Faculty Development of Education Researchers in Academic Anesthesiology

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Published scholarship in medical education (ME) began just over 50 years ago with the *Journal of Medical Education*.[1] Before that time, fads, politics, and ideology rather than evidence guided much of medical educational decision-making.[2] Currently, ME is a rapidly growing field of study with an increasing number of manuscripts, conferences, collaborative research efforts, and journals (ie, *Academic Medicine*, *Medical Education*, *Medical Teacher*, *Teaching and Learning in Medicine*, *Journal of Graduate Medical Education*) dedicated to reporting research and issues in ME despite the fact that medical education research (MER) is largely unfunded.[1] In the field of anesthesiology, a new journal, *Anesthesia and Analgesia Case Reports*, publishes important teaching points or scientific observation related to anesthesiology education including case reports, educational interventions, and assessment methods.[3] The Best Evidence Medical Education Collaboration (BEME, http://www.bemecollaboration.org) is an example of an attempt to disseminate best evidence to support ME, synthesize existing literature, and systematically inform our practice of ME.[4]

In light of this expansion, many have called for higher quality in MER, more rigorous and creative study designs, greater methodological rigor, and clear, meaningful outcomes in ME and MER.[5] For these goals

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to be obtained and for the future of education in anesthesiology to be evidence-based, more academic anesthesiologists must obtain formal training in educational research and participate in the performance of MER.[6] This will aid in the attempt to improve the quality of MER.[7] Although this may seem circular in reasoning, one of the major needs in health care today is an understanding of how to close the 15-year gap from publication of new evidence to application in clinical practice.[8] This is primarily an education problem involving many facets of educational theory and practice that are ripe questions to be asked in MER involving process and outcomes metrics. To recruit and retain faculty in academic centers who can conduct this level of research, development opportunities and rewards for those with passion and interest should be provided, as is done for basic, translational, and clinical scientists. In short, while educational research and scholarship should by no means supplant others areas of inquiry, it should also be recognized that a major need facing the future of health care is a better understanding of how to transmit knowledge and skill into improvements in health-care delivery on the individual and population levels. These are problems for educational researchers, and the answers are greatly needed.

There are published reports about what defines rigor and quality in MER[9–11] that delve deeply into educational theory (ie, positivism, postconstructivism) as it relates to MER,[12] or focuses on theoretical perspectives in ME and learning theories.[13] However, the purpose of this chapter is to define MER and compare it with classical physical science research, to review current educational research literature related to faculty development in MER, and to describe the important individual factors and critically important context of departments in which MER is occurring. We will describe the process of idea generation to educational research study including obtaining funding and getting published. Suggestions for obtaining further education to support a career path in MER will also be provided.

All faculty in academic anesthesiology might benefit from an awareness and understanding of MER; a smaller number of faculty members may have the desire and ability to participate in MER, while the skill and expertise to conduct an independent research program in MER is necessary for a few. This chapter on faculty development of medical education researchers will provide practical information and guidance for anesthesiology departmental leadership, for faculty who teach and assess learners, and others who have an interest in developing anesthesiology faculty with expertise in MER. Optimally, our specialty will develop a group of medical education researchers who can design, test, and improve educational interventions and also mentor others in this, with the ultimate goal of continuing as a specialty that leads the way in improving patient safety and outcomes in a rapidly evolving world of medical science, and knowing how to educate for continued progress and sustainable gains.

■ What is MER?

Research is a systematic attempt to provide answers to questions. MER seeks to deepen the knowledge and understanding of learning, teaching, and education that is not focused on just solving concrete, local problems, nor on providing universal and generalizable solutions.[11] (Table 1). It is the process of identifying a problem or question, obtaining a thorough understanding of current knowledge related to the problem or question (ie, literature review), constructing a hypothesis, creating a relevant research design with appropriate methodology, collecting and analyzing data, drawing conclusions about relations or variables, and writing and disseminating results. It is important to state these simple principles because they should apply to all forms of research, even if the proper methodological approach may vary based upon the type of question being asked and the study aims.

Some have pointed out that the physical sciences model for "ideal research" may not match up well with MER and question what really constitutes "evidence." They avoid using the word "evidence" when discussing MER, because it implies the narrow focus of proof that something works rather than a much broader definition of "an available body of evidence."[10,11] There continues to be debate about what constitutes "good" research in ME[7,14,15] and calls for MER to use the scientific approach[5] and focus less on whether an intervention works and more on why it does or does not work.[10] Moreover, those who read or apply MER value rigorous methods, clear writing, and research questions, but in deciding what they read and interventions to implement they also consider MER that is (1) provocative, novel, or challenges established thinking; (2) relevant to practice, role or needs, and present situation; and (3) feasible with practical application in real-world settings.[16]

The predominant published literature in ME is focused on medical school training,[17] less on graduate ME, and very little on the specialty of anesthesiology. Those with an interest in MER have a unique opportunity to contribute to the literature support for what we do in anesthesiology education.

■ Comparison of MER and Physical Science Research

MER is compared with classical physical science research in Table 2. Unlike much of medical research, MER cannot always and should not always use controlled experimentation (ie, randomized controlled trials) as the method of preference. Qualitative study designs in which teaching and learning styles are explored, understanding people's experiences and the meanings they assign to those experiences, and factors that

Table 1. *Selected Examples of Medical Education Research Topics*

Topic	Specific Examples
Simulation training (mannequin-based)	Crisis management (team/individual), team leadership, skills training (airway, CVL, regional anesthesia, echocardiography)
Virtual patients	Palliative/goals of care discussions, disclosure of adverse events training
Teaching methods	Flipped classroom, TPACK model in GME, asynchronous workplace-based learning, effective use of technology
Assessment	Validity and reliability testing of assessment tools, effective use of milestones system, competency-based assessment, CUSUM analysis for longitudinal assessment of skill or care delivery
Implementation science	Most effective methods for educating anesthesia care team members on evidence-based practice changes (eg, ERAS pathways) or for the dissemination of new knowledge (eg, effect of smartphone apps on adherence to new AHA/ACC or ASRA guidelines)
Professionalism	Methods for developing and testing professionalism and ethical development
Well-being	Factors affecting faculty and resident resilience and burnout
Duty hours	Effect on patient safety, effects on resident work-life balance and development as a clinician

AHA/ACC indicates American Heart Association/American College of Cardiology; ASRA American Society of Regional Anesthesia and Pain Medicine; CVL, central venous line; ERAS, enhanced recovery after surgery; GME, graduate medical education; TPACK, Technological Pedagogical and Content Knowledge.

Table 2. *Medical Education Research Compared With Classical Physical Science Research*

	Medical Education Research	Physical Science Research-Scientific Method
History	≈1950	17th century
Design	Complexity Time from intervention to measure often long with multiple variables	Simplicity Control
Goal	Generalizability vs. contextually rich localized solutions	Attempt to obtain simple generalizable solutions
Methods	Mixed methods, qualitative and quantitative Social science methodology Case studies, surveys	Quantitative methods predominate Randomized controlled trials
Question	Focus on understanding and answer why it works	Discover what exists through prediction and control and answer does it work or not, yes or no?

influence perspectives and interactions may be part of MER. Some have suggested that the quality of research is defined by the integrity and transparency of the research philosophy and methods rather than superiority of any one strategy of inquiry (ie, quantitative, qualitative, mixed methods).[12]

The path from ideas to research studies follows a similar pattern to physical science research, with some important differences. Research begins with an idea or a problem. In the case of MER, this idea or problem may come from a local setting and is one of the criticisms of MER by some. After identification of an idea or problem, a literature review, synthesizing what is known and not known about the idea or problem, should be accomplished. This should identify gaps in the literature and justify the rationale for performing the research study. One should then formulate both a general research question and specific research questions and determine the purpose of the study. For example, is this a (1) descriptive study of what is done that does not include a comparison group, a (2) justification study comparing one intervention with another to answer whether an intervention works, or even "better" a (3) clarification study that is designed to answer why or how an intervention worked?[5] Following this, a determination of the best approach to the research question should be undertaken: whether it is an explorative study, experimental study, observational study, or translational study. The results of an MER study are considered T1 outcomes if the interventions increase or improve knowledge, skills, attitudes, and professionalism (simulation lab), T2 if the intervention improves patient practices (clinic, bedside), and T3 if it improves patient outcomes (clinic and community) (Fig. 1).[18]

The process of idea generation through publication is discussed later in this chapter.

■ Faculty Development in Research—Current Evidence

The multiple facets of faculty development in health professions has recently been reviewed in a book entitled *Faculty Development in the Health Professions*,[19] and it includes a discussion of faculty development of scholarship and research. Is faculty development in MER needed? A survey[20] of an international group of faculty members (n = 860, 76 countries) explored conceptions about priorities for faculty development, and at the top of the list was research methodology. Research development requires a different focus in faculty development than pedagogical skills paradigms.[21] It has been suggested that faculty development programs should address faculty members who want to become medical education researchers[22] and that the traditional domains of faculty development should include specific development for scholarship and

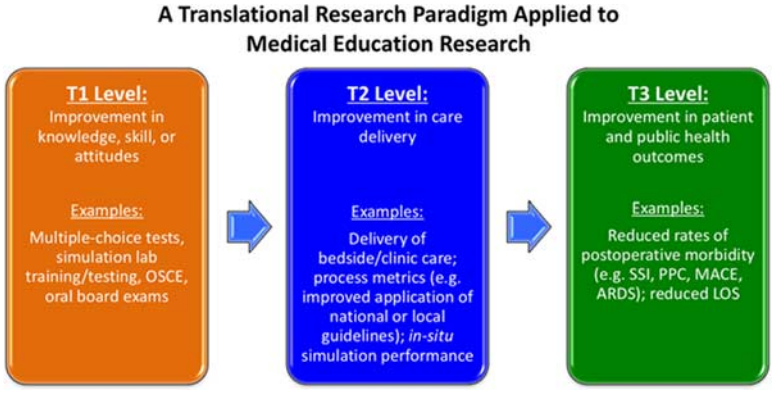

Figure 1. *A translational research paradigm applied to medical education research.* full color online

research.[23] Does faculty development in MER improve patient outcomes? The traditional linear model is the notion that education flows from faculty members to learners to patients and implies that if students "do better" then patients will do better (outcomes). This has recently been challenged.[22] However, faculty development can result in an improvement in quality and output in MER.

Participants

Several characteristics of successful researchers include the ability to form a relationship with a mentor, disciplined work habits, ability to communicate and maintain professional contacts (ie, networking), a high level of motivation, and the ability to work autonomously.[24] However, a requisite should be the intellectual commitment to discovery.[25] Just because an individual has a commitment to discovery and may even be experienced in discovery through physical science research, it does not necessarily translate into success at MER. In fact, some basic scientists may have difficulty adapting to the approaches of MER.[26] Research development requires a different focus than the classical pedagogical skills, the focus of many faculty development initiatives.[21]

Importance of the Research Environment

Individual researcher productivity is associated with characteristics of the researcher, as discussed previously, but even more importantly with the quality of their research environment.[27] Organizational development is just as important as faculty development when it comes to MER development and productivity. Suggested interventions to optimize career development of clinician researchers include reducing role conflicts, providing continuity of research training, creating

a positive mentorship culture, and creating positive outcome expectations.[28] Institutional support and investment of resources,[27] supportive promotion and tenure processes, space and time, salary structure, recognition, and leadership are key elements of research environment and context. If the stated curriculum is to encourage faculty development in MER but the "hidden curriculum" is not supportive, then faculty are less likely to conduct more or better research.[29] Faculty development without attention to context of environment (eg, time, mentoring, funding) is not likely to be as effective. If a nurturing research environment is not present, programs should consider linking faculty with mentors from outside institutions that have a greater research focus.[30]

Example MER Pathway—Overview

A needs assessment of potential participants and the department and/or organization should be performed before initiating a faculty development program in MER. In the case of individuals, meetings with research mentors with prioritization of career goals and determination of planned career path are key.

Faculty development implementation may include short workshops, multiday modular workshops in certificated programs, longitudinal fellowships and scholars programs, research fellowships, and graduate degrees. The goal of the individual academic faculty should be carefully considered. Single faculty development sessions on MER are less likely than longitudinal approaches to produce enduring results.[31] Modular, multiday programs such as the Research Essentials in Medical Education in Europe (RESME) course associated with the Association for Medical Education in Europe (AMEE) and Medical Education Research Certificate (MERC) developed by the AAMC Group on Educational Affairs[32] can provide foundational knowledge in MER. Faculty development content in MER should include the following: (1) developing an MER question(s), (2) performing a literature search, (3) mentoring and networking, (4) sampling, study design/methodology, (5) writing for and getting published in MER journals, (6) obtaining funding, and (7) following a line of questioning and systematic publishing in MER.

It has been suggested that medical education researchers should attempt to link interventions (MER) with patient outcomes,[17] align objectives of study with appropriate methodology,[5] and use conceptual frameworks and theories to design better research.[33] To develop academic anesthesiologists who can be successful in MER, increased productivity and quality of MER seems most likely to occur when (1) the individual has obtained foundational knowledge of MER, (2) the context/culture is conducive to research (ie, support, time, and advancement), (3) effective mentoring is provided and networks of

ME researchers established, and (4) guided implementation of MER is accomplished.

■ Getting Started—Path to Success

There are 2 major components to developing a career in MER: the individual and the structure of the department/institution. From a structural perspective, several things are crucial to success. First, there must be recognition of the importance of MER to the current and future states of health care. This would ideally come from the institution and the department, but the latter is most important. Unless the individual holds a university (eg, school of medicine) appointment that funds a part of their time to perform MER, it will be the chair and departmental leadership that allocate time, resources, and support for career development for any MER faculty. In addition, the most common career track for anesthesiology faculty at many academic institutions is the clinician-educator track. As such, if the department is willing to support the initial efforts of a faculty member interested in this path, academic and professional advancement is possible. However, research productivity in education needs to be appropriately valued to give the faculty clear sights on career trajectory, at least for promotion. The presence of these structural components should aid the ability of any department to develop a core group of faculty members interested in performing rigorous MER.

If such a robust and supportive environment exists, the onus is then on the individual to pursue the correct steps to build a career as an educator who performs MER. It is important for this to be recognized, as this is quite different from pursuing a career as an academic anesthesiologist who is a good clinical teacher. As with any line of inquiry, the individual first should be able to define the question(s) that they desire to answer over the course of their career with at least a 3- to 5-year plan for approaching the first problem (Fig. 2). As noted above, the current problems within ME for various learner levels are well defined and numerous. Senior faculty in the department should help this individual find a mentor and develop a mentorship plan. This can prove to be quite challenging, as the number of faculty members who have the experience necessary to mentor in the area of anesthesiology MER is limited. For this reason, the Foundation for Anesthesia Education and Research (FAER) Academy of Education Mentors in Anesthesiology was established in 2012. The members are willing to serve as mentors for faculty with an interest in developing an MER career. Mentorship is essential and all sources should be considered within the department, within the university as a whole (eg, a school of education), and from faculty at other institutions.

Figure 2. *Development of cycle of faculty as medical education researcher: 3- to 5-year plan. *For example, FAER Research Fellowship Grant or research in education grant, APSF grant, etc. #Additional sources that fund educational research include AHRQ, NIH, NLM, and Foundations, such as GE Foundation and the Gates foundation. This step should be discussed from outset of plan in order to set expectation for sustained and overlapping funding during career.* full color online

The performance of MER requires specific educational mentorship, as the proper methodology, psychometrics, and statistical analysis require skills that are not possessed by most basic or clinical scientists. Getting this right from the beginning will place the individual or the group on the path to successful publication—and success can beget success.

■ From Ideas to Education Research Studies

Idea Generation

As with all research, generating the question and hypothesis is the important first step. The research question or problem often arises from a desire to study a local intervention by an isolated researcher to identify a solution to a recognized problem. Although a passion to study a local educational intervention is not to be discouraged, a mentor might help that researcher develop a research question that will have more generalizability and fill a gap in the literature. Furthermore, if the question is one faced by many institutions, then collaboration is an option. Accordingly, ideas for education research studies can be obtained or vetted by attending national anesthesiology meetings (eg,

ASA or IARS annual meeting), ME meetings (eg, SEA, SGEA, ACGME Annual Meetings), surveying educators in the specialty, and networking with other educational researchers. Finally, the existence of a publication to application gap of > 15 years should be a clarion call to medical educators and should lead to a host of research ideas.[8] The entire area of implementation science is a massive educational challenge. The rapid evolution of perioperative medical knowledge on a monthly basis necessitates that educational researchers collaborate to find the best, most generalizable methods by which to disseminate new knowledge, assess acquisition thereof, and measure its application, all for the sake of our patients.[34] In addition, this is true for all learners on the care team.

Resources

Given the proper institutional and departmental environment, as well as the internal characteristics for success, faculty members are well positioned to design, conduct, and publish MER. However, multiple additional resources help to smooth the path to success in this research area. Nonphysician educators [Education Specialists (ES)] can provide tremendous support to physician researchers in the pursuit of MER. These professional educators come from a variety of educational backgrounds such as adult education, curriculum and instruction, training and development, educational psychology, ME, and human resource development. Some may also come from clinical, but non-physician, backgrounds, such as nurses or physician assistants with additional training or experience in education.[35] ES may possess a Bachelor's, Master's, EdD, or PhD level of education, although most of them commonly have obtained at least a Master's level degree.[36] ES may be employees of a university's School of Medicine (and thus provide assistance to both undergraduate medical educators and various graduate ME specialties) or may be employees of a single department. The addition of an ES as a departmental employee is beneficial in that it assists the individual in becoming immersed in the unique clinical language, culture, expectations, and educational strategies and needs of the specialty. An ES may be an invaluable addition to a department as a professional who can devote 100% time to the educational mission of the department, including the MER mission, as well as help to innovate and improve the resident education curriculum and promote the academic endeavors of the faculty and residents.

Much like the clinical faculty researchers in MER, there are both institutional/departmental and individual factors for success of an ES. From the institutional or departmental level, necessary components are mentoring for the ES from clinical and research faculty, and a commitment to providing opportunities for continuing education for the ES. Individual skills and attributes that are important for the success

of an ES include the following: knowledge of adult learning principles and practices, instructional design and curriculum development, excellent written and oral communication and interpersonal skills, collaborative and teamwork skills, leadership skills, ability to provide clear and effective feedback, ability to learn and understand new processes, facilitation and teaching skills, ability to use web-based and digital media resources, self-direction, flexibility, and creativity. Depending on the needs of the department and its faculty interested in MER, as well as the knowledge and skillset of the individual, the ES can help to fill many roles such as grant writing, writing Institutional Review Board (IRB) protocols, and manuscript preparation and submission. The ES role within the department can assist in advancing the MER mission in a cost-effective manner. Additional resources available in most academic medical centers include both statisticians and assistance with finding appropriate funding sources for MER and grant writers.

Study Subjects in Educational Research

The study subjects are often the learners (residents/students) or faculty in the medical educational researcher's education program. A small sample size from a single institution can limit statistical power and generalizability of the study results, as well as logistically restrict the methodologic and statistical approaches that can be performed. Therefore, as many MER questions cannot be answered by studies using participants from a single institution in 1 to 2 years, accomplishing the study can require collecting data over multiple years or the creation of longitudinal databases for outcome studies.[37] Alternatively, collaboration between multiple programs can allow for rapid completion of studies with a large sample size and high degree of generalizability.[38,39] It should be noted in all MER that the hierarchy of teacher/evaluator and learner must be carefully considered and respected, especially when study subjects are in the program that the researcher has some responsibility for, in an effort to avoid any perceived coercion.

Study Design

Although it is beyond the scope of this article to fully discuss all types of educational research methodologies, it is important for anesthesiologists to understand the basics of such methods, and that a wide array of approaches to MER exist. A recent review article highlighted four major research paradigms: positivism, postpositivism, critical theory, and interpretivism.[12] Most biomedical scientific research is performed in the positivistic and postpositivistic frameworks, which use quantitative approaches to data collection and analysis. Except for the rare case-based narrative analysis, this is true for almost all educational research

undertaken within the specialty and subspecialties of anesthesiology. That is, most educational research is quantitatively describing a problem and performing a quantitative analysis of the data generated. However, there are some differences in the specific approaches to much educational research, as the problems being addressed are not the same as those being examined in basic or clinical research. For instance, rigorously assessing the validity and reliability of a technical skill assessment tool is analogous to validity and reliability testing of a new laboratory assay in a basic science laboratory. However, the research methods used to answer each question, as well as the statistical analysis of the data (eg, Bland-Altman plots vs. Anghoff standard setting procedure with intraclass correlation coefficients), are different.[40,41] In addition, the appropriate research methods and statistical analysis required in educational research on competency assessment (eg, CUSUM analysis for technical skill performance) are quite separate from the traditional basic and clinical science approach.[42–44] This is of major significance today because the "gold standard" prospective, randomized, placebo-controlled trial (RCT) is often neither appropriate, feasible, nor actually possible in some areas of educational research.[45,46] Furthermore, a basic understanding of educational research methods may help the clinical community appreciate the analogs from this domain of science to basic and clinical science.

The first principle to understand in MER design, as with all research, is that the studies themselves "are shaped by the form of the questions asked and by the methods used to answer them."[47] With that in mind, it is the responsibility of the researcher(s) to determine the best methodological approach to the question being posed. On the basis of this decision, at the outset of any study there should be an explicit statement of methodology by which the study is to be performed and data are to be collected and analyzed.[12,47] A recent review in the family medicine literature found that the vast majority of educational research studies did not clearly specify the methodology used.[48]

In MER, relevant questions may be approached using quantitative, qualitative, or mixed methods. Quantitative research collects numerical data (continuous or categorical) to explain observations through hypothesis testing, whereas qualitative research involves the use of narrative data and visual observations to understand a particular phenomenon of interest.[47,49] Within the quantitative methods, a wide variety of approaches may be appropriate, ranging from prospective RCTs to descriptive and correlational studies, such as characteristics of residents associated with passing the written board examination.[50] In the middle of the spectrum, a very common method of MER is the quasi-experimental approach. This is appropriate when true randomization is not possible or ethical, but a control group can exist.[47,49] An example of this type of study would be where one class of residents

receives instruction through traditional teaching methods and the next class receives instruction through a new pedagogical approach (eg, flipped classroom). This design is experimental in that the pedagogical approach is being varied and the traditional approach serves as the control, but true randomization is not possible. In fact, this is often the most appropriate methodology for this type of educational research. Randomization within the same class for a longitudinal intervention would open the possibility for significant subject contamination and bias, as the subjects often interact with one another in a variety of settings not controlled by the experiment (eg, clinical, educational, and non-work settings). In the translational paradigm presented in Figure 1, RCTs can be very important at the T1 and T2 levels to establish causality of educational approach with performance outcomes. However, they can prove to be practically impossible at the T3 level either because of logistics or contamination of subjects in the clinical setting. Accordingly, the quasi-experimental educational research design may have great utility at the T3 level when considering the best pedagogical approach by which to educate anesthesia care providers to apply a new clinical guideline, understand and adhere to principles of enhanced recovery after surgery, or properly use a technology.

Beyond these major concepts of research methodology, it should also be noted that rigorous study is needed to properly create the assessment tools and grading paradigms used in MER, as this is needed for any valid and reliable approach to competency-based education. For the assessment tools themselves, this research falls into the domain of validity and reliability testing.[51,52] The need for these studies is quite expansive, ranging from the development and assessment of multiple-choice tests to grading checklists for simulation-based assessments to clinical assessment tools for regional anesthesia or central venous catheter placement. However, it is interesting to note that much of this research has only emerged in recent years as part of a more rigorous approach to competency-based education.[53–56] This is also occurring for grading paradigms by which minimum passing scores are being created, not only for multiple-choice tests but also for skills assessments. The typical methods used in these approaches include the Anghoff and Hofstee standard setting techniques, which have been validated and used for years in other domains of educational research.[41] Finally, an emerging trend in MER, particularly in skills-based assessment, is cumulative summation (CUSUM) analysis. This technique allows for the longitudinal assessment of performance over time rather than in disconnected testing sessions.[57,58] The goal is that the combination of these approaches, in addition to the more traditional methods, could yield robust educational research producing significant and generalizable findings that define the future of how efficient and effective anesthesiology education ought to be performed.

IRB and MER

Similar to bench, clinical, or translational research, to conduct and publish MER, IRB review and approval must be obtained before embarking on these studies. Common misconceptions surrounding MER include notions that (1) there are no patients involved, so there are no "subjects"; and/or (2) educational studies pose no risks to the participants, and thus do not require IRB review. As described in the Belmont Report, "… the term 'research' designates an activity designed to test a hypothesis and permit conclusions to be drawn."[59] In the context of MER, the subjects/participants are the individuals who are the subjects of the research (eg, the medical students, residents, fellows, faculty). Thus, investigators on MER protocols must have current Human Subjects Protection training and follow all policies and procedures of their local IRB. It is true that many educational studies may pose minimal risk to learners, but few studies are entirely without risk. For example, the risk of loss of confidentiality is considered a risk by the IRB and must be considered when weighing the risks and benefits of a study design.

Many educational studies posing minimal risk to the participants may be appropriately submitted to the IRB as an Exemption. However, it should be noted that an IRB exemption does not mean that the protocol is exempt from being reviewed or that the investigator is exempt from following the policies, rules, and regulations of IRB-approved studies. Examples of MER studies that the IRB may certify as Exempt include survey studies, research involving the study of existing educational data or documents, interviews, or research on instructional strategies. The IRB will need to review each protocol to determine whether it is appropriate for Exemption, including considerations of whether coercion is minimized and whether the benefits of the MER outweigh the risks to the subjects.

Examples of types of studies that would require an Expedited review include protocols in which the risks to subjects are minimal and the risks are reasonable in relation to anticipated benefits, such as protocols investigating factors associated with improved in-training exam (ITE) scores. A protocol with this description would likely fall into the Expedited (rather than Exempt) category because of the inclusion of test scores, which falls under the Family Educational Rights and Privacy Act (FERPA), the federal law that protects privacy and confidentiality of personally identifiable education records. Full IRB review is required for research involving greater than minimal risk to subjects, and it is uncommon in MER. As with other types of research, investigators in MER will be required to obtain written informed consent from their subjects, unless a waiver of this requirement (or a waiver of the requirement for documented informed consent) is obtained from the IRB.

MER investigators will be well-served by establishing a good working relationship with their local IRB and asking questions to ensure full compliance with all standards. As a final note, many IRBs require the MER investigator to receive an additional layer of approval from the UME or GME community at the institution to ensure that the education community approves of the study and is confident that the proposal does not place undue burden on the medical students/residents and is not coercive.

Importance of Collaboration

There is opportunity for collaboration in MER within the field of Anesthesiology. The Society for Education in Anesthesia (SEA) is an outstanding group of possible collaborators in education research (http://www.seahq.org). Recent annual meetings have had an increased focus on discussing the initial "nuts and bolts" for starting MER projects. Along the same lines, as mentioned above, the FAER Academy of Education Mentors was recently started to aid in the career development of faculty desiring to move from clinician-educator to clinician-educator-educational researcher (http://www.faer.org). Finally, the Study group for Anesthesiology Graduate Education, known as the S.A.G.E. Collaborative, was founded in 2013 and now has over a dozen institutions collaborating on various research projects. The initial collaborations have resulted in numerous abstracts at national meetings and 2 publications in *Anesthesiology*.[38,39] A website is in the process of being completed, and anyone who is interested in this group can join free of charge. The goal is to share ideas and stimulate collaboration so that better and larger MER studies can be accomplished with much larger sample sizes in a rapid time frame, much like a clinical research counterpart that was started 25 years ago.[60]

■ Getting Published: Journals That Regularly Publish Education Research

Key components have been presented for faculty starting a career in education research, as well as steps to move from study ideas to completing the research. However, the goal of academic research is to share the results through peer-reviewed publication to move the science forward. Thus, understanding potential target journals, as well as other publication sites, is important. From an impact factor perspective, peer-reviewed educational research is regularly published in the *Journal of the American Medical Association* (impact factor >30) to some journals without an impact factor, such as the new *A&A Case Reports* that is intended to publish specialty-specific case reports "as well as peer-reviewed reports that make an important teaching point or scientific observation related to education, the management of perioperative services, global health,

and patient safety initiatives in anesthesiology" (http://journals.lww.com/aacr/pages/aboutthejournal.aspx). Table 3 has an extensive, although not exhaustive, list of target journals. In general, more quantitative and specialty-specific research will go in higher-impact journals, whereas more qualitative and theory-based educational research is often published in lower-impact journals. However, it should be noted that a lower impact factor does not signal less importance, just a narrower impact. Within the medical educator community, there are often very important papers published in such journals—papers that often inform the direction for future research in an area of inquiry. Textbooks are another area of publication that should not be overlooked. Although they are not of the same impact as peer-reviewed manuscripts, these endeavors can often hone one's writing skills and add to the development of one's *curriculum vitae* in an area of interest. Finally, outside of traditional publication venues, educators today are creating content that is worth sharing, and, if the quality is excellent, can pass peer-review. This is true of the MedEd Portal from the American Association of Medical Colleges. Within anesthesiology, the Anesthesia Toolbox is a relatively new peer-reviewed anesthesia-specific publication that is gaining wide support and subscription (http://journals.lww.com/aacr/pages/aboutthejournal.aspx).

Table 3. *List of Target Journals and Impact Factor*

Journal Title	Impact Factor
New England Journal of Medicine	55.873
Journal of the American Medical Association	35.289
Anesthesiology	5.879
The British Journal of Anaesthesia	4.853
American Journal of Preventive Medicine	4.527
Anesthesia and Analgesia	3.472
Medical Education	3.196
The European Journal of Anaesthesiology	2.942
Academic Medicine	2.934
Advances in Health Sciences Education	2.124
Evaluation and the Health Professions	1.909
Best Evidence in Medical Education	1.679
Simulation in Healthcare	1.477
Journal of Continuing Education in the Health Professions	1.361
Journal of Interprofessional Care	1.339
Medical Education Online: an Electronic Journal	0.833
Teaching and Learning in Medicine	0.659
Canadian Medical Education Journal	
Journal of Graduate Medical Education	
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■ Obtain Funding for MER

A significant step for a researcher in any domain is obtaining funding. For medical educational research, this is particularly challenging as the funding streams are much narrower and more shallow.[23] Programs that are resource-intensive from medical school years, such as the medical scientist training programs (MSTP), do not exist for those desiring to pursue a career in educational research. Although a student could pursue a dual degree, such as a Masters or Doctorate in Education, the next steps beyond that training and the return on investment are less clear. Students entering an MSTP are expected to match into a residency, and are often highly sought out for their presumed skillset. A picture can be painted for NIH training grants and the T-K-R sequence (T32, K08 training grant, and R01 funding) mapped out. Although this is by no means a guarantee in today's funding climate, and resubmissions are often necessary, it is certainly a clear path that many have walked.[61]

Thankfully, our specialty has several cost-share grants and early career awards that specifically help foster anesthesiology research.[62] The FAER Research in Education Grant is the most specific award aimed at developing the careers of education researchers. Furthermore, the FAER Research Fellowship Grant is a funding mechanism for trainees to begin the pursuit of funding early in their careers. The Anesthesia Patient Safety Foundation also consistently awards grant funding in domains of research (eg, simulation training) that are clearly within the purview of education researchers.[63] Beyond these funding sources, the stakes are much higher. The AHRQ and NLM each have several funding opportunities that are significant and can lead to sustained and overlapping funding throughout a career. In addition, there are a number of foundations that fund educational research and education capacity-building efforts, such as the GE Foundation, the Clinton Global Initiative, and the Gates Foundation. These foundations have an interest in the development and scaling of educational solutions to improve the delivery of safe anesthesia, surgery, nursing, and critical care in the developing world.

Overall, the goal of obtaining sustained and overlapping funding should be set early in the career of one desiring to actively pursue MER. However, without departmental and institutional leadership that supports such work from the start, success is difficult. This recognition has actually led the University of Michigan to institute a grant funding mechanism for MER related to innovative approaches for implementing and assessing GME changes in the Milestones era.[64] With such support, an investigator can aim to receive institutional funding, then small foundation funding ($50,000 to $100,000), then federal or large foundation funding (> $500,000), with a goal of continuing a line or several lines of investigation throughout one's career.

■ Obtaining Further Education in MER

As a part of career development, mentors of a faculty pursuing MER should recommend further education in this domain of research that has many aspects different from traditional basic or clinical science research. For the early initiation to MER, a review of the ME literature (ie, BEME; Best Evidence Medical Education Collaboration) including introductions to research in ME (AMEE Guide; The research compass; an introduction to research in medical education: AMEE Guide no 56) is suggested.[65] Further options for education in MER include the following.

Attend Educational Theme Meetings

The SEA (http://www.seahq.net) and Accreditation Council for Graduate Medical Education (ACGME, http://www.acgme.org) have educational theme meetings including faculty development workshops in which the individual interested in MER might develop a better foundational knowledge of ME concepts and theories, learn more about issues and problems in ME that might spawn ideas for MER projects, and develop networks for possible mentoring and research collaboration.

Faculty Development Programs (Local, National, International)

Faculty development is a broad category and is often perceived by academic faculty as personal and career development rather than the enhancement of specific competencies such as MER. Local (departmental, graduate medical education, college of medicine), as well as national (SEA, ACGME, AAMC) and international (AMEE), faculty development sessions on MER are available. Local faculty development sessions may not be attended because of clinical responsibilities and lack of protected time and logistical issues such as timing and location.[66] Multiple longitudinal faculty development sessions with assigned mentors working with the faculty member on MER projects is more likely than single "one off" sessions to be valuable and productive.

Academies of Medical Educators

Academies of Medical Educators are present in many institutions. Characteristically they are a formal school-wide organizational structure with designated leadership, include distinguished educators, and have as a mission to advance and support educators.[67,68] Although many academy programs are focused on developing teaching skills in faculty members, MER may also be included.

Certificate Programs in Education/MER

An example of a certificate program with focus on MER was one developed by the Group on Education Affairs of the AAMC and initiated in 2004. It is a series of half-day workshops traditionally offered at regional and national (AAMC, SEA) meetings with 6 of 11 content-based workshops required for certification. This MERC Program is intended to provide the knowledge necessary to understand the purposes of processes of MER, to become informed consumers of MER literature, and to be effective collaborators in MER (https://www.aamc.org/members/gea/merc/), and it is not intended to produce independent medical education researchers. The Emergency Medicine specialty (CORD: Council of Emergency Medicine Residency Directors) has added a mentored, collaborative education research project to the independent learning model of the MERC workshops.[69,70] Collaboration in research projects is an effective, problem-based approach to learning MER methods and facilitate development of networks of medical education researchers.[71,72] In 2007, AMEE created the Research in Medical Education (RESME) course[65] that is a 4-day curriculum provided during an AMEE or other conference. The curriculum includes orientation to MER, asking research questions, and an introduction to both quantitative and qualitative design and analysis. Participants analyze and critique actual research that is being presented at the same conference and also develop the outline of a research proposal that along with mentorship from a course facilitator is refined further over the following year. Some universities may offer certificate programs in ME, but if the goal is MER training one must assure that this aligns with the certificate curriculum.

Master's Degree Programs in Education

The programs in the United States that offer Master of Medical Education, Master of Educational Health Professions, and Master of Academic Medicine were recently reviewed and compared in Table 4.[73] The curriculum of the Master's programs usually includes educational theory, leadership, curriculum design, adult educational theory (andragogy), instruction development, and other topics, but the emphasis of each Master's program varies and may have little training in MER.

Doctoral Programs in Education (MD, PhD)

There are several international programs offering a PhD in health professions education (University of Maastrict, University of Chicago, University of Toronto, McMaster University). However, the time commitment and expense make it appropriate for few. Therefore, collaboration between PhDs and clinicians[74] is encouraged. Although

Table 4. *Master's Programs in Education Available in United States*

Institution	Degree Title	Program Delivery
University of New England	Master of Science in Medical Education Leadership	Online
University of Pennsylvania	Master of Education	Online
Johns Hopkins University	Master of Education in the Health Professions	On campus or online
Vanderbilt University (executive)	Master of Health Professions Education	On campus
University of Florida	Master's Degree in Curriculum and Instruction with an Emphasis in Medical and Professional Education	Online
University of Pittsburgh	Master of Science in Medical Education	On campus
Lake Erie College of Osteopathic Medicine	Master of Science in Medical Education	Online
University of Cincinnati	Master of Education	Online
University of Illinois	Master of Health Professions Education	On campus or online
University of Iowa	Master of Medical Education	On campus
University of Houston	Master of Education	On campus
University of Southern California	Master of Academic Medicine	Online

Adapted from Udani and Macario.[73] Adaptations are themselves works protected by copyright. So in order to publish this adaptation, authorization must be obtained both from the owner of the copyright in the original work and from the owner of copyright in the translation or adaptation.

clinicians may be in the best role of identifying key practical questions to study, PhDs, because of the academic training, can contribute to the advancement of knowledge with their knowledge of biostatistics, psychometrics, educational assessment, and so on. Those PhDs in fields such as psychology and sociology may be especially helpful when qualitative or mixed methods research methodologies are used in MER. Whether certificate programs, fellowships, or advanced degrees, if the goal is attainment of MER skills and knowledge, then one should assure that the program of study provides this training.

■ Future of MER

So what is the future of MER, particularly in the specialty and subspecialties of anesthesiology? We believe that our specialty is at a major inflection point, as is health care as a whole. Embracing a future of constantly pushing the limit to improve patient care will mean that we continually work to better understand how to educate current and

future practitioners and trainees in our field. To be successful in this task, several components are crucial. First, medical educators need to embrace a scoping vision of educational research focused on goals as lofty as the Institute for Healthcare Improvement's Triple Aim. This is what was called for over 100 years ago in the preface to the Flexner Report, and nothing has changed in the overall goal of improving health-care delivery, which is built upon high-quality ME. Second, departmental leadership across the globe needs to value the work of educators whose resolve is to be rigorous and thoughtful in their approach to testing methodological approaches in education. Third, collaboration must expand between groups interested in similar questions so that in 25 years we too can celebrate the success of scores of publications that have improved our knowledge of how to educate and thereby improved care delivered to patients, as well as their outcomes. Fourth, we must take what is learned in countries with a high level of resources and transmit these lessons and the research itself to low-income and middle-income countries. Is this a large investment? Yes. However, excellent anesthesiology education saves lives and improves outcomes—which has always been and will always be the return on investment in anesthesiology education.

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