Common Technologies in Medical Education

There are numerous frameworks that may be used to characterize and classify educational technology applications. Colloquium participants considered three broad categories based on the predominant usage in medical education. While these applications overlap in terms of technology components and instructional possibilities, they are sufficiently distinctive to consider independently:

1. **Computer-aided Instruction (CAI)**—Instruction in which computers play a central role as the means of information delivery and direct interaction with learners (in contrast to applications such as PowerPoint); to some extent human instructors are replaced. These programs may make use of Internet technologies (Web-based learning), and include a wide variety of standalone applications or online materials.

2. **Virtual Patients (VP)**—A specific type of computer-based program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical exam, and make diagnostic and therapeutic decisions.

3. **Human Patient Simulation (HPS)**—The use of mannequins or models to simulate patient care environments for instructional or assessment purposes. Tools in this category include task-based trainers that simulate specific procedural tasks (e.g., virtual reality colonoscopy trainers).

Each of these approaches has advantages and disadvantages (see Table 1) based on its inherent technical capabilities.

Table 1. Advantages and disadvantages of various educational technologies.

Type of Instruction	Advantages	Disadvantages
Computer-aided Instruction	• Useful for visualizing complex processes • Independent exploration of complex phenomena • Easy access • Relatively low-cost of production	• Limited physical interactivity • Limited fidelity
Virtual Patients	• Encompasses multiple aspects of clinical encounter • Longitudinal and multidisciplinary care lessons • Easy access • Readily customized	• Limited physical interactivity • Limited fidelity • High production costs
Human Patient Simulation	• Immersive, active experience • Engages emotional and sensory learning • Fosters critical thought and communication • Animates basic science in clinical context	• Cost and space requirements • Limited to simulator and staff availability • Engineering limitations

Effective programs match instructional approaches with educational goals. The medical education environment may include any combination of cognitive, perceptual, and psychomotor educational goals. Each type of goal may be achieved through the use of at least one educational technology. Table 2 suggests how the various technologies might be used, based on a combination of available research, perceived benefits, and technical capabilities:

The Role of Fidelity

When designing an application that simulates a biomedical or patient care phenomenon, instructors should consider the appropriate level of fidelity and the degree to which the technology accurately simulates the intended task, resource, or environment. Many computer-aided instruction applications are considered low-to-medium fidelity as the display is limited to a computer monitor and learner interaction consists of standard keyboard and mouse inputs. In contrast, human patient simulation (HPS) applications are often high-fidelity because they require learners to assume the behaviors of a healthcare providers in realistic healthcare environments centered on models and mannequins. However, even with human patient simulation scenarios and full-scale simulations, there are limitations to the fidelity that can be achieved. Moreover, perceived fidelity has a strong subjective component and participants may have different experiences. Fidelity should be conceived more as a negotiable currency than an absolute concept.

How fidelity affects learning is not clearly understood; certain high-fidelity features can be costly and haven't yet proved to improve learning. Furthermore, some low-fidelity models have been shown to improve surgical skill acquisition. Appropriately matching the level of fidelity with the learner's expertise and the corresponding educational goal is, however, generally accepted. This being the case, since the optimal level of fidelity (realism) required ***likely*** varies depending upon the learner's degree of prior practical experience and exposure, a novice can engage in a meaningful learning experience with less sophisticated fidelity than might be needed for an expert learner who has already acquired substantial expertise and

Table 2. Educational technologies best suited to accomplishing particular educational goals.

Educational Goal	Suggested Educational Technology
Facilitate basic knowledge acquisition	Computer-aided Instruction Virtual Patients
Improve decision making	Computer-aided Instruction Virtual Patients Human Patient Simulation
Enhance perceptual variation	Computer-aided Instruction Virtual Patients
Improve skill coordination	Human Patient Simulation Task Trainers
Practice rare/critical events	Virtual Patients Human Patient Simulation
Conduct team training	Human Patient Simulation
Improve psychomotor skills	Task Trainers

experience. While not definitively substantiated, Figure 1 illustrates the conventionally posited relationship of optimal level of fidelity along the novice, experienced, and expert learner continuum.

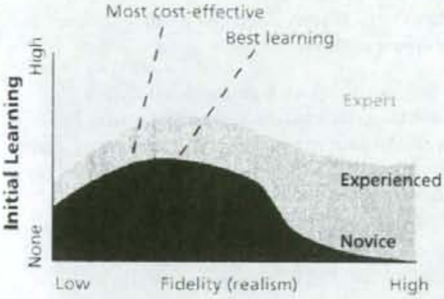

Figure 1. The hypothesized relationship between level of learner and degree of fidelity. This diagram suggests that the optimal level of fidelity may change with the learner's level of experience. Diagram adapted from Alessi S. Fidelity in the Design of Instructional Simulations. *Journal of Computer-Based Instruction*. 1988; 15: 40-47.

Evidence-Based Features and Practices that Promote Effective Learning

Multimedia
(computer-aided instruction, virtual patients)

When designing or purchasing an educational technology resource that contains multimedia components, particular attention should be paid to the selection, sequencing, and presentation of information. Certain elements can induce cognitive overload and detract from learning, such as the presentation style of information and the appropriateness of the learning material. Thus, one challenge of effective instructional design is creating applications that include only those features that promote learning while avoiding gratuitous elements that may distract. Richard Mayer's widely accepted ten instructional multimedia principles can offer medical educators guidance on the application of multimedia components in educational interventions in order to maximize the positive effects for optimum student learning. With these principles in mind, instructional multimedia should conform to the following:

1. **Coherence Principle**—Exclude extraneous words, pictures and sounds.
2. **Pre-Training Principle**—Ensure students possess prior knowledge about names and characteristics of the main concepts.
3. **Spatial Contiguity Principle**—Present corresponding words and pictures in close proximity to one another.
4. **Temporal Contiguity Principle**—Present corresponding words and pictures simultaneously rather than successively.
5. **Signaling Principle**—Highlight important words.
6. **Redundancy Principle**—Pair animation and narration together ***without*** on-screen text.
7. **Voice Principle**—Use non-accented human spoken voice for narration over a machine simulated or foreign-accented human voice.
8. **Personalization Principle**—Employ conversational style, instead of formal, to present words.
9. **Segmenting Principle**—Offer narrated animation in learner-paced segments rather than a continuous unit.
10. **Modality Principle**—Pair animation and narration together ***instead*** of pairing animation and on-screen text.

Simulation
(virtual patients, human patient simulation)

An increasing number of specialized programs in medical education employ high-fidelity simulations. They vary in how technology is utilized, how instructors are engaged, and the extent to which the simulation activity is incorporated into the curriculum. Because they can be costly, investments in high-fidelity simulations usually demand evidence of positive results. A recently published qualitative, systematic review—spanning 34 years and 670 peer-reviewed journal articles—identified 10 characteristics of effective high-fidelity medical simulations in a range of specialties, including anesthesiology, cardiology, and surgery. Many characteristics are consonant with Ericsson's model of deliberate practice for mastering professional performance. Although this list was derived from research on high-fidelity simulation, many principles may well apply to virtual patients.

1. **Feedback**—Formative and constructive feedback of performance is the single most important feature of simulation-based medical education. It is the most important factor in ensuring skills transfer to patient settings and helps slow the deterioration of skill over time.

2. **Repetitive practice**—Opportunities for learners to engage in focused, repetitive practice with the intent of skill improvement, not idle play, is an essential learning feature. This factor is also essential to ensuring skills transfer to actual patients; the practice "dose" should be determined by learners' needs, not instructors' demands.

3. **Curriculum integration**—Simulation-based education should not be an extraordinary activity, but built into learners' routines and required training schedules, and grounded in the ways learner performance is evaluated. Simulation should also be fully adopted within the broader medical school educational program and not dependent on a single "champion," who often has competing research or patient care responsibilities.

4. **Range of difficulty level**—Learning is enhanced when learners have opportunities to engage in medical skills practice across a wide range of difficulty levels. Helping learners master skills at increasingly difficult levels slows their deterioration of skills over time.

5. **Multiple learning strategies**—Ideally, simulations should offer a variety of educational strategies including large groups (e.g., lectures), facilitated small groups (e.g., tutorials), and both individual and small-group learning without an instructor. The strategies adopted should be determined by the desired outcomes, the available resources, and the institution's educational culture.

6. **Capture clinical variation**—High-fidelity medical simulations that capture or represent a wide variety of patient problems or conditions are more effective than simulations having a narrow patient range. This provides more "contextual experiences" that are critical for obtaining problem-solving skills.

7. **Controlled environment**—In a controlled clinical environment, learners can detect and correct patient care errors without adverse consequences, while instructors can focus on learners rather than patients.

8. **Individualized learning**—Learners' opportunities for reproducible, standardized educational experiences in which they are active participants, not passive bystanders, is an important feature.

9. **Defined outcomes or benchmarks**—Learners are more likely to master key skills if outcomes are defined and appropriate for their training level prior to the simulator exercise.

10. **Simulator validity**—A high degree of realism or fidelity provides an approximation of complex clinical situations, principles, and tasks and is essential to help learners increase their perceptual skills and to sharpen their responses to critical incidents. Although it is important to note that the desired outcome should be matched with the appropriate degree of fidelity. Many competencies can be learned and mastered with relatively low-fidelity simulators.

Faculty Development and Training

The effective use of technology in medical education is in large part dependent on faculty readiness. This is especially true for sophisticated mannequin-based devices and virtual reality environments that may involve physiological responses to drug administration and drug interaction, interpretation of three-dimensional visual displays, and interpersonal conflict within medical teams. Medical faculty should be prepared in at least two ways to insure optimal use of these educational technologies: they must be skilled in the technical operation of simulators and other devices, and know how to employ the technologies to facilitate learning and assessment.

Expertise in clinical teaching is necessary within a simulated clinical environment but is not sufficient, as there are important differences in the two settings. Faculty training in the specific demands of simulation-based teaching is key, especially with high-fidelity settings utilizing human patient simulation technology.

These demands go beyond an understanding of simulator technology. In clinical teaching, patients' needs always take priority. In simulation-based teaching, learners' needs become central, dramatically altering the emphasis of the encounter. This shift may have a significant impact on teaching style and should be explicitly addressed.

Moreover, approaches to debriefings, feedback, and learner support within a simulation may differ from those employed by teachers in clinical practice. Considerable support may be needed to help clinicians function effectively in simulated settings.

Faculty use of educational technology to maximum advantage will not occur by chance or seniority. The academic medical community should develop competency-based faculty training and certification programs in the use of advanced educational technologies. The programs should teach the theoretical underpinnings of educational technology, coupled with practical expertise in specific approaches. Just as the weight of evidence shows that clinical experience alone does not determine the quality of an individual's delivery of health care, medical faculty competence in educational technologies should be assured, not assumed. In many cases, specialists with formal training in instructional design can serve as useful advisors to faculty content experts.

In addition, certified training expertise should be available to various health professionals, as physicians are not the sole source of medical education. Clinicians in physical therapy, respiratory therapy, specialized nursing, and surgical support, among others, should be eligible for training and certification, especially for simulator operation.

Putting it All Together

There is clearly no single theory or set of principles to guide the practical use of technology in medical education. Researchers have proposed dozens of frameworks and models. Ideally, the effective use of educational technology should begin with the classic instructional design approach, a systematic method of analyzing learner needs and developing appropriate instructional activities. The 'ADDIE' framework is commonly used to help organize an educational technology project. The acronym represents the following steps:

Analyze	Analyze relevant learner characteristics and tasks to be learned
Design	Define objectives and outcomes; select an instructional approach
Develop	Create the instructional materials
Implement	Deliver the instructional materials
Evaluate	Ensure that the instruction achieved the desired goals

The design, development, and implementation phases of this process have been further extended by educational psychology researchers. Robert Gagné's *Nine Events of Instruction* constitutes one instructional design framework:

1. **Gain attention**—Capture learners' attention by presenting a problem, a case, a compelling question, or an interesting statistic. Focus learners' attention so they will be engaged by the material.

2. **Inform learners of educational objectives**—Convey expectations to learners by introducing the educational objectives. Consider describing them in terms of specific knowledge, skills, or behaviors that learners are expected to acquire.

3. **Stimulate recall of prior knowledge**—Help learners build on what they already know by reminding them of prior knowledge (previous material, personal experience, etc.) that is relevant to the current material.

4. **Present the material**—Present logically organized information (or practice) to avoid cognitive overload. Consider incorporating Mayer's principles for the effective use of multimedia. Organize material in order of increasing difficulty. Periodically revisit concepts to facilitate recall.

5. **Provide guidance for learning**—Offer learners specific guidance on how to best understand concepts or acquire skills. Use a different media or format to avoid confusion with the instructional material.

6. **Elicit performance**—Present learners with numerous opportunities to use newly acquired knowledge, skills, or behavior. Repeated practice allows learners to confirm their understanding.

7. **Provide feedback**—Provide learners with specific, constructive, and immediate feedback regarding their performance.

8. **Assess performance**—Assess learners against the aforementioned learning objectives to determine if the knowledge, skills, or behavior have been appropriately acquired.

9. **Enhance retention and transfer**—Review the material. Inform learners of opportunities to apply the new knowledge, skills, or behavior. Offer opportunities for additional practice.

Gagné's method is intuitive to many instructors and can readily be used within educational technology environments. While the relative merit has not been proven for each recommendation, they continue to serve as 'good practices' employed by researchers. Table 3 suggests how the principles might be effectively used with the three common educational technologies. While, medical educators may not be accustomed to such a formal approach in developing an educational activity, instructional design may be even more important when using educational technologies than in face-to-face teaching, because the learning activities must be explicitly planned in advance. A systematic approach to instructional design is essential to the effective use of educational technology, and indeed, educators unfamiliar with such approaches may benefit from engaging experts in instructional design when newly developing learning materials.

Table 3. Technical approaches to help realize each phase of instructional design.

	Computer-aided Instruction	Virtual Patients	Human Patient Simulation
Gain attention	Present a short patient scenario, an interactive model, or a compelling video clip.	Display an opening video (e.g., a dramatic patient presentation).	Put learners in urgent patient scenarios (e.g., cardiac arrest) with worsening condition until appropriate action taken.
Inform learners of educational objectives	Clearly state desired learning objectives/outcomes.	Clearly state desired learning objectives/ outcomes.	Clearly state desired learning objectives/ outcomes.
Stimulate recall of prior knowledge	Analyze material presented in "gain attention" phase or offer an advance organizer to help bridge prior and new knowledge.	Present a series of multiple choice questions related to the "gain attention" phase and consider offering succinct feedback.	In "gain attention" phase, elicit proper actions to manage cardiac arrest—e.g., implement proper protocol for pulseless ventricular tachycardia.
Present the material	Use text or multimedia to present basic concepts (see Mayer's principles) through combinations of lecture, narratives, cases, interactive multimedia, and drill and practice problems.	At the end of a single virtual encounter, direct learners to a Web-based, menu-driven tutorial that addresses core topics of the case.	Provide clinical experiences in controlled settings applicable to real clinical situations. Learner experiences should evoke feelings associated with similar clinical situations.
Provide guidance for learning	Guide understanding by analyzing problems, summarizing, or alternate explanation of concepts.	Use a virtual preceptor to provide decision guidance when too much time has elapsed.	With clear goals allow learners to make mistakes while guiding them on technique or course of action.
Elicit performance	Assign practice problems or cases.	After they view a tutorial on diagnostic imaging, ask learners to interpret a series of radiographs.	Offer opportunities for all learners to be actively engaged and evaluated in simulation experience regardless of role.
Provide feedback	Deliver specific feedback regarding practice problem performance.	When learners ask virtual patients interview questions, the virtual preceptor comments on their relevance to the chief complaint.	Focused formative feedback during simulation or teachable moment. Review video recordings during formal debriefing with faculty and peers.
Assess performance	Deliver a post-exercise exam aligned with the learning objectives.	At program's end, learners receive scores summarizing their performance on multiple-choice questions.	Align objectives and learning opportunities with performance evaluations. Use checklists and rating scales to evaluate processes or outcomes. .
Enhance retention and transfer	Consider revisiting material through periodic email updates, reminders, or practice cases.	After using the virtual patient, learners write a narrative reflection on how it reminded them of a real-life patient experience.	Integrate learning strategies and evaluation tools from simulation into clinical practice. Implement mandatory remediation training for skills most prone to deterioration.

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A Research Agenda

Colloquium participants agreed that the current evidence base for educational technology in medicine is anemic. Although numerous publications have documented the feasibility of technology to enhance learning in various settings, ***little is established about precisely when to employ technology during medical education*** (versus the many other methods and media available), and ***how best to use it when it is employed.*** Although much can be learned from research in non-medical education fields, future research on educational technology in medical training will require a significant change in focus. Simple answers are unlikely. Rather, solutions will be contingent upon multiple factors including learner attributes, desired learning outcomes, institutional characteristics, and other factors in the learning environment. Future research will have to accommodate these complexities as well.

Colloquium participants called for fewer studies that simply compare instructional approaches (e.g., computer-aided instruction versus lectures) and instead set out the challenge that subsequent research should clarify the uses of technology to facilitate learning—for example, the effectiveness of specific technological features or instructional methods—and when and how to integrate educational technology into the medical training continuum.

Proposed Research Questions

Addressing the following research questions will serve to clarify the appropriate use of education technologies in medical education:

HOW

- How can instructional methods and designs be tailored to individual learner's needs?
- How does the use of educational technology differ for groups compared with individuals?
- How does fidelity impact learning outcomes, educational contexts, and learner characteristics?
- Which technology approaches are appropriate for particular learning outcomes?
- How can we best integrate educational technology into existing curricula?
- What is the most appropriate use of specific simulation technologies?
- What infrastructure (human and technical) is needed to effectively support educational technology in the curriculum?

WHEN

- What are the barriers to successful integration of educational technology into the curriculum?
- What are the characteristics of individuals and institutions that have successfully integrated educational technology into the curriculum?
- How can educational technology be integrated in existing educational settings?
- What is the cost-benefit ratio of various technologies?
- What outcome measures are reliable, valid, and feasible?
- What training opportunities will help ensure that educators possess the necessary competencies listed above?

Case Study 2

A surgery residency program director would like to improve her junior residents' ability to work as a cooperative team during patient crises in the Surgical Intensive Care Unit (SICU). She asks a professional educator to help plan and design the instructional activity. The educator suggests conducting the communication training with a new human patient simulator capable of portraying crisis scenarios. Before designing a simulation scenario, they agree to conduct a literature search and consult other faculty to develop the relevant knowledge, skills, and behaviors; they then develop specific learning objectives and desired outcomes.

They choose a high level of fidelity, designing an environment that includes the human patient simulation device, a nurse, and recognizable features of the SICU. They will videotape group performance to facilitate feedback sessions; some scenarios vary in level of difficulty. Each scenario requires active participation from all residents.

The session is offered at the start of the PGY-1 year and again at the end of PGY-2. The instructor begins the session by sharing an incident from her own experience and asks participants to articulate what they know about teamwork. Educational goals are shared with the team before the scenario begins. After each scenario the instructor plays the video and offers specific feedback. Participants are encouraged to exchange roles during subsequent practice scenarios. The instructor revisits key concepts through an existing weekly seminar series.

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Improving Patient Care by Linking Evidence-Based Medicine and Evidence-Based Management

EBMとエビデンスベイスドマネジメント（EBMG）をリンクさせることによって患者ケアを改善する

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Improving Patient Care by Linking Evidence-Based Medicine and Evidence-Based Management

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NOT UNTIL ABOUT 100 YEARS AGO COULD A TYPICAL patient expect to benefit from the medical care provided by a typical physician. Today most patients benefit from medical care, but all patients could benefit more if clinicians routinely provided care consistent with the latest scientific knowledge. One report suggests that only 55% of US adults receive care consistent with current recommendations.[1] In 2001, the Institute of Medicine concluded that a chasm lies "between the healthcare we have and the healthcare we should have."[2] Moreover, the results of efforts to improve medical quality have been modest and uneven to date.[3]

Two components are necessary to improve the quality of medical care: advances in evidence-based medicine (EBM), which identify the clinical practices leading to better care, ie, the content of providing care,[4] and knowledge of how to put this content into routine practice. These advances in evidence-based management (EBMgt) identify the organizational strategies, structures, and change management practices that enable physicians and other health care professionals to provide evidence-based care, ie, the context of providing care.[5] Until both components are in place—identifying the best content (ie, EBM) and applying it within effective organizational contexts (ie, EBMgt)—consistent, sustainable improvement in the quality of care received by US residents is unlikely to occur.

Providing High-Quality Care

Ensuring the delivery of high-quality care requires integration of knowledge from EBM and EBMgt. The content of

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what should be done—eg, evidence on which drug, medical device, procedure, or treatment plan is most likely to improve patient outcomes—needs to take into account the organizational and community context in which the care is delivered. Randomized clinical trials (RCTs) emphasizing internal validity are the gold standard for creating EBM, but have limited generalizability to patients, clinicians, and treatment settings different from those in the RCTs.[6] Practical or pragmatic clinical trials can address some of the generalizability issues but can be costly and generally do not address explicitly the underlying organization of care.[7] EBMgt focuses on the underlying organizational issues that influence how care is delivered. The evidence base comes largely from the social and behavioral sciences, human factors engineering, and the field of health services research. In addition to RCTs, EBMgt uses observational data and approaches such as the PDSA (plan-do-study-act) quality-improvement method for making small-scale changes to improve care.[8]

An example of the value of using EBM and EBMgt together is treatment of patients with acute coronary syndromes. Evidence-based guidelines recommend that symptomatic patients presenting in the emergency department receive immediate evaluation, in an effort to decrease the time between the onset of symptoms and the initiation of treatment. In practice, not all patients at risk for an acute coronary syndrome receive prompt evaluation or treatment because of factors that can vary across emergency departments, eg, triage bottlenecks due to limited space.[9]

One hospital, however, reduced its door-to-balloon time for patients with acute myocardial infarctions (AMIs) after reviewing the existing management research on workflow processes and drawing on case studies from similar hospitals for ways to initiate electrocardiograms faster in symptomatic patients.[9] This hospital was able to use EBMgt knowledge to help put EBM into practice.

Substantial clinical evidence and established guidelines recommend the use of certain medications in patients with AMI; yet, use of β-blockers after an AMI continues to be uneven across hospitals. Four organizational characteristics of hospitals are associated with greater improvement in use of β-blockers over time than that evident in lower-performing hospitals. These include developing shared goals for improvement, providing substantial administrative support, having strong physician leadership, and using credible data feedback.[10]

Using the best knowledge to identify what to do and how to make it part of routine practice appears obvious, but this integration of content and context seldom happens. Within both EBM and EBMgt there are substantial, similar barriers to evidence use: time pressures, perceived threats to autonomy, the preference for "colloquial" knowledge based on individual experiences, difficulty in accessing the evidence base, difficulty differentiating useful and accurate evidence from that which is inaccurate or inapplicable, and lack of resources.[3,11] Integrating EBM and EBMgt also requires practitioners who are aware of and able to draw on evidence from both. Few physicians read management studies; few managers read clinical studies; and few persons read all relevant studies within their own field.

EBMgt for Chronic Illness and Patient Safety

More than 90 million US residents have at least 1 chronic condition; many have more than 1; and chronic conditions account for nearly 75% of all health care expenditures.[12] Disease registries, clinical guidelines, automatic reminder systems, system redesign processes, physician feedback reports, and patient self-management education programs, ie, elements of the chronic care model, are associated with better patient outcomes.[13] Yet practices in the United States with 20 or more physicians use, on average, fewer than half of the recommended chronic care model elements when caring for patients with asthma, congestive heart failure, depression, and diabetes, and only 1% of such practices use all recommended elements for all 4 conditions.[14]

EBMgt can help expand the use of recommended chronic care processes by providing knowledge about incentives and organizational capabilities. For example, existing research examining the influences of financial rewards to physician practices for meeting quality standards ("pay-for-performance" programs) has found mixed effects.[15-17] Future evaluations of these programs should inform such questions as how much payment is required to induce desired behavior; what are the unintended or negative consequences; whether payment incentives are best placed at the level of the group, the individual physician, or both; and how the payment incentives interact with the practice setting, organizational structure, or other quality-improvement initiatives.

Effective management for patients with chronic illness also requires the effective use of health care teams. An important component is providing teams with the necessary information, resources, autonomy to experiment, autonomy to select members suited to each task, and feedback to track performance.[18] Teams with such characteristics also make a greater number of changes and more in-depth changes (eg, creating disease registries) in implementing elements of the chronic care model to improve care.[18]

Medical care is not nearly as safe as it could and should be. EBMgt can help by using knowledge from human factors engineering,[19] on high-reliability organizations,[20] on changing organizational culture, and on developing high-performing teams.[21] For example, using Lean Production process engineering methods, Virginia Mason Medical Center reports decreasing ventilator-acquired pneumonia cases from 40 per year in 2000 to 5 in 2006, saving an estimated 10 lives and $1.7 million in costs.[22] Furthermore, a recent study of more than 100 intensive care units found a significant reduction in catheter-related bloodstream infections by developing a comprehensive unit-based safety program, or CUSP, that involved changing the culture of senior leaders, team leaders, and front-line staff.[21] Specifically, the management evidence suggests that better performance comes from having a culture in which caregivers tell each other about their mistakes, ask for help when needed, share with each other how they have fixed their mistakes, and continually question what is being done and how to do it better.[24]

Integrating EBM and EBMgt

The nexus of EBM and EBMgt represents an important frontier for improving the nation's health care system. Given the likely increased demand for better and measurably valuable care, combined with increasing cost and quality pressures and calls for health care reform, the following suggestions may be helpful for promoting the integration of EBM and EBMgt and for reducing the barriers to their use.

Synthesizing the EBMgt Knowledge Base. The federal government should consider establishing a national evidence-based health care management center. For example, the Agency for Healthcare Research and Quality could extend its Evidence-Based Practice Centers initiative with input from the National Quality Forum and related groups. The program's primary responsibilities would be to ensure that management/organizational research data are rigorously assessed and synthesized, such as with meta-analyses; made widely available in usable forms for managers and clinicians; and effectively linked to other evidence-based management and medicine repositories. Related efforts from other countries include the National Institutes for Clinical Excellence in the United Kingdom, which has established an NHS (National Health Service) program for service delivery and organization (http://www.sdo.lshtm.ac.uk/); the Cochrane Collaborative on Effective Practice and Organization of Care Group; the UK National Library for Health (http://www.nelh.nhs.uk/); and the Canadian Health Services Research Foundation with the development of HEALnet (http://www.chsrf.ca/). The national program also would provide an annual assessment of gaps in knowledge and suggest areas for further research attention for funding agencies and the research community. Of particular importance is the need for rigorous, scientifically sound syntheses of organization-wide interventions and initiatives to improve the uptake of evidence-based clinical guidelines and practices, to increase patient safety, and to improve the overall quality of care provided.

Adding to the EBMgt Knowledge Base. Practice-based research networks should be expanded, such as Agency for Healthcare Research and Quality's Accelerating Change and Transformation in Organizations and Networks. This network involves partnerships of hospitals, health plans, physician organizations, and researchers to address questions regarding the scientific evidence on what does and does not work to improve care in real-world settings. Similarly, the joint National Academy of Engineering/Institute of Medicine Report on Building A Better Delivery System[19] has recommended that Congress fund university-based practitioner-linked Engineering/Healthcare Management Research Centers that bring together engineers, clinicians, researchers from multiple disciplines, and executives to work on expanding the applications of tools and methods for improving care, evaluating the applications, and rapidly sharing the learning. The federal government also can require that all Medicare demonstration projects involve explicit evaluation of patient outcomes as well as implementation efforts, ie, both content and context. These initiatives should be linked with the National Institutes of Health translational roadmap research agenda and are consistent with the goal of translating scientific knowledge from the bench to the bedside to the community.

Creating the Market for EBM and EBMgt Integration. External accreditation, certification, and licensing bodies should consider "evidence" of EBM and EBMgt linkages in their reviews. While such reviews should emphasize outcomes rather than the methods used to achieve them, organizations and individuals should be held accountable for not using evidence-based approaches, much like clinical performance efforts target both process and outcome end points. The Quality Improvement Organizations of the Centers for Medicare & Medicaid Services can provide assistance in the implementation of EBM as well as EBMgt and ensure that interventions to improve care use the best available evidence from both.[25] These entities can help create a national expectation that clinicians and managers will work together to identify issues, formulate questions and interventions, and work with the research community to address both content and context. Furthermore, hospital and health system governing boards might create financial incentives for managerial and clinical leaders to implement evidence-based changes that result in improved quality and cost performance.

Developing the Intellectual Capital to Support Integration. There is great need for improving the education of all health care professionals in the use of EBM and EBMgt. Relevant topics would include assessment of what constitutes credible and applicable evidence, how to conduct meta-analyses and systematic reviews, and how to apply evidence in everyday practice. Clinical residency and management accreditation groups should consider including these topics in their list of requirements for training programs.

Conclusion

Practice and policy recommendations and interventions are needed to bring both components—EBM and EBMgt, the content and the context—together to provide better patient care. Only an integrated evidence-based approach can reduce the quality gap and instill greater confidence in the US health care system.

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臨床研修医を対象とする全国アンケート調査実施計画書

臨床研修医の知識基盤/問題対応能力についての
アンケート調査

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はじめに

近年の医学・医療の進歩には目を見張るものがあり、国民の健康に大きく寄与している。

新知見の集積が急速に進むとともに既存知識の陳旧化は以前にも増して加速し、臨床医が“最新・最良”の臨床情報を身に付けておくには多くの努力を要する。一方、医療の現場では、”安心・安全な”医療を求める国民の声は益々強くなり、医療機関であれ、医師個人であれ、医療の提供者は、透明性と説明責任を果たすことを強く求められている。このような医療環境の下では、医学知識の新陳代謝も益々早くなり、当然のことながら、医療専門職としての道を歩み始めた臨床研修医にとってもおおきな負荷となっていることは想像に難くない。

EBMの現状と問題対応能力

然るに、“最新・最良”の臨床情報と患者アウトカムを重視するEBM(根拠に基づく医療)の意義は概ね受け入れられ、臨床研究の成果を基盤とする臨床実践も着実に根付きつつあるとはいえ、標語としてのEBMは、医学文献の検索と吟味との狭義に解釈されることが多く、臨床現場での課題発見と“目の前の”患者のための問題対応能力を身に付けるプロセスは、研修医個人の努力に任されるか、従来からの経験則に基づく指導にゆだねられている。臨床医としてのスキル習得や医師としてのコミュニケーション能力の獲得と同様、研修医がどのようにして臨床医としての知識基盤/問題対応能力を身に付けてゆくかについては、これまで十分な調査が行われてこなかった。

Ⅰ．試験の目的

上記のような環境下で臨床の日々を送っている臨床研修医のニーズに合致した臨床教育カリキュラムを開発するために、臨床研修医が知識基盤/問題対応能力を習得してゆくためにどのような努力をしているか、その実像を探ることを通じて一人ひとりの研修医が一人前の医師へと成長してゆく過程を明らかにすることを目的に、臨床研修医を対象とした全国規模の実態調査を行う。

Ⅱ．対象

調査対象は、医師臨床研修制度に基づいて現在、臨床研修に従事している全国の臨床研修医とする。

そのために、全国の大学病院、臨床研修病院を対象として、各施設のプログラム責任者または臨床研修センター実務統括者に調査の主旨を説明し、協力を要請する。

Ⅲ．調査方法

アンケート用紙(別紙の通り)を研修プログラム(研修施設)のプログラム責任者ないしは臨床研修センター長を通じて研修医に配布し、回答を求め、この場合は郵送で回収する。また、回収率向上のために、研修医がインターネット上で回答できる環境を整える。

Ⅳ. 個人情報保護

アンケート調査依頼状やアンケート調査用紙そのものに、本アンケートへの回答は任意であることと用途(厚生労働科学研究班としての研究発表)を明記するので、アンケートへの回答そのものによって対象者が調査に同意したことを確認できる。

Ⅳ. 評価項目

1.主たる評価項目：研修医が知識基盤・問題対応能力を習得する過程についての現状把握

2.副次的評価項目：研修環境と知識習得過程との相関の有無

Ⅵ. 資金源

厚生労働科学研究費補助金で賄われる。

Ⅷ. 目標回答数(詳細は別紙1)

全国の臨床研修医 1500～2500 名

Ⅸ. 調査実施期間

平成 20 年（2008 年）11 月 1 日～平成 20 年（2008 年）12 月 31 日

XⅠ. 研究組織(詳細は別紙2)

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