CHEST

Commentary

PATIENT SAFETY FORUM

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## The Imperative of Routine Simulation in Modern Health Care

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**Technology-enhanced patient simulation has emerged as an important new modality for teaching and learning in medicine. In particular, immersive simulation platforms that replicate the clinical environment promise to revolutionize medical education by enabling an enhanced level of safety, standardization, and efficiency across health-care training. Such an experiential approach seems unique in reliably catalyzing a level of emotional engagement that fosters immediate and indelible learning and allows for increasingly reliable levels of performance evaluation—all in a completely risk-free environment. As such, medical simulation is poised to emerge as a critical component of training and certification throughout health care, promising to fundamentally enhance quality and safety across disciplines. To encourage routine simulation-based practice as part of its core quality and safety mission, Massachusetts General Hospital now incorporates simulation resources within its historic medical library (est. 1847), located at the center of the campus. In this new model, learners go to the library not only to read about a patient's illness, but also to take care of their "patient." Such an approach redefines and advances the central role of the library on the campus and ensures that simulation-based practice is centrally available as part of everyday hospital operations. This article describes the reasons for identifying simulation as an institutional priority leading up to the Massachusetts General Hospital Bicentennial Celebration (1811-2011) and for creating a simulation-based learning laboratory within a hospital library.** ***CHEST 2012; 141(1):12–16***

**Abbreviations:** MGH = Massachusetts General Hospital

On the evening of September 25, 1905, in an address to the Association of Hospital Superintendents at the Boston Medical Library, Grace Whiting Myers, the then assistant librarian at the Treadwell Library of Massachusetts General Hospital (MGH), described the key role of a medical library on the campus of a modern hospital:

> A medical library in a hospital is a necessity. . . . Like the doctor, it must be ready for emergencies. It welcomes alike the physician and the surgeon, the house officer and the student, and supplies to each according to his needs. It is a quiet place in the midst of much activity, where the doctor may come and make the most of a few moments snatched at odd times during busy hours. It is a library situated in close association with hospital wards . . . [where] theory and fact are brought to near relation, and an atmosphere created of study and investigation, which to the doctor has value beyond estimate. For, as the much-honored Regius Professor [William Osler] has expressed it: "To study the phenomena of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all."[1,2]

Over the next 100 years, medical libraries became standard, then required,[3,4] elements of hospital culture, serving as the embodiment of evidence-based practice. Today, however, the instant availability of digital resources has revolutionized the field of information science. Many modern libraries have become full-service educational centers, offering streamlined access to a wide range of knowledge resources. Yet even in the most advanced hospital libraries, knowledge acquisition mainly occurs through exposure to printed and digital resources, rather than through experiential learning.

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Despite a century of creating unified medical training curricula through integrating "books" with "patients,"[2] the artificial segregation of complementary learning methods persists in many teaching hospitals. While many medical training programs offer weekly readings, lectures, and conference sessions to inform daily patient care duties, there remains a paucity of reliable opportunities to "practice" action-oriented skill sets in a protected, reflective setting.[5] This realization, coupled with increasing work-hour restrictions for hospital trainees, has resulted in the increasing use and development of simulation centers across academic medical campuses.[6] These educational centers are designed to replicate clinical care in a realistic yet artificial teaching environment, a setting typically populated by dynamic robot-mannequins and trainers.[7,8] The centers, however, are often located at some distance from the main hospital campus, and core activity is typically more occasional than routine.

To encourage "deliberate practice" as part of daily activity—the hallmark of any field of expertise[9]—MGH now incorporates simulation opportunities as part of the Treadwell Library suite of services; a flexible simulation ward is now located within the walls of the library itself, in the heart of the campus. In this model, learners go to the library not only to read about a patient's illness, but also to take care of their "patient," accessing a clinical environment fully supported by modern knowledge resources. Such an approach redefines and advances the role of the library on the campus and ensures that simulation-based practice is institutionalized as part of the hospital quality and safety mission. This article describes the reasons for identifying simulation as a key institutional priority and for creating a simulation-based learning laboratory within a hospital library.

## Why Is Simulation So Important?

Integrating simulation-based training within an established medical library of a major teaching hospital is one of many signals that patient simulation has emerged as an enduring pedagogic approach. Building on decades of experience with standardized actor-patients and problem-based learning, there are now organized simulation societies across the globe, a body of evidence-based academic literature,[10] and an indexed journal devoted to the field (*Simulation in Healthcare*). Most academic medical centers have either deployed or are discussing simulation capability.[11] This revolution in health-care education over the last decade is no accident. It has progressed because simulation inherently addresses core pedagogic objectives that were very difficult to fully achieve in the absence of simulation technology. Chief among them are the following imperatives: (1) to ensure patient safety while developing trainee autonomy, (2) to mitigate inherent variability in the individual learning experience, and (3) to maximize efficiency in organized training approaches. Simulation helps address all three foundational objectives, offering a robust platform for achieving core goals that could never be fully addressed in the "presimulator" era.

## Ensuring Patient Safety as a Cultural Priority

Enhancing individual well-being and ensuring patient safety have always been at the heart of medicine, even as well-intentioned therapies have in retrospect proven to be ineffective or even harmful. With the advent of modern science, education in the health professions became rooted in empirical observation and evidence-based practice, an evolution catalyzed in the United States and Canada by the 1910 Flexner Report.[12] This approach to medical education, characterized by a rigorous course of scientific study followed by supervised clinical practice, was rooted in the desire to maximize therapeutic benefit.[13] Teaching hospitals in particular leverage multiple layers of supervision to ensure patient safety while providing an authentic clinical training experience: The student is supervised by the intern, who is supervised by the junior resident, who is supervised by the senior resident, who is supervised by the fellow, who is supervised by the attending physician—all surrounded by a team of experienced nurses, pharmacists, therapists, technicians, and other health-care professionals who staff vital hospital services on a daily basis. Despite all these layers of oversight and support, the Institute of Medicine highlighted patient safety as a major concern in modern hospital practice over 10 years ago, and quality and safety concerns still dominate the health-care landscape.[14,15]

Why does patient safety persist as a major concern in health care despite impressive advances in other high-risk industries? Other high-risk industries such as the military, aviation, and nuclear engineering have

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all prioritized and instituted systems of routine practice to develop and maintain expert performance. Even in social and cultural pursuits like music and performance arts, or sports and games, an individual or team may practice every single day of the week in preparation for "game day." Yet prior to the advent of simulation in health care, every day was game day.

As simulation platforms become increasingly available, the question in the "simulator era" is whether medicine will remain an outlier in serious quality and safety efforts. Such efforts require ongoing off-line practice as a routine component of the health-care enterprise. We already know that simulation-based training enhances performance,[10] but initial training is not enough; maintenance of skill requires ongoing longitudinal practice.[16] While medicine is admittedly unique—provider groups cannot practice hours per day away from actual patient care—surely our educational practice patterns can be measured in days, weeks, or months, rather than years and decades.

Properly designed, funded, and staffed, simulation-based practice can be as accessible as a book on a library shelf, but it takes institutional commitment. Why not open (or close) the operating rooms and procedure suites 15 min later each day, allowing for a brief period of team-based practice designed to improve overall efficiency, performance, and safety (thereby leveraging the expended time and resources as a strategic investment[17])? Or add 15 min of simulated practice time to daily rounds? Or use conference or lecture time as clinical practice time? We are not restricted to one "right" model, but surely we can find the time for more routine practice in health care—if not daily, then weekly, and if not weekly, then monthly. Our patients expect it, and our profession demands it.

## Mitigating Variability in Individual Learning

Prior to the advent of simulation technology, medical learning was subject to the restrictions of "time and chance" encounters in clinical practice. Whether a particular trainee had personal experience with a particular disease process often depended on whether the provider was "on call" for the relevant consultation or hospital admission. Yet, all practitioners are expected to have core competency across their field of practice.

In the presimulator era, there was only one solution to ensuring comprehensive experience for all trainees—spending more time with patients. Shortly after the Flexner Report, all doctors would need not only four years of medical school, but also a general postgraduate internship (still the legal standard in many states). Then, residency training beyond internship became the standard, with initial programs offering an additional year or two of experience, later progressing to incorporate multiple years of postgraduate residency training. Many residents now go on to complete fellowship programs, also initially offered as a year or two of additional training, and now even more.

This practice of spending more time with patients—not only on a daily basis but also in the yearly length of training programs—was an ideal approach to mitigating the inherent variability of an increasingly complex caseload and ensured that practitioners maintained predictable levels of excellence in the face of an ever-increasing knowledge base. However, in the 21st century, this approach appears to have reached the limit of its flexibility. Training programs cannot continue to add more years of education ad infinitum, and work-hour restrictions are actually decreasing the time trainees spend with patients. This new reality requires a fundamental reassessment of an educational paradigm in which chance encounters are mitigated by the length of training.

Simulation, by definition, offers predictable access to clinical scenarios on a compressed and controllable time schedule. By no means a substitute for the real patient, simulation offers an opportunity to expose the trainee to case scenarios that are becoming increasingly difficult to reliably provide through actual ward or clinical experience. In this way, modern simulation preserves the values of the prior era by ensuring adequate training time, but in a way that advances the quality and safety standards of a new era.

## Maximizing Efficiency Through Memorable Training

In addition to standardizing and accelerating clinical exposure, immersive simulation can work to accelerate learning in an even more fundamental way—by replicating the kind of intense personal and emotional engagement that serves to rapidly codify and preserve new information. In essence, simulation is engaging enough to be memorable, the hallmark of Dewey's seminal theory of experiential learning.[18] A lesson learned through intense personal experience (actual or simulated) is often learned more quickly, can be recalled more readily, and may be retained longer than lessons otherwise learned.

It seems paradoxical that an artificial medical experience can be uniquely powerful in stimulating an authentic emotional response, yet intense engagement in medical simulation is a fundamental tenet of its pedagogic value.[19] The Circumplex Model of Affect,[20,21] as interpreted and applied by investigators of the Institute for Medical Simulation at the Center for Medical Simulation in Cambridge, Massachusetts, offers a grounding theory for understanding the unique impact of immersive simulation. Originally derived as a research framework for understanding the spectrum of human emotional response, the model holds that individuals operate across four broadly conceived emotional states (Fig 1): (1) pleasantly activated (happy, excited); (2) pleasantly deactivated (calm, relaxed); (3) unpleasantly deactivated (sad, bored); or (4) unpleasantly activated (nervous, stressed).

Traditional educational approaches such as lecture, readings, and conferences often engender a relatively low activation profile (Fig 1, Area A). For many learners, these experiences are pleasant, but they are typically passive and may not be particularly memorable. In contrast, individuals tend to vividly remember emotionally heightened experiences in which they are actively engaged. Health-care providers in particular often have indelible recall of memorable encounters in which important lessons are quickly learned and consolidated (eg, "I remember the case of Mr. Jones, who . . .").

Medical simulation—like actual patient care but without the inherent risk—appears unique in its ability to stimulate the kind of activated emotional response that provides an affective anchor for efficient learning (Fig 1, Area B). Catalyzing and controlling learner activation as part of an orchestrated educational process thus places the original theory of experiential learning firmly in the realm of modern biologic and behavioral science. The concept of grounded cognition[22] updates the analytic framework, holding that "knowledge of the world is 'embodied,' or grounded, by a network of broadly distributed, diverse, multimodal states which are encoded during the experience of a given stimulus. . . . What you know about an object is therefore based, in part, on its affective impact in the past."[23]

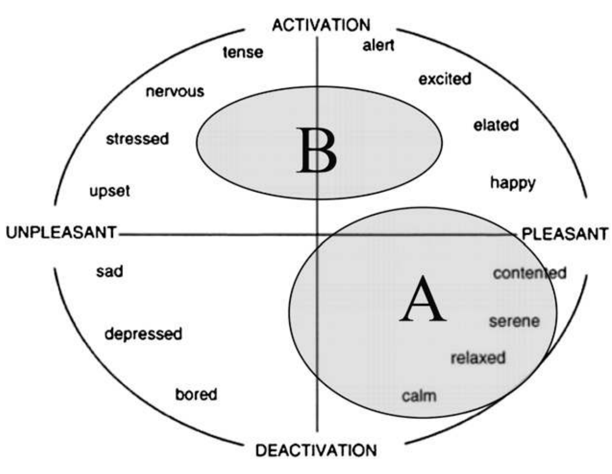


Figure 1. The Circumplex Model of Affect[20,21] as hypothetically applied to the medical learning environment. Area A represents the emotional state commonly experienced by learners during traditional pedagogic exercises (eg, lectures, conferences, readings); area B represents the typical emotional state of learners during immersive simulation exercises. This dichotomy is thought to represent a unique and fundamental difference between simulation and alternative teaching and learning environments. Areas A and B of overlay on the core circumplex model represent a theory described by investigators at the Institute for Medical Simulation at the Center for Medical Simulation in Cambridge, Massachusetts. (Core circumplex model, without areas A and B, reproduced with permission from Cambridge Journals.[21])

Creating and maintaining "affective impact" in a simulation environment is important not only as a teaching and learning tool but also in creating authentic conditions for evaluation and assessment. In contrast to traditional evaluation tools (ie, written tests, oral examinations), the simulated environment can be immersive enough to more accurately reveal and predict actual clinical behavior (ie, what you do in the simulation laboratory is what you will do in the real world).[24] To that end, organizations like the American Board of Medical Specialties are now actively exploring the added value of simulation for enhancing life-long learning and certification processes across physician specialties.[25]

## Conclusion

Patient simulation has emerged as an important new modality for teaching and learning in medicine. In particular, immersive simulation platforms that replicate the clinical environment promise to revolutionize medical education by enabling an enhanced level of safety, standardization, and efficiency across health-care training. Such an experiential approach seems unique in reliably catalyzing a level of emotional engagement that fosters immediate and indelible learning and allows for increasingly reliable levels of performance evaluation—all in a completely risk-free environment. As such, medical simulation is poised to emerge as a critical component of training and certification throughout health care, promising to fundamentally enhance quality and safety across disciplines.

Over a century ago, the MGH assistant librarian described how the hospital library was "a necessity," a sentiment supported by the American College of Surgeons (1930s) and later enshrined by the standards of the Joint Commission on Accreditation of Hospitals (1950s).[3,4] In 2008, the American Board of Surgery voted to incorporate simulation-based training curricula as a certification requirement for all general surgery trainees completing residency as of 2010,[26] and the American Board of Anesthesiology now requires simulation training and practice as part of its Maintenance of Certification cycle.[27] In 2011, the year of the MGH Bicentennial Celebration, we are proud to integrate simulation into our historic medical library, a partnership that will not only enhance and redefine the role of the hospital library, but we hope will also help institutionalize routine simulation as a quality and safety standard in modern health-care practice.

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