Quality Improvement (QI) in medicine has seen increasing emphasis since the Institute of Medicine’s seminal “To Err is Human,” which demonstrated the astounding scope of avoidable harm in the United States (US) healthcare system. Moreover, with incentives for quality improvement embedded in the Affordable Care Act, systems-based improvements via QI methods are poised to take a prominent role in the future of US healthcare. Healthcare QI, in contrast to hypothesis-driven basic research, is concerned with improving or assessing healthcare processes, programs, or systems as judged by accepted standards. The type of systems-based training inherent to successful implementation of QI projects has started to gain traction in US medical schools, and it has been shown that QI curricula can improve knowledge, attitudes, and participation in QI activities. Importantly for medical students, it has been shown that progression of QI knowledge is not tied to a learner’s progression through medical school, residency and beyond. In other words, the opportunity exists for medical students to make meaningful contributions to QI even though they are still developing the skills to contribute clinically to patient care.

QI is an appealing arena for medical students because they can contribute to efforts to prevent patient harm. Furthermore, students develop skills required by the Accreditation Council for Graduate Medical Education (ACGME) as part of the Clinical Learning Environment Review (CLER) that requires resident physicians to develop projects in one of six focus areas including patient safety and health care quality. These skills can also be applied for the benefit of patients throughout one’s career. While QI projects may be accessible to medical students, undertaking such a project as a student provides unique challenges and barriers. Discussion below of a QI project at an academic medical center illustrates the challenges of medical student-lead QI and informs suggested strategies to address these challenges.

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**Demonstrative QI Project**

This QI project sought to assess the presence, nature, and scope of post-discharge problems for elderly patients, and implement an intervention of post-discharge follow-up calls
using the QI “Model for Improvement” methodology of Plan-Do-Study-Act (PDSA) cycles. Essentially, each PDSA cycle involves planning and implementing an intervention (which may be very small), evaluating the results, and then using these results to inform the next PDSA cycle or to potentially implement a permanent change. The goal was to improve patient transitions following hospital discharge with the aims of reducing 30-day readmission rates and improving patient satisfaction.

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Follow-up calls were conducted on English-speaking patients discharged to home from the Acute Care of the Elderly (ACE) service, ideally within 24 to 72 hours of discharge. Calls assessed four areas: (1) new or worsening symptoms, (2) problems with medications, (3) problems with homecare or durable medical equipment, and (4) primary care follow-up appointment scheduling. During the first PDSA cycle, a single physician performed post-discharge follow-up calls assessing the four areas above. For the second PDSA cycle, multiple physicians on a single hospital floor performed follow-up calls using a standardized data collection form developed based on the findings of PDSA 1. The third PDSA cycle explored performance of calls by non-physician personnel and incorporating follow-up calls into the standard work of the unit.

**PDSA Cycle 1**

PDSA cycle 1, conducted by a single physician champion over five months, sought to generally assess symptoms, medications, follow-up appointments, and homecare without a formal interview script or data collection form. This PDSA cycle aimed to inform question format and content, to assess the types of patient concerns raised, and to evaluate what types of providers could address the patients’ issues. Data on the categories of the problems encountered post-discharge were collected from 23 patients. Average call duration was approximately five minutes. Symptom problems, which required physician expertise to resolve, were the most common with 30% of patients reporting them. Medication problems, potentially addressed by a pharmacist, represented 17% of problems. Homecare and follow-up appointment problems comprised 13% each (26% total) and could generally be addressed by case management. 57% of patients contacted had one or more problems. Overall, approximately 70% of the calls could be addressed by non-physician staff (i.e., 30% of the calls resulted in issues that needed physician level expertise). The physician anecdotally reported the calls to be a positive experience personally as well as for patients based on her assessment of their responses.

**PDSA Cycle 2**

In PDSA cycle 2, follow-up calls were conducted by multiple physicians on the ACE service over the course of two weeks. Based on the results of PDSA 1, key project metrics (detailed in Table 1) were used to develop an interview and data collection form. Thirty-day re-admission rates were excluded from this list as this PDSA cycle was not powered to detect a significant impact.

This cycle sought to achieve uniformity of data collection using a standardized format, to assess the feasibility of performing calls on an increased scale, and to validate the assessment of post-discharge problems using a diverse group of providers. Of 22 patients reached,
medication problems were most common at 27%, with fewer symptom problems (9%) than PDSA 1. There was a similar incidence of homecare and follow-up appointment problems at 14% each. Overall, 41% of patients reported a problem in one or more areas. Similar to PDSA 1, approximately 70% of the calls could have been completed by a non-physician provider. PDSA cycle 2 also included an explicit patient satisfaction query, which found that 73% of patients reached were very or extremely satisfied with the discharge process. Calls took longer than PDSA 1 with an average of 12 minutes per call. Importantly, the finding that only about 30% of the calls required physician expertise, coupled with questions of sustainability of physician-based calls, lead to exploration of using non-physician providers as a cost effective initial screen for follow-up calls in the subsequent PDSA.

**PDSA Cycle 3**

The initial objective of PDSA 3 was to pilot the use of patient-resident liaisons (PRLs, non-nursing hospital staff who are responsible for scheduling follow-up appointments and obtaining medical records for patients during hospitalization) for follow-up calls as a potential solution to the likely barriers of assigning follow-up calls to physicians for all discharges. A PRL-specific questionnaire form with a call script was developed in consultation with the PRL team. The plan was to have PRLs conduct calls while having the on-service physician consult on medical triage issues if necessary. Although several PRLs were enthusiastic about adding follow-up calls to their scope of activities, questions of liability exposure and PRL staff availability raised by the PRL manager necessitated exploring a different option.

With similar goals, the hospital conducted a follow-up call pilot with unit nurses conducting calls in addition to their usual patient care responsibilities. Calls were attempted between 24 to 72 hours after discharge for all patients discharged from both the ACE unit and a neurology unit. Data collection was integrated
with the electronic medical record system (EMR). In 43 patients reached, the pilot found medication problems (19%), follow-up appointment problems (16%) and homecare/DME issues (16%) at similar rates as PDSA 1 and 2. Interestingly, the nursing follow-up calls pilot did not identify symptom problems. This is likely due to a difference in script – the script from PDSA 2 asked directly about concerning symptoms whereas the nursing follow-up calls only asked to rate symptoms since discharge. Given the high rate of “triage questions” noted by the nurses, it is likely that symptom issues could have been reported if allowed by the data collection form. This finding illustrates the importance of data collection process design in the outcome of the study. Calls took an average of 15 minutes, which was longer than observed during PDSA 1 or 2. Nurses reported stress due to the need to triage patient’s medical questions, and found the calls to be time consuming when added onto their patient care responsibilities. Nonetheless, patients appreciated receiving the calls and were found qualitatively to have numerous questions regarding medications. Overall, it was felt that the nursing staff did not have the staffing or sufficient triage training to conduct the calls long-term which resulted in the termination of this pilot.

Project Outcome Summary

A major success of this project was the ability to collect meaningful data with a relatively small team that did not require dedicated funding from internal or external sources. This was made possible largely by the support of the resident and attending physicians on the clinical team. The unique role of the medical student as learner embedded within clinical teams and relationships with faculty and staff within a clinical microsystem can be leveraged to reduce barriers to buy-in for early small scale pilot investigations such as this. Limitations of this technique to expand from early findings were illustrated by the third PDSA cycle, where it was planned to transition the delivery of the calls using non-physician providers. At this stage the critical importance of administrative leadership buy-in and demonstration of ROI to the hospital was highlighted in moving to increase project scope and change project scale. Although multiple approaches were explored, concerns by hospital administrators regarding liability and scope of practice prevented the use of PRLs from making the calls. A trial of post-discharge follow-up calls conducted by hospital nurses encountered similar concerns. This provided an illustrative example of the concept that quality improvement is dependent on the local milieu. A strategy which works well for one institution may encounter barriers in another due to variation in institutional receptiveness, risk tolerance, and culture. It demonstrated an important learning point for medical student led QI on the challenges inherent in transitioning from small scale pilot to sustainable maintenance of a QI intervention. Overall, this project provided excellent learning in QI methods such as the PDSA cycle, the challenges of changing the scale and scope of a project, and the importance of considering the organizational framework within which you are trying to impart a change.

Strategies and Tips for Success

From the experience on this project and institutional experience at the University of Colorado encouraging and promoting medical student involvement in QI project work, a practical set of 10 strategies for student-led QI were developed. These strategies can be roughly grouped into project initiation/organizational navigation, project sustainability, and optimization of QI training, as described below.

Project Initiation/Organizational Navigation

Starting a QI project requires navigation of an
organizational framework in which medical students typically lack formal authority or organizational influence. Our first four tips relate to project initiation and propagation within a hospital organization.

1. **Find an ally.** A physician champion or mentor for your project is essential. In our project, we had formal mentorship through a student QI program, but were also fortunate to have enthusiastic physician champions. Having this support enabled implementation of initial PDSA cycles and navigated unit-level hurdles that would have been otherwise prohibitive.

2. **Engage the frontline.** Ultimately, a QI project seeks to improve patient care by making change. Before getting started, think about the staff involved in testing your proposed change and additional personnel that might be involved as you increase scale or change scope. During our project, we engaged front-line PRLs in the follow-up call intervention concept. This generated enthusiasm for the project with the PRLs, and their collaboration helped refine our follow-up call script and data collection form. Importantly, lack of buy-in from those who need to help you implement your change (such as the PRLs) can undermine your project just as quickly as a “no” from a decision maker. Collaborate with your team to develop your intervention: once again, this will improve your project and establish buy-in.

3. **Know the organization chart.** Within every healthcare organization, there are people who can make or break your project. In addition to frontline staff, these include decision makers in positions of management. Even in the pilot stages of a project, decision makers hold the key to whether a proposed change is tested or enacted. Engage them early. Solicit ideas on how best to proceed with your project: this will not only increase your chances of success, it will develop buy-in where it matters most. For our project, although the PRLs themselves were enthusiastic about making the calls, the PRL management later raised barriers which precluded PRL involvement in the intervention. This deficit created delay and obstacles in our implementation farther down the path. Anticipating future high-influence but low engagement stakeholders at the outset and throughout project expansion can allow efforts to involve them earlier in the QI project to avoid this pitfall.

4. **Set goals and track milestones.** A great idea will stay an idea unless it has a well-organized plan of action behind it. Start by setting clear goals. Develop timelines and milestones for these goals, measure progress, and re-adjust. Not only are you learning project management, you’re setting your project up for success. For our follow-up calls project, we used a simple spreadsheet to track progress towards milestones. More complicated projects can benefit from the multitude of sophisticated project management software tools.

**Project Sustainability**

A formidable challenge for any QI project, and especially for medical student-driven projects, is finding ways to make change sustainable. These strategies offer ways to make lasting improvements.
1. **Determine the return-on-investment (ROI) for your project.** Hospitals need to generate revenue to provide care and pay staff. Any change to existing systems involves some cost, which may be minimal or conversely could be prohibitive. In order to be sustainable, costs associated with improving quality must have a tangible benefit and ROI. In our follow-up calls project, the extra staff needed to complete follow-up calls needed to be balanced against demonstrated improved re-admission rates and patient satisfaction scores to obtain administrative buy-in to dedicate staff time to the project long term.

2. **Don’t fight gravity.** When completing your PDSAs to test your intervention, pay close attention to the perceptions of team members implementing the change. Is the intervention seen as extra work without reward? Or does it enhance job satisfaction? A change that is seen as chore must overcome formidable resistance. For our project, follow-up calls had a positive perception of increasing job satisfaction through helping patients. This positive perception, however, was weighed against the increased stress of the time required to complete the calls on top of existing tasks. Making the calls sustainable may require additional staff to absorb the new workload or reduction of some other responsibility to maintain morale.

3. **Embrace setbacks.** QI in healthcare involves changing systems that are often complicated, ingrained, and full of inertia. Accept that it is common for your first (even second or third) attempt to produce unexpected or unwanted results. This is an essential part of the process and of using PDSA cycles. For your next PDSA cycle, be curious about why your previous approach didn’t work and try something different. Remember that in QI, small, frequent and rapid tests of change are the way to go. In our follow-up calls project, we found during our third PDSA that it was not feasible to perform the calls using PRLs. That and a subsequent trial using floor nurses informed an important lesson: our change would need additional staff, or compensatory change to other responsibilities, and specific training in order to be completed by non-physicians. This was actually a key finding of our project. Barriers are an opportunity to engage in inquisitive inquiry and, through this, gain new understanding.

4. **Find a successor.** It is the nature of medical school to be constantly moving from one phase to the next, from one rotation to the next, and eventually to graduate and potentially change institutions. If you are the sole driver of a change, that change will die on the vine when you leave. Find someone to take on your cause, and give yourself a chance of making a lasting change. Ideally, your successor is a person or team that is already imbedded in the clinical microsystem with the ability to continue to implement the changes that you started.

### Optimize Your QI Training

Clearly, medical students are trainees and QI training is becoming another aspect of preparing the physicians of tomorrow. Just like with your clinical and basic-science training, there are
ways to get the most education out of your QI experiences.

1. Present your work. It is likely the project you’ve undertaken has applicability at other institutions. Find opportunities to share your work through conference presentations, posters, or even peer-reviewed articles. This begins to establish your expertise in QI and expand the benefit of your efforts. For our follow-up calls project, we presented a poster at institutional and regional conferences, had an article in the hospital newsletter, and submitted a project summary to the Society of Hospital Medicine’s QI database (SQUINT). In large part, this publicity engendered a hospital-sponsored pilot to tackle the issues this project identified in the needs analysis.

2. Get certified. Beyond publication of your work, there are QI certifications that you can obtain as a medical student. The Institute for Healthcare Improvement (IHI) offers a web-based basic certificate, as well as a QI practicum certificate. You can earn the practicum certificate by submitting documentation of your project through their QI 201 online course, with the help of a physician QI mentor. These certifications are an excellent way to objectively demonstrate your QI expertise.

Conclusions

There is no doubt that the systems in which we deliver healthcare have a profound impact on its outcomes. Through QI education, we can develop tools to ensure that these systems are working for us rather than against us. What’s more, numerous institutions are establishing QI curricula and developing pathways for medical students to participate meaningfully in the improvement of our healthcare systems. QI skills, best gained experientially, are rapidly becoming a prerequisite for the modern physician. We hope that these strategies described above will empower medical students at all stages of training to undertake their own successful QI projects, and to make this first step in their careers towards gaining control of our healthcare systems.

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