Virtual Mentor
American Medical Association Journal of Ethics
September 2011, Volume 13, Number 9: 620-625.

MEDICAL EDUCATION

Improvement Science—A Curricular Imperative

Samara Ginzburg, MD

In 1999, the Institute of Medicine (IOM) released *To Err is Human* [1], which estimated that 44,000 to 98,000 deaths occur each year in U.S. hospitals from injuries and complications of care and that the majority of these were preventable through the proper redesign of care delivery. This was followed in 2001 by *Crossing the Quality Chasm* [2], which highlighted the urgent need to incorporate patient safety and quality improvement into the daily work of health care professionals, and throughout the medical education continuum.

To date, efforts made to address these needs in both undergraduate [3] and graduate medical education [4] have fallen short, and the needs remain unmet [5]. At Hofstra North Shore-LIJ (Long Island Jewish) School of Medicine, we are launching with our inaugural class a 4-year curriculum in patient safety, quality, and effectiveness.

One of the first concerns that arises when considering and discussing the topics of safety and quality is nomenclature. Many keywords are used to refer to these topics, including but not limited to: patient-centered care, family-centered care, outcomes research, interprofessional education, team-based care, systems-based practice, practice-based improvement, and efficiency care. These terms are related through the IOM's six "Aims for Improvement" [2], inasmuch as care starts with patients (patient-centeredness) and practitioners must work together through a collaborative approach involving other professionals, patients, and families to deliver the right care (care that is safe, effective, efficient, equitable) at the right time (timely).

Striving to satisfy the IOM's six aims is known as practicing "improvement science," which has been defined by the NIH-supported Improvement Science Research Network as, "all aspects of research that investigate improvement strategies in health care, systems, safety and policy" [6]. Improvement science is the basis for the ACGME core competencies of practice-based learning and improvement and systems-based practice.

There are many barriers to developing a curriculum in improvement science, the greatest being lack of space in an already full curriculum. Others include the fear that basic sciences will be compromised, uncertainty of curricular content and lack of physician expertise in improvement science, and institutional culture. Improvement science involves working smarter, not harder—doing and improving one's work simultaneously. This same approach can be used to incorporate improvement science into a curriculum. In curricular reform, there is an opportunity to use Toyota's "lean"

approach and eliminate "waste" and then to begin integrating improvement science into existing content (see later examples). Given our professional responsibilities as physician educators, improvement science is an imperative, regardless of the curricular circumstances [1, 2, 5, 7].

The first step in creating a curriculum in improvement science is to bring together a design team, which may include patient care professionals with strong interests in areas related to improvement science—safety, quality, business administration, professionalism, simulation, anesthesiology, economics, public health, population health, quality—along with improvement council members, patient advocates, statisticians, community leaders, ethicists, organizational leadership such as chief patient safety and quality officers, chief medical and nursing officers, and others who work in hospitals and undergraduate medical education training programs.

The design group then needs to identify, in the form of learning objectives, the content they would like expressed through the curriculum. Expert recommendations for content can be found in *Preparing Medical Students for the Continual Improvement of Health and Health Care: Abraham Flexner and the New "Public Interest"* [8], *Designing a Patient Safety Undergraduate Medical Curriculum: The Telluride Interdisciplinary Roundtable Experience* [9], and *Eight Knowledge Domains for Health Professional Students* [10]. The ACGME Bulletin *Change and Improvement in the Learning Environment* [4] is an excellent resource for developing an institutional disclosure program and addresses the barrier of institutional culture.

Once the learning objectives are written, the next step is determining where this content will live in the curriculum. The choices usually include isolated individual sessions (e.g., one session per year), a thread of related sessions (e.g., one session per month that relates to prior sessions), a block of dedicated time (e.g., one-month elective), or a longitudinal experience (e.g., weekly sessions for 4 years). Whether a team is working as part of a total curricular reform or adding this content into an existing curriculum will dictate which of these options is most feasible.

Having determined where in a curriculum this content will live, the team can then approach the task of allocating the learning objectives to the appropriate sessions and determining the pedagogy for those sessions. Here it is helpful to consider Kolb's experiential learning model [11], which stresses the role experience plays in learning, a critical component of improvement work. Applied to improvement science, Kolb's model includes (1) reflective observation (watching others engage in and thinking about improvement work), (2) abstract conceptualization (understanding the theory and having a clear grasp of improvement science), (3) concrete experience (receiving practical tips and techniques from a subject matter expert), and (4) active experimentation (caring for patients while engaging in improvement work). Pedagogical approaches should vary to allow these different components of experiential learning to take place.

The continuous longitudinal integrated clerkship (CLIC) model can be used as the basis for a core experiential curriculum (including all its components), upon which a patient-centered curriculum in improvement science can be built. The CLIC model, in which students follow patients across time through different venues, establishes three types of continuity—continuity of care, continuity of curriculum, and continuity of supervision [12]. Students following patients longitudinally are natural observers of health care systems, and there is an opportunity to create a fourth continuity relationship in CLICs between student and health care system. This relationship, yet to be investigated seriously, has great potential.

As they follow patients longitudinally, students can be prompted to notice and describe safety and quality issues. They can be asked to describe a situation in which a patient didn't receive the right care at the right time or one in which finances affected care. This is a form of "reflective observation" that engages the students in recognizing firsthand that gaps in care exist.

At selected intervals, students can be brought together in small groups for a discussion facilitated by content experts, perhaps drawn from the design team, in which students present their patients' stories in response to a particular prompt. Using the themes brought out by these student presentations, groups can discuss related foundational topics and engage in "abstract conceptualization," learning necessary theory and how to apply it.

Students can then apply this knowledge as "active experimentation" by returning to the clinical setting and practicing their newly acquired skills, generating process maps and performing point-of-care assessments for patients and clinical teams by analyzing processes, patterns of interruptions, and inefficiencies; drafting aims; reviewing evidence; discussing measurement; collecting data and selecting outcomes for study; and participating in Plan-Do-Study-Act (PDSA) cycles [13]. They bring the results of their work back to the group and their facilitator for discussion and the "concrete experience" of getting expert feedback and cycling between performing improvement work and receiving expert coaching.

CLIC is currently used in the third year of medical school, and some of the new medical schools are planning to begin a version of CLIC in the first year. If CLIC begins earlier in training and is inclusive of an improvement science curriculum, the opportunity exists for a 4-year developmental, experiential curriculum in improvement science. Third- and fourth-year students could become team members and ultimately team leaders on inpatient or outpatient improvement teams, graduating with the knowledge, skills, and attitudes they need to become physician leaders of health care improvement.

For medical schools that need to fit improvement science into an existing curriculum, consideration of some of the following pedagogical approaches commonly used in other schools as well as publicly available resources can be helpful.

Root cause analysis (RCA) is a process used to identify the cause(s) of an undesired outcome or adverse event in order to create effective corrective actions to prevent that problem from recurring. Many hospital departments perform RCAs on a regular basis, bringing together an interdisciplinary team to investigate the event and devise solutions for prevention. By participating in real or simulated RCA, students can gain exposure and begin to develop skills needed to approach undesired outcomes; gain appreciation for the insight and contributions of interdisciplinary team members, human-factors engineering, systems errors, and institutional culture towards errors; and acquire skills needed to begin devising solutions for them. Morbidity and mortality conferences often employ a RCA approach. The Institute for Healthcare Improvement has RCA-type case studies available for use on its web site [10].

Case studies are often used in business school education and are available for use in medical education. These cases are in-depth studies of a specific situation, for example health care delivery in a third-world country, that do not provide answers but allow students to study a problem in depth, use critical thinking, and apply their knowledge to analyze the case and draw conclusions. Skills learned from case studies include critical thinking, analysis, and knowledge of contributors to health outcomes in areas like public health, business decisions, and medical economics. Case-study analysis can be facilitated by people familiar with this pedagogy, through MBA or MPH programs, for example.

Simulation provides learners an opportunity to participate in performance-based acquisition of clinical skills in a psychologically safe environment for constructive discussion about errors and without adverse consequences. Simulation can be used for training purposes as well as for assessment of a team's clinical performance. By participating in simulation, learners can move from pure knowledge about clinical skills to performance of those skills, with the opportunity for direct coaching for improvement in real time. Simulation provides learning opportunities for development of knowledge, skills, and attitudes related to personal improvement, crew resource management (CRM), and patient safety as individuals and as members of health care teams.

Live or videotaped stories of medical errors told by patients or their family members help listeners appreciate the importance of patient safety and quality outcomes and recognize the reality of these cases, and they engage and awaken the listener's professional responsibility to participate in improving care. A content expert should facilitate discussion of these stories, whether they are videos or presented live by panels of patients who have experienced errors.

Online materials on improvement science topics are available for self-directed learning or as the basis for group instruction. The IHI Open School and MedEdPORTAL both feature excellent resources [14, 15].

The time has arrived for all medical educators to consider how to implement an improvement science curriculum in their institutions' undergraduate medical education and on into GME and CME in effective ways. This can be done by eliminating waste from a curriculum, tapping into an institution's existing improvement science resources, developing a fourth continuity relationship with the health care system in a CLIC, and creatively integrating improvement science into curricular experiences so that we equip physicians with the knowledge, skills, and attitudes they need to lead and transform the delivery of health care in our country.

References

1. Kohn KT, Corrigan JM, Donaldson MS. *To Err Is Human: Building a Safer Health System.* Washington, DC: National Academies Press; 1999.
2. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academies Press; 2001.
3. Alper E, Rosenberg EI, O'Brien KE, Fischer M, Durning SJ. Patient safety education at U.S. and Canadian medical schools: results from the 2006 Clerkship Directors in Internal Medicine survey. *Acad Med*. 2009;84(12):1672-1676.
4. McDonald T, Smith HM, Mayer D. "Full disclosure" and residency education: resident learning opportunities within the context of a comprehensive program for responding to adverse patient events. *ACGME Bulletin*. 2008;May:5-9. http://www.acgme.org/acWebsite/bulletin/bulletin5_08.pdf. Accessed August 19, 2011.
5. Lucian Leape Institute Roundtable On Reforming Medical Education. *Unmet Needs: Teaching Physicians to Provide Safe Patient Care*. National Patient Safety Foundation; 2010. http://www.npsf.org/download/LLI-Unmet-Needs-Report.pdf. Accessed August 19, 2011.
6. Improvement Science Research Network (ISRN). What is improvement science? http://www.improvementscienceresearch.net/about/improvement_science.asp . Accessed August 19, 2011.
7. Cooke M, Irby DM, O'Brien BC. *Educating Physicians: A Call for Reform of Medical School and Residency*. San Francisco, CA: Jossey-Bass; 2010.
8. Berwick DM, Finkelstein JA. Preparing medical students for the continual improvement of health and health care: Abraham Flexner and the new "public interest." *Acad Med*. 2010;85(9 Suppl):S56-S65.
9. Mayer D, Klamen D, Gunderson A, Barach P. Designing a patient safety undergraduate medical curriculum: the Telluride Interdisciplinary Roundtable experience. *Teach Learn Med*. 2009;21(1):52-58.
10. Institute for Healthcare Improvement. Eight knowledge domains for health professional students. http://www.ihi.org/offerings/ihiopenschool/resources/Pages/Publications/EightKnowledgeDomainsForHealthProfessionStudents.aspx. Accessed August 22, 2011.

11. Kolb DA, Boyatzis RE, Mainemelis C. Experiential learning theory: previous research and new directions. In: Sternberg RJ, Zhang L-F, eds. *Perspectives on Thinking, Learning, and Cognitive Styles*. Mahwah, NJ: Lawrence Erlbaum Associates; 2001. Educational Psychology Series.
12. Hirsh DA, Ogur B, Thibault GE, Cox M. "Continuity" as an organizing principle for clinical education reform. *N Engl J Med*. 2007;356(8):858-865.
13. The Plan-Do-Study-Act (PDSA) cycle was originally developed by Walter A. Shewhart as the Plan-Do-Check-Act (PDCA) cycle. W. Edwards Deming modified Shewhart's cycle to PDSA, replacing "Check" with "Study." See: Deming WE. *The New Economics for Industry, Government, and Education*. 2nd ed. Cambridge, MA: The MIT Press; 2000.
14. Association of American Medical Colleges. MedEdPORTAL. http://www.mededportal.org. Accessed August 19, 2011.
15. Institute for Healthcare Improvement Open School for Health Professions. http://www.ihi.org/IHIOpenSchool. Accessed August 19, 2011.

Samara Ginzburg, MD, is an assistant dean for medical education at the Hofstra North Shore-LIJ School of Medicine in Hempstead, New York, where she works as part of a team that develops innovations in medical education. Dr. Ginzburg has a particular interest in integrating improvement science into all 4 years of undergraduate medical education.

Related in VM

Patient Safety Organizations Are Step 1; Data Sharing Is Step 2, September 2011

Never Events? Well, Hardly Ever, September 2011

After the Apology—Coping and Recovery After Errors, September 2011