DOI: 10.1111/tct.13473

INNOVATION, IMPLEMENTATION, IMPROVEMENT

THE CLINICAL TEACHER ASME

Win-win: Summer QI programme for medical students

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Abstract

Background: Most undergraduate medical students (UMS) do not receive any formal exposure to quality improvement (QI) efforts in healthcare during the entirety of their undergraduate programme. This is despite the rising interest amongst UMS and the unique potential that UMS hold as an innovator unencumbered by previous biases. To explore this, we implemented an undergraduate training programme that provides experiential QI education.

Approach: The 15-week Summer Healthcare Improvement Programme (SHIP) was established in 2017, supported by a regional physician QI leadership coalition, a QI consultant preceptor who is linked to both the local university and health organisation and an UMS leadership group. Students were assigned QI projects that were aligned with the health organisation's purpose and scope. Students co-led the project to completion with mentorship from both physician QI leaders, and residents. Student competencies were formatively assessed by completing QI activities and a programme survey.

Results: From 2017 to 2019, 19 students completed 22 QI projects, academic posters and publications, and all received QI certification. The majority (72%) of students felt involvement in SHIP increased their QI knowledge and skills, 90% believed SHIP would benefit their peers, and 71% of students felt it directly applied to their future careers.

Discussion: Benefits of the programme were threefold: provided students with early experiential QI exposure, provided student QI leaders who possess dedicated time and effort to complete projects over the summer months and provided a physician QI learning continuum implemented with minimal to no additional cost to either the university or health organisation.

1 | BACKGROUND

More undergraduate medical students (UMS) are expressing the need for quality improvement (QI) as an integral component for their careers as physicians and healthcare leaders[1]; however, the UMS's knowledge and confidence in QI continue to lag behind.[2] UMS are strongly positioned to improve the quality and care processes as they experience multiple sites and specialties and can more readily focus on projects unburdened by clinical responsibilities that come later in their training. That is, they can act as a knowledgeable outsider who can provide innovative solutions and identify outdated practices.[3–5]

Recent studies suggest that integration of the QI curriculum into the school curriculum with combined didactic and experiential teaching produces a successful result.[6,7] However, studies have also identified several challenges. For instance, the curricular time is limited, and many schools lack the sufficient faculty with QI expertise; thus, schools are seeking strategies to increase this teaching capacity.[8,9]

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Therefore, we aimed to establish an effective and efficient UMS QI education by providing first-hand exposure to QI interventions, with ultimate goal of improving patient safety, quality and efficiency at the clinical frontline.

2 | APPROACH

We developed a 15-week extracurricular Summer Healthcare Improvement Programme (SHIP) designed to support the application of improvement science and develop medical learner QI capability. The goal of the SHIP was to (i) provide basic QI literacy, (ii) offer mentorship by a QI consultant and physician leader, (iii) increase the number of co-learners (faculty physicians, residents, fellows and UMS) trained in QI, (iv) provide hands-on experience of leadership and (v) demonstrate how system-level changes lead to improved patient outcomes within various clinical settings. That is, at the completion of this programme, participating students would be better equipped to navigate future QI projects and bring positive changes to clinical environment.

The SHIP leveraged the strategic partnerships between academic institutions and health organisations. SHIP drew from the pre-existing infrastructure set up by a physician QI leadership coalition that formed in 2015. The coalition combined the two health system partners: the local medical school and the health zone and facilitated physician-led health organisation projects with an interdisciplinary clinical team supported by the coalition QI consultant. Importantly, this programme was able to occur during UMS's summer break and therefore did not conflict with other curricular requirements.

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Pre-programme activities occurred annually in March as physician leaders from the coalition and the QI consultant selected appropriate projects for UMS to complete during the SHIP. The second-year Medical Students Association (MSA) leaders conducted recruitment in April and matched prospective UMS to QI projects. More students applied than available spots, with capacity determined by available funding, providing $500–1500 per student. Selection was based on interest in QI and skill development rather than prior experience. The programme started mid-May under the instruction of the QI consultant and lasted until the last week of August. Once UMS completed initial QI training and clinical QI team meetings, they were allowed to work independently. This allowed the UMS to pursue other interests and electives if needed. Student SHIP participation was voluntary, and

organisation and/or research ethics approval was obtained as required by specific projects.

The curriculum for this programme was developed sequentially over the first 2 years (2017–2018) gathering informal feedback from students, physicians and QI interdisciplinary team members and based on internal knowledge of medical school curricular challenges. The programme followed four QI phases: (i) defining the opportunity, (ii) building the understanding, (iii) act to improve and (iv) share findings. The curriculum included six key activities: (i) Evidence-based Practice for Improving Quality (EPIQ) workshop,[10] (ii) Institute for Healthcare Improvement online modules (*optional*), (iii) weekly readings, (iv) organisational QI online modules, (v) leading QI project data collection, analysis and recommendations under supervision and (vi) completion of a QI poster and abstract.

Participating UMS were required to complete one Plan-Do-Study-Act (PDSA) improvement cycle and present a QI poster at the annual university QI event. UMS were also encouraged to present at appropriate national and international conferences along with developing a manuscript for publication. Generally, one UMS was assigned per project. Each training phase had defined learning activities to guide the development of an intervention that could be tested. Mandatory check-in meetings between the consultant and the UMS were completed to ensure progress and provide guidance (Figure 1).

The QI project team structure utilised a hub-and-spoke design, where the QI consultant mentored the faculty physicians, residents, UMS, operational leaders and the clinical frontline interdisciplinary teams. These QI projects (Table 1) represented diverse clinical settings and specialties.

We employed Kirkpatrick's four-level model[11] to guide the evaluation of the SHIP (Table 2). UMS's experiences were assessed through administering questionnaires to the 2018 SHIP cohort before beginning training (T1), after receiving EPIQ training (T2) and at the end of the programme (T3). Each assessment consisted of a series of 5-point Likert scales asking UMS to rate their knowledge, appreciation for QI and, for T2/T3 surveys, their experience. For the 2019 SHIP cohort, T1 data collection was missed due to administrative errors. Additionally, each year, the MSA collected and anonymised qualitative feedback. To assess UMS's learning, the consultant reviewed completed tasks/activities and the self-assessed comfort with QI tools. Additionally, results were evaluated through assessing whether project aims were achieved and to allow further programme improvements.

3 | EVALUATION

3.1 | QI projects and impacts

Since the programme launch (May 2017 to August 2019), 19 UMS have completed the SHIP. For most projects (15/19), the aim statements were met; and where it was not, improvements were made. Eight projects were shared at national/international conferences or produced manuscripts. All UMS received certification in QI training from both EPIQ and health organisation. The QI consultant was nominated by UMS and received a teaching award for her role in the SHIP from the faculty.

3.2 | Student feedback

UMS's voluntary survey responses to the SHIP have been favourable, and the 90% (9/10) felt their peers would benefit from this programme.

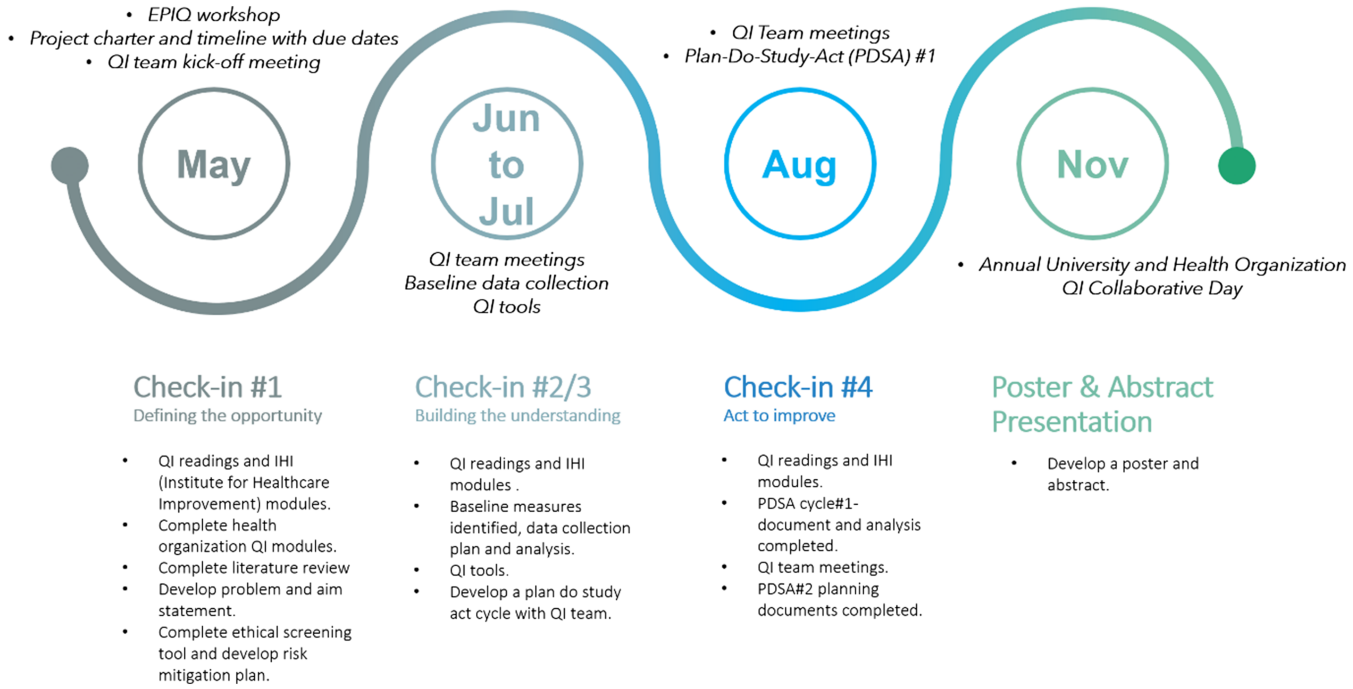

FIGURE 1 Curriculum overview

TABLE 1 Examples of QI projects per academic year involving undergraduate medical student

Academic year	Title of project	Project overview
2016–2017	Implementation of a Clinical Decision Laboratory Ordering Algorithm for Preeclampsia: A Quality Improvement Initiative	The volume and quality of laboratory investigations in the context of suspected pre-eclampsia patients were examined prior to and after implementing two newly developed interventions: (1) a standardised lab test ordering algorithm that removed inappropriate laboratory tests reducing ordering and costs and (2) targeted educational session provided to health care providers. Baseline data indicated that most healthcare providers ordered broad panels of investigations, inconsistently re-evaluated frequency, and laboratory costs were unknown. Approximately 10,462 blood tests were ordered ($69,350) (January to April 2017). Post-intervention data (September 2017 to April 2018) revealed a 39% reduction in blood test cost ($6851/month), particularly those of lower clinical utility. Essential laboratory test ordering, such as creatinine, did not change in volume post-intervention[13]
2017–2018	A Multifaceted Quality Improvement Initiative to Reduce Unnecessary Laboratory Testing on Internal Medicine	The volume of routine daily 'core' labs (CBC, electrolytes, creatinine and urea) were compared before and after a quality improvement study consisting of education and unit-based process change interventions were implemented on one general internal medicine unit. The initiative led to an 18.9% decrease in the total number of core labs ordered and an 18.2% absolute decrease in repeating daily lab orders. A multifaceted QI intervention aimed at reducing unnecessary lab testing was beneficial at reducing the number of lab tests ordered and changing physician lab ordering behaviour[14]
2018–2019	Patient-centered approaches to targeting incomplete bowel preparations for inpatient colonoscopies	To improve the success rate of bowel preparation prior to colonoscopy procedure, nursing tip sheet for troubleshooting symptoms, a standardised order label (split prep dose) and a patient educational placemat were implemented. Prior to the intervention, 44% (44/99) of inpatient colonoscopies had poor bowel prep, resulting in 10 repeat procedures (10%). Post-intervention, 60% (28/47) of the colonoscopies used the standardised label, 66% of physician orders used 2-L split prep, and 80% of patients were provided with the educational placemat. Of the 47 colonoscopies audited post-intervention, there was a significant decrease in poor prep (27.7% [13/47], $P = 0.038$) for colonoscopies. The percentage of repeated colonoscopies decreased to 4% (2/47)[15]

Notes: This table shows overviews of three studies (out of 18, from 2016 to 2019 period) completed and published under SHIP. UMS contribution in projects were similar in nature and consisted of a brief literature review, assistance with QI tools, documentation related to change cycles, data collection (survey, chart audit) and analysis, intervention development, project poster, abstract and manuscript development. For a full list of QI projects involving undergraduate students, please refer to Table S1.

TABLE 2 SHIP evaluation

Kirkpatrick's Model Level	Broad course objective(s)	Data collection method/instruments	Timing
1	**Reaction**: - Students' anecdotal perception of both the didactic and experiential QI learning activities - Specifically focusing on what they liked and/or disliked about the training	Student reflection	Monthly
		1:1 check-in meeting (informal interview)	Monthly
		Final preceptor and programme evaluation (completed by student using the programme questionnaire)	Final- Week 15
2	**Learning and confidence:** - Student can complete QI tools (cause and effect, process map, etc.) and documents (implementation plan, poster and abstract)	Preceptor observation and review of the QI activities/tasks	Monthly, after the completion of task(s)
3	**Application and implementation:** - Student can develop a current state summary report, synthesising all baseline findings - Student can lead one QI team meeting sharing the current process gaps and explaining QI methods used and provide recommendations for improvement interventions to the health organisation clinical quality council committee - Support the clinical QI team to launch and assess the first test of change cycle	Preceptor observation and review of the QI activities/tasks (current state summary report)	After the completion of meeting and test of change cycle 1 (Week 10 or 11)
		Informal feedback gathered from the QI team	
4	**Business impact:** - Project aim statement developed and approved by the health organisation project leader - Complete one test of change cycle with measurement and analysis -Draft test of change cycle 2 or provide recommendations for next steps	Preceptor observation and review of the QI activities/tasks (improvement cycle audit tool and statistical analysis)	After the completion of improvement cycle 1, Week 15

All UMS who responded (12) indicated there was a deficit in medical education regarding QI, 71% (10/14) thought experience gained would be applicable in future clinical practice, and 72% (8/11) felt they had a noticeable increase in skills and knowledge from the training received. Denominators vary based on response rates and stages of the surveys presented. The main challenges mentioned by students were acquiring timely access to local EMR systems and keeping up with the fast project pace.

The UMS qualitative responses were organised to three themes: (1) *Experiential QI provides foundational leadership experience*; 'I appreciated how [physician leader and QI consultant] involved me in all of the meetings with frontline staff, which has taught me a significant amount about leadership'. 'I like that my supervisor has allowed me to guide my own project'. (2) *Organised curricular approach and early onboarding is necessary for QI projects*; 'It would be great to have standardized templates for QI activities at the beginning of the project'. 'While it isn't practical to fit it all in within a summer, it may benefit students to become involved in the QI process from the beginning of the projects'. (3) *Students recognise the importance of QI*; 'I think QI research is what drives hospital procedures to become more effective for patient care'. 'I understand the impact of QI initiatives on staff & patient experience'.

4 | IMPLICATIONS

The strength of this programme has been the centralised QI consultant who coordinated multiple projects with clinical preceptors; this ensured a standardised approach to completing projects and ensured scholarly expectations were achieved. Because students worked with existing clinical and physician QI leaders, project activities and impact continued beyond the programme timeframe. However, this hub-and-spoke approach was also the main limitation of SHIP. Having a single QI consultant, who had other organisational responsibilities, as the central spoke made it difficult to mentor and complete numerous projects simultaneously during the short timeline of SHIP, we recommend aligning university and health organisation's quality department to a unified body as a way to overcome the capacity limitation of current set-up.

We acknowledge that the programme was implemented with a limited pool of UMS and the lack of a robust evaluation approach limited out ability to assess objective gain in QI knowledge. However, to enhance programme evaluation we plan to employ a pre- and post-Quality Improvement Knowledge Assessment Tool—Revised (QIKAT-R)[12] and student self-assessment, along with a questionnaire for residents, staff physicians and the QI team members. Using the UMS feedback gathered thus far, we standardised the student onboarding process to ensure a smoother approach and the UME secured funding for three students per year to be remunerated comparable with other summer research positions. The SHIP continues each summer, with a steady supply of UMS, and a plan to develop an objective evaluation of student learning and programme goals is underway.

5 | CONCLUSION

Establishing the extracurricular SHIP has illustrated a *win-for-all* within the health system (UMS, physicians, residents, university, health organisation and patients), the benefit of preclinical QI teaching and leadership development has served to bring multiple engaged experts and stakeholders together to address how to provide hands on QI knowledge and experience for medical students. The multi-medical learner approach has been beneficial for mentorship, establishing a physician QI culture, project completion and clinical outcomes.

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ACKNOWLEDGEMENTS

The authors wish to thank Dr Jennifer Croden and Jennifer Halasz for their assistance in coordinating students and gathering data. We would also like to thank all the physician QI project leaders: Dr Elaine Yacyshyn, Dr Marlene Dytoc, Dr John Elliott, Dr Stephanie Smith, Dr Linda Sun, Dr Frances Carr, Dr Anca Tapardel and Dr Winnie Sia.

CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

ETHICS STATEMENT

This study did not require full ethical approval based on article 2.5 of the Tri-council Policy Statement Ethical Conduct for Research involving humans (https://ethics.gc.ca/eng/tcps2-eptc2_2018_chapter2-chapitre2.html#5) as the purpose was for programme evaluation and improvement; however, organisational approval was obtained to share this educational approach. All the feedback gathered from participating students and researchers were obtained under their informed consent and under organisational approval.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

How to cite this article: Mathura P, Barber P, Han T, Hillier T, Kassam N. Win-win: Summer QI programme for medical students. Clin Teach. 2022;19(3):240–246. https://doi.org/10.1111/tct.13473