies should consider differences in outcomes across a variety of contexts such as different health-care professions, experienced versus less experienced participants, and long versus short interventions.
(4) While behavioral change (such as number of publications, successful grant applications, or conference abstracts or presentations) was the most common outcome observed post-intervention, the quality of products, and persistence of engagement post-intervention is uncertain. Thus, a broader assessment of products and longer follow-up time is required to determine the quality and feasibility of a sustained behavioral change.
(5) We must continue to work together to evaluate RCB initiatives and draw from the broader literature regarding RCB to develop higher quality evaluation techniques across local and regional research networks.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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Supplementary material

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