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COMMENTARY

Medical Education Research in the Context of Translational Science

Abstract

Health care struggles to transfer recent discoveries into high-quality medical care. Therefore, translational science seeks to improve the health of patients and communities by studying and promoting the translation of findings from bench research into clinical care. Similarly, medical education practice may be slow to adopt proven evidence of better learning and assessment. The *Academic Emergency Medicine* (*AEM*) consensus conference was designed to promote the dissemination of evidence-based education research and practice. We will pull from the work developed by the consensus conference as a means to create a roadmap for future medical education research using the framework of translational science.

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The *Academic Emergency Medicine* (*AEM*) consensus conference "Education Research in Emergency Medicine: Opportunities, Challenges, and Strategies for Success" was designed to move emergency medicine (EM) educators and scholars toward disseminating evidence-based practice. Specifically, the consensus findings argue for a strong research agenda across multiple domains to promote the translation of educational research into educational practice. In this commentary, we use the framework of *translational science* to examine the work developed from the consensus conference and to set the agenda for future medical education research.[1–7]

Significant efforts are being made to disseminate evidence-based medicine so as to ensure appropriate treatments and avoid harm.[1–3] In clinical practice, a simplistic view presupposes that after treatments are rigorously evaluated, the results are incorporated into clinical practice.[5] Unfortunately, transfer from research to widely accepted practice is haphazard, uneven, and frequently obstructed. It usually takes more than a decade for the findings from bench research, such as the benefits of beta blockers in acute myocardial infarction, to become adopted into standard practice.[5,8,9] The field of translational science has developed to systematically describe, study, and promote this complex process of dissemination and adoption. Translational science seeks to improve the health of patients and communities by studying and promoting the movement of findings from bench research into clinical care. The field has identified three distinct steps in this process: from bench research into clinical research (T1), from clinical research into evidence-based guidelines for patient care (T2), and from individual patient care into systematic acceptance and widespread use (T3; Figure 1).[1–3]

Similar to clinical research findings, educational research often fails to translate into educational practice.[10] To accelerate the pace and spread of evidence-based educational practice melded with educational research, we must create a learner-centered, evidence-driven, health care learning enterprise,[11] but there are barriers to doing so. Ironically, academic medical centers are not always optimal settings for educating their learners. Instead, the focus is clinical practice and especially revenue generation—medical education is often seen as a costly distraction. Necessary culture changes include a refocusing of medical education and training on multidisciplinary learning and the integration of clinical care and medical education into a science of health care delivery.

Medical education is the process of equipping learners at all levels with the knowledge, skills, and attributes of the profession. Learners are educated through multiple methodologies, including didactic sessions, problem-based learning, technology-facilitated learning, and workplace learning. The learning takes place in classroom, educational laboratory, and patient care settings. While learning is ubiquitous, there is limited research focused on measuring learner outcomes and how these can best be attained. Likewise, there is only piecemeal translational evidence supporting the validity evidence for assessment tools and data-driven evaluation of programs.

In clinical science, T1 translation moves basic laboratory discoveries to clinical research. In medical

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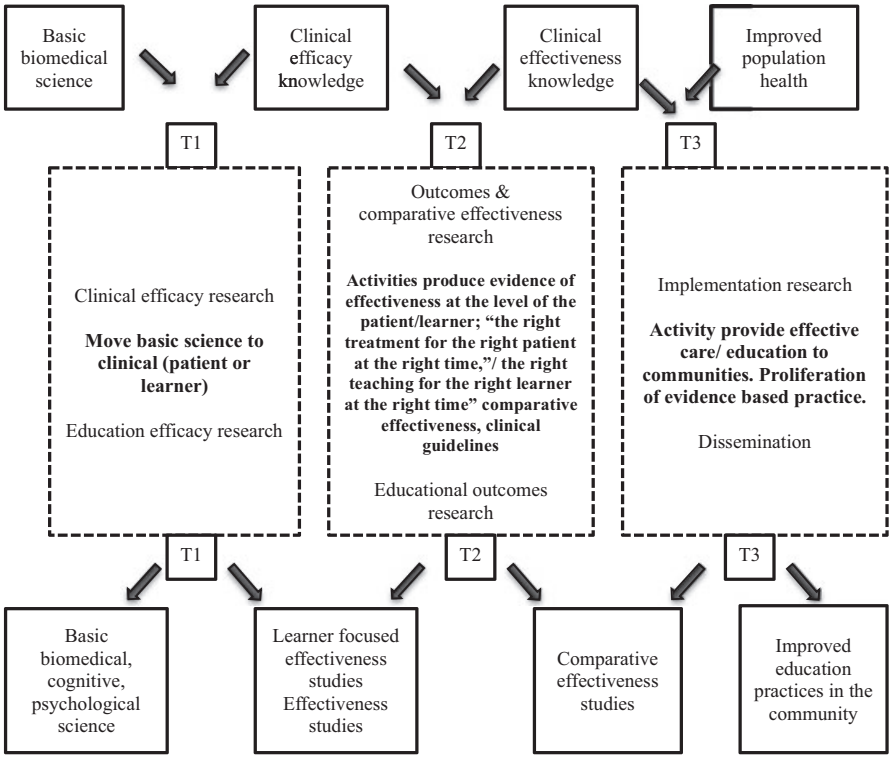

Figure 1. Clinical and educational model.[4]

education, T1 can be considered as applying fundamental cognitive, psychological, and educational principles, theories, and phenomena to learners in classrooms, simulation labs, and clinical settings. The consensus breakout group on assessment of diagnostic reasoning serves as an example.[12] These authors note that there is extensive research in cognitive psychology that examines how individuals reason—the equivalent of bench research.[13–16] T1 is the translation of these findings, principles, and theories to medical education by researching ways to understand the process of clinical reasoning as a specific form of cognitive reasoning.[15–20] For example, studies show that there are two main cognitive processes in reasoning and problem solving: pattern recognition and analytic problem solving. Studies in medical education investigate how these processes work in physicians and take into account difference in learners, contexts, and domains. They therefore examine how the cognitive process is manifested in a learner in the context of medical education. From these studies, we have an understanding of clinical reasoning, but there are pieces of the picture missing. There are remaining T1 questions, such as what is the effect of interruptions on the quality of clinical reasoning? What stimulates experts to switch from one process to another? Thus, T1 research takes psychological and cognitive concepts and applies them to health care learners to determine the effectiveness or the fit of the concept to medicine.

T2 in clinical care takes research from clinical trials to patient care. In the medical education analogy, the patient is the learner. So this translation aims to produce evidence of teaching effectiveness at the level of the learner; to compare the success of different educational programs to identify the right teaching modality for the right learner in the right way at the right time. Further, T2 translates these results into practice guidelines for teachers. Returning to clinical reasoning, most of the research has been in the T1 domain. From the research, we have a model for clinical reasoning with an understanding of pattern recognition and analytic thinking. T2 translation might investigate how we teach clinical reasoning to medical students or which clinical reasoning processes are most effective for which learners—analogous to comparative effectiveness studies in clinical research. There is some comparative effectiveness research in the assessment of clinical reasoning, such as comparing script concordance with true–false questions, short-answer management problems, and a simulated oral examination.[21–23] Nonetheless, there is a need for more T2 studies about effective teaching of clinical reasoning and comparisons of assessment methods of clinical reasoning, medical knowledge, and patient care.[12,24,25]

The evaluating educational effectiveness consensus group examined the T1 and T2 research on several key areas, including the use of Web 2.0, asynchronous learning, and didactic presentations. They focused on the comparative effectiveness studies of these modalities, making recommendations for their use and further research.[26] They recognized that establishing an educational research consortium would move studies from single institutions to broad-based, generalizable comparative effectiveness studies.[27] Additionally, from this research will come education practice guidelines based on the evidence.

In clinical care, T3 addresses the translation of effective patient care practices into general clinical practice, i.e., the widespread adoption of evidence-based practice.[1–3,28] In medical education, there are several examples of successful T3 translation. Simulation provides one example; T1 translation built upon the basic research findings in deliberate practice and cognitive theory of procedural learning and applied it to simulation with learners to test whether simulation was effective as an educational intervention.[29] T2 studies have built on earlier studies to develop informed practices around simulation including debriefing, teamwork, and assessment of procedural competences.[30–32] T3 moves simulation from proof-of-concept studies to general educational practice, and nearly every residency program now has access to a simulation center. Simulation is considered to be one of the major methods for teaching procedures, for providing feedback about teamwork and communication, and for assessing learners on complex medical reasoning skills.[33] In addition, simulation has been proven to help T3 translation of clinical research to practice.[34,35] Similarly, the use of standardized patients in undergraduate medical education has been translated from conceptual plausibility to initial implementation (T1), through implementation in individual interventions and medical schools (T2), to the point of broad adoption such that instruction and assessment using standardized patients is virtually a requirement for educational programs (T3).[36]

T3 brings effective educational practices into broad adoption by educators. This process is facilitated by the dissemination of effective teaching practices through programs such as educational research fellowships and faculty development programs such as those highlighting how to optimize the teaching skill set.[37–40] Further, the consensus conference and published proceedings are prime examples of T3 dissemination that takes what is understood about effective educating and transmits it to the population of EM educators.

In education, like clinical research, translation at all levels requires leadership, collaboration, development of diverse skill sets (simulation, assessment, curricular design), and the availability of tools and established resources. When the Association of American Medical Colleges (AAMC) set forward the scholarship of teaching, building on Boyer and Glassick, it served to highlight the evaluation and dissemination of education innovations.[41–43] Educators should be encouraged to disseminate their curricula and interventions for others to study, rather than fear intellectual property violations. For example, the papers on suggested core content for education scholarship fellowships and experiences with education fellowships are models of sharing practices.[37,38,44] The field would benefit from a wider sharing of good educational practices that appropriately recognizes their origin.

In addition, medical educators need to continually test the effectiveness of these practices as they translate to other contexts and learners. In clinical translational research, there is a major movement from single-center studies to multi-institutional research. Medical education research still commonly uses a population at a single site. These single-institution studies often do not have the sample size to determine effectiveness with precision nor to build external validity evidence. Moving to collaborative research with networks of researchers using rigorous methods across populations will allow for higher quality confirmatory research (T2 and T3) that is generalizable across learners and contexts. For example, the Medical Education Research Certificate program from the Council of EM Residency Directors teaches educational methodology and requires cross-institutional research. Further EM educational research needs to expand the assessment toolbox with the creation of innovative instruments and methods that have validity evidence supporting their use across contexts.[27]

The purpose of the 2012 *AEM* consensus conference was to move the field of EM education research forward. When we look at the proceedings, we can map these initiatives along the translational continuum. To repeat another study of beta blocker effectiveness in myocardial infarction has no utility. Likewise, studying the effectiveness of teaching through simulation experience with central line placement does not further advance our knowledge. On the other hand, studies that identify ideal timing of beta blocker administration to improve patient care. Similarly, in education, better understanding how novices compare to experts in self-monitoring during central line procedural simulation might improve practice. As Cook and colleagues[45] stated, we need to be intentional about the research that we do, to fill the knowledge gaps but not to repeat studies that have already been done. Their systemic reviews of technology and simulation showed that teaching with technology works. However, in most cases it is not better than other methods (comparative effectiveness).[45] Further work might identify the specific learners, topic domains, or cognitive processes for which teaching with technology is more effective. Analyzing the current medical education literature using translational research frameworks brings into focus the next steps for education research: T2- and T3-level work that moves beyond simple descriptive reports of interventions to the use of collaboration and sound research principles, to develop evidence-based guidelines and widespread use of substantiated approaches that result in robust outcomes for learners.

SUMMARY

The consensus leaders noted that many instructional methods in medical education are not based on the results of well-designed studies, thus pointing out the need for higher-quality medical education research.[10] The consensus conference and proceedings were intentional reviews of the state of translational education research and practice in EM and pulled from the broader field of medical education. The articles reviewed the T1 basic learner research, the T2 comparative effectiveness, and the T3 dissemination of effective education and research to practice. More importantly, the consensus groups have effectively summarized the current state, recognized limitations of the evidence, highlighted gaps, and made clear recommendations for future research. It is now the time for EM medical educators to share their successful educational products,

to engage in multi-institutional T1 and comparative effectiveness research, and to disseminate effective educational practices.

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