Journal of Public Health Student Capstones

Original Research 1(1), 2022

Evaluation of the Enhanced Kampala Advanced Trauma Course in Uganda: A Mixed-Methods Study

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DOI: https://doi.org/10.15586/jphsc.v1i1.20

Published: 12 September 2022

Abstract

Objective: Managing of acute traumatic injuries presents unique challenges in low resource settings. The Kampala Advanced Trauma Course (KATC) and its integrated scenario-based moulage are aimed to address gap in skills for physicians-in-training to manage high trauma burden in Uganda. This study aimed to assess the effectiveness of KATC by quantifying immediate knowledge retention, and to describe perceptions of applicability and clinical feasibility of the course in the context of Uganda.

Methods: We administered pre- and post-tests and student evaluation surveys, and conducted focus groups at a single site prior to and after the KATC conducted in May 2016. Student and facilitator cohorts comprised medical/surgical interns and course provider and instructors who participated in focus groups. Median scores were compared using the Wilcoxon Signed Rank Test. Qualitative data were analyzed using a deductive approach with framework analysis.

Results: Pre- and post-tests depicted no significant student knowledge retention following the completion of KATC ($P > 0.05$), although median evaluation scores were high across all 14 sections of the course. Both KATC and its scenario-based moulage were perceived favorably by both student and facilitator cohorts. Reported KATC strengths included emphasis on practical skills, perceived applicability, and engaging teaching style. Areas for improvement included time constraints and lack of course material for students for reference after completing the course.

Conclusion: The enhanced KATC was well-received by providers, yet additional research is required to establish its effectiveness in transferring knowledge and clinically applicable skills before it is scaled-up across Ugandan referral hospitals.

Keywords: trauma; education; surgery; global health

Introduction

Trauma is a leading cause of mortality and morbidity worldwide, accounting for over 5 million deaths annually, and 90% occurring in low- and middle-income countries (LMICs).[1,2] Uganda represents a key low-resource setting that bears a high trauma burden, particularly from road traffic injuries and interpersonal violence, which are leading causes of disability-adjusted life years (DALYs).[3] Managing trauma patients in the immediate outcome of an injury presents its own set of challenges for healthcare providers in Uganda, provided the scarce availability of supplies, low quality of infrastructure, high workload, staffing shortage, and inadequate management.[4] Owing to these resource constraints, novice physicians often deal with difficult work environments, where they lack training and skill-building opportunities, and receive less guidance from attending surgeons.[5,6]

Addressing emergency care of injured patients to reduce morbidity and mortality from acute traumatic injuries requires a systematic approach to deliver care.[5] Several educational curriculums have been developed to teach key approaches to the initial care and

management of trauma patients at the pre-hospital and emergency care levels in low-resource settings, yet they have not been broadly integrated in the sub-Saharan African settings.[7–9] Hence, there is a requirement for innovative, locally driven skill-based training in trauma techniques for the existing workforce to strengthen health systems and capacity.

Since 2007, the Kampala Advanced Trauma Course (KATC) has attempted to address skills gap in trauma care in Uganda.[10] The course provides free lecture-based and hands-on skills sessions covering trauma topics, including burns, fractures, and other related procedures, to rotating Masters of Medicine trainees in anesthesia and surgery, as part of an established medical and surgical (med/surg) rotation at Mulago National Referral Hospital (MNRH).[10] Up to 2015, this context-specific course incorporated skills training but still aimed to incorporate medical simulations with visual and tactile cues to aid in learning, as with moulage simulation. In 2016, the KATC added a scenario-based moulage component designed to reinforce primary and secondary trauma survey skills.[11] Since then, the course has been offered at other regional referral hospitals (RRHs) with a plan to scale up to all RRHs and level-IV health centers across the country.[12]

Although the course has evolved, research has yet to evaluate effectiveness of KATC as a learning tool and the clinical feasibility of the moulage design integrated into the curriculum.[11] Evaluation of this enhanced course could serve to inform educational policy for trauma and emergency care in Uganda as well as establish a context-specific trauma training education that could be adapted to other resource-constrained settings. The aim of this study was to evaluate effectiveness of KATC by measuring student's knowledge retention following completion of the course, and to explore perceptions of students and facilitators on the requirements, applicability, and feasibility of the curriculum. We hypothesized that the KATC would improve knowledge acquisition, and students and facilitators would express positive views of the course and its moulage component.

Methods

Study design

We conducted a mixed-methods study over a 2-week period during the KATC conducted in May 2016. The course consisted of seven lectures and six skill sessions, including two new moulage sessions that were delivered over 3 consecutive days. We administered surveys, pre- and post-tests, and conducted focus groups to assess participants' views and knowledge prior to and after the KATC (Figure 1).

Study sample population

Study participants were recruited into two cohorts of students and course facilitators. The student cohort comprised 14 interns in medicine/surgery enrolled in the KAT course conducted in May 2016. Students were conveniently sampled from the final incoming intern rotation class of the academic year. Only interns present for all three days of the course instruction and had completed pre-, post-test, and evaluation survey were included in the final analysis. Each student participated in two moulage sessions, either as an actor or an observer.

Facilitators were purposively sampled from a group of KATC voluntary instructors having at least 1 year of prior experience teaching the KATC in Uganda (Figure 2). The cohort comprised four Ugandan surgeons with KATC experience ranging from 1 to 9 years. Facilitators were tasked with leading at least one moulage scenario during the KATC conducted in May 2016. Prior to the course, a member of the research team trained these participants in moulage facilitation. This hour-long training included a handout review on moulage theory and practical technique application as well as two role-playing sessions and a question and answer period.

Quantitative data collection and analysis

Students were administered two 35-item pre- and post-test to measure immediate knowledge retention of skills and protocols discussed in the course. These test questions were designed by anesthesiologists and surgeons from the United States and Uganda to reflect learning objectives of the course and the low-resource context of the country. A score of over 70%, or 25 correct responses out of 35 total questions, in each test was considered passing or acceptable. Owing to sample size, median pre- and post-test scores were compared using the Wilcoxon Signed Rank Test. The data were then further stratified by gender and response type.

Students completed evaluation surveys quantifying their reactions to the 14 KATC components. Students were asked to score each lecture and moulage session (primary and secondary survey) on a scale of 0 to 4 (poor, fair, good, and very good, respectively). Median evaluation scores for individual course components were then quantified. All data were analyzed using the STATA software, version 10.[13]

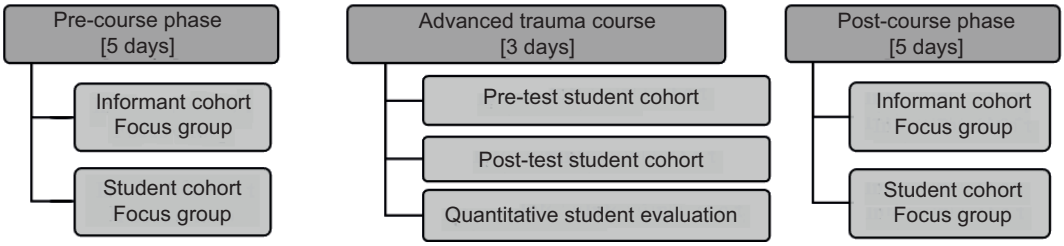

Figure 1. The student cohort (medical/surgical interns) was involved in each study phase whereas the informant cohort (surgeons/KATC facilitators) was involved in pre- and post-course phases.

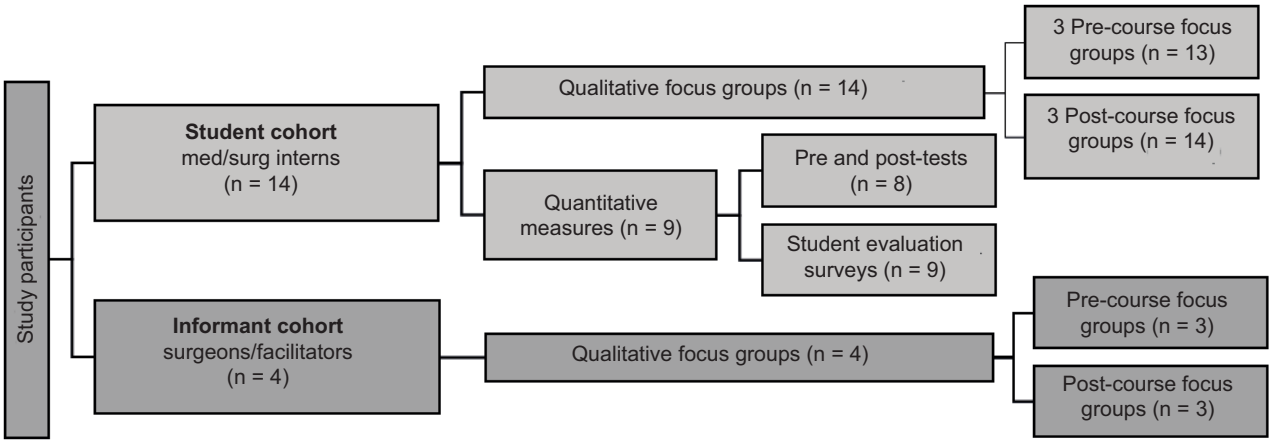

Figure 2. Number of participants varied based on exclusion criteria for the student cohort. In both cohorts, the focus group arms varied by not more than one participant.

Qualitative Data Collection and Analysis

Four focus groups, one consisting solely of facilitators and three of students, were conducted prior to and after completing the KAT course, for eight focus group discussions (FGDs). Each FGD was composed of three to six participants. Semi-structured focus group guides were reviewed and edited by two fellow researchers prior to their use. All data were audio recorded and transcribed by a third-party transcription service. Field notes were included to integrate nonverbal observations.[14] Transcripts were coded and analyzed using a deductive approach through framework analysis.

Results

Quantitative findings

The student cohort comprised six female and eight male interns. Over half, that is 57%, of the cohort completed both pre-and post-test questionnaires (n = 8), and 64% completed evaluation surveys of the KATC components (n = 9). Overall test scores increased for half of the cohort (n = 4) and decreased for the other half (n = 4) of the students who completed both tests. Out of 35 questions, 25 correct answers or more than 70% was considered acceptably passing for each administered test. As outlined in Table 1, the median number of incorrect answers (P = 0.0112) and unanswered questions (P = 0.014) significantly changed after completion of KATC. Incorrect answers increased by a median difference of three responses, while unanswered questions (no response) decreased by a median difference of five unanswered questions. However, no significant change was observed between median pre- and post-test scores when stratified by the number of correct answers (P = 0.525) or gender (P = 0.166).

Table 2 displays median evaluation scores for individual KATC components. Overall, students ranked most lectures and skill sessions as good or very good, and a poor rating was never attributed.

Table 1. A bivariate median test result table stratified by gender, as well as number of unanswered questions, incorrect and correct answers given, along with associated p-values.

Variable	Pre-Tests Number of Responses [35 Questions Total]	Post-Tests Number of Responses [35 Questions Total]	P-value
Male Correct (n = 3)	22 IQR: 20–22	19 IQR: 18–22	0.166
Female Correct (n = 5)	16 IQR: 15–18	19 IQR: 19–21	0.103
Incorrect Answers (n = 8)	12 IQR: 10.5–12.5	15 IQR: 13.5–16.5	0.0112
Unanswered Questions (n = 8)	5 IQR: 1–8.5	0 IQR: 0–0	0.014
Correct Answers (n = 8)	19 IQR: 15.5–22	19 IQR:18.5–21.5	0.525

Qualitative findings

Eight qualitative codes emerged from FGDs with both student and facilitator cohorts prior to and after the KATC conducted in May 2016. These qualitative codes were categorized into four overarching themes (Figure 3).

Perceived requirements of interns

Prior to the course, multiple students expressed feeling of being ill-equipped to deal with trauma care, citing deficiencies in their medical education and lack of resources to apply their skills. When asked about clinical challenges, students often mentioned the lack of support and mentorship, and conceiving as unprotected and unguided as new providers. Multiple students indicated interest in the course only if it had practical skill sessions, provided updated standards of practice protocols, and addressed different learning styles.

When discussing intern requirements with facilitators, they described the KATC as an opportunity to identify the individual requirement of medicine/surgery interns through observing and answering student questions. The recalled that gaps in trauma management led to the course's development. Following the course, many agreed that the KATC was a good means to gauge students' strengths and weaknesses prior to encountering them in the wards.

Table 2. Median scores from 10 anonymous student evaluation surveys obtained immediately after the KATC completion and post-test administration.

Lecture topics	
Initial assessment	4
Airway management	4
Shock	3
Thoracic trauma	4
Musculoskeletal trauma	3
Burns	4
Head injuries	4
Pediatrics	3
Skill sessions/moulage	
Primary survey (moulage)	4
BLS*	4
Chest draining	4
Venous cut down	4
Airway management	4
Secondary survey (moulage)	4

Score scale: 0 = unable to score, 1 = poor, 2 = fair, 3 = good, and 4 = very good.
*BLS = Basic Life Saving.

KATC experience

Generally, student interns came to a positive consensus that most sessions were well-managed, interactive, and built their confidence in handling cases quickly and decisively in a context-specific manner. After the course, one student recalled: "…previously, I would fear such (trauma) patients … now I know how to attack…". The context-specific lens of KATC was described by one facilitator with the following example:

> Make sure the patient is not going to become hypothermic (when you expose them), but we do not have those fancy warmers (…), cover the patient (with whatever little clothing you can find) ...so they know what the ideal is but we bring them back to our reality, but make sure the end goal is the same.

Students also noted that facilitators effectively answered their questions, provided new perspectives, and made time for their concerns. Facilitators brought up how different learning styles were accommodated by including a mix of lectures and practical sessions.

The most-mentioned weaknesses of KATC included time-constraint and lack of equipment. Two students expressed difficulty in balancing their responsibilities in wards while attending the KAT course. Students also complained that some sessions were rushed through and the schedule lacked punctuality. Multiple students wanted more sessions and suggested extending KATC to a full week

Figure 3. The flow chart depicts common themes between both cohorts which were categorized and further grouped into codes as determined by the research team.

or three full days. Facilitators also mentioned how time-constrain limited students' time for practicing hands-on skills. Two students also described the post-test as unfair with respect to time and content. They elaborated that the questions were too long-winded for the allotted time and the test was not based on their context-specific scope.

Students and facilitators also expressed concerns about the availability of equipment. For example, one student was concerned that KATC taught students how to obtain a blood pressure (BP), but some hospitals had scarce BP cuffs. He wished they were taught more about what to do if resources were absent or included a takeaway equipment as part of participation incentives.

Moulage sessions

The moulage component of the KATC was well-received by both students and facilitators. Both described its integration into the course format as contributing to the active engagement and confidence-building of participants. One facilitator described student reactions to the component as involved and willing to step out of their comfort zone when acting out cases. Another facilitator explained how a student came to instructors during the KATC and felt hesitant to act things out at first, but the student's willingness to try suggested an acceptability of this new learning platform.

As for the students, one expressed that the scenarios felt context-specific, and multiple students agreed that it was stimulating and made you think in a timely manner: "(Facilitators) emphasized that you have a few seconds to have a patient alive …, so we have to act very fast and work as a team." Multiple student focus groups described the debrief sessions that followed the scenario role-play as positive because it felt cohesive, encouraging, and students felt supported by facilitators. One student described this as "encouraging, because they (facilitators and students) were really paying attention and were really looking for the negative and positive parts… (this is) even good when critical."

Applicability and feasibility

All facilitators and one student spoke about a requirement to reinforce skills in clinical settings as necessary next steps. The facilitators described clinical reinforcement as revisiting topics with students in the wards. Both cohorts discussed the desire for a trauma guidebook for later reference, feeling more supported, and endowing future learning. The facilitators also discussed a requirement to condense lecture information, and organize additional equipment, such as mannequins, so that more people could practice. Some students expressed concern that resource limitations would still impede their care delivery, but others identified new, learned clinical advantages, such as how to use bystanders for support in patient care if human resources were lacking.

Facilitators also discussed the challenges and the potential for scaling up the KATC. One facilitator noted that gaining administrative support could be challenging; however, they had experience in assuring institutions warming up to the course over time. Two facilitators described the KATC as a new standard and standalone course for regional and national referral hospitals' internship programs. Facilitators also highlighted the importance of engaging key stakeholders, such the Ministry of Health and the College of Surgeons of East, Central and Southern Africa (COSECSA) to possibly enable funding and scale up opportunities. Lastly, they discussed the value that KATC could have for providers from high-income settings to learn how to provide innovative care in resource constraints.

Discussion

Our study assessed the effectiveness and explored perceptions on the strengths, weaknesses, and clinical feasibility of KATC and its moulage component. The latter exploration was approached with focus groups to allow for interaction, including agreement and/or dissent to reinforce and inform themes across the perceptions of both educators and learners prior to and after this enhanced course. Although weaknesses were identified, notably in the course's ability to transfer new knowledge, most participants viewed the KATC as a positive learning experience. Participants indicated that the moulage integration was empowering and engaging for both cohorts, suggesting that it is applicable to promote learning and morale-building. Our findings were an addition to the limited existing literature on trauma training courses in LMICs, suggesting that moulage-enhanced trauma training in low-resourced settings was feasible to implement and warranted for future courses.[8,9]

When measuring students' immediate knowledge retention and quantifying student evaluation forms, we found a discrepancy between test performance and views of course quality. Student test scores revealed no significant increase in immediate knowledge retention or acquisition after completion of KATC. Unlike results from prior studies, none of the students in the KATC achieved an acceptable score as determined by course experts (25 correct questions or 70%).[9] However, responses on the evaluation surveys demonstrated that these interns rated most sessions with high marks. It is important for course administrators to dissect whether the problem lies with the students' learning, the course instruction, the learning environment, or the test itself. We recommend that the future research must assess knowledge acquisition with a larger cohort over a longer period to allow for richer statistics, time flexibility, and scientific controls to be implemented such as establishing a comparison group and matching pre- and post-test questions using the data and experience of this study.

Our findings suggested that adjustments to the KATC or knowledge test were required in this setting. During FGDs, multiple students characterized the test as unfair, expressing that the allotted time was too limited, and the context-specific nature of the course was not well-represented in the test. In the next iteration of the test, it would be prudent to increasingly consider the input of local collaborators as well as seek to shorten content or lengthen administration time. We recommended that the future research must evaluate student responses to teaching style and compare that with test topic performance. Moreover, application of the skills acquired from the KATC must also be assessed to evaluate its impact on the assessment of trauma patient and outcomes in clinical settings.

Ensuring the availability of low-cost equipment and materials could have important implications for the scaling-up and sustainability of KATC. Our findings indicate a requirement to develop

a low-cost guidebook for interns for later references, as well as a formal training handout in moulage facilitation for new course instructors. During focus groups, facilitators highlighted the future directions of the course, which included the following: growing and sustaining it through local funding; offering it to interns at all public hospitals; and implementing it globally. Since 2015, the course has expanded to multiple RRHs as a required training model for intern education. Focus of KATC on relevant skills overlaps the published literature, and describes procedures that may help Uganda tackle its high trauma burden.[1,15,16] However, effectiveness of the course requirements to be established before the KATC is further adopted as a national standard trauma training course. The future studies must measure clinical impact and evaluate long-term knowledge retention from additional cohorts to ensure that appropriate, evidence-based adjustments are made to the course. Hence, this study had broader implications for managing trauma patients and quality improvement efforts in Uganda based on context-specific training from locally adapted courses such as KATC.

Limitations

The limitations of this study included time and testing issues and the sample size. The time limitation of the study as pointed out by an intern presented scheduling challenges that potentially limited the interns' ability to speak about perceived clinical applicability in the post-course phase, as not all of them had rotated through casualty wards. Some students arrived late at class and missed a portion of the pre-test because of other obligations. Another limitation of the study was its small sample size, especially during our quantitative evaluation. The study was part of a graduate Capstone project. It has a fixed timeline at end of the academic year using existing, nonmatched pre- and post-test questions to evaluate that year's last group of rotating interns. This increased potential bias in quantitative data as well as constricting the sample size and ability to establish a control group.

Conclusion

The KATC program is valued by stakeholders and is a feasible tool to improve potentially the trauma response and surgical education of the healthcare workforce in Uganda and potentially other low resource settings. This study found that the moulage enhanced KATC, and its local facilitators empowered and trained providers in an engaging manner. However, the knowledge transference was not confirmed. With adjustments to the course, such as redevelopment of pre- and post-test to better accommodate the context, additional modifications could be made to further optimize and grow the course. Additional research is required to fully evaluate its potential for practice, including making noted improvements to the course as well as the future study designs and implementing a clinical rating tool to assess its practice applicability. Moreover, additional research may describe development of the future program, including exploring long-term perceptions of participants and stakeholders, quantifying acquired knowledge, and generating findings on behavioral changes and results in clinical settings.

Conflict of Interest

All authors declared no competing interests.

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