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Impact of a Workshop on Medical Students' Knowledge and Attitude towards Quality Improvement in Healthcare: A Quasi-experimental Study

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Abstract

Although several global health and accreditation authorities encourage quality improvement as a competency in medical education programmes, literature tackling quality improvement education in undergraduate medical education is scarce. This study aims to assess the knowledge and attitude of medical students at Beirut Arab University towards quality improvement, using the BASIC-QI tool. The intervention consisted of a five-hour workshop including theoretical and hands-on parts. Students completed the survey just before, immediately after, and one month following the workshop. This longitudinal time-series quasi-experimental study targeted all fifth-year medical students at Beirut Arab University throughout the academic year 2020-2021, each group during their family medicine rotation. Fifty-five out of 77 students completed the survey at all three stages. The mean scores of each of the "Attitude and Beliefs Scale", and the "Knowledge of QI Scale" both showed a significant increase right after and one month after the session. Thus, given the favourable results of this study, we advocate that quality improvement workshops be included in the curriculum of medical schools and health professions faculties, and in such an interactive and hands-on format.

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Introduction

Quality improvement is any structured process aiming at improving patient safety, clinical effectiveness, or patients' experience of healthcare (Jackson et al., 2018). It plays an important role in the reduction of patient morbidity and mortality (Shen et al., 2016). Quality improvement also focuses on ensuring health services are based on current evidence-based knowledge (Barton, 2009). Therefore, graduating medical students should be exposed to, and gain experience in quality improvement in clinical care (Jackson et al., 2018).

There is a disconnect between theoretical models of improvement science and their practical implementation. It is clearly important that both healthcare providers and trainees take part more actively to lessen preventable adverse events and enhance patient health outcomes. Although the recent efforts in health professions education have focused on developing quality improvement training programmes, literature regarding quality improvement education is scarce, particularly at the undergraduate level in medical education (Shah et al., 2020).

Despite the medical curriculum being crowded, literature reveals the importance of integrating quality improvement into it (Brown et al., 2019a; Gould et al., 2002; Kutaimy et al., 2018). Several global health authorities, including the World Health Organization, General Medical Council, and the Association of American Medical Colleges, lately encourage quality improvement as a competency in medical education programmes, which can be guaranteed by implementing it into the medical curriculum from the undergraduate phase (Brown et al., 2019a; Shah et al., 2020). However, there is no worldwide consensus on a single way to deliver it to health professions students. Thus, multiple strategies are being adopted to improve teaching quality concepts (Wise et al., 2017).

In postgraduate qualifications, quality improvement education is provided through electives, workshops, and quality improvement projects (Weingart et al., 2004; Wong et al., 2010). For instance, a community-based family medicine residency programme in the United States had a structured longitudinal education experience that included quality improvement in different residency years, followed by a quality improvement project upon graduation (Diaz et al., 2010). Literature tackling medical students' knowledge and attitudes towards the concepts of quality in healthcare is limited.

To address the gap in medical school curricula, early exposure of medical students to quality improvement seems essential.

Literature review

Governments and policymakers have become conscious of the significance of proving the effectiveness of their higher education systems in providing educational opportunities and cultivating a skilled workforce for the knowledge-based economy (Harrison et al., 2022). The quality of teaching is a cornerstone for assessing the performance of higher education institutions, and thus playing a crucial role in modifying the rankings of universities both within and across national higher education systems (Greatbatch & Holland, 2016; Musselin, 2018; Williams et al., 2013).

In the past twenty years, higher education institutions have witnessed impressive growth in an ever more competitive global landscape. Furthermore, higher education has undergone globalisation, with more students pursuing their studies abroad and/or engaging in online learning. In turn, this trend has increased the competitiveness that institutions encounter while striving to meet the diversity of their students' needs (Hénard & Roseveare, 2012).

In this dynamic global setting, several countries have attempted implementing plans to attain excellence in education, viewing teaching quality improvement as a key management strategy to enhance the status of teaching and learning in higher education institutions (Pratasavitskaya & Stensaker, 2010). Similarly, available data showed that several countries in the Arab region are aiming to improve the patient safety culture in their healthcare systems (Elmontsri et al., 2017).

Healthcare organisations have adopted quality improvement strategies to fulfil accreditation bodies' qualifications. The Joint Commission on the Accreditation of Healthcare Organizations in addition to many other organisations, and other stakeholders as well as patients and hospitals, are all demanding accountability for healthcare quality, while others such as the Association of American Medical Colleges, the Council on Graduate Medical Education, and residency review committees from different specialties and subspecialties are requiring that continuous quality improvement be added to the curricula for all health professionals (Gould et al., 2002).

The World Medical Association published the 'Declaration on Guidelines for Continuous Quality Improvement in Healthcare,' emphasising that physicians and healthcare institutions hold ethical and professional obligations to consistently improve the quality of services and patient safety (World Medical Association, 2019). Additionally, the Association of American Medical Colleges has initiated a programme aimed at training clinical faculty members in the effective teaching of quality improvement principles to students, residents, and other clinicians. This initiative ensures the integration of quality improvement into the training curriculum from day one (Association of American Medical Careers, 2023). Concurrently, the Accreditation Council for Graduate Medical Education is actively soliciting proposals for institutions to join a collaborative effort focused on quality improvement and addressing healthcare disparities. These proposals encompass the implementation of a framework for involving early learners in quality improvement initiatives to tackle healthcare disparities within their clinical learning environments (Accredited Council for Graduate Medical Education, 2018). Coleman et al.'s (1998) study of teaching faculty showed that of those who received training in teaching continuous quality improvement, more than 60% reported they had applied the principles at their organisations in the one-year post-workshop survey.

In summary, these organisations play pivotal roles in ensuring the quality assurance and enhancement of medical education on both national and international scales. Their efforts contribute significantly to the training of competent and compassionate healthcare professionals capable of delivering quality care to patients worldwide.

Overall, quality improvement exposure has targeted postgraduate medical trainees more than undergraduate level (Mookherjee et al., 2013). Nevertheless, integrating quality improvement early as part of medical school curriculum allows for a smoother transition into the clinical phase, in which learners are usually faced with problems that require clinical judgements. Thus, having quality improvement knowledge at an early stage would be beneficial for both the healthcare

system and individuals to enable them to handle clinical encounters more efficiently (Burnett et al., 2018; Dumenco et al., 2019).

In the undergraduate phase, quality improvement was introduced in a variety of ways and at different levels of the curriculum. For example, a medical school in New Zealand provided classrooms, online quality improvement lectures and skills learning, through interprofessional teams, during the six-year undergraduate medical curriculum (Wise et al., 2017). Other schools integrated workshops, and lectures, followed by quality improvement projects (Brown et al., 2019a; Dumenco et al., 2019; Gould et al., 2002; Shah et al., 2020). In some cases, the quality improvement training was delivered as an elective component of the curriculum rather than a mandatory one (Dumenco et al., 2018). Implementing quality improvement as a formal training early in medical school curriculum was reflected in improved long-term outcomes for medical students regarding knowledge, attitudes, and skills enhancement (Burnett et al., 2018; Dumenco et al., 2019). It changes the way medical students perceive themselves and allows them to be major influencers in the future (Brunett et al., 2018). Moreover, it positively influences interprofessional collaboration within healthcare organisations. As a result, high-standard patient care is delivered (Burnett et al., 2018).

In Lebanon in 2012, the majority of medical students were not introduced to the concept of quality in healthcare in medical school, as evidenced by their limited awareness of quality and patient safety (Natafgi et al., 2012). As a result, our university Beirut Arab University began early to implement quality improvement to graduate physicians aware of the quality concepts in healthcare. The Faculty of Medicine at Beirut Arab University offers a six-year medical education programme, divided into three years of pre-clerkship and three years of clerkship. This is usually followed by a one-year rotating clinical internship, before entering specialty training. The family medicine module is one of the four rotations during the fifth year.

In order to address the literature gap regarding the lack of a standardised approach to teaching quality improvement to medical students, a targeted workshop was designed. This study aims to assess the knowledge and attitude of medical students at Beirut Arab University towards quality improvement before and after the workshop integrated in the family medicine module.

Method

Study design

This longitudinal time-series quasi-experimental study was performed on fifth-year medical students at Beirut Arab University throughout the academic year 2020-2021. All fifth-year medical students were targeted, each group during their family medicine rotation.

Ethical consideration

An informed consent form with the participant's rights was available online before conducting the questionnaire. The research was approved by the institutional review board at Beirut Arab University (Exemption code 2020-H-0110-M-R-0466).

Intervention

The intervention in this study was a five-hour workshop, 'Quality in Healthcare', given in the family medicine module, divided into a theoretical lecture and a hands-on practical. The theoretical

lecture is delivered by a family medicine faculty member, followed by an interactive discussion through which students are introduced to basic concepts of quality in healthcare. Root cause analysis (RCA), plan, do, check, and act (PDCA) cycle, fishbone diagrams, and other concepts are explained, then, during the hands-on section, students are divided into subgroups of three to four members to apply what they have learnt by conducting a fishbone diagram for a problem they usually encounter during their rotation in ambulatory healthcare centers. The whole group discusses the different proposed diagrams with the instructor at the end of the session. A total of 55 students participated in all sections of the study.

Questionnaire

Data was collected by using an online questionnaire filled by the students to assess their knowledge and attitude towards quality improvement in healthcare. The questionnaire was sent in Google Forms via the WhatsApp groups of the corresponding class.

Assessment of the attitudes, beliefs and knowledge of quality improvement was conducted using the Beliefs, Attitudes, Skills and Confidence in Quality Improvement (BASIC-QI) tool, a previously validated instrument considered a reliable tool to assess the impact of quality improvement curricula on learners (Brown et al., 2019b)

The intervention was completed in three phases. In the first phase, students completed the questionnaire just before the workshop. The second and third phases consisted of students filling out the questionnaire immediately after and one month following the workshop. Participants who did not fill out all three questionnaires were excluded from the analysis.

The questionnaire was divided into three main sections: demographic data, subject-generated identification code (SGIC), and BASIC-QI scale questions. Consent was required online before the start of the questionnaire. Demographic data included age, gender, and Cumulative Grade Point Average (CGPA). The usefulness of SGIC for every participant is that they can refill the questionnaire in the different phases anonymously, while data could still be linked across the different time points. BASIC-QI scale questions started with a general ‘Yes/No' question about prior quality improvement experience. This was followed by three BASIC-QI subscales sections: ‘Attitudes and Beliefs towards QI’, ‘Knowledge about QI’, and ‘QI Skills’. Both ‘Attitudes and Beliefs’, and ‘Knowledge about QI’ contained nine items while quality improvement skills contained twelve items. These items were in the form of questions to be answered in a Likert scale form. The Likert scale used in this study included seven options, one being strongly disagree, four being neither agree nor disagree, and seven being strongly agree. The ‘Skills’ part in the quality improvement scale was omitted due to missing data resulting from a technical issue.

Therefore, attitudes and beliefs towards quality improvement and knowledge about quality improvement were the two subscales used in our study; each subscale contains nine items, and each item is answered in a seven-option Likert scale assigned a score from one to seven. The total score of each subscale is the sum of the individual scores of each item yielding a score that ranged from 9 to 63. The two subscales were tested for reliability independently during the three phases of filling and showed high reliability with Cronbach’s alpha > .9 across the three phases on both subscales, except for the attitudes and beliefs subscale filled directly after the workshop which was .88 as shown in Table 1. These tests were undertaken again in this study to check their reliability in this unique sample.

Table 1

The Reliability of the Subscales Used During the Three Different Phases

Subscale	Phase of filling	Cronbach's alpha
Attitudes and Beliefs	Before the Workshop	.94
	Directly After the Workshop	.88
	One Month After the Workshop	.96
Knowledge of QI	Before the Workshop	.96
	Directly After the Workshop	.98
	One Month After the Workshop	.97

Statistical Analysis

Data was exported from Google Forms to an Excel Spreadsheet; then it was entered and cleaned in Statistical Package for the Social Science (SPSS) version 23.0 software (SPSS, Chicago, IL).

Descriptive statistics for the continuous variables, which are the age and the scores of the 'Attitudes and Beliefs Scale' and the 'Knowledge of QI Scale' recorded before, directly after, and one month after the workshop, are reported as means ± standard deviation. Those of the categorical variables, which are gender, CGPA, and prior experience in quality improvement, are reported as absolute and relative frequencies. The data of the differences in the scores of the 'Attitudes and Beliefs Scale' and the 'Knowledge of QI Scale' between the three different surveys (before, directly after, and one month after the workshop) were tested with the Kolmogorov-Smirnov test of normality showing a p-value of >.05 accepting the null hypothesis that the data are normally distributed.

A paired-samples t-test was used to analyse the significance of the difference in the scores of the two scales between the three different surveys. To analyse the correlation between the two scales before, directly after, and one month after the workshop, Pearson's Correlation was used. Cohen's d was used as a measure of effect size interpreted as very small if value < .2, small if <.5, medium if <.8, and large if >.8. The results were considered statistically significant at $p < .05$.

Results

Participants

A total of 77 students received the survey before the start of the workshop. Sixty-eight of them filled out the first survey, five failed to fill out the survey sent right after the workshop, and eight failed to fill out the survey one month after the workshop. This yielded a sample of 55 participants with a response rate of 71.4% and an attrition rate of 19.1%.

General Characteristics

Table 2 provides details on the participants' general characteristics. A total of 55 students with a mean age of 22.4 ± 1.21 years were included in the study, 32 (58.2%) of whom were females. Around two-thirds of the participants (63.6%) had a CGPA between three and four. Only three (5.5%) had prior experience in quality improvement before the workshop.

Table 2

General Characteristics of the Study Participants (n=55)

Variable		Mean ± SD
Age		22.4 ± 1.21
Gender	Male	23% (41.8)
	Female	32% (58.2)
CGPA	2-2.99	20% (36.4)
	3-4	35% (63.6)
Prior Experience to QI	Yes	3% (5.5)
	No	52% (94.5)

Note. CGPA= Cumulative Grade Point Average.

Attitudes and Beliefs

The mean scores of the "Attitudes and Beliefs Scale" were 46.31 ± 9.43, 56.64 ± 4.71, and 54.27 ± 7.2 points before, directly after, and one month after the workshop respectively (Table 3). The mean scores of this scale directly after, and one month after the workshop are significantly greater than those before the workshop with mean differences of 10.33 and 7.96 points respectively. The mean score one month after the workshop is statistically less than the score directly after the workshop with a mean difference of -2.36 points and a p-value of <.01 (Table 4).

Table 3

Participants' Scores on the "Attitudes and Beliefs" and the "Knowledge of QI" Subscales in the Three Phases (possible scores range from nine to 63)

Subscale	Mean ± SD		
	Before the Workshop	**Directly After the Workshop**	**One Month After the Workshop**
Attitudes and Beliefs	46.31 ±9.43	56.64 ± 4.71	54.27 ± 7.2
Knowledge of QI	24.44 ± 11.03	53.15 ± 9.8	51.04 ± 9.28

Table 4

The Difference in the Participants' Scores in the Subscales Between the Three Surveys Filled in Three Phases

Subscale	Paired Surveys	Mean Difference	95% Confidence Interval of the Difference	Cohen's *d*	p-value
Attitudes and Beliefs	Directly After – Before the Workshop	10.33	7.74, 12.91	1.08	<.01
	One Month After – Before the Workshop	7.96	5.39, 10.53	.84	<.01
	One Month After – Directly After the Workshop	-2.36	-3.91, - 0.82	.41	<.01
Knowledge of QI	Directly After – Before the Workshop	28.71	25.36, 32.06	2.32	<.01
	One Month After – Before the Workshop	26.6	22.97, 30.23	1.98	<.01
	One Month After – Directly After the Workshop	-2.11	-5.43, 1.21	.17	.21

Knowledge of Quality Improvement

The mean scores of the 'Knowledge of Quality Improvement Scale' were 24.44 ± 11.03, 53.15 ± 9.8, and 51.04 ± 9.28 points before, directly after, and one month after the workshop respectively (Table 3). The mean scores of this scale directly after, and one month after the workshop are greater than those before the workshop with mean differences of 28.71 and 26.6 points respectively. The mean score one month after the workshop is less than the score directly after the workshop with a mean difference of -2.11 points, but it was not statistically significant (p=.21, Table 4).

Correlation between the two scales

In the survey filled out before the workshop, there was no significant correlation between the two scales (r=.26, p=.06). However, in the surveys filled out directly after and one month after the workshop, the two scales had a significant positive moderate correlation (r=.45, P<.01) and a significant positive strong correlation (r=.81, P<.01) respectively (Table 5).

Associations of the Cumulative Grade Point Average of the Participants with the Scores Scored in the 2 Subscales

Independent samples t-test was used to test the difference in mean scores of the two scales between the CGPA groups. Upon separating the sample into 2 groups according to their CGPA, 35 (63.6%) had a CGPA between three and four, and 20 (36.4%) had a CGPA between two and 2.99. The mean scores of the "Attitudes and Beliefs Scale" in these two groups were not significantly different before, directly after, and one month after the workshop with p-values of .1, .47, and .12, respectively. In addition, when testing the difference of the mean scores of the

“knowledge of QI Scale” concerning the CGPA groups, there was also no significant difference between them before, directly after, and one month after the workshop with p-values of .34, .24, and .07, respectively (Table 6).

Table 5

The Correlation Between the Participants' Results in the "Attitudes and Beliefs" Subscale and the "Knowledge of QI" Subscale in the Three Phases

Variables	Phase of Filling	Pearson Correlation Coefficient	p-value
Attitudes and Beliefs Subscale vs Knowledge of QI Subscale	Before the Workshop	.26	.06
	Directly After the Workshop	.45	<.01
	One Month After the Workshop	.81	<.01

Table 6

The Associations of the Cumulative Grade Point Average of the Participants with the Scores Scored in the Two Subscales (possible scores range from 9 to 63)

Subscale	Timing of Survey	Mean (CI 95%)		Cohen’s *d*	p-value
		CGPA = 2-2.99	CGPA = 3-4		
Attitudes and Beliefs	Before the Workshop	43.5 (38.28, 48.72)	47.91 (45.15, 50.68)	.48	.1
	Directly After the Workshop	57.25 (54.8, 59.7)	56.29 (54.77, 57.8)	.2	.47
	One Month After the Workshop	51.95 (47.65, 56.25)	55.6 (53.71, 57.49)	.52	.12
Knowledge of QI	Before the Workshop	26.35 (21.05, 31.65)	23.34 (19.61, 27.08)	.27	.34
	Directly After the Workshop	55.2 (52.88, 57.52)	51.97 (47.98, 55.96)	.33	.24
	One Month After the Workshop	47.65 (42.35, 52.95)	52.97 (50.44, 55.5)	.59	.07

Discussion

This study highlights the importance of adding quality improvement in medical school curricula, showing a significant increase in scores for attitudes, beliefs, and knowledge of quality improvement post-workshop. As shown in the results, the mean scores of each of the 'Attitudes and Beliefs Scale', and the 'Knowledge of QI Scale' both showed an increase immediately after and one month after the quality improvement session. Both attitudes and knowledge means remained significantly elevated after the intervention, with only a minor decrease when comparing the immediate and one month later measures. This is surprising, considering that the "Ebbinghaus forgetfulness curve" noted that memory retention significantly decreases soon after new information is introduced. Typically, most of the information acquired from a lecture or a learning session is forgotten just hours or days after the event, but revisiting the material at intervals can significantly slow the rate of decline described by the forgetfulness curve. Effective retention strategies include reviewing the information shortly after the teaching session, followed by reviews at 24 hours, one week, and one month intervals. This enables students to achieve enduring learning outcomes to maximize long-term retention (Wollstein & Jabbour, 2022). The importance of repetitive interventions and reminders over different time intervals was also highlighted in other studies (Hall et al.,2010; Schneid et al., 2019). Although the designed workshop was delivered with no material revisit at different intervals, it included a hands-on part in addition to the didactic one, which might have aided long-term knowledge retention. There was no significant relationship between the CGPA of the student and their knowledge, attitudes and beliefs scores. This suggests that any medical student, irrespective of their level, can acquire the necessary tools and background for quality improvement.

Our study's strength stems from the fact that it is prospective, with matched pre- and post-survey data available to properly measure the effectiveness of a self-directed educational intervention for medical students. Most participants had little prior understanding of quality improvement since there was no formal quality improvement teaching introduced to this medical school curriculum before the current workshop. This has resulted in realistic and accurate data concerning the influence of the designated quality improvement workshop.

Our study's post-workshop results revealed a moderate correlation immediately afterward ($r=.45$, $p<.01$) and a strong correlation one month later ($r=.81$, $p<.01$). Similarly, following the completion of the Program for Innovation in Scholarship and Medicine (PRISM) workshops in another study, done as a collaboration between the Royal College of Surgeons in Ireland and a medical school in Canada, there was a significant increase in BASIC-QI scores (Brown et al., 2019a). The significant improvement observed in the BASIC-QI scores post-intervention in both studies indicates the success of the structured quality improvement educational interventions in boosting students' knowledge and attitudes in quality improvement. The lasting impact of the training emphasises the workshop's success in bridging the gap between theoretical knowledge and practical beliefs about quality improvement to better prepare students for their future roles in healthcare, highlighting a common educational goal shared globally across different settings (Brown et al., 2019a).

The attrition rate of 19% in the current study seems acceptable as compared to other similar interventions described in the literature, for example, 66% of the students completed the exit

survey that followed the PRISM programme (Brown et al., 2019a). This highlights the challenges of maintaining student engagement in longer-term educational activities, particularly with time constraints and already saturated curricula (Brown et al., 2019a).

Our study's intervention serves as a practical implementation of effective quality improvement curricula, demonstrating clear objectives and a structured approach that is smoothly integrated into the family medicine module. This reflects the principles underlined in the systematic review by Brown et al. (2021) about the importance of curricular integration. The immediate and sustained improvements in knowledge and attitudes among students shows how this integration optimises educational outcomes and is crucial for successful learning. The inclusion of hands-on part within the workshop not only enhances theoretical concepts but also prepares students to apply their learning in actual healthcare settings, tackling real-world problems. This also aligns with literature's emphasis on the effectiveness of combining didactic and practical teaching for effective learning (Brown at al., 2021; Shah et al., 2020).

Following this study, the proposed modifications to the workshop were implemented: (1) handouts with a summary of the course for students to take home, (2) multimedia content to increase student involvement, (3) extra time for hands-on practice of each quality improvement/patient safety skill, and (4) the importance of longitudinal inclusion of quality improvement in curriculum, not restricted to a single workshop.

Limitations

There are several limitations in this present study. First, there was no comparison group, and the sample was relatively small and homogenous, given that all participants were fifth-year medical students. Also, some participants lost interest during data collection, particularly during the post-1 and post-2 data collecting phases, which made them ineligible to continue in the study. It would have been helpful to conduct a re-testing phase three or six months after the workshop in order to assess the knowledge and attitude retention for a longer time. Additionally, the use of self-reported assessments (questionnaires) has the disadvantage of being prone to answer bias, such as social desirability bias. Another important limitation of this study was the omission of the "Skills" part of the tool used, due to unforeseen technical issues that led to missing data. Therefore, the findings of the current study may not fully capture the impact of the intervention on all aspects of students' competencies, particularly the skills component.

Conclusion

Given the favourable results of this study which highlight the importance of teaching quality improvement in undergraduate medical education, one can advocate that quality improvement workshops be integrated in the curriculum of medical schools, as is encouraged by international health organisations. This workshop can be replicated in other medical schools and health professions faculties worldwide, as well as incorporating an interprofessional component to the workshop or longitudinal quality improvement theme that allows teaching additional healthcare quality concepts earlier in medical or health professions education curricula. This will help in preparing future physicians and healthcare workers to be competent in quality improvement and develop skills that will serve them well in their future careers.

Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there are no financial interests to report. The authors have not used artificial intelligence in the creation of this article and comply with all principles of JULTP authorship. The submission is original work and is not under review in any other publication.

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