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Lisa M. Vinci, MD,¹ Julie Oyler, MD,¹ and Vineet M. Arora, MD¹

Abstract

Future physician leaders will need the knowledge and skills necessary to improve systems of care. To address this need, Pritzker School of Medicine implemented a 4-year scholarly track in quality and patient safety for medical students. The Quality and Safety Track (QST) includes an intensive elective that teaches basic quality-improvement skills, an individual mentored scholarly project, and engagement in the Institute for Healthcare Improvement Open School. The first-year elective incorporates a group project that allows students to apply basic process improvement skills. Institutional quality and safety leaders also present their work, giving students context for how these skills are used. To date, 23 students have completed the elective, and 11 chose to pursue QST throughout their medical school experience. Students who completed the elective reported improved confidence in using core quality improvement skills. QST is a feasible and innovative program to develop future health care leaders in quality and safety.

Keywords

medical education, scholarly tracks, quality and safety

Given the persistent shortcomings in health care quality, future physicians will need the knowledge and skills necessary to evaluate and improve health care quality and to lead system change. Policy leaders and medical educators have called for the integration of training in health care quality and safety into medical education. The landmark Institute of Medicine report *Crossing the Quality Chasm* calls for “the restructuring of clinical education to be consistent with the principles of the 21st century health system throughout the continuum of undergraduate, graduate, and continuing education.”¹ A recent report released by the Association of American Medical Colleges, *Teaching for Quality*, calls for integrating “quality improvement and patient safety concepts into every facet of medical education, beginning in the first year of medical school.”²

Engineering such educational experiences can be daunting for undergraduate medical educators. Challenges to incorporating health care quality and patient safety into the medical school curriculum include lack of time in an already crowded curriculum and a shortage of faculty with necessary expertise in this area.^{3,4} In addition, pre-clinical students have had limited exposure to the clinical setting and thus may not be able to recognize problems in the delivery or outcomes of care. A potential approach is the introduction of a scholarly track that focuses on quality and patient safety. Many schools have incorporated

track programs that offer advanced training in basic science, ethics, global health, and medical humanities; no school has described such an approach for quality and safety.^{5–7} Although focused scholarly tracks do not address the educational needs of all students, they allow an institution to develop and test educational curricula that could be adopted on a wider scale and cultivate clinician educators in quality and safety.

The aim of this article is to describe the implementation of a longitudinal scholarly track program in quality and patient safety, the Quality and Safety Track (QST). The aim of QST is to produce future physician leaders who have the knowledge and skills necessary to improve health care systems.

Methods

Setting and Participants

In 2005, the University of Chicago Pritzker School of Medicine began a redesign of its curriculum called the

¹Pritzker School of Medicine, University of Chicago, Chicago, IL

Corresponding Author:

Lisa M. Vinci, MD, Pritzker School of Medicine, University of Chicago, 5841 S Maryland, MC 3051, Chicago, IL 60643.
Email: lvinci@medicine.bsd.uchicago.edu

Table 1. Quality and Safety Track Components.

Year of Medical School	Goals	Curricular Elements
MS1	Explore broad interests, meet potential mentors, cultivate scholarly skills, learn basic process improvement skills	Introduction to Quality and Patient Safety (2 hours) Quality and Patient Safety Track Elective: Fundamentals of Quality Improvement and Patient Safety (20 hours) Individual Scholarly Project: Summer Research Project (SRP; 240 hours)
MS2	Conduct focused work on a scholarly project and practice skills and expertise in track area	Final Track Application Due (Fall) Quality and Safety Track quarterly meetings (4 hours) Institute for Healthcare Improvement Open School Modules (8-10 hours) Individual Scholarly Project: Spring Research Block—continue project started during SRP or start new project (160 hours)
MS3	Learn clinical medicine	Participate in relevant clinical quality improvement conferences during clinical rotations
MS4	Complete scholarly project, obtain advanced skills, disseminate work	Senior Project Completion: continue project or work on presentation or publication of completed work, 1-3 months (100 credits/month)

“Pritzker Initiative,” which included development of a required scholarly track system. Quality improvement (QI) educational leaders proposed the creation of a track dedicated to quality and patient safety. As a result, QST was created to serve as a way to integrate quality and safety content into the existing 4-year curriculum while also cultivating leaders in quality and safety.

Program Description

The authors seek to identify students who are interested in health care quality and offer them focused training in quality and patient safety via an intensive elective, participation in the Institute for Healthcare Improvement (IHI) Open School, and completion of an individual scholarly project over the course of the 4-year curriculum (Table 1). QST was designed to impart knowledge, build practical skills, produce an individual scholarly project, and provide strong mentoring on a longitudinal basis. To graduate from the track, a student must complete 12 IHI Open School online modules and an individual scholarly project relevant to quality or patient safety. Participation in the first-year medical school (MS1) elective, “Fundamentals of Quality Improvement and Patient Safety,” is strongly encouraged but not required.

The authors adapted the educational materials from the existing Quality Assessment and Improvement Curriculum, a 2-year required course that teaches internal medicine residents to evaluate the quality of care provided in their continuity clinic, implement a small QI project, assess the impact, and complete additional

Plan-Do-Study-Act (PDSA) cycles.⁸ This process improvement approach was adapted from the IHI Model for Improvement.⁹

Introduction to Quality and Patient Safety. Each fall quarter, all MS1 students receive a series of lectures on general scholarly skills. Leaders from each track give a 2-hour introduction to their respective discipline. This approach gives all students a broad exposure to each track and the track leaders early in their training.

The introductory lecture for QST includes an overview of health care quality and its relevance to physicians, and the Model for Improvement. Two senior QST students present their scholarly projects. This exposes the MS1 students to concrete examples of typical projects and allows the senior students to gain experience in presenting their work. Other core concepts in health care quality and patient safety are integrated into existing courses. The Clinical Skills course includes lectures on patient safety, hospital-acquired infections, pressure ulcer prevention, procedural safety, and interprofessional education. The Health Care Disparities course discusses inequities in quality of care, and pay for performance is discussed in the Social Context of Medicine course. MS4 students receive training in safe handoffs, informed consent, and error disclosure.

Quality and Patient Safety Track Elective. To provide hands-on experiential learning, a 10-week, spring quarter elective, “Fundamentals of Quality Improvement and Patient Safety,” is offered, which meets for 2.5 hours weekly. This elective serves as a cornerstone of the track and provides the primary opportunity for students to learn core

Table 2. Fundamentals of Quality Improvement and Patient Safety Elective.

Topic	Speaker Titles	Real-World Examples	Group Project Activity	Themes
Introduction to course Introduction to Q/S Introduction to Hospital Compare Data Aim statements	Associate program director for IM residency (track leader) and director, primary care group (track leader)	Hospital quality initiatives, HCAHPS survey	Introduction to project	Quality Safety Leadership
Process mapping	Track leaders	Ecuador clinic flow project Specimen collection in clinic	Pick a project/Write an aim statement Introduction to process mapping/Start a process map	Quality Leadership
Principles of measurement	Medical education and Q/S researcher	IBCD checklist (inpatient safety checklist)	Complete stakeholder interviews/Refine process map/Choose measures	Quality Safety
Cycles of change	Former Director of Quality, Department of Surgery	Reducing surgical site infections	Propose small interventions/Rate feasibility and impact	Quality Leadership
Safety and taxonomy	Medical education and Q/S Researcher, PhD student in operations research	Aviation safety	Refine proposed interventions/ Complete a fishbone diagram	Safety
Developing Interventions/ Pay for Performance (P4P) Sustainability and Spread	Associate Chief Medical Officer Track leaders	Reducing readmissions Current institutional P4P initiatives	SWOT analysis of proposed project Teams work on project presentation	Safety Leadership Quality Leadership
Lean Methods	Director and Vice President for Operational Excellence	Using lean methods to improve operations	Teams work on project presentations	Quality
Final group project presentations	All speakers and all students enrolled in QST invited		Teams present project proposals	Quality Safety Leadership

Abbreviations: Q/S, quality/safety; IM, internal medicine; HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems; IBCD, immunizations, bed sores, catheters, and deep-vein thrombosis prophylaxis; SWOT, strengths, weaknesses, opportunities, threats; QST, Quality and Safety Track.

improvement skills, such as process mapping, fishbone diagramming, and using PDSA cycles, in the context of developing a project proposal. Short, weekly lectures cover common QI topics including choosing measures, designing interventions, patient safety, and pay for performance (Table 2).

To gain experience and apply their newly acquired skills, students work in groups of 4 to 6 to develop a project proposal. Students review institutional quality data available on the Centers for Medicare and Medicaid Services Web site (www.hospitalcompare.gov) and choose an area of interest. The track leaders chose to use Hospital Compare data for several reasons. Data collection can be very challenging in a complex health care system, and a readily available data source is needed. Hospital Compare allows them to highlight the availability of public data on the Internet and discuss how Medicare and other agencies use this information. Finally, the track leaders want to expose students to measures that are high profile and relevant to their institution. After choosing an area of focus, the track leaders review more granular and recent data that the institution collects. The track leaders find that using Hospital Compare data

provides an opportunity to teach many quality and safety measurement and reporting concepts with readily available data.

After choosing an area of interest, students review the literature and best practices relevant to the chosen problem. Working in small groups, they write an aim statement to define their improvement goal. Students visit the relevant clinical areas and interview stakeholders, including patients, thus giving students broad exposure to patients, clinical operations, and direct care providers. Process-mapping skills are demonstrated, and students complete a process map with input from all stakeholders in the care process. After a lecture on choosing measures and presenting data, students choose potential measures and discuss the challenges to and strategies for collecting data. The lecture on measures includes a discussion of the differences between structure, process, and outcome measures and the challenges to achieving and measuring outcomes. Finally, the group is introduced to the PDSA methodology and uses this format to assess the feasibility and impact of proposed interventions and to design small tests of change. The course is interactive and includes discussions with institutional quality leaders, including the former director

Table 3. Examples of Fundamentals of Quality and Patient Safety Elective Projects.

Project/Year	Number of Students	Aim	Measure	Interventions
Improving timeliness of antibiotics in the ED for patients with pneumonia/2010	5	To improve ED administration of antibiotics within 6 hours for patients with pneumonia from 84% to 95% within the next 6 months	Percentage of patients with pneumonia who received appropriate antibiotics within 6 hours of presentation to ED	<ol style="list-style-type: none"> 1. Include inclusion criteria on Category P form 2. Develop checklist for triage nurses 3. Implement additional training for Category P
Reducing overuse of MRI for acute low back pain/2011	4	To decrease the percentage of MRIs ordered for low back pain that are not indicated by current guidelines from 35.1% to 20% by August 1, 2011	Percentage of MRIs ordered without following guideline recommendations for a trial of conservative care	<ol style="list-style-type: none"> 1. Information on management of back pain in waiting rooms 2. Low back pain action plans in clinic 3. Share individual physician referral rates with colleagues
Improving use of the Asthma Action Plan (AAP) for children admitted with asthma/2011	5 (1 Master's of social work student)	To increase the percentage of children and families receiving complete AAPs at discharge after hospitalization for asthma from 55% to 90% within 6 months	Percentage of patients who receive a completed AAP on discharge from the hospital	<ol style="list-style-type: none"> 1. Provide education on completing AAP to nurses 2. Implement an electronic form of the AAP into the EMR 3. Standardize work for the appointment coordinator

Abbreviations: ED, emergency department; MRI, magnetic resonance imaging; EMR, electronic medical record.

of quality for the department of surgery and the associate chief medical officer for clinical innovation. The course concludes with the presentation of project proposals to institutional leaders, project stakeholders, and senior QST students (Table 3). Attendees are asked to evaluate the project proposals using the Quality Improvement Project Assessment Tool.¹⁰

Leadership training is integrated into the MS1 elective. During the elective, each speaker discusses his or her various leadership roles and experiences to provide students with multiple examples of quality and safety leadership roles. Presenters discuss challenges they faced in leading change and how they approached these challenges. Opportunities to obtain leadership training in quality and safety also are highlighted. As students work on their group project proposal during the MS1 elective, the track leaders frequently discuss the barriers to change and how these might be addressed. The MS1 elective topics that are most relevant to leadership include stakeholder interviews, cycles of change, and sustainability and spread (Table 2). Students also are encouraged to apply for leadership training opportunities, and several have attended leadership training programs offered by the IHI Open School.

Final Track Application. The final track choice occurs in the first quarter of the MS2 year. Students must submit a formal application, including a description of their individual project proposal signed by their mentor. All track leaders meet as a group to review applications and make final track assignments. Students begin quarterly meetings with track leaders and other students after the final track assignments.

Individual Scholarly Project. Completion of an individual scholarly project is a required component of QST. Students have 2 opportunities to identify a mentor and begin a project. The first opportunity occurs the summer after the MS1 year when students can participate in a mentored project through the National Institutes of Health–funded Summer Research Program (SRP). Students select from a catalog of projects that are submitted by faculty and are categorized by their relevance to the tracks offered. If students begin an SRP project, they may choose to continue it as their QST project throughout the 4 years.

The second opportunity to start an individual scholarly project occurs during the required 5-week MS2 Spring Research Block. In preparation for the Spring Research Block, students meet with track leaders and potential mentors to discuss available projects. Once a project is chosen, the project mentor and student are required to sign an agreement that outlines mentor and mentee responsibilities and project goals. Track leaders review the agreements to confirm the project mentor's understanding of track requirements and to ensure that the project is achievable within the time and resources available. Integrating a student into an ongoing project can be challenging because the QST students must meet clearly defined curricular goals within a specified time frame. During the Spring Research Block, track leaders and students meet regularly as a group to discuss progress and provide feedback. Students are expected to submit a structured progress report using Glassick's criteria for scholarship (Clear Goals, Adequate Preparation, Appropriate Methods, Results, Dissemination, and Reflection) at the beginning of the Spring Research Block as well as an e-poster that

summarizes their work at the end of the block.^{11,12} Individual scholarly projects are quite diverse and have included translating diabetes education and empowerment materials into Spanish, improving patient flow in the radiation oncology clinic, and improving transition to adult care for pediatric rheumatology patients. Continuing to work on their project between the SRP, the MS2 Spring Research Block, and the MS4 year is encouraged but not required, although many students continue work on their projects. They have additional time during their MS4 year to complete their project and disseminate the results.

IHI Open School. All students in QST are expected to participate in the IHI Open School (<http://www.ihio.org/offering/ihioopenschool>). This online learning community makes educational and networking resources available to students who are interested in QI. QST students are required to complete 12 online educational modules relevant to QI and patient safety by the end of their MS4 year. The IHI issues a certificate for completion of the modules. The Open School offers an extensive menu of readily available, high-quality resources.

Senior Project Completion. QST students revisit their scholarly project for 1 to 3 months during their fourth year, earning 100 credits per month. Students who started their projects between the first and second year should be at the point of submitting their work for publication, whereas others may be finishing projects begun during their second year. Track leaders offer a series of mentoring sessions to assess progress and provide feedback. To receive credit and complete the track, students must submit a final abstract and poster, which is graded by the QST leaders.

Dissemination. Students are expected to present an abstract or poster at an internal conference such as the Hospital Quality Fair or Senior Scientific Session. Students are encouraged to produce a scholarly product, such as an abstract submitted to a professional society meeting by the end of the fourth year. The medical school provides funding for travel to 1 conference for students who are presenting their work.

Individual Scholarly Project Mentor and Track Leader Roles

Track leaders are responsible for identifying faculty interested in serving as individual project mentors and connecting them with students. The faculty mentor is primarily responsible for identifying the project and assigning the student responsibilities while the track leaders, using the Model for Improvement framework, guide the

student through the mechanics of improvement. Mentors tend to have a variety of skills and interests ranging from health services research to surgical quality and safety. They are not required to have formal training, although most have some experience in quality or safety research or lead quality or safety efforts for their departments. The QST track is designed so that the track leaders provide training in QI and patient safety through the MS1 elective and the IHI Open School Modules, such that the faculty project mentors benefit from having a trained student working on their project. This approach reduces the burden of teaching QI skills to their student.

Results

Program Evaluation

In the first 2 years of the QST program, 11 students chose to pursue the QST track for the duration of medical school, with 6 of these starting their projects through the SRP. To date, 23 students have completed the MS1 elective.

Baseline Experience in Quality and Safety

The MS1 classes of 2013 (n = 78), 2014 (n = 85), and 2015 (n = 82) were surveyed at the start of the year about previous experience with QI and comfort level with basic QI skills. In all, 18/245 (7%) had an educational experience, 15/245 (6%) had research experience, and 18/245 (7%) had work experience; 12 (5%) had a quality and safety experience that was longer than 1 year in duration and was completed outside of school. Only 35/245 (14%) answered that they were “very likely” or “somewhat likely” to pursue a career in QI or safety.

Evaluation of Quality/Safety Elective

The Quality Improvement Knowledge Assessment Tool (QIKAT), a pretest (n = 22) and posttest (n = 23) of self-assessed comfort level with QI skills, was administered on the first day and on completion of the MS1 elective.¹³ This tool contains the same questions as those posed in the survey of the entire MS1 class. Fischer 2-sided tests were used to compare the percentage of students who reported that they were comfortable with various QI skills at 3 different time points: (1) all first-year students on entry to medical school; (2) QI elective students pre elective; and (3) QI elective students post elective (Figure 1). Using a 4-point Likert scale, the percentage of MS1s and MS1s pre elective who felt moderately or extremely comfortable “making changes in a system” improved from less than 40% to more than 90% after the QST elective. Similarly, the percentage of MS1s and MS1s pre elective

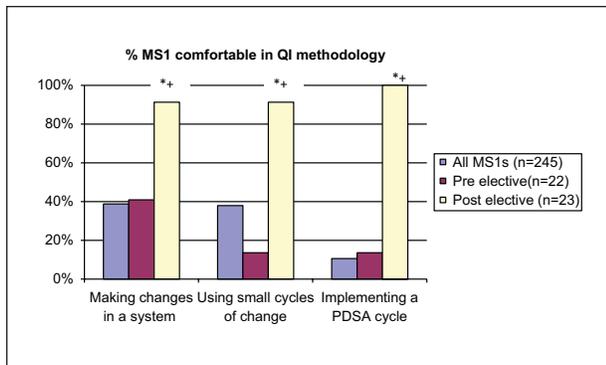


Figure 1. Results of student survey of comfort with common QI skills.^a

^a†P < .001 preelective versus postelective; *P < .001 all MS1 versus postelective.

Abbreviations: MS1, first-year medical student; PDSA, Plan-Do-Study-Act; QI, quality improvement.

who felt moderately or extremely comfortable “using small cycles of change” improved from less than 40% to more than 90% after the QST elective. Finally, the percentage of MS1s and MS1s pre elective who felt moderately or extremely comfortable “implementing a PDSA cycle” improved from less than 15% to 100% after the QST elective. Students provided multiple positive comments on the course evaluation: “The most important thing I gained was how to identify a problem and lay out a specific plan to fix or attack that problem, especially through mapping out the process that leads to a specific outcome” and “The class helped me to think about quality improvement in a practical and systematic way.”

Scholarly Achievements. Two students were selected for an IHI leadership development program; 6 students presented their projects at a national IHI meeting, 3 students presented their work at the Midwest Society for General Internal Medicine meeting, and 2 students presented their summer projects at the Society for Hospital Medicine national meeting.

Discussion

Early experience with the QST has shown that a scholarly concentration program in this area is feasible and attractive for certain students. A survey completed at the beginning of medical school showed that students starting medical school have little experience or training in QI. Participation in the MS1 elective significantly improved self-assessed comfort with core QI skills. Engagement with the IHI Open School offers additional opportunities for learning QI skills and presenting scholarly work, as well as support for leadership training. Despite any concerns about teaching QI skills to students prior to their clinical rotations, self-assessed comfort levels improved

significantly. Longer-term outcomes, such as the impact on future engagement in QI activities, need to be assessed. Limitations of this innovation include the elective nature of the QST, which selects students who are interested in quality and safety and does not address the broader needs of all medical students. In addition, the track leaders are challenged by scalability. In the most recent MS1 class, 15 (18%) students have expressed interest in the track and have enrolled in the QST elective. It will be challenging for 2 faculty track leaders to provide effective oversight and mentoring to 15 students per year for 4 years. Adding additional track leaders or limiting the number of students in the track will need to be considered.

It also has been found that students who complete the MS1 elective, Fundamentals of Quality and Patient Safety, are more successful in completing their individual projects and require less-intensive oversight by the track leaders. To address this, track leaders are considering making the elective a requirement of participation in QST.

Identifying accessible and effective project mentors remains the biggest challenge to sustaining the curriculum. Although there is a well-established culture of mentorship at the University of Chicago around the basic and clinical sciences, few faculty have formal training in quality and patient safety. Identifying and engaging faculty able to mentor students through clinical quality and patient safety projects with specific goals and within a defined time frame is a relatively recent effort and can be challenging.^{4,14,15} As track leaders have gained experience, it has become clear that they must proactively coach students through choosing a mentor, defining clear project goals, and communicating with mentors. Track leaders also have learned that they need to guide mentors to set realistic and clear expectations for their students, work within the defined time frame of the track, and leverage the students’ newly acquired skills. It is hoped that as faculty mentors have increasingly frequent and positive interactions with QST students, they will be willing to mentor additional students. The track leaders believe that participation in this track will foster the development of physicians who have the skills and knowledge required to ensure a high quality and safe health care system.

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References

1. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academies Press; 2001.
2. Association of American Medical Colleges. Teaching for quality: integrating quality and safety into medical education continuum. <https://www.aamc.org/newsroom/reporter/325912/quality.html>. Accessed June 25, 2013.
3. The Lucian Leape Institute of the National Patient Safety Foundation. Unmet needs: teaching physicians to provide safe patient care. <http://www.npsf.org/about-us/lucian-leape-institute-at-npsf/the-patient-safety-imperative-for-health-care-reform/unmet-needs/> Accessed December 22, 2011.
4. Association of American Medical Colleges. Teaching for quality: integrating quality improvement and patient safety across the continuum of medical education. <https://members.aamc.org/eweb/upload/Teaching%20for%20Quality%20Report.pdf>. Accessed April 23, 2013.
5. Bierer SB, Chen HC. How to measure success: the impact of scholarly concentrations on students—a literature review. *Acad Med*. 2010;85:438-452.
6. Boninger M. Foreword: scholarly concentrations in the medical student curriculum. *Acad Med*. 2010;85:403-404.
7. Gotterer GS, O'Day D, Miller BM. The emphasis program: a scholarly concentrations program at Vanderbilt University School of Medicine. *Acad Med*. 2010;85:1717-1724.
8. Oyler J, Vinci L, Arora V, Johnson J. Teaching internal medicine residents quality improvement techniques using the ABIM's practice improvement modules. *J Gen Intern Med*. 2008;23:927-930.
9. Langley GL, Nolan KM, Nolan TW, Norman CL, Pronovost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. 2nd ed. San Francisco, CA: Jossey-Bass; 2009.
10. Leenstra JL, Beckman TJ, Reed DA, et al. Validation of a method for assessing resident physicians' quality improvement proposals. *J Gen Intern Med*. 2007;22:1330-1334.
11. Fincher RM, Simpson DE, Mennin S, et al. Scholarship in teaching: an imperative for the 21st century. *Acad Med*. 2000;75:887-894.
12. Glassick CE, Huber MT, Maeroff GI. *Scholarship Assessed: Evaluation of the Professoriate*. San Francisco, CA: Jossey-Bass; 1997.
13. Vinci LM, Oyler J, Johnson J, Arora VA. Effect of a quality improvement curriculum on resident knowledge and skills in improvement. *Qual Saf Health Care*. 2010;19:351-354.
14. Boonyasai RT, Windish DM, Chakraborti C, Feldman LS, Rubin HR, Bass EB. Effectiveness of teaching quality improvement to clinicians: a systematic review. *JAMA*. 2007;298:1023-1037.
15. Stille CJ, Savageau JA, McBride J, Alper EJ. Quality improvement "201": context-relevant quality improvement leadership training for the busy clinician educator. *Am J Med Qual*. 2012;27:98-105.