Creating a Quality Improvement Course for Undergraduate Medical Education: Practice What You Teach

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Abstract

Problem

More than half of U.S. medical schools have implemented curricula addressing quality improvement (QI); however, the evidence on which pedagogical methods are most effective is limited.

Approach

As of January 2015, students at Vanderbilt University School of Medicine are required to take a QI course consisting of three 1-month-long (4 hours per week) blocks during their third or fourth year, in which student-identified faculty sponsors are paired with highly trained QI professionals from Vanderbilt University Medical Center.

The three blocks of the course include didactic instruction using Institute for Healthcare Improvement Open School modules, readings, weekly assignments, and experiential learning activities (i.e., students develop and implement a QI project with two Plan–Do–Study–Act cycles using a systematic approach that employs the principles of improvement science, which they present as a poster on the last day of the third block).

Outcomes

From January 2015 to January 2017, 132 students completed all three blocks, resulting in 110 completed QI projects. On evaluations (distributed after each completed block), a majority of students rated the clinical relevance of the blocks highly (191/273; 70%), agreed the blocks contributed to their development as physicians (192/273; 70%), and reported the blocks motivated them to continue to learn more about QI (168/273; 62%).

Next Steps

The authors have applied QI methods to improve the course and will aim to assess the sustainability of the course by tracking clinical outcomes related to the projects and students' ongoing involvement in QI after graduation.

Problem

One of the major priorities for medical educators is preparing medical trainees to function expertly within health care systems. For learners to do this, they need to acquire essential skills to achieve the Institute for Healthcare Improvement's (IHI's) Triple Aim.[1] Imparting these skills requires the transformation of undergraduate medical education (UME) curricula to incorporate activities that teach the evolving science of health care

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delivery. To this end, both the World Health Organization and the Association of American Medical Colleges have endorsed teaching quality improvement (QI) and patient safety (PS) during medical school.[2] More than half of U.S. medical schools have implemented curricula addressing these topics; however, the evidence on which pedagogical methods are most effective is limited.[3–5]

Incorporating teaching methods that reflect adult learning styles and student preferences can be challenging. Thain and colleagues[6] found that students preferred Internet-based learning (70%) over reflection assignments using blogging (30%) and role-playing (36%). In comparison, Teigland and colleagues[7] found that students rated computer modules (2.4 out of 5) and class lectures (2.5 out of 5) as least helpful. Both studies, however, found that discussion of real-life near misses and physician-guided QI projects were rated highly.[6,7] In another study, Headrick and colleagues[5] described developing an interprofessional experience across six sites in QI and PS using both didactic elements and experiential learning. Each site approached their teaching differently and

many challenges were identified, including scheduling, engaging students, limited faculty knowledge about QI and PS, creating a meaningful clinical experience, and measuring the outcomes of the learning experiences.[5] Another model, described by Ogrinc and colleagues,[8] paired QI-trained faculty members and their projects with select teams of students. This model received positive qualitative responses about faculty members' and students' experiences and has been expanded to allow more students the opportunity to participate.

While the specific approaches taken to teaching QI and PS across medical schools differ, one issue remains the same: the need to successfully prepare future professionals for the health care challenges of tomorrow. To this end, we describe an experiential learning QI course that is designed with the aim of promoting a lifetime of professional activities centered on the IHI's Model for Improvement.

Approach

Background

In 2012, Vanderbilt University School of Medicine transitioned its UME

curriculum from a traditional model, with two years of basic science followed by two years of clinical training, into a fully integrated approach, called Curriculum 2.0, which blends basic science and clinical experiences starting with the first year of UME.[9] Curriculum 2.0 has been funded in part by an Accelerating Change in Medical Education grant from the American Medical Association and has been reviewed and approved by the Vanderbilt University institutional review board.

The required Curriculum 2.0 course work consists of three sequential phases—medical knowledge (year 1), clinical care (year 2), and immersion (years 3 and 4)—and three longitudinal elements—foundations of health care delivery (FHD), learning communities, and research—that traverse the phases. Each required curricular element is designed to help students meet competency expectations across domains as well as to provide a supportive structure for learning foundational knowledge, skills, and attitudes.

FHD provides a variety of experiences that promote an understanding of systems approaches to health care delivery. FHD includes modular activities focused on advocacy, QI, PS, advanced communication skills, population health, and interprofessional teamwork. As of January 2015, as part of FHD, students are required to take a QI course consisting of three 1-month-long (4 hours per week) blocks during their third or fourth year to graduate. Students have the option of completing the courses consecutively or dispersing them throughout their third and fourth years.

For our QI course, we developed a collaborative partnership between the Vanderbilt University School of Medicine leadership and faculty and the Vanderbilt University Medical Center's quality, safety, and risk prevention department. Rather than using a previously described QI teaching model that requires training a cohort of physician educators prior to implementing the curriculum,[7,8] we elected to partner student-identified faculty sponsors with highly trained QI professionals from the medical center. We selected this model to try to mitigate the following barriers with training faculty members prior to implementing new

courses: (1) the high cost of providing the necessary training, (2) the maintenance of a critical mass of faculty with QI experience, and (3) the resulting delay to the implementation of the new course. By pairing faculty sponsors and QI experts, the faculty members (who are not required to have QI knowledge) receive just-in-time support, students are able to observe the collaboration and partnership between departments, and QI experts are able to guide both the students and faculty sponsors toward institutional QI priorities. Additionally, we designed this partnership between the medical center and medical school to afford students the necessary experiential learning activities needed to demonstrate competency in QI, to allow the medical center to benefit from the students' activities, and to ensure the sustainability of the QI course.

Course development and adaptation

The three blocks of the QI course include didactic instruction using IHI Open School modules, readings, weekly assignments, and experiential learning activities (i.e., activities related to the QI projects, http://www.ihi.org/education/IHIOpenSchool/Pages/default.aspx). Each block has defined goals and learning activities to guide the student's growth in achieving the defined Curriculum 2.0 competencies (see Supplemental Digital Appendix 1 at http://links.lww.com/ACADMED/A549). The course directors (the QI experts mentioned above) serve as "QI coaches" to the students and lend expertise to the faculty sponsors as needed. Students attend four separate 1-hour face-to-face meetings with the course directors over the duration of the three blocks and must complete a QI project by the end of the blocks. Students are expected to set aside 4 hours per week for their QI projects, didactic modules, readings, and weekly assignments for a total of 48 hours dedicated to learning about QI (see Figure 1 for a timeline of the course). Students may work in pairs or individually on their QI project. While students must demonstrate the ability to develop and implement a QI project with two Plan–Do–Study–Act (PDSA) cycles, using a systematic approach that employs the principles of improvement science, they are not required to meet their aim statement to pass the course.

QI block descriptions

The first QI block (QI 1) provides the foundational knowledge necessary to

bridge the quality rift by having students complete a microanalysis of an identified clinical problem. The QI 1 goals are to (1) understand the need for QI in health care to be conducted in a thoughtful and organized framework, (2) recognize the IHI Model for Improvement (http://www.ihi.org/resources/Pages/HowtoImprove/default.aspx) as a means to systematically enact change, and (3) understand different QI tools (e.g., fishbone diagram, 5 whys, flow diagram, stakeholder analysis). The whole month of QI 1 is dedicated to thoroughly understanding the identified clinical problem via understanding the current state of the system in which the QI project will be aimed and developing measures for assessing improvement. Weekly assignments include the successful completion of IHI Open School modules QI 101–103, the identification of a clinical problem and faculty sponsor, the use of two QI tools to understand the problem, a literature review of the problem, a measurement plan for baseline data collection, preliminary data collection, a preliminary aim statement, participation in discussion boards, and a knowledge assessment.

In the second QI block (QI 2), students collect baseline data and learn how to implement change by initiating their first intervention. Key goals for QI 2 include (1) understanding the importance of collecting baseline data prior to initiating change, (2) understanding the cultural barriers to enacting change, (3) strategizing ways to motivate health care providers to enact change, and (4) appreciating the advantages of using small-scale PDSA cycles for QI projects. During this block, students create and complete their first intervention (PDSA cycle). While they are creating this intervention, they submit one section of the IHI PDSA Worksheet for testing changes (http://www.ihi.org/resources/Pages/Tools/PlanDoStudyActWorksheet.aspx) each week for feedback from the course directors. This feedback affords students the time for thoughtful reflection on each step of their intervention. Other assignments include completing IHI Open School modules QI 104 and 105, baseline data collection with a final aim statement, and a knowledge assessment.

The goals for the third QI block (QI 3) are to (1) continue collecting data and
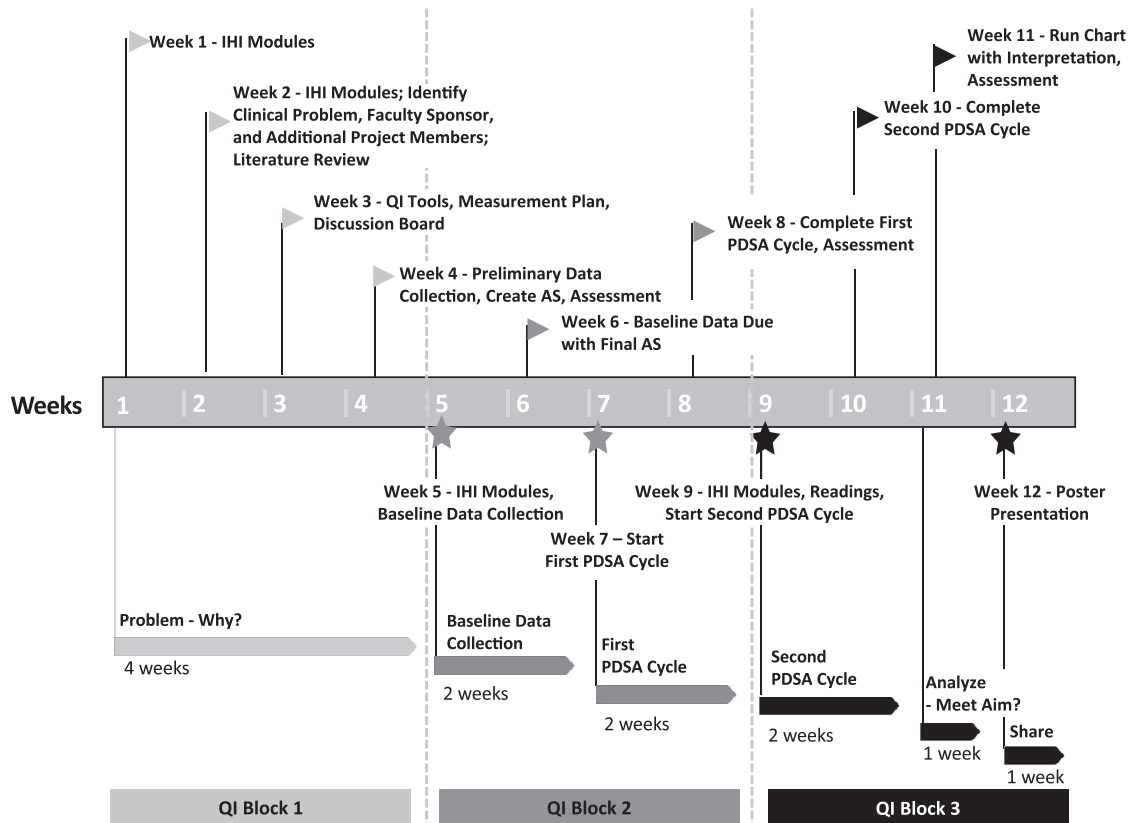
Figure 1 Schematic showing the timeline and project milestones of the quality improvement (QI) course, implemented in January 2015, at Vanderbilt University School of Medicine. The QI course consists of three 1-month-long blocks (4 hours per week) that students must take during their third or fourth year to graduate. The triangles indicate block assignments, and the stars indicate block "stop-the-line" milestone checkpoints; by "stopping the line," students can ask for assistance, if needed, before progressing to the next step in their QI project. Abbreviations: IHI indicates Institute for Healthcare Improvement; AS, aim statement; PDSA, Plan–Do–Study–Act.

assessing the effects of the tested changes; (2) summarize the findings and reflect on ways to implement, sustain, and spread the tested changes; (3) understand the life cycle of a QI project and the factors to consider when spreading change to other clinical settings; (4) recognize the need for repeated PDSA cycles to fully implement a QI project and review approaches for broadening the scale and scope of test cycles; and (5) understand the methods and value of run charts to enhance understanding of whether the tested changes are leading to improvement. Students' assignments for QI 3 include completing the IHI Open School module QI 201, assigned readings, a second PDSA cycle, a run chart with interpretation, and a knowledge assessment. Students present their project in the form of a poster on the last day of class (for an example, see Supplemental Digital Appendix 2 at http://links.lww.com/ACADMED/A550).

Clinical faculty sponsors

Faculty sponsors play a pivotal role in the QI blocks, allowing students access

to their clinical patient care area for their QI project. While most students solicit the support of a faculty sponsor based on their previous work in that faculty member's research lab or clinical area, other students require the assistance of the QI course directors to identify a faculty sponsor. Faculty sponsors do not receive any salary supplement for their time, but some faculty members have used the QI projects to satisfy maintenance of certification requirements. While the faculty sponsors are provided with an overview of the course requirements and expectations, experience in QI is not required. The faculty sponsor must approve the problem analysis (i.e., the literature review, findings from the QI tools used, and measurement plan), aim statement, and interventions. Housestaff may not serve as the primary faculty sponsor for the QI project, but they often do serve as additional QI project team members. Students identify additional project members as they work through the assignments in QI 1.

Evaluations

We assess students according to how well they assimilate the elements covered in the didactic portions of the course into their QI projects (Kirkpatrick Level 3–Behavior), and we invite students to complete a course evaluation after each completed block (thus, some students have completed multiple evaluations). In December 2016, we also began surveying the faculty sponsors, using REDCap (Vanderbilt University, Nashville, Tennessee), about their experiences with sponsoring medical students and the impact the QI projects have had in their clinical area.[10]

Outcomes

Between January 2015 and January 2017, 180 students have enrolled in at least one of the QI blocks and 132 have completed all three blocks. The majority of these 132 students completed their QI project without a student partner (88; 67%), while a third worked with a partner (44; 33%). Overall, students

demonstrated a preference for completing the blocks over three consecutive months (93; 70%). Most students completed a novel QI project that they initiated (117; 89%), while a small number of students continued a prior student's QI project (15; 11%; Table 1).

There have been 110 QI projects completed, most commonly in the student-run primary care clinic (25; 23%) or adult medicine (24; 22%). The majority of projects focused on process improvement (52/141; 37%) and PS (36/141; 26%; see Table 1 for an explanation of the denominator for this characteristic and examples). Forty-two (38%) projects met their aim statement. Of the projects that met their aim statement, most were done by students who completed the three blocks consecutively (30; 71%) instead of dispersing them over their third and fourth years (12; 29%). Among the 44 students who partnered with another student, 22 QI projects were completed; of these, 14 (64%) met their aim statement.

There have been 310 course evaluations sent to students; of these, 273 (88%) have been completed. One hundred ninety-one (70%) students indicated that they were very satisfied or satisfied with the clinical relevance of the blocks. Overall, students rated their satisfaction with the learning experience as very satisfied or satisfied (183; 67%). The vast majority of students reported that the courses were "about right" (260; 95%) versus "too challenging" (9; 3%) or "not challenging enough" (3; 1% [1 response was missing]). A few example comments from students' evaluations are (1) "Quality improvement in my mind is an essential component of medical education. The IHI modules are some [of] the best online modules that we have been required to complete…"; (2) "Great skills to learn and appreciate the process of QI. It's also nice to work with a faculty mentor on this aspect of health care"; and (3) "I am very grateful for the opportunity to learn about the QI process and develop a project under guidance from QI experts." Of interest, 192 (70%) students stated that they strongly agreed or agreed that the blocks contributed to their development as physicians, and 168 (62%) reported that the blocks motivated them to continue to learn more about QI.

Table 1

Characteristics of the Students Who Completed All Three Quality Improvement (QI) Blocks and of the QI Projects They Completed, QI Course, Vanderbilt University School of Medicine, January 2015–January 2017

Characteristics	No. (%)
Students (n = 132)	
Worked with a partner	
Yes	44 (33)
No	88 (67)
Blocks taken over	
Three consecutive months	93 (70)
The student's third and fourth years	39 (30)
Continuation of another student's QI project	
Yes	15 (11)
No	117 (89)
Changed projects during the course	
Yes	11 (8)
No	121 (92)
Received an incomplete grade	
Yes	16 (12)
No	116 (88)
QI projects (n = 110)	
Specialty area	
Student-run clinic	25 (23)
Adult medicine	24 (22)
Children's hospital	14 (13)
Emergency medicine	11 (10)
Orthopedics	8 (7)
Cancer	8 (7)
Otolaryngology	4 (4)
Women's health	2 (2)
Other	14 (13)
Population	
Pediatrics	21 (19)
Adults	86 (78)
Both	3 (3)
Focus area[a]	
Process improvement[b]	52 (37)
Patient safety[c]	36 (26)
Education	20 (14)
Cost/resource utilization	15 (10)
Patient satisfaction	13 (9)
Employee safety	5 (4)
Aim statement met	
Yes	42 (38)
No, but improvement was made	34 (31)
No	34 (31)

[a]Because more than one focus area per project could be indicated, the total number for this characteristic is 141 instead of 110.
[b]For example, appointment show rates, radiology and laboratory orders, and capturing Healthcare Effectiveness Data and Information Set measures.
[c]For example, vaccinations, proper hand hygiene, adherence to evidence-based protocols, and medication-related errors.
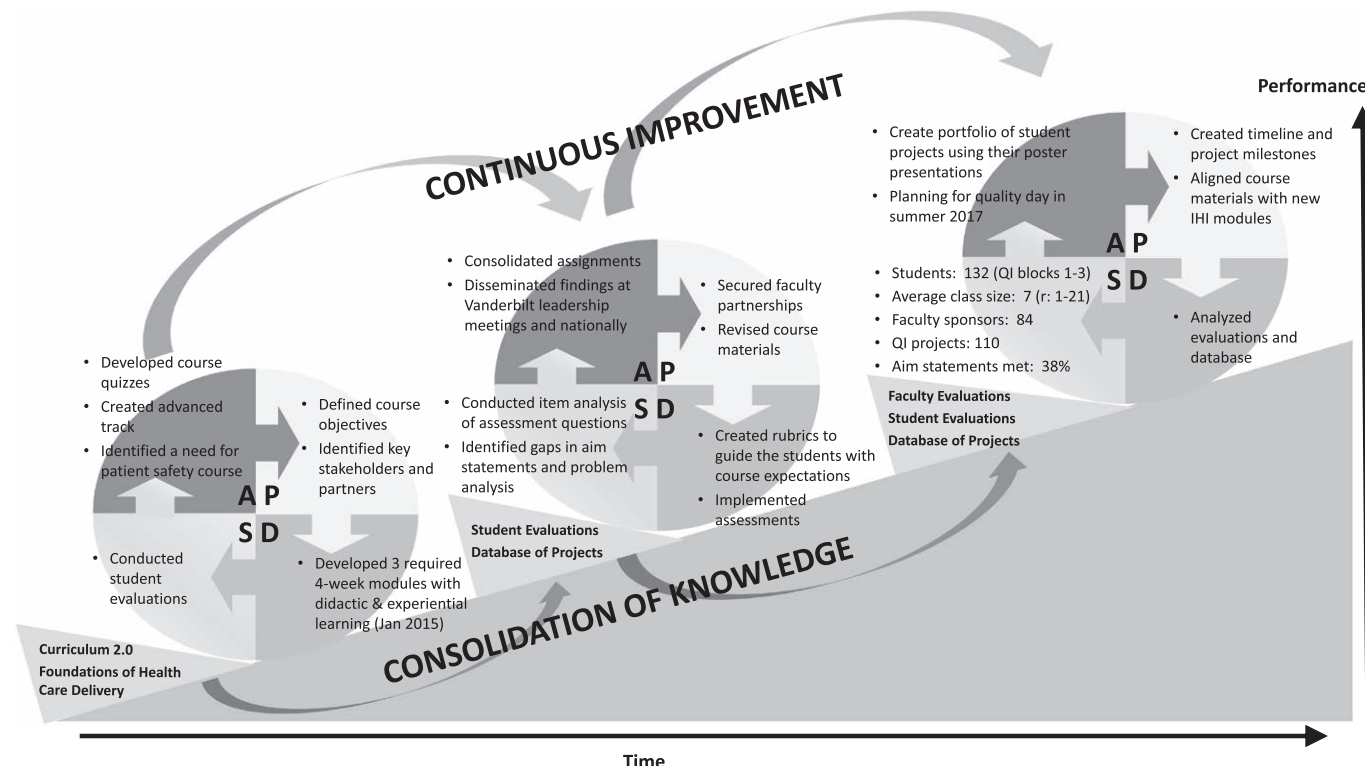
Figure 2 Schematic showing the quality improvement (QI) tools and methods used to improve the QI course, implemented in January 2015, at Vanderbilt University School of Medicine. Abbreviations: P indicates plan; D, do; S, study; A, act; IHI, Institute for Healthcare Improvement; r, range.

Eighty-four faculty members have sponsored QI projects in their clinical practice areas since the course was implemented. Since December 2016, 46 faculty sponsors have received a survey and 28 (61%) have completed a survey. Of these, 13 (48%) faculty sponsors described their comfort level with QI as confident or very comfortable (1 faculty sponsor did not respond to the comfort question). Slightly more than half (7; 54%) of these 13 faculty sponsors reported that they had higher levels of involvement with their students, as defined by meeting with them at least twice a month and reviewing assignments prior to submission. Most of the 14 faculty sponsors who felt only somewhat comfortable with QI also reported minimal involvement with their student (9; 75% [2 responses were missing]). Of the 28 faculty sponsors who responded to the survey, only 7 (25%) of their students met their aim statements. Of the 7 students who met the aim of their QI project, only 1 (14%) had a very involved faculty sponsor who was also very comfortable with QI principles. Eleven faculty sponsors rated the impact of the QI project in their clinical area as substantial (2; 18%), medium (6; 55%), or minimal (3; 27%).

Next Steps

We aimed to use experiential learning to teach our medical students about the QI component of health care delivery through the development of a three-block QI course. Since implementing the QI blocks, students and faculty sponsors have disseminated their QI findings through multiple scholarly presentations and articles. Most importantly, however, medical students have been able to identify clinical problems and apply learned knowledge to impact clinical practices across the medical center.

Through our collaborative partnership between the Vanderbilt University School of Medicine leadership and faculty and the Vanderbilt University Medical Center's quality, safety, and risk prevention department, we have also applied some of the QI tools and methods that the QI course taught to the evaluation of the course by reviewing aggregate data and trends, conducting multiple PDSA cycles, and consolidating the knowledge acquired with each class to promote student learning and a culture of safety and to maximize the resources that lead to meaningful outcomes (e.g., helping to identify meaningful QI project areas within the medical center and providing

just-in-time education to faculty sponsors with limited QI knowledge; Figure 2). In doing so, several opportunities to improve the course have been identified from faculty sponsors' and students' evaluations and from block directors' observations, including (1) revising the face-to-face meetings to provide additional feedback on project development, (2) providing flexibility for longitudinal assignment due dates, (3) optimizing delivery of just-in-time information to faculty sponsors, (4) aligning students' QI projects with the medical center's strategic initiatives, and (5) disseminating students' QI projects across the medical center to share lessons learned and recruit additional faculty sponsors. Future PDSA cycles will aim to measure and assess the sustainability of the course by tracking clinical outcomes related to the projects and students' ongoing involvement in QI after graduation.

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