

Preparing Medical Students for the Continual Improvement of Health and Health Care: Abraham Flexner and the New “Public Interest”

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Abstract

In 1910, in his recommendations for reforming medical education, Abraham Flexner responded to what he deemed to be the “public interest.” Now, 100 years later, to respond to the current needs of society, the education of physicians must once again change. In addition to understanding the biological basis of health and disease, and mastering technical skills for treating individual patients, physicians will need to learn to navigate in and continually improve complex systems in order to improve the health of the patients and communities

they serve. Physicians should not be mere participants in, much less victims of, such systems. Instead, they ought to be prepared to help lead those systems toward ever-higher-quality care for all. A number of innovative programs already exist for students and residents to help integrate improvement skills into professional preparation, and that goal is enjoying increasing support from major professional organizations and accrediting bodies. These experiences have shown that medical schools and residency programs will need to both

teach the scientific foundations of system performance *and* provide opportunities for trainees to participate in team-based improvement of the real-world health systems in which they work. This significant curricular change, to meet the social need of the 21st century, will require educators and learners to embrace new core values, in addition to those held by the profession for generations. These include patient-centeredness, transparency, and stewardship of limited societal resources for health care.

Abraham Flexner’s report¹ has informed the shape of medical education for a full century. Its impact has endured in large measure because Flexner successfully combined his careful analysis of the state of medical education with fundamental insights about what society needed from medical care. That is, although his immediate topic was improving training of future physicians, he stated explicitly that this was not an end in itself. As recently noted by others,² he wrote, “The public interest is then paramount, and when public interest, professional ideals, and sound educational

procedure concur in the recommendation of the same policy, the time is surely ripe for decisive action.”^{1(p19)} In reconsidering Flexner 100 years later, our challenge is similar: to explicitly connect an analysis of problems and proposed solutions for today’s medical education with today’s social needs. The nature of “the public interest” may have changed with the times, but it is still paramount.

In many ways, Flexner would be proud of the education of physicians today. As he intended, it is rooted in biological and physical sciences, organized, rigorous, and regulated by the profession and society. The overwhelming majority of those it trains work according to high ethical principles with the well-being of their patients as a primary goal; and, through their work, they have contributed to striking increases in both the length and quality of life.³

Nonetheless, 100 years on, many believe that the “public interest” has changed enough that medical education requires redesign. For example, the president of the Association of American Medical Colleges (AAMC) has called for “revolutionary overhaul” in training of the health care workforce⁴; accrediting bodies, such as the Accreditation Council for Graduate Medical Education

(ACGME), have embraced changing needs through their competency requirements⁵; and the Carnegie Foundation has recently released a report recommending dramatic change in both the aims and strategies for medical education.^{6,7} These leaders call for new approaches, not because Flexner’s reforms and their successors were unsuccessful in their time, but rather because those reforms are today insufficient to allow us to realize the *additional* gains in human health of which we are now capable. Medicine will continue to require the most modern science and technology, whether the topic is the emerging knowledge of infectious diseases of Flexner’s day or the genomic revolution of ours. But we cannot harvest the potential benefits of this new knowledge without mastering new designs and modern methods for the delivery of care. New designs and new methods make new demands on the preparation of health professionals.

Proposing even small changes in medical education, let alone big ones, runs straight into a tangle of three constraints: (1) we can’t give up the current content (because our students need to know it); (2) we can’t merely layer new material on top of the old (because there is no spare time in the curriculum); and (3) we can’t

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allow the status quo to persist (because we will thereby miss the social need). Cutting this Gordian knot demands disciplined attention to both the context and the aims of health care.

First, it requires hard-headed exploration of how the technical and social contexts of medical care have changed in a century. The context has shifted profoundly, especially with respect to technology. Proposals for medical education reform must address the need to optimize care in an era of lightning-speed information retrieval, complex systems of care, and demands by society for a system that effectively and efficiently meets their needs. Knowing and remembering facts are less critical in an age of handheld devices that are better at both. Second, cutting the knot requires dispassionate assessment of options according to the single metric that Flexner asserted: the public interest. The following question should guide us: “What changes in medical education will produce the largest gains in health for both individual patients and populations?”

Flexner’s Report in its Social Context

In 1910, the age of modern science had arrived, and technology was overtaking craftsmanship as the primary foundation for production. As Beck⁸ put it, “Most of the public and virtually all physicians now believed in the superiority of scientific medicine [which required] not... the memorization of accepted truths, but... the systematic application of the scientific method throughout medical training.” But, as most also knew, the traditional preparation of physicians in apprenticeships, unregulated, without standards, and in small, disconnected places was not up to the task of reliably linking professional practice and identity to science and knowledge.

Flexner’s inquiry was comprehensive and his recommendations were bold, implying the need to close many small medical schools, to change entrance requirements, faculty composition, laboratory infrastructures, and relationships with teaching hospitals. To be sure, Flexner was not a lone voice, and his report has been called “more catalytic than innovative.”⁹ Leading schools had already moved toward more structured,

science-based education. In fact, it was the formal leadership of the profession, the American Medical Association, that fostered Flexner’s independent inquiry through the Carnegie Foundation, and championed the changes through its Council on Medical Education.¹⁰ But Flexner did succeed in shining a bright light on the system as a whole. As Beck⁸ pointed out, Flexner¹ recognized that the social imperative trumped the profession’s potential interest in maintaining the status quo: “The right of the state to deal with the entire subject [of medical education] in its own interest can assuredly not be gainsaid. The physician is a social instrument.”

Despite the formal sponsorship that Flexner had, we suspect that that assertion that “the physician is a social instrument” raised hackles in 1910; we suspect it does today, as well. It invokes a set of responsibilities and a level of accountability that could threaten the heart of professional self-identity. In his landmark study, *Profession of Medicine*, sociologist Eliot Freidson¹¹ in fact *defined* a profession as a work group that reserves to itself the authority to judge the quality of its own work. Society yields that prerogative to the profession, Freidson claimed, because it assumes beneficence (that physicians put patients’ interests above their own), specialized knowledge (that physicians have access to technical knowledge not easily accessible to laypeople), and self-regulation (that physicians will keep their own house in order). Actually, Freidson himself seems not so certain that the facts warrant such confidence. “[A]fter becoming autonomous the profession has less and less come to reflect what the public asks of it and more and more come to assert what the public should get from it,” he wrote.^{11(p350)} And, with even more edge, “[S]o far as the terms of work go, professions differ from trade unions only in their sanctimoniousness.”^{11(p367)} Such a profession might have a hard time viewing itself as “a social instrument.”

Alarming or not, Flexner’s ideas won out, apparently with large-scale support from the profession of medicine, and medical education transformed to a historic degree into an enterprise that espoused practice based on modern science, not on mere habit or lore. And with some courage, it seems to us, the process of medical education began a majestic, decades-long

evolution into a more structured, regulated enterprise with consistency across schools, mostly abandoning a path of idiosyncratic local apprenticeship.

The Context of Our Time

At the 100th Anniversary of Flexner’s courageous blueprint, we are again at a historic juncture. Again, the context has changed. Again, the capacity and activity of the physician as a properly employed “social instrument” require refreshed definition. Again, medical education is called upon to take on new, needed, and largely unfamiliar roles. And again, courage matters.

Comparing the social contexts of, say, 1810 to those of 1910, relevant dimensions in the latter included revolutions in science and technology, breakthroughs in the understanding of disease, germ theory, and human physiology, and the benefits and technical foundations of mass production, urbanization, and better transportation. Physics was about to burst into bloom with relativity theory and, soon thereafter, quantum mechanics. A large middle class was emerging with new requirements and articulated rights. It would have been entirely syntonetic with these changes to ask, “Why shouldn’t medical care be scientific?” Confidence in science was on the rise, and Flexner’s recommendations fell on fertile soil. Indeed, they arose from that same soil.

Comparing 1910 to 2010, the dimensions of difference are not the same. Science remains the primary basis of healing in allopathic medicine, and the benefits realized from technical advances are likely more impressive than even Flexner envisioned. But a century after Flexner, medicine is connected to a far more complex world. Interdependencies are now crucial to the fate of individuals and societies in ways Flexner could not easily have imagined. A tubercle bacillus that mutates to resistance in India can be in New York the next morning. The cost and sustainability of American health care are strongly tied to the health of the entire global macro-economy. These interdependencies have led the AAMC, and others, to encourage inclusion of a population health perspective in medical education in order to broaden the view of future physicians beyond the patients in front of them to the communities and

larger populations of which they are a part.¹²

Clinical care of individual patients in Flexner's time was also simpler. A doctor visited a home or attended on a hospital ward, chose from a limited (by the standard of today) armamentarium of treatments, and "ordered" them given by a nurse and taken by a patient. Diagnostic tests were few, specialists were virtually unheard of, and information about biology, illness, and treatment was completely unavailable to the general population. In short, life (and death) was simpler. For the vast majority of illnesses, in Flexner's time, the likelihood of cure depended on attributes of the condition and the host, with only marginal contributions by the medical care provided. In effect, the quality of care mattered less than it does now, because care, itself, had less to offer. Today, *because* the potential effectiveness of science-based treatment is dramatically higher for many conditions, the reliability and overall quality of that care (though likely still less potent than social, environmental, and genetic factors¹³) have much greater impact on health.

To oversimplify, a major change in context is this: In 1910, the new social context required preparation of physicians based on biological science; in 2010, the new social context requires preparation of physicians to thrive in systems of inescapable interdependence; and their comfort in that interdependence is now a precondition to providing high-quality care.

Evidence on the Current Performance of Health Care

Evidence on the current performance of U.S. health care shows a troublesome picture. The most significant recent contributions to summarizing and interpreting that evidence were the landmark Institute of Medicine (IOM) reports, *To Err Is Human* (1999)¹⁴ and *Crossing the Quality Chasm* (2001).¹⁵ The former flagged an enormous burden of unsafe care: injuries and risks to patients from health care, itself, often the consequences of human errors and systemic failures. Famously, *To Err Is Human* estimated roughly that 44,000 to 98,000 deaths occur each year in U.S. hospitals from injuries and complications of care—not the diseases that brought the

victims into care—and that the majority of these are avoidable through the proper redesign of care. *Crossing the Quality Chasm* went further, placing *safety* at the top of a list of six dimensions of quality, which it translated into six "Aims for Improvement" of health care:

- safety (reducing harm from care);
- effectiveness (increasing the reliability of alignment between scientific evidence and practice, reducing both underuse of effective practices and overuse of ineffective ones);
- patient-centeredness (offering patients and their loved ones more control, choice, self-efficacy, and individualization of care);
- timeliness (reducing delays that are not instrumental, intended, and informative);
- efficiency (reducing waste in all its forms); and,
- equity (closing racial and socioeconomic gaps in quality, access, and health outcomes).

The IOM reports are components of what has become a large—indeed, worldwide—social movement to improve the performance of the health care system in these six dimensions and more. In fact, substantial progress has been made over the past decade in putting patient safety and care improvement on the radar of most hospitals and health care systems.¹⁶ This has been accomplished through a combination of requirements (by accreditation bodies and payers) and education, changing hearts and minds to view existing quality of care as unacceptable, given the improvements that have been shown to be possible in some systems.¹⁷

More recently, special emphasis in the United States has been placed on the dimension of *efficiency*, or, more directly, *cost*. Now surpassing 16% of America's gross domestic product, with 45% or more coming from public sources of funding,¹⁸ the cost of health care has become an enormous drag on the nation's economy and erodes resources for other worthy public and private investments. The tantalizing fact that no other developed nation on earth spends even as much as 60% *per capita* on care as the United States does and that the performance of the U.S. health care

system lags well behind that of at least two dozen other nations suggests that health care of much higher value than ours is attainable.¹⁹ And yet, changes of the type and magnitude needed to achieve that goal are not yet in evidence at a large scale.

However, organizations and clinicians who have embraced the aim of delivering better quality at lower cost are achieving local successes. In recent years, numerous health care-acquired infections previously thought inevitable have been proven to be nearly eradicable, such as central venous line bacterial infections,²⁰ ventilator-associated pneumonia,²¹ and some forms of surgical site infection.²² Large reductions in surgical complication rates have been documented following standardization of evidence-based practices in anesthesia, peri-operative antibiotic prophylaxis, protection from venous thromboembolism, and preoperative checklists.²³ Many hospitals and outpatient facilities have reduced unwanted waits and delays by redesigning procedures according to modern principles of operations research and queuing theory.²⁴ Some hospitals have measured and reported on accelerated reduction of hospital-wide mortality rates following the introduction of suites of process improvements,²⁵ and national campaigns on patient safety are bearing fruit.^{26,27} A number of progressive hospitals have been attempting to reduce waste directly by eliminating nonvalue-added processes, in many cases adapting the methods of so-called "lean production" or the "Toyota production system" that were pioneered in manufacturing.²⁸ Such efforts all appear to contribute to improved health system performance, but the overarching lesson for students early in their careers is not about a particular example or singular approach; it is that improved outcomes on all of the IOM dimensions of quality¹⁵ are possible by the application of structured, science-based approaches to system change, and, further, that, as professionals, they can and should be good citizens and leaders in that change. In Flexner's time, the "social need" required medical education to make care more scientific to reduce the burden of disease. A century later, it has become equally urgent for medical educators to train future physicians *to continually improve the delivery of health care to realize, sustainably, its fullest potential*

benefit to the health and well-being of the population.

The Roles of Physicians in Improvement

Physicians are essential to progress in improving health care systems. Unprepared or unwilling, they can be barriers to badly needed changes. If they do not understand—indeed, if they do not thrive in—the world of interaction and interdependency in which they work now, and if they, unscientifically, regard their own deeds as sufficient for excellence, then they can confound systemic excellence and impede needed system changes. At their best, well-prepared and willing, they can lead and accelerate changes in care processes that are grounded in good data and sound theory.

We and others^{29–32} argue that the training of health care professionals ought to equip them to accept accountability for participation in and, when appropriate, leadership of the continual improvement of the performance of the systems in which they work. As “incorporating science into practice” was the primary form that a new social need took for Flexner, so should “incorporating system improvement into practice” be the response to the emerging social need 100 years later.³² What effective improvement projects have in common, almost no matter what the specific aims or setting, is a focus on systems.³³ The undesired and much less effective alternative is a focus on components, individuals, requirements, inspection, or incentives.

The term *system* in this regard is not vague; it denotes a set of interrelated elements or components, interacting to achieve some shared goal, whether that goal be articulated or not. An automobile is a system—hundreds of parts interacting to achieve transport with desired qualities like safety, fuel economy, comfort, and durability. So is the human body; any student of the hypothalamic-pituitary-adrenal axis knows that. So is the work of health care. No patient has ever successfully gone onto cardio-pulmonary bypass and off again without a highly coordinated, consciously designed ballet of interactions among people, machines, supplies, and supports. Elements and

interactions—systems—provide safe and effective pain control, infection-free intensive care, proper chronic disease support, and ideal end-of-life care. On occasion, a “good doctor” is all it takes to assure that a patient does well; but those occasions are rare, indeed, perhaps vanishing. The “good doctor” remains necessary often, but today is almost never sufficient. The improvement of care is the improvement of systems, and that is a team sport.

The Current Status of Training for Physicians as Leaders of Improvement

How well are physicians currently prepared for their needed roles in improvement? A comprehensive survey of medical schools with respect to teaching skills of improvement and patient safety would be difficult, given the diversity of places and guises in which such teaching appears in the curriculum. However, the situation appears to be similar to that which Flexner observed at the turn of the last century, when individual schools were innovating and testing new content and models, while many others (even if they professed interest) lagged behind. In one recent survey, internal medicine clerkship directors reported that 25% of medical schools had explicit training in patient safety, although many more respondents endorsed its importance.³⁴ A 2003 review of published reports of educational programs in this area revealed a variety of approaches and some evidence of success, though its magnitude is difficult to quantify.³⁵ More importantly, this review explicated the consensus of leading educators that effective training in improvement (1) should appear across the continuum of medical training from early in medical school until the end of residency (and fellowship), and (2) should include both didactic education regarding the language and science of improvement and also experiential learning. This is completely consistent both with modern views of competency-based education and also theories of learning that highlight a transition from “knowing” to “doing.”³⁶

The similarity to Flexner’s time goes deeper. In particular, although Flexner’s report was disruptive in many ways, it actually embodied a growing consensus among professional groups of the time. As

noted above, current professional and accrediting bodies, including the AAMC, ACGME, and the Joint Commission, all are en route to aligning their intent to incorporate improvement skills into professional preparation. At the undergraduate medical education level, a working group of the AAMC in 2001 elaborated on skills for medical students relative to health care quality, as part of the Medical School Objectives Project.³⁰ The Liaison Committee on Medical Education (LCME) seeks information about where quality improvement and patient safety exist in the curriculum as part of the medical education database that schools must complete during accreditation, though there is no independent standard for these topics.³⁷ And several undergraduate medical educators have been developing and testing innovative curricula for almost two decades.^{38–42}

At the postgraduate level, the ACGME has served as a major catalyst for change by including *systems-based practice* and *practice-based learning and improvement* among its six required core competencies for all residency training programs.⁵ Every program director must certify that these competencies have been achieved, and a number of leading programs have made serious attempts to construct relevant learning experiences and to measure the competence of their trainees in these domains.^{43–45} The Robert Wood Johnson Foundation funded development and testing of the Achieving Competency Today (ACT) program, which provides basic content and a template for engagement of residents in improvement projects in their home institutions. ACT is in use in a substantial number of residency programs across the country.⁴⁶ Reviews of the effectiveness of quality improvement and patient safety programs in residency⁴⁷ and barriers to their success⁴⁸ have been recently published. The most comprehensive postgraduate training in this area is the Dartmouth-Hitchcock Leadership Preventive Medicine residency program started in 2003.⁴⁴ Through this two-year program, residents from a variety of clinical specialties receive extensive training in systems improvement, complete a masters degree in public health, carry out a practicum in leading change to improve health in a defined population, and complete a longitudinal experience in a public health agency.

While not all residencies will make such leadership training their primary focus, this program provides important lessons regarding the types of active learning experiences that can be effective engines for professional growth.

No broad consensus yet exists among educators or schools about exactly when and through what experiences the majority of health professions students can best learn skills for improvement. However, well-developed curricula on patient safety and improvement sciences and skills are starting to emerge, so that schools will no longer have to develop them completely *de novo*. Among the most thoroughly developed is a curriculum in patient safety skills published under the banner of the World Health Organization's World Alliance for Patient Safety.⁴⁹ Another initiative, The Patient Safety Education Project, created by Emanuel and colleagues,⁵⁰ uses a "train the trainer approach" for those seeking to teach patient safety skills at their home institutions. The AAMC has developed innovative resources for educators, students, and schools under its Integrating Quality (IQ) initiative.⁵¹ Individual academic institutions and health systems have developed other, locally successful curricula. The Health Professions Education Collaborative, sponsored by the Institute for Health Care Improvement (IHI), helped to spur innovative curricular changes at 16 institutions, all of which promoted interprofessional learning as well as competency development in improvement and patient safety.⁵²

In 2008, in order to catalyze expansion of improvement learning in health professional schools, the IHI launched an international project to offer instruction directly to students of health professions—medicine, nursing, dentistry, osteopathy, pharmacy, health care administration, and others. This effort was intended both to accelerate adoption of improvement, patient safety, and related topics into health professions training and also to help fill the current gap in the professional preparation of improvement leaders while the educational institutions catch up with the need. Enrollment in the IHI Open School for Health Professions soared immediately upon launch.⁵³ One and a half years after starting, approximately 20,000 online courses have been taken by individuals self-identifying

as students, with an additional 18,000 accessed by faculty and other health professionals. Open School students have started over 210 local "chapters" on their university campuses in nearly 30 nations. This response is an indication that interest in systems thinking and system performance is now wide-spread among future health professionals and many of their teachers. This degree of alignment may not be as pervasive as that which Flexner met when he suggested to a willing world that the preparation of health care professionals ought to be rooted in science, but it is a start.

Skills, Knowledge, and Attitudes for Improvement of Care

So, what, specifically, should curricula on quality and systems thinking try to teach? What's the *content*? Examining all of the plausible learning goals and needed competencies for career-long engagement in health care improvement would require a monograph or more. If they are to help systems improve, physicians must attend to the following three domains, at least: (1) achieving personal excellence in both technical and humanistic skills, (2) mastering the scientific foundations of system performance and encouraging their use in design and practice, and (3) participating in and leading team-based improvement.

Achieving personal excellence and clinical skill

The first of these, achieving personal excellence and clinical skill, is, of course, a goal familiar to physicians. This pursuit takes the form, in part, of "keeping up with the literature" with respect to subject matter and disciplinary knowledge. It also includes the growth in humanistic and clinical skill that comes through experience and reflective practice throughout one's career. The promotion of improved system performance does not diminish at all the duty of individual professionals to engage in continuous study of subject matter and to function at the highest possible levels in their disciplines. The system improvement imperative is not a substitution; it is an expansion of the range of needed competencies, including those described below.

Mastering the scientific foundations of system performance

The scientific foundations that underlie systems improvement are different from the scientific foundations of discipline-specific knowledge. In the era of Flexner, medical education leaders believed that familiarity with the core scientific foundations of practical diagnosis and therapy would help make practitioners better. Pursuant to Flexner, studying physiology, biochemistry, pharmacology, anatomy, and histology became preludes to studying pathology, organ systems, and treatment, even for doctors who would never again enter a research laboratory. (The selection of required premedical courses to include the basic sciences thought to underlie biomedical sciences—such as mathematics, physics, chemistry, and biology—further reflected this belief.)

Improving health system performance also has roots in science—the sciences of systems. No dominant, certified list of system-related sciences exists, but several scholars have tried. For example, in the latter decades of the 20th century, the quality scholar, W. Edwards Deming,⁵⁴ classified what he considered to be required "knowledge for improvement" into four realms: (1) knowledge of systems (such as understanding nonlinear dynamics, reliability sciences, safety sciences, and communications theory),^{55,56} (2) knowledge of variation (such as being able to interpret streams of data accurately and to sort random fluctuations from meaningful ones),^{57,58} (3) knowledge of psychology (including, for example, understandings of conflict resolution and negotiation, group process, human motivation, cognitive and social psychology, and creativity),^{59–61} and (4) epistemology (especially, understanding how to gain knowledge in very complex environments and messy real-world processes).^{62,63}

Although we regard no particular framework as canonical or exactly right for application to modern health care systems, we find the scheme proposed by Batalden and colleagues in the Institute for Health Care Improvement quite helpful.⁶⁴ These authors have expanded the categorization of the subjects that are especially useful in the pursuit of improvement into eight domains, as follows:

- *Customer/beneficiary knowledge:* Understanding the needs and preferences of patients, families, and communities with respect to their health, health care, and overall well-being.
- *Health care as a process/system:* Understanding the dynamic properties of health care overall, including the components of health care and their interrelationships. This applies at all levels of aggregation, from tiny “microsystems” of practice to the larger “macro-systems” of organizations and their connections among each other.
- *Variation and measurement:* Understanding how to gather and learn from data efficiently, and how to use data to support improvement.
- *Leading, following, and making changes in health care:* Understanding how to function in, and to lead, teams, and to organize and participate in intentional change.
- *Collaboration:* Understanding cooperation and motivation, especially as they relate to change and improvement, and across entire systems.
- *Developing new, locally useful knowledge:* Engaging in proper exploration, through cycles of change and reflection, for the purpose of continual improvement.
- *Social context and accountability:* Understanding values, value, and social responsibility.
- *Professional subject matter:* Understanding the subject-matter and discipline-specific skills and knowledge relevant to one’s goals.

In the context of health care as a system, many specific technical topics have relevance to improvement skills, just as subject-matter knowledge of microbiology has relevance to the treatment of infectious diseases. The Appendix contains a more detailed, though only suggestive and still far-from-complete, list of specific technical topics that a curriculum in improving health care quality might include. They include the scientific underpinnings of reliability and resilience, performance measurement, and human factors, as well as those underlying communication and shared decision making. It remains an

open question, but a plausible theory, that physicians who master these and related areas of personal competence ought to be better equipped to improve their own work, and to participate actively with others in improvement projects and teams.⁶⁵

Participating in and leading team-based improvement

Improvement of systems is an activity, not merely a knowledge domain. Understanding *how* to improve systems, without applying that knowledge, effects no improvement at all. In organizations and departments, quality improvement work often takes the form of projects pursued by teams, and physicians are often asked to participate in these. (This is in part why the ACGME identified a need for competence in “practice-based learning and improvement.”) Physicians’ effects on teams and projects—favorable or unfavorable—can be profound, and training and practice can and should build skills for effective participation. The pioneering efforts in this regard have met with some success, but they have uncovered challenges as well. For example, Ogrinc and Headrick developed an integrated one-month block rotation for residents at Case Western Reserve University School of Medicine and Dartmouth Medical School to meet the ACGME requirement for “practice-based learning and improvement.”⁴⁵ The rotation engaged learners in a diverse range of improvement projects embedded in a curriculum to promote understanding of underlying principles (e.g., the need for interprofessional teams) and specific skills for improvement (e.g., implementing “plan-do-study-act” cycles and using specific portrayals of data over time to support improvement). They were successful in helping residents achieve measurable improvement across a range of skills that are fundamental to improvement. These early pilot programs have now expanded in scope, providing lessons on delivering these programs to larger numbers of resident learners, and as required experiences rather than elective ones.⁶⁶ Headrick and others have articulated the requirement for experiential learning and also provided detailed roadmaps to educators for effective integration of experiential learning.^{42,67} Varkey and colleagues at the Mayo Clinic have successfully linked training in ACGME practice-based learning across the 115

residency and fellowship programs in the Mayo Clinic system.⁴³ Finally, although we have focused on medical students and residents, postresidency fellowship programs to develop expert leaders of health system improvement, such as the Veterans Health Administration Quality Scholars Program, provide a further stage in the continuum of training that is needed.⁶⁸

Implications for Educational Processes and Programs

The changes that Flexner introduced were profound, far-reaching, and probably uncomfortable for many in the *status quo ante*. They affected the content of instruction, the setting of education, and the foundational values for both. The changes needed now must also have these characteristics if we are to succeed in helping the new professional be a master of improvement.

Changing curricula

We face several obstacles in moving forward to improve physician capacity in areas of improvement, safety, and stewardship. The biggest is limitation in available time. Many medical educators believe that the necessary content expertise in the biomedical and clinical sciences for future physicians already exceeds what can be learned in a four-year curriculum, and the content is expanding daily. Introducing skills for improvement (or anything else), it seems, threatens to force out other worthy areas of focus. Effective training in improvement skills, as with clinical improvement itself, will require finding efficiencies through integration (rather than adding), as well as fundamental changes in medical education systems themselves. The improvement skills described above need not displace learning how to take a patient history, for example; they can become *part* of it.

*The Carnegie report Educating Physicians: A Call for Reform of Medical School and Residency Foundation,*⁷ has helped to place integration of training in improvement within the larger context of medical education. Its recommendations are categorized in four domains: (1) standardizing learning outcomes and individualizing the learning process, (2) promoting multiple forms of integration, (3) incorporating habits of inquiry and improvement, and (4) focusing on the

progressive formation of the physician's professional identity.^{7(p25-26)} Within each of these domains appear specific recommendations for increased attention to skills related to team-based care and quality improvement. Among the "habits of inquiry and improvement," in particular, appear recommendations for learners to "participate authentically in inquiry, innovation, and improvement of care" and to "engage learners in initiatives focused on population health, quality improvement, and patient safety."^{7(p25-26)}

So, we are in the most exciting and creative phase of developing educational programs: when we know something must be taught but have not yet proven how best to do so. Educators in the vanguard of systems improvement have developed both successful frameworks and also specific curricula for improvement training for students and residents. The next challenge is to make these a standard part of the curriculum so that every student emerges from training with competence in these domains. The ACGME has taken a bold first step in its revision of the required competencies for graduate medical education. The LCME should likewise specifically require training in these domains as part of its accreditation standards.

Changing the settings

But curricular integration is not enough. Even with it, the simple incorporation of new topics into traditional medical education in traditional settings may prove wholly insufficient to prepare 21st-century doctors to thrive in the world of interdependence and continual improvement. Flexner could not simply graft "scientific medicine" onto existing institutional structures and teaching settings. His report stated a need for changes in the contexts and institutions themselves. The same may well prove necessary if the doctors of the future are to master and use the personal, team-based, and scientific skills explored above.

The challenge is that quality improvement links to the real world of process. If improvement work is to be systemic, data-rich, team-based, patient-centered, continual, and rich with cycles of learning and invention, then it can thrive only in settings with the same attributes: cooperative, team-oriented,

patient-centered, avid for measurement, tolerant of risks, and friendly for learning. We will not venture to guess to what extent these words characterize the average medical school classroom, teaching hospital, or clinical clerkship today, but we suspect that there are gaps. In effect, we can perhaps take one page directly from Flexner in suggesting that there are both "basic sciences" of improvement (outlined above) that all future physicians should have as a platform, and then "clinical" experiences through which these skills would be consolidated and applied in action.

It is good news that, unlike in Flexner's time, medical schools already exist as part of hospital and health systems that provide care as complex systems, and that require continual improvement. However, on the whole, current undergraduate medical education first segregates basic science (for the first 18–24 months) from clinical care, and then, on clinical rotations, segregates clinical care (mastering the physical examination and proper intravenous fluid management, for example) from learning about the system in which it is delivered (improving reliability, handoffs, and transparency, for example). It is like focusing workers on a complex assembly line only on their (necessary) part of the process, and failing to encourage them to understand the system as a whole – its structures, its processes, its failures, and opportunities for improvement.

It is especially difficult to engage students in understanding systems if they are temporary participants for only short blocks of time (e.g., four-week rotations). As "renters instead of owners,"⁴⁸ it is almost impossible for them to understand the system and become a part of improvement efforts. Even if excellent improvement efforts are under way, other members of the care team (nurses and other professional and nonprofessional staff) find it difficult to learn the names of the student-rotators let alone engage with them actively in interdisciplinary improvement processes. The solution to this conundrum will vary by school and health system, but we see promise in the trend toward longitudinal integrated clerkships as the backbone of undergraduate medical education in many places.^{69,70} Students who are "resident" in a single system for eight months or more will gain more system

knowledge, forge better relationships, and have the time to conduct and analyze tests of change.

Ideally, training for improvement will be not just longitudinal but also multidisciplinary and team-based, or else it will belie in action the espoused theory that system quality rests on interdependent relationships. To nurture improvement skills will require teaching settings that also value and support measurement of outcomes and clinical progress, active use of improvement methods in daily work, and new ways to involve patients centrally in their own care.

The last of these – involving patients and families in new ways in their own care – is perhaps the boldest of the changes involved in mature quality improvement. One of the most exciting frontiers of innovations in health system design today involves customization of care to individuals, equipping patients and families for much higher levels of autonomy and self care, and achieving unprecedented transparency and information flow for them. And this leads us directly into terrain far more uncomfortable than merely modifying our curricula and our organizations; it raises questions about our values.

Changing the value system

It is appropriate to explore not just the content and mechanics of education but also the value system that we wish to underlie professional preparation for the decade ahead. Beneficence, technical mastery, and self-regulation were values-laden concepts in the form of professionalism studied by Eliot Freidson.¹¹ What might be professional values for this era, equally powerful and even better suited to the century?

Our goal here is not to glibly *declare* a value system that we think is well-suited to what we might call "the professionalism of continual improvement," but rather to invite an exploration of such values by the larger community of teachers and learners of medicine. Among the candidate values that we propose for further consideration are the following. Some represent changes from those Flexner would have recognized; others do not:

- *Patient-centeredness in all things:* The new health professional places the

interest of patients before the interests of self or guild, and is willing to customize all processes and rules to the needs of each individual.

- *Awareness of economics, health care costs, and social stewardship:* The new health professional remains mindful that his nor her own behaviors and choices draw upon a limited “commons” of resources available for all health care, and that health care itself draws upon a limited “commons” of resources available for all private and public goals.
- *Continual reduction of waste:* The new health professional participates in the continual reduction of waste of all forms in health care, including, for example, the waste associated with unscientific variation in practice, oversupply, injuries from health care, failures of coordination and cooperation, loss of morale, needless procedures, medication, visits, and tests, and failure to maximize the use of the skill, knowledge, and capacities of patients, families, and communities.
- *Continual pursuit of safety in care:* The new health professional participates in never-ending improvement of safety for patients and the health care workforce, largely through the mastery and application of safety sciences, such as human factors science and reliability engineering, as they apply to health care systems.
- *Commitments to justice and equity in health care and health status:* The new health professional regards health care as a human right, and seeks actively to close gaps in health care and health status that are consequences of social, racial, and economic inequity.
- *Honesty, openness, transparency, and disclosure:* The new health professional supports openness in the assessment of performance of health care organizations and systems, welcomes transparency, and encourages disclosure and honesty about hazards, defects, and injuries in patient care in pursuit of learning and continual improvement.
- *Teamwork and accountability of professionals to each other, across disciplinary lines:* The new health professional fosters teamwork and dialogue, and works continually to

break down barriers among disciplines, organizations, and roles, for the betterment of smooth, safe, respectful, and efficient patient care.

- *Refocusing effort on the pursuit of health, rather than on the provision of care as an end in itself:* The new health professional understands that the social need for health is supraordinate to the pursuit of health care, and that the latter only partially and weakly achieves the former. Therefore, the new health professional encourages and participates in health-producing endeavors, at the level of individuals and populations, to the full extent consistent with their clinical role. They also seek partnerships outside of the health care system (for example, with public health professionals, educators, community leaders, and others) to achieve these goals.
- *Commitments to recognize and redress anomalies in professional behavior:* The new health professional neither exhibits nor obscures nor tolerates disruptive, fragmenting, or disrespectful behaviors among colleagues.

A Final Word

Some clinicians, educators, and students may find disconcerting our image of physicians as citizens in systems of interdependency, trained to understand that the needs of patients and society require degrees of deference, teamwork, and mutual accountability that Flexner might not have imagined, let alone thought essential.⁷¹ If they fear that we somehow believe that physicians of the future should become proletarian and automatic, and, as a consequence, that physicians will become demoralized, they have us wrong indeed. Our belief is quite the opposite. We think that the anxiety, demoralization, and sense of loss of control that afflict all too many health care practitioners today directly come not from finding themselves to be participants in systems of care, but rather from finding themselves lacking the skills and knowledge to thrive as effective, proud, and well-oriented agents of change in those systems. In 1910, a concerned, caring doctor sat helpless at the bedside of a child dying from pneumonia without the leverage of antibiotics to change that fate. In 2010, equally concerned, caring doctors feel helpless to keep patients from getting lost

in the complexity of medical technocracy, to protect them from being injured by the medical procedures that were supposed to help, and from the confusion of unreliable, opaque care. They will continue to feel helpless until we give them the tools to help change the processes and organizations in which they work.

A physician equipped to help improve health care will be not demoralized, but optimistic; not helpless in the face of complexity, but empowered; not frightened by measurement, but made curious and more interested; not forced by culture to wear the mask of the lonely hero, but armed with confidence to make a better contribution to the whole. It is not worth debating whether physicians will function as members of health care systems; they already do. What is at stake for them is only their joy, pride, and sense of self-efficacy in that inescapable, modern condition. And what is at stake for their patients is what has always been at stake for those who depend on the professions to help them: comfort, confidence, counsel, and full, long, lives.

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Appendix

Examples of Technical Topics Relevant to the Improvement of Health Care

We do not try here to list completely the specific, technical topics that may compose a thoughtful curriculum on systems and their improvement; rather, we offer the following list by way of a partial and suggestive beginning. A complete list will be different, far longer, and ever-changing as knowledge and science change.

- **Safety in Systems and Human Factors:** What makes for hazards and safety in complex, non-linear human enterprise? The work of James Reason⁵⁹ is seminal here, as are more recent studies of high reliability organizations.⁷² A growing number of empiric reports and theoretical analyses exist in these fields specifically applied to health care settings and professional work.
- **Reliability and Resilience:** Although a good deal of popular writing on standardization, protocols, and compliance with “evidence-based guidelines” remains anecdotal and exhortatory, the basic underlying theories of reliability engineering and resilience in design are increasingly well-developed and more and more applied directly to health care. Recent work by Amalberti,⁷³ Woods,⁷⁴ and Cook⁷⁵ is relevant.
- **Patient-Centeredness and Shared Decision-Making:** How can patients and their loved ones become more deeply and significantly involved in making the decisions that affect their care and outcomes, and in designing and improving the systems in which that care is delivered? How can effective self-care, especially for patients with chronic illness, be maximized? The work of Wennberg⁷⁶ and Wagner^{77,78} is particularly salient.
- **Teamwork and Cooperation:** How do teams and groups function most effectively? How does one lead and participate in cooperative endeavors and effective teams? The work of Argyris⁶⁰ and Senge,⁵⁵ for example, is relevant.
- **Measurement and Interpretation of Performance:** What are modern and proper approaches to the measurement of quality and outcomes in health care? How does one interpret measurement and variation so as to facilitate learning and improvement? Modern approaches to statistical process control and lessons from clinical epidemiology are salient.^{79,80}
- **Quality Improvement Methods:** What are state-of-the-art methods in quality control, planning, and improvement? How do they apply to health care? Recent textbooks by Langley et al⁶² and by Balestracci⁸¹ are useful.
- **Flow and Industrial Engineering Applications in Health Care:** How and where are modern principles of operations research, industrial engineering, and related sciences helpful to health care performance and improvement? Of what relevance are these sciences to professional knowledge and behavior? Writings by Spear⁸² and Litvak⁸³ are relevant.
- **Efficiency:** What are the forms and causes of waste and inefficiency in health care? How can costs be reduced without harming patients? Recent writing on lean thinking and Toyota production system in health care are relevant.²⁸