Experiences in Teaching and Learning

Teaching quality improvement concepts to pharmacy students using the Evidence-based Practice for Improving Quality (EPIQ) workshop

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ARTICLE INFO

ABSTRACT

Background and purpose: Despite the benefits of quality improvement (QI) training, there is a scarcity of information on QI teaching formats for undergraduate pharmacy education. The Evidence-based Practice for Improving Quality (EPIQ) workshop was evaluated as a teaching format for a group of multi-year undergraduate pharmacy students, assessing knowledge acquisition and learner reactions.

Educational activity and setting: Using a convergent mixed-method analysis, 10-item pre- and post-workshop multiple-choice questionnaires measured students' knowledge acquisition of foundational QI concepts. A six-item pre- and post-workshop survey and a voluntary post-workshop focus group evaluated students' attitudes towards QI training and the teaching format. Mann-Whitney *U* non-parametric test was used to analyze the quantitative data, while thematic analysis was applied to analyze the qualitative data.

Findings: Twenty-nine pharmacy students participated in the workshop. There was a statistically significant improvement in pharmacy students' QI knowledge before and after participating in the workshop (77% vs. 86%, *P* = .008). The evaluation of the EPIQ teaching format resulted in three important findings: (1) undergraduate pharmacy students identified a QI learning need; (2) the EPIQ workshop effectively provided foundational QI literacy for all pharmacy student years using a "learning by sharing" methodology and pharmacy-specific case studies; and (3) interested students may benefit from an experiential elective to apply QI techniques.

Summary: The perceived value of QI training for pharmacy students using the EPIQ workshop was demonstrated: students expressed an interest in lifelong learning and a desire to pursue QI projects at school, during a clinical rotation, or at work.

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Background and purpose

Health care delivery is constantly evolving, and the COVID-19 pandemic has highlighted the critical importance of designing agile and adaptive health care systems.[1] In response to the evolving health care environments, medical training programs (i.e. schools, residencies, and fellowships) prepare their learners by teaching quality improvement (QI) principles.[2–5] QI is any systematic process that seeks to improve patient safety, clinical effectiveness, and patient experience in health care.[6] Globally, many health organizations and university programs provide QI training to health care professionals and students[7–9] so that they can become well-versed in this applied science, which emphasizes innovation, rapid-cycle testing, and knowledge generation about which interventions produce sustainable and effective improvements in health care delivery.[10]

The pharmacy profession is also integrating QI training for its students. The Canadian Council for Accreditation of Pharmacy Programs has established an accreditation standard that mandates pharmacy schools design a curriculum that enables their first professional degree graduates to lead QI efforts within the health care system.[11] The Accreditation Council for Pharmacy Education Accreditation Stanards from the United States (US) also emphasize the "application of QI," including it as one of five competencies that all health care professionals should acquire during their training.[12]

Pharmacy students who are trained in QI concepts demonstrated an improved ability to identify errors, implement strategies to decrease errors in clinical settings, and reflect on the impact of these errors on patient health.[13] Moreover, QI training nurtures leadership and project management skills, while fostering a greater understanding of health system limitations.[14] Despite the benefits of QI training for pharmacy students, a 2017 cross-sectional study revealed inadequate coverage of QI concepts in US pharmacy school curricula.[15] Similarly, only a few pieces of literature describe QI training in pharmacy school curricula in Canada.[16]

In response to the acknowledged necessity of training future health care professionals in QI concepts, several teaching formats were developed, each with different durations and contents. These educational opportunities can vary from integrating QI-themed lectures into an existing course to creating an advanced experiential elective dedicated to learning QI concepts. As a result, QI learning offerings could last a few hours to several weeks.[16–17] One such educational offering is the Canadian Evidence-based Practice for Improving Quality (EPIQ) workshop hosted by the Office of Lifelong Learning of the University of Alberta.

Educational activity and setting

The EPIQ workshop offers QI training for individuals or health care teams using a simulation-based stepwise curriculum. The workshop follows a modular design and can be delivered over four to six hours to a small group, focusing on minimal didactic content delivery. The EPIQ workshop is informed by three frameworks: (1) the EPIQ Quality Improvement Cycle, which emphasizes the iterative nature of QI activities and the importance of information, collaboration, and implementation; (2) the EPIQ 10 Steps, a process map with the following steps (a) Identify the problem, (b) Select your team, (c) Brainstorm causes, (d) Choose a priority, (e) Map the process, (f) Identify indicators, (g) Explain your aim, (h) Engage partners, (i) Implement change, (j) Share knowledge); and (3) the plan-do-study-act cycle.[18–19] Each module of the EPIQ workshop employs social constructivist concepts, consisting of a brief, an activity, and a reflection. Social constructivism is a learning theory that suggests individuals learn through dialogues and interactions within a group, known as "learning by sharing."[20] The QI learning methodology from the EPIQ workshop has demonstrated generalizability across different learners, facilities, and health systems.[21–23]

To enhance relevance to pharmacy students, two Canadian EPIQ facilitators and a professor from the Faculty of Pharmacy at the University of Alberta developed three distinct clinical scenarios to practice their QI knowledge: medication errors, patient counseling, and prescribing errors. These scenarios were inspired by common cases encountered by pharmacists in practice that require process improvement for effective resolution. The students were assigned to one of the scenarios, with an equal distribution among the three groups.

Invitations to the workshop were extended outside the regular standard curriculum. With the assistance of the Alberta Pharmacy Student Association, an online registration form was created using Google Forms, version 1.9 (Alphabet, Inc.) and distributed to first- to fourth-year pharmacy students through the dedicated social media page of the student group. A total of 29 pharmacy students volunteered to participate in the workshop, which took place on 31 January 2020. The breakdown of pharmacy students by training year was as follows: seven first-, nine second-, 10 third-, and three fourth-year students. No pre-learning activity was required.

Method of assessment

The study aimed to achieve three objectives: (1) to introduce foundational QI concepts to a group of Canadian pharmacy students spanning first- to fourth-year; (2) to assess the effectiveness of a four-hour EPIQ workshop in imparting basic QI knowledge; and (3) to evaluate students' attitude towards QI training and the EPIQ workshop format before and after the training. The study was approved by the University of Alberta Human Research Ethics Board (Pro00096622).

To evaluate students' acquisition of foundational QI concepts, the participating students were requested to voluntarily complete a multiple-choice questionnaire (MCQ) test before and after the workshop (eAppendix). The 10-item MCQ test had been validated in previous workshops with undergraduate medical students (K Aziz, MD, Professor, University of Alberta, scientific poster document, 29 March 2023). While this may limit its validity to pharmacy students, the MCQ test has proven effective in assessing QI knowledge acquisition in previous workshops aimed at interdisciplinary audiences. De-identified MCQ test responses with coded identifiers were collected electronically before and after the workshop using Google Forms. The results of the MCQ test before and after the workshop were individually scored and then were analyzed using repeated measures student t-test with Microsoft Excel, version 2013 (Microsoft

Corp.).

Attitudes towards undergraduate QI training and the EPIQ workshop teaching format were assessed through a six-item survey. The survey questions were specifically developed for this learning opportunity in consultation with EPIQ facilitators and a faculty member from the pharmacy school. Students were asked to indicate their level of agreement of disagreement with a set of statements using a rating scale (0 = prefer not to answer, 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree) using Google Forms. Survey responses were analyzed using the Mann-Whitney *U* non-parametric test in Minitab, version 19.2 (Minitab, LLC).

Students were invited to participate voluntarily in a post-workshop focus group to provide more detailed insights into their attitudes towards QI training and the workshop teaching format. A trained researcher in qualitative research conducted the focus group, which lasted approximately 40 min. Open-ended questions were used to explore the pharmacy students' experiences in the workshop and their perspectives on receiving QI training during their undergraduate years. Examples of the focus group questions included: (1) Why should pharmacy students learn about QI in their training? and (2) When is the best time to introduce QI training to pharmacy students in their training? The semi-structured focus group interview was digitally recorded using Samsung Voice Recorder, version 21.1.00.18 (Samsung Electronics Co., Ltd.) and transcribed verbatim. The transcribed text was then organized in Microsoft Excel for data coding and retrieval of coded quotations. Thematic analysis, as described by Braun and Clarke,[24] was employed to identify themes from the textual data. Initially, two authors independently coded all textual data and then collaboratively reviewed the emerging codes, discussed areas of agreement and disagreement, and reached a consensus to resolve any discrepancies. Once all coding was completed, the codes were independently grouped into initial emerging themes. The authors engaged in discussions to refine the emerging themes as needed, resulting in key themes, representative quotes, and recommendations. The quantitative and qualitative data were then integrated using the convergent mixed-methods analysis, as described by Clark,[25] to gain a more comprehensive understanding of the effectiveness of the EPIQ workshop.

Findings

All 29 students completed the MCQ test before and after the workshop. A statistically significant improvement in QI knowledge among pharmacy students was observed from pre- to post-workshop (77% vs. 86%, *P* = .008, two-tailed *t*-test).

All 29 students also completed pre- and post-workshop attitude surveys. The majority of students (79.3%) expressed disagreement or strong disagreement with the notion that their current pharmacy curriculum provided sufficient QI training (Table 1). Following the workshop, "agree" or "strongly agree" was the most common response to whether QI training should be mandatory (93.1%) (Table 1). Post-workshop, there was a general consensus among students regarding the value of multilevel group learning (86.2% "agreed" or "strongly agreed") and interdisciplinary (89.7% "agreed" or "strongly agreed") group learning. The only statistically significant change in response from pre- and post-workshop was observed in relation to the statement, "Quality improvement training is best delivered to a group of audience with varying levels of clinical experience (e.g., novice to veterans)," with 82.7% agreeing or strongly agreeing before the workshop, compared to 86.2% after the workshop (Table 1).

Qualitative analysis

Eight students, including three first-year students, two second-year students, two third-year students, and one fourth-year student, volunteered to participate in the focus group discussion. Thematic analysis of the collected textual responses resulted in the identification of four key themes: (1) QI education should be offered as a continuum of a learning process that balances clinical pharmacy

Table 1
Pre- and post-workshop attitude survey.

Questions	Median			CI for difference (−1,0)	Not adjusted for ties[a,b]		Adjusted for ties[a,c]	
	Pre	Post	Difference	Achieved confidence	W-value	P value	W-value	P value
QI curriculum in schools								
QI training should be a mandatory part of the pharmacy school curriculum	3	4	-0	95%	600.5	.13	500.5	.10
QI training is a valuable addition to the pharmacy school curriculum	3	4	-0	95.13%	723	.16	723	.11
My program currently provides a sufficient amount of QI training	2	2	-0	95.05%	789	.31	789	.25
QI workshop training								
QI training is best delivered to a group of audience with varying levels of clinical experience (e.g., novice to veterans)	3	4	-1	95.17%	654	*.02	654	*.009
QI training is best delivered to an interprofessional/interdisciplinary group of audience (e.g., with other health sciences colleagues	3	4	-0	95.06%	637	.18	637	.13
QI training was relevant and appropriate at this stage of my pharmacy training	3	4	-0	95.02%	684	.09	684	.06

QI = quality improvement.
[a] A tie occurs when the respondent provides the same value in both samples.
[b] Not adjusted for ties yields a more conservative estimate.
[c] Adjusted for ties yields a more accurate estimate.

experience throughout the undergraduate program; (2) QI education supports the adoption of multilevel and interprofessional team-based (TBL) approaches; (3) QI education inspires leadership skills; and (4) the EPIQ workshop (four-hour) provides a structured and facilitated introduction to QI principles for pharmacy students across all years of study (first to fourth years).

Theme 1. QI education should be offered as a continuum of a learning process that balances clinical pharmacy experience throughout the undergraduate program. From the pre- and post-workshop attitude surveys, pharmacy students from all years expressed their interest in learning QI principles. A pharmacy year (PY) 1 shared, "It's very challenging [to learn and apply all QI concepts] in one year, but students in their first year should have the exposure. If an elective was made for more sophisticated learning, such as handling QI projects with a preceptor, that would be more suitable for upper years." A PY2 student echoed this sentiment, stating, "Having a QI elective would be helpful for third- or fourth-year students to get a foot in the door and get mentorship from [trained preceptors] to complete a [personal QI] project." A PY4 suggested that "[introducing] QI concepts in the fourth year and then pursuing sequential education, such as a master's or PhD [doctor of philosophy] degree, [...] would allow students to solve real-life problems [...and] reinforce QI learning." The emphasis on the continuum of learning was shared among pharmacy students from all years.

Theme 2. QI education supports the adoption of multilevel and interprofessional team-based approaches. While this EPIQ workshop consisted only of pharmacy students, the learners naturally identified that TBL, particularly multilevel and interprofessional learning approaches to QI, was critical. A PY4 students shared that multilevel, TBL created a supportive environment where "if [a participant] did not understand a concept quickly, pharmacy students from other years were available to help." This is one of the advantages of having students with varying years of clinical experience participate in the workshop together. Additionally, regarding the team-based QI learning approach, a PY1 student suggested that "since health care is multidisciplinary in nature, it would be important for all disciplines to learn QI. It is hard to eliminate miscommunication [in practice] if future pharmacists act as change agents, but future nurses are not so receptive to that mindset." The team-based approach was viewed as a positive strategy for QI learning.

Theme 3. QI education inspires leadership skills. Pharmacy students from all years agreed that QI education is associated with leadership and perceived that literacy in QI concepts supports interest in pharmacy leadership roles. A PY3 shared that "[students] who are naturally motivated to take on leadership roles [are] inclined to sign up for [QI] workshops [...] to learn a new science or to take on initiatives that improve health care systems." A PY1 expressed that "[Attending the EPIQ workshop] showed [me] that [I] can learn the QI skills to pave the way for improved clinical practice even when [the regulations, and] subsequently the practice environment, changes with time." Another PY2 student suggested that "if [pharmacy students] could do more quality improvement [learning] in school, they would [aspire] to become agents of change [...] and become more receptive to [implementing] changes when they work [as pharmacists.]" A PY4 with more clinical experience shared that "the QI concepts are [...] more applicable to people who are in management positions or policy-making sectors. If [a pharmacy student] is interested in pursuing [this type of career], QI would be a good elective for them."

Theme 4. The EPIQ workshop (four-hour) provides a structured and facilitated introduction to QI principles for pharmacy students across all years of study (first to fourth years). The EPIQ workshop teaching format effectively guides students through all stages of the QI cycle, allowing the student to learn and apply concepts in a timely and efficient manner. A PY4 student expressed that "Since QI application in real-life is a set of continuous steps, [...] if it was taught in a lecture, the concepts would be fragmented and the connection between steps would get lost." Additionally, a PY2 student mentioned that "[the QI training is best delivered] as a workshop for professional development rather than doing it as a formal course because then it becomes more like homework rather than for [our] own professional growth." Overall, the EPIQ workshop was perceived as an effective means of introducing and applying QI principles, providing a valuable learning experience for pharmacy students of all years.

Discussion

Integrating the qualitative and quantitative data, three important lessons emerged from this learning opportunity: (1) undergraduate pharmacy students identified a QI learning need; (2) the EPIQ workshop effectively provided foundational QI literacy for pharmacy students from all years using a "learning by sharing" methodology and pharmacy-specific scenarios; and (3) interested students, particularly, fourth-year students, may benefit from pursuing an experiential elective to apply QI tools and develop leadership skills at medical institutions.

The study identified barriers to teaching QI to pharmacy students using the EPIQ workshop. These barriers included the students' lack of background knowledge of the health system and clinical settings in which opportunities for improvement could be identified. Junior learners may face challenges due to their unfamiliarity with certain administrative and clinical contexts in various practice settings. Another challenge involved students' application of QI tools, such as the fishbone diagram, and their difficulty in understanding how different QI tools are interconnected. Certain QI concepts may be more difficult to grasp within the limited time available in a four-to-six-hour workshop format.

The barriers described above were effectively addressed through the social constructivist approach of the EPIQ workshop. In this approach, participants with a better understanding of the health system and clinical context shared their knowledge and experiences with those who had less clinical experience. The workshop facilitators, maintaining a ratio of one facilitator to 10 students, played a crucial role in guiding the simulation-based learning and offered clear explanations when students inquired about the purpose of each QI tool. There were differing opinions among participants regarding the ideal "example scenario," but the students agreed that the ability to relate to the presented clinical problem facilitated their understanding of QI concepts. In the future, the workshop's simulation-based approach would allow for the use of real-life scenarios that could be tailored to the local contexts, enhancing the relevance of the learning experience.

While QI efforts in the past primarily focused on patient safety, the scope of QI has now expanded to broader areas. As highlighted

in the study, pharmacy students recognize that learning QI and actively participating in QI initiatives inspire the development of leadership, collaboration, and change management skills. These skills are of utmost importance for Canadian pharmacy students, particularly as they enter an exciting phase of pharmacy scope expansion.[26] This expansion provides them with opportunities to make a greater impact on patient care and contribute more effectively than ever before.

Summary

This study provides valuable insights into the importance of undergraduate QI training for pharmacy students. The findings indicate that students who attended the workshop expressed a strong interest in further expanding their QI knowledge and engaging in QI initiatives during their academic studies, clinical rotations, and future work endeavors. The study also assessed the effectiveness of the EPIQ workshop as a teaching format for QI. Notably, the workshop's relatively short duration and active learning approach make it a suitable complement to existing QI curricula in Canadian pharmacy schools. Additionally, given the flexibility of delivering the EPIQ workshops in-person or online, they can be easily adapted to meet the specific curriculum needs of different institutions, particularly considering the ongoing COVID-19 pandemic.

As the first study to evaluate the effectiveness of the EPIQ workshop in teaching QI to pharmacy students in Canada, the perspectives and implications gathered from the data hold relevance for all pharmacy schools seeking to design effective QI curricula. The study's findings highlight the significance of equipping the next generation of pharmacy leaders with the necessary competencies to drive practice changes effectively.

Disclosure(s)

The EPIQ workshop was funded through an in-kind donation of 32 seats from the Office of Lifelong Learning (L3).

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in the *Currents in Pharmacy Teaching and Learning*.

Authorship contributions

D.H. Lee, P.V. Mathura, and K. Aziz were responsible for the conception and design of the study, acquisition of data, analysis and/or interpretation of data, and drafting of the manuscript.

D.H. Lee, P.V. Mathura, K. Aziz, J. Shkrobot, and N. Kassam were responsible for revising the manuscript critically for important intellectual content.

D.H. Lee, P.V. Mathura, K. Aziz, J. Shkrobot, and N. Kassam provided approval of the version of the manuscript to be published

Declaration of Competing Interest

No potential conflict was reported by the first author. Dr. Aziz Khalid is the Medical Director (Quality Improvement) for the Office of Lifelong Learning that conducts EPIQ workshops globally.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cptl.2023.07.002.

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