Special Communication

# Medical Education
## Part of the Problem and Part of the Solution

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Medical education today is pedagogically superb, but the graduates of our educational programs are still unable to successfully translate decades of biomedical advances into health care that reliably meets the Institute of Medicine quality criteria. Realizing the promise of high-quality health care will require that medical educators accept that they must fulfill their contract with society to reduce the burden of suffering and disease through the education of physicians. Educational redesign must begin with the understanding that the professional identity of the physician who was successful in the acute disease era of the 20th century will not be effective in the complex chronic disease era of the 21st century. Medical schools and residency programs must restructure their views of basic and clinical science and workplace learning to give equal emphasis to the science and skills needed to practice in and lead in complex systems. They must also rethink their relationships with clinical environments so that the education of students and residents accelerates the transformation in health care delivery needed to fulfill our contract with society.

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From a pedagogical perspective, this is the golden age of medical education. Innovative teaching and assessment methods grounded in educational theory have been deployed and are currently being implemented in medical schools and residencies.[1] Objectives-based teaching has yielded to competency-based learning.[2] Passive lectures have given way to interactive small-group learning experiences. Simulation-based training in communication, procedural skills, and complex decision making has replaced practice on patients.[3,4] Board certification now fully supports lifelong learning by requiring continuous cycles of multidimensional learning and assessment rather than a single, multiple-choice examination at the end of residency. Countries outside the United States are striving to emulate our educational system.[5] This pedagogical transformation of medical education has paralleled a similarly dramatic improvement in our scientific understanding of health and disease. Thanks to the breathtaking advances in biomedical science over the past century, the physician graduates of our medical education system have access to an ever-expanding armamentarium of preventive, diagnostic, and therapeutic strategies to use as they strive to provide the highest quality care for their patients.

If biomedical science and medical education are so outstanding, why is the US health care system not better? Medical education is part of the problem: although our educational techniques are outstanding, our collective target is wrong. The goal of medical education is not simply to produce physicians. It is to improve the health of our patients and their communities.[6] Achieving this goal means that we must pursue our education reform process with the end in mind: targeting the development of the physician who can be successful in the 21st century health care environment rather than further refining our ability to produce the 20th century physician.[6-10]

Medical education targets the same physician model today that we have had since Flexner: the personally expert sovereign physician. The sovereign physician was autonomous, independent, and authoritative. Such physicians were expected to be personally accountable for mastering a body of biomedical science and using this knowledge along with clinical skills to manage their patients' conditions. The physician was a self-contained clinical microsystem, accountable for devising his or her own unique processes to care for patients and for continuously refreshing knowledge and skills. The sovereign physician model was highly effective in the first half of the 20th century when disease was predominantly acute, patients had a single physician, the public had no access to medical information except through their physicians, the educational hierarchy between physicians and other health care professionals was extreme, and the sum total of diagnostic and therapeutic options could easily fit into the iconic physician's black bag.

Medical education then and now is designed to replicate the sovereign physician. Despite longstanding and persistent calls for improved attention to systems-based practice and interprofessional teamwork,[11-13] our didactic and experiential learning opportunities focus predominantly on perfecting the physician competencies for the clinical encounter: taking a history, performing a physical examination, obtaining diagnostic tests and interpreting their results, performing procedures, making a diagnosis, and ordering treatment. Our students and residents spend the vast majority of their time in single-discipline teams. Our assessments are geared to ensure that the graduates of our schools and programs can function expertly as solitary, independent practitioners. We assume that assembling a group of these expert practitioners together will yield a similarly expert health care system.

Table 1. Principles Shared by High-Functioning Educational Programs and High-Functioning Clinical Microsystems[1,20,24]

| Principles | Ideal Educational Programs | Ideal Clinical Microsystems |
|---|---|---|
| Standardized outcomes | Physician competency goals are standardized and performance is assessed; learning paths are individualized for each student. | Clinical quality, safety, and satisfaction goals are standardized and performance is measured; care is individualized for each patient. |
| Integrated workplace learning | Workplace learning experiences are integrated with foundational science experiences throughout the curriculum. | Data-driven quality improvement is integrated into the daily work of the care delivery team. |
| Inquiry and innovation | Evidence-based inquiry and innovation are expected competencies, achieved by challenging students to use scientific methods to build on existing knowledge and disseminate results for peer review. | Innovation is an expected goal of microsystems, expressed by applying and identifying ways to improve on evidence-based best practices to meet specific populations and local needs and disseminate results for peer review. |
| Continuous accountability | Continuous longitudinal assignments allow faculty and teams to accept accountability for student learning and support and the student to accept accountability for contributing to the success of the unit. | Microsystem members are accountable for a sustained commitment to continuously improving care for the population of patients served by their system, whether the population is fixed, as in a primary care practice, or dynamic, as in a critical care unit. |
| Optimization of professional identity and roles | Professional identity formation focuses on the development of personal expertise, the mastery of interprofessional teamwork and leadership, and the importance of lifelong learning. | Professional roles within microsystems are assigned on the basis of education and demonstrated competencies; professionals are expected to continuously learn to enhance their ability to work with others and contribute to the success of the microsystem. |

Today, disease is chronic and complex and requires active engagement with the patients for optimal management. Information is plentiful—too plentiful, as the amount of information we know about a given patient or a given disease exceeds our cognitive capacity to manage.[10] Medical knowledge is doubling at a rate unimagined by Flexner. Delivering all evidence-based preventive and chronic disease care to a standard panel of patients requires more time than is available in a working day.[14,15] More than a decade after the publication of the Institute of Medicine reports on safety and quality, problems with consistent delivery of patient-centered, evidence-based, safe, and equitable care persist.[16,17]

The response of the profession to these care challenges has not been to discard the sovereign identity but to narrow the landscape over which each physician has sovereignty. Trends in physician workforce have shown a precipitous decline in generalists while new specialties have emerged to focus not only on different types of disease (eg, oncology) and therapeutic options (eg, transplantation, interventional radiology) but also on different stages of a patient's illness (eg, hospital medicine, emergency medicine, and palliative care). Patients find themselves in a complex web of highly specialized health care professionals who are all individually expert but who are often unaware of who else is on the team and how best to work with them. Moreover, physicians often lack the knowledge, attitudes, and skills to measure their impact and redesign care to truly meet the needs of patients and communities.[7,9,10,18-20]

Our failure to translate the biomedical advances of the past century into health care that is consistently of high quality, safe, effective, patient centered, and equitable is not a failure of medical educators to ensure that their graduates are individually expert. It is a failure of the medical education enterprise to realize that individual expertise is necessary but no longer sufficient. Tackling this challenge will require that we sunset the target of the personally expert sovereign physician and, in its place, target the development of the collaboratively effective systems physician. This physician values interdependence rather than autonomy and works effectively with others to give and improve care. This physician accepts accountability for patient outcomes, integrates measurement and improvement into his or her daily work, leads and empowers others to optimize the patient experience and health outcomes, and collaborates with other microsystems to ensure a holistic approach to solving patients' problems.

This transformation of physician role and identity will not happen by adding learning modules, simulated experiences, required committee work, or time-limited improvement projects to medical school and residency curricula. Like Nelson's phase 1 of improvement, ad hoc quality improvement activities that are not integrated into daily clinical work will result neither in sustainable changes in the quality of care delivered nor in the expressed accountability for systems improvement on the part of health professionals or students.[9,18,21-23] What is needed is a fundamental reframing of the medical school and residency experience: one in which knowledge and skills in patient-centered, data-driven, collaborative, continuous improvement of clinical microsystems are integrated with and are of equal importance to traditional basic science and clinical skills. The road map for this disruptive change should be guided by a set of principles shared by experts in clinical microsystems and in medical education,[1,20,24] summarized in **Table 1**.

First, the "basic science" that physicians master must be redefined to include the sciences needed by the collaboratively effective systems physician. This includes but is not limited to clinical informatics, systems and human factors engineering, process improvement and safety science, implementation science, health care economics and financing, and leadership (**Figure**).[7-10,18-20] The new domains of knowledge and skills relevant to systems improvement (**Table 2**) should be integrated into existing didactic and clinical learning experiences. Today's curriculum integrates teaching about the molecular causes of cancer and pharmacologic mechanisms of action of antineoplastic agents along with clinical diagnosis, staging, treatment, and prevention strategies. Tomorrow's curriculum should further integrate instruction on the use of systems tools to ensure the safe delivery of chemotherapy, the universal deployment of evidence-based guidelines, and the causes of and solutions to disparities in breast cancer survival for women of color.

Second, clinical science should be reconceptualized to include both the skills relevant to the patient encounter, as well as the skills relevant to work within systems (Figure). The clinical application of systems thinking should be taught at the start of medical school by embedding interprofessional groups of students longitudinally into

Figure. Expanded Competencies for the 21st Century Physician

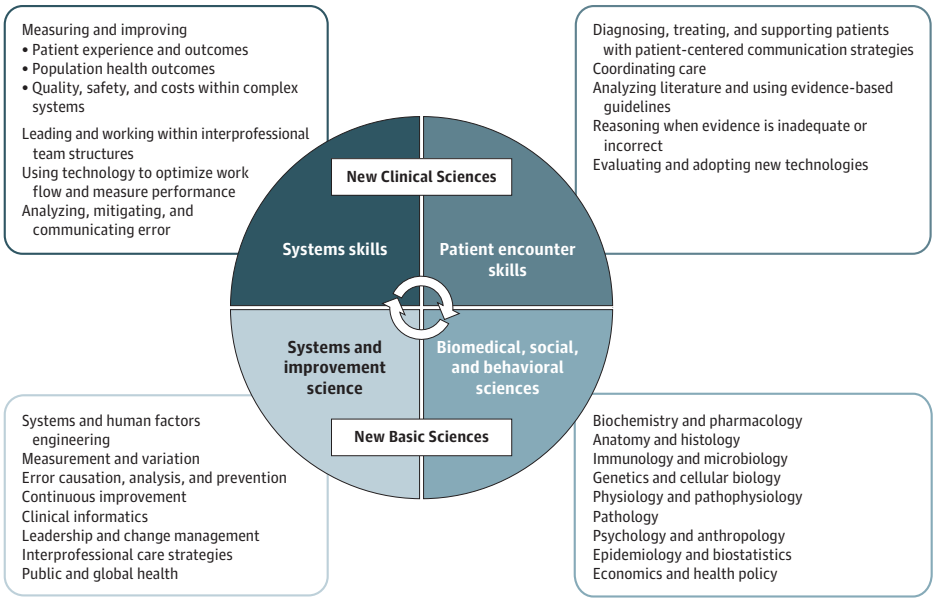


Table 2. Competencies Needed to Optimize Health Care Delivery and Systems[a]

| Domains | Competencies |
|---|---|
| 1. Focusing on patient needs | Prioritize, understand, and measure the needs of patients and populations of patients. |
| 2. Thinking in systems | Describe and analyze health care as a system comprising interdependent microsystems, mesosystems, and macrosystem; identify and use process engineering principles to optimize performance. |
| 3. Measuring performance | Identify relevant metrics to assess performance, understand variation, and correct gaps in performance. |
| 4. Managing change in complex systems | Differentiate between technical and complex adaptive problems; plan processes to support change; identify and engage important constituents; recognize and manage barriers to change. |
| 5. Optimizing cooperative work | Describe and evaluate different forms of collaboration and teamwork; assess the competencies of others in the environment and assign responsibilities accordingly; establish cooperation across boundaries of time and geography. |
| 6. Innovating to continuously improve safety, quality, and satisfaction | Identify and implement current best practices in prevention, diagnosis, treatment, and safety; measure their effectiveness and propose innovations that address the unique needs of the microsystem; understand human contributions to errors; conduct root cause analyses; mitigate errors and discuss errors with patients; disseminate results. |
| 7. Using technology | Understand the use of technology to assist in measurement, monitoring, decision making, and communication; recognize when technology is malfunctioning. |
| 8. Eliminating waste and increasing efficiency | Manage finite resources to achieve optimal health outcomes as safely and efficiently as possible. |
| 9. Demonstrating accountability for systems results | Focus on outcomes, as well as processes; accept responsibility for monitoring the performance and results of all who affect patient care. |
| 10. Accepting accountability for personal expertise and lifelong learning | Identify and use strategies to measure personal effectiveness in all aspects of care delivery; develop personal learning plans to address learning needs. |

[a] Adapted from Berwick and Finkelstein[9] and Batalden and Davidoff.[20]

clinical microsystems with developmentally appropriate responsibilities for addressing gaps in quality, safety, and patient satisfaction. After introductory instruction on systems and improvement, beginning medical students could assume the role of team-based systems contributors, charged with developing and refining competency in patient experience, health care as a process, and variation and measurement. Their contributions to the team would be at the systems level: obtaining and interpreting data on microsystem performance, reviewing literature and best practices to suggest innovations in care delivery, and serving as a liaison between the microsystem and the institutional quality, safety, and satisfaction mesosystems. Their assignments should be of sufficient duration to allow each student to become a truly valued and accountable member of the microsystem. This would allow them to work through multiple cycles of data-driven inquiry and improvement around different aspects of care. Advanced students, having developed competency in and an appreciation for improving the system, will gradually integrate their systems work with more direct and personal responsibility for provision of patient care. The patient care team, now inclusive of a group with time and talent in systems thinking, can fully integrate care improvement with care delivery. Interns and residents can focus on developing skills in leading and managing change, leveraging local knowledge, and social accountability for improvement.

In its move from simply declaring systems-based practice a competency to insisting that residents actively participate in high-

quality institutional initiatives to improve patient outcomes, the Accreditation Council for Graduate Medical Education's Next Accreditation System can serve as a catalyst for this paradigm shift.[25] Early success in integrating systems improvement work with usual clinical experiences has been seen in a handful of institutions. Longitudinal assignment of internal medicine residents to clinical microsystems with support for improving activities integrated with patient care responsibilities led to improved satisfaction with work and learning and also improved attitudes about quality improvement on the part of the residents.[26] Giving residents from all disciplines incentives to work on institutional quality and safety initiatives resulted in substantial improvement in key efficiency, safety, and quality metrics.[27] Student improvement teams assigned to meaningful work on institutional priorities in Texas, Missouri, and Colorado successfully addressed issues such as hand hygiene and fall risk.[22]

Educational innovations such as this have the potential to demonstrate that both the process and the product of medical education can add value to our communities. Medical education goals and strategies will explicitly align with national and institutional priorities for the safety, quality, and value of health care. Institutions that support educational programs will have an annually renewable intervention force to tackle important problems. Students will be active facilitators of delivery system change instead of passive observers who decrease clinical productivity. And, of course, graduates will assume the 21st century identity of the collaboratively effective systems physician.

Achieving success in our endeavor to shift the professional identity of physicians to the collaboratively expert physician will require that our care delivery systems and medical schools accept the need for culture change while our faculty and students embrace new roles, responsibilities, and ways of working. Care delivery systems must realize the value of and commit to supporting the integration of continuous improvement into the daily work of all professionals within each clinical microsystem. Structural changes that could facilitate this culture change include reorganizing patient care assignments so that residents and faculty become accountable members of patient-centered care units rather than visitors to a nursing unit; restructuring workflow and performance expectations so that a daily interprofessional team huddle to analyze and improve performance metrics is an essential component of clinical work; redesigning rounding and documentation behaviors so that communication between professions and disciplines occurs at the bedside with the patient; and rethinking the management of quality, safety, and satisfaction data so that information is continuously available for analysis and action by frontline clinicians. Leaders of care delivery systems and their professional organizations must advocate to change reimbursement strategies, scope of practice regulations, and other outdated policies and procedures that impede care delivery innovations.

Medical schools must explicitly commit to implementing educational programs that measurably improve health care today while educating the physicians of tomorrow. Medical education outcome metrics should incorporate the quality, safety, and satisfaction of patients cared for by trainees. Declarations that there is no room in the existing curriculum for new content or experiences must give way to thoughtful processes in which faculty from across the school can explore what enduring social, systems, biomedical, and behavioral constructs must be mastered by students to help them understand the human condition, participate in the continuous improvement of health care, and prepare for lifelong learning.[28] Schools and their educational scholars must work with licensing agencies and certifying boards to develop new ways to assess physician performance in their roles as individuals entrusted with the care of patients and as members of interprofessional microsystems.

Whereas some faculty members and practicing physicians are already experts in systems improvement, all faculty must accept the responsibility to develop proficiency in the competencies needed to ensure that biomedical advances are effectively translated into improved outcomes.[29] Learning and applying new evidence-based practices to continuously improve care delivery should be considered as important as embracing new treatments for heart disease or new techniques for surgical procedures. Medical students who have the time and training to assist faculty in measuring and improving important outcomes may serve as accelerants of these necessary changes in physician professional identity.

Importantly, students choosing careers as physicians need to embrace the collaboratively effective physician role rather than quest after the sovereign physician role. Students preparing for medical school should pursue experiences working within systems to solve complex problems. Students matriculating into medical school must commit to serve while learning from the beginning of their curriculum.

Medical education must be part of the solution to the complex problems facing our health care delivery system today. Working with our clinical partners on new models of workplace learning, we can fulfill our social contract to improve the health of our communities by educating the physicians we want in the systems that we need.

ARTICLE INFORMATION

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