

ORIGINAL RESEARCH

A randomized matched-pairs study evaluating a hybrid, structured skills course for clinical officers in Tanga, Tanzania

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Abstract

Background

A hybrid training programme for the Fundamental Interventions, Referral and Safe Transfer (FIRST) course was conducted because of the COVID-19 pandemic to prepare clinical officer students for the FIRST OSCE. The course occurred in Tanzania with in-person instruction, while a Canadian team lectured remotely. This study determined the effectiveness of the hybrid course by comparing OSCE performance between students who did and did not take the course. Student and instructor feedback on the virtual portions of the FIRST course were also evaluated.

Methods

Clinical officer students were matched in pairs based on age, sex, work experience, and school performance. One student from each pair was assigned to take the hybrid course (intervention), while the other did not (control). Both groups of students took the OSCE, and their performance was scored. The FIRST course was provided to the control group after the OSCE. Both groups then completed precourse and postcourse surveys to identify successes and challenges with conducting the course. Analyses were based on descriptive statistics, as well as paired t-test and Wilcoxon signed-rank test analysis.

Results

The 22 students in the intervention group outperformed the 22 control students ($P < 0.001$). The intervention group's mean score was 39/50, compared with 27/50 for the control group. The hybrid FIRST course successfully prepared students for all OSCE skills. There was no difference between the 2 groups in terms of performance on written quizzes. The survey response rate was 77%. Almost all students (94%) believed the course would help them provide better patient-centred care. Overall, 88% of the students recommended that the college continue teaching the hybrid FIRST course.

Conclusions

COVID-19 has prompted adaptation. We demonstrated that hybrid courses are feasible and effective strategies for providing future clinicians with the skills needed for patient-centred care, during and potentially even after the resolution of the COVID-19 pandemic.

Keywords: clinical officers; COVID-19; Fundamental Interventions, Referral and Safe Transfer (FIRST) course; objective structured clinical examination (OSCE); Tanzania

Introduction

The COVID-19 pandemic, declared in March 2020, has altered the structure and availability of clinical training programmes globally.^[1] Clinical educators living abroad were initially unable to return to their home countries, and colleges were forced to temporarily close or postpone the

training of medical, nursing, midwifery, and clinical officer students to halt the spread of the virus.

Virtual teaching for medical professions is a new and promising avenue to overcome the barriers of the COVID-19 pandemic.^[2] Through virtual platforms, such as Zoom, Quizizz, and YouTube, students can complete certain educational requirements while remaining mindful of physical

distancing guidelines.[3]-[4] However, hands-on skills sessions are essential in the training of clinicians.[5]-[7] Thus, many colleges are now faced with the challenge of having to balance in-person training for their students with physical distancing requirements. It has been previously demonstrated that international curriculum review and lecture-based training for clinical education are feasible using these virtual means,[8]-[10] but there is a lack of literature that demonstrates if and how these methods can be applied to hands-on skills training.

Before the COVID-19 pandemic, clinical officer students training in Tanga, Tanzania, were required to take the Canadian Network for International Surgery's (CNIS) Fundamental Interventions, Referral and Safe Transfer (FIRST) course during the third year of their training. Clinical officers are trained in basic medicine and primarily provide healthcare to individuals in rural and semiurban settings.[11]-[12] The FIRST course is conducted annually at the Tanga College of Health and Allied Sciences by the college's instructors and CNIS representatives, who normally travel to Tanga to teach the course.

The FIRST course was first piloted in Awassa, Ethiopia, in 2009, and it has facilitated considerable success in meeting the specific learning needs of healthcare students across Africa.[13] The FIRST course equips clinical officers with the ability to prepare management plans for their patients, and it teaches them fundamental surgical and obstetrical skills. Students begin by learning fundamentals in patient care, followed by surgical and obstetrical skills. Upon taking the FIRST course, a student's performance is evaluated with an objective structured clinical examination (OSCE), which directly assesses knowledge, patient management, and hands-on skills.[14] Due to historical successes with the FIRST course in Tanga, the FIRST OSCE was designed and implemented to formally assess clinical officer students after they complete the FIRST course. The FIRST OSCE has since become a standard component of clinical training for clinical officer students.

A hybrid FIRST course was taught during the COVID-19 pandemic by a Tanzanian team who conducted in-person skills sessions with clinical officer students, while CNIS instructors lectured and participated remotely. This study investigated the effectiveness of the hybrid course by comparing OSCE performance between students who did and did not take part in the hybrid course. The students' feedback and opinions on the virtual portions of the FIRST course were also evaluated and compared to feedback received by instructors who were teaching remotely and in-person.

Methods

Study design and setting

This was a matched-pairs study that randomized matched pairs of clinical officer students from the Tanga College of Health and Allied Sciences in Tanzania in their third year of training to either take part in a hybrid course (intervention) or prepare for the OSCE independently (control). Clinical officer students were matched based on age, sex, work experience,

and school performance. These variables were selected for matching based on prior knowledge of FIRST OSCE score distributions. Students with more clinical experience and higher academic performance generally performed better on the FIRST OSCE than students with fewer clinical experiences and lower grades. Work experience and academic performance were ranked by the Tanzanian instructors using the students' academic profiles at the local college and performance in previous internships and clinical rotations. Participation was voluntary, and informed consent was received from the students who participated.

All students were provided standard materials from the college, which they were expected to study in preparation for the OSCE. The standard materials were adapted from the FIRST course that was conducted at the college prior to the COVID-19 pandemic. The control students were instructed to use these materials to prepare for the OSCE. The intervention students were given the same instructions; however, they were also invited to take part in the hybrid FIRST course to supplement their understanding of the material, as well as practice relevant skills.

The hybrid course took place in August 2020 over a period of 3 days and included 2 CNIS instructors lecturing via Zoom software (Zoom Video Communications, Inc.; San Jose, CA, USA),[15] with 4 instructors in Tanzania conducting hands-on training with the students. Prerecorded PowerPoint (Microsoft Corp., Redmond, WA, USA) presentations embedded with animations and other visual aids formed much of the material presented by the CNIS representatives.[16] Quizizz (Quizizz Inc., Bengaluru, India) is an online platform that allows the instructor to create free video game-like quiz questions and interactive lessons, which both the CNIS and Tanzanian teams used for teaching hands-on skills and lecture material.[17]-[18] The CNIS team was also involved with teaching skills by demonstrating select techniques and procedures using Zoom teleconferencing, through which the CNIS team was also available to help students who needed assistance with certain skills. Both the intervention and control students took the OSCE after the hybrid course was provided for the intervention students. The Tanzanian instructors were responsible for administering the OSCE, including scoring the students' performance. The FIRST course was then provided to the control group after the OSCE so that all students could complete precourse and postcourse surveys about the hybrid course. This allowed for the identification of successes and challenges with conducting the course. All 6 instructors were also invited to take part in a postcourse survey.

Data collection and analysis

The OSCE was scored according to the guidelines provided in Table 1. Students were scored out of 50 points, with a passing grade being 25/50 (50%). There were 12 stations as well as a bonus station. Four of the 12 stations involved case studies and quiz questions based on FIRST reading material and lecture notes. Eight of the 12 stations required the student to demonstrate mastery of specified hands-on skills. Students were graded, and the students' reports were photocopied, and data from the reports were entered into Excel (Microsoft

Table 1. Grading structure of the 2020 FIRST OSCE in Tanga, Tanzania

Station	Total points	Component(s)	Scoring structure
Station 1	4	Quiz on risk	1 point for each question
Station 2	4	Quiz on danger signs	1 point for each question
Station 3	4	Repair a laceration	Aseptic technique Local anaesthesia Interrupted closure Dressing
Station 4	4	Instrument tie	Holding needle holder First throw of knot Second throw in reverse of the first Secure knot
Station 5	4	Case study and quiz	2 points for each question
Station 6	4	Drain an abscess	Aseptic technique Holding scalpel Making incision Opening abscess
Station 7	4	Apply a plaster slab	Identify forearm Avoid trauma to patient Join above and below Bandage is not too tight
Station 8	4	Nasogastric tube insertion	Measure Lubricate Pass the tube Check for placement
Station 9	4	Case study and quiz	2 points for each question
Station 10	4	Vacuum delivery	Apply cup Apply suction Traction in line Delivery
Station 11	4	Repair episiotomy	Suture vagina Suture deep tissue Close skin Overall result
Station 12	4	Deliver placenta	Diagnosis Follow the cord 1 hand on abdomen and the other on cord Delivery of placenta
Bonus	2	Participation	
Total	50		

FIRST, Fundamental Interventions, Referral and Safe Transfer course; OSCE, objective structured clinical examination

Corp.) for preliminary analysis and visualization. The questionnaires sent out to the students and instructors utilized a modified Likert scale to assess feedback about the hybrid course.^[19]

The Excel spreadsheets containing the students' grades were imported into RStudio 1.1 (RStudio, PBC; Boston, MA, USA) for statistical analyses. Data analyses were based on basic descriptive statistics, paired t-tests, and nonparametric Wilcoxon signed-rank tests for median scores.^{[20]-[21]} Univariate analyses highlighting proportions, means, and medi-

ans were calculated for the grades of each the intervention and control groups. Bivariate analyses were used to compare the mean OSCE scores and median grades for each station between the intervention and control groups. *P* values <0.05 were considered statistically significant.

Ethical considerations

Approval to conduct this study was obtained from the Tanga College of Health and Allied Sciences. Students' anonymity was ensured, and all test scores were kept confidential.

Table 2. Median scores of intervention and control students for each OSCE station

Station	Procedure	Median score in intervention group	Median score in control group	P value
Station 1	Quiz on risk	3	3	0.06
Station 2	Quiz on danger signs	4	4	>0.99
Station 3	Repair a laceration	3	1	0.006
Station 4	Instrument tie	4	1	0.004
Station 5	Case study and quiz	2	1	<0.001
Station 6	Drain an abscess	4	3.5	0.04
Station 7	Apply a plaster slab	4	2	<0.001
Station 8	Nasogastric tube insertion	3	2	0.002
Station 9	Case study and quiz	3	2	0.002
Station 10	Vacuum delivery	4	2	0.004
Station 11	Repair episiotomy	3	2	0.02
Station 12	Deliver placenta	3	2.5	0.03

Each station is out of 4 points

OSCE, objective structured clinical examination

Results

Findings from the FIRST OSCE

A total of 44 students participated in this study: 22 in each the intervention group and control group. All clinical officer students at the Tanga College of Health and Allied Sciences in their third year of studies (n=44) agreed to participate, and there was no dropout during the study period. The intervention group's mean OSCE score was 39/50 (78%), while the mean OSCE score for the control group was 27/50 (54%) ($P<0.001$).

Table 2 outlines the median scores for each of the procedures and skills tested at each station. The intervention group outperformed the control group on all hands-on skills stations and case study questions. There was no difference between the 2 groups in terms of performance on the written quizzes (Table 2).

Feedback from the FIRST course surveys

The student survey response rate was 77% (n=34), with 32% of respondents (n=11) being female. Most of the respondents (n=32, 94%) believed that the course would help them provide better patient-centred care and found the provided course materials, self-assessment questions, and management case studies to be helpful. Most of the respondents (n=31, 91%) found remote teaching to be effective and enjoyed learning from PowerPoint presentations and answering quiz questions in video-game format. Overall, 88% of the students (n=30) recommended that the college continue teaching the hybrid FIRST course to clinical officer students (Figure).

The instructor survey response rate was 100% (n=6). Half of the instructors were female, and all instructors were medical doctors. The instructors found that remote instruction via Zoom software was effective when interspersed with hands-on skills training sessions. The use of PowerPoint presentations, quiz games, and breakout rooms in Zoom were found to be effective for the students' understanding of the material and skills. The primary challenges brought up by instructors were regarding connectivity and network issues. All instructors indicated that they would teach a hybrid course again and supported conducting this hybrid course with the next group of clinical officer students.

Discussion

This was the first study to pilot a hybrid skills course with online and in-person teaching for clinical officer students. The results demonstrated that the hybrid FIRST course successfully prepared students for all OSCE skills, including: case study comprehension, recognizing risk, laceration and episiotomy repair, instrument ties, abscess draining, applying plaster slabs, nasogastric tube insertion, vacuum delivery, and delivering placentas. There was no difference between the 2 groups in terms of their performances in stations comprising quiz questions, likely due to the hybrid course's emphasis on learning hands-on skills, both virtually and in-person, rather than lecture material, which the students were expected to have studied independently.

It is evident that students who do not participate in skills training sessions are disadvantaged when it comes to examinations like the OSCE. However, we demonstrated that hybrid training activities can be used to supplement, and

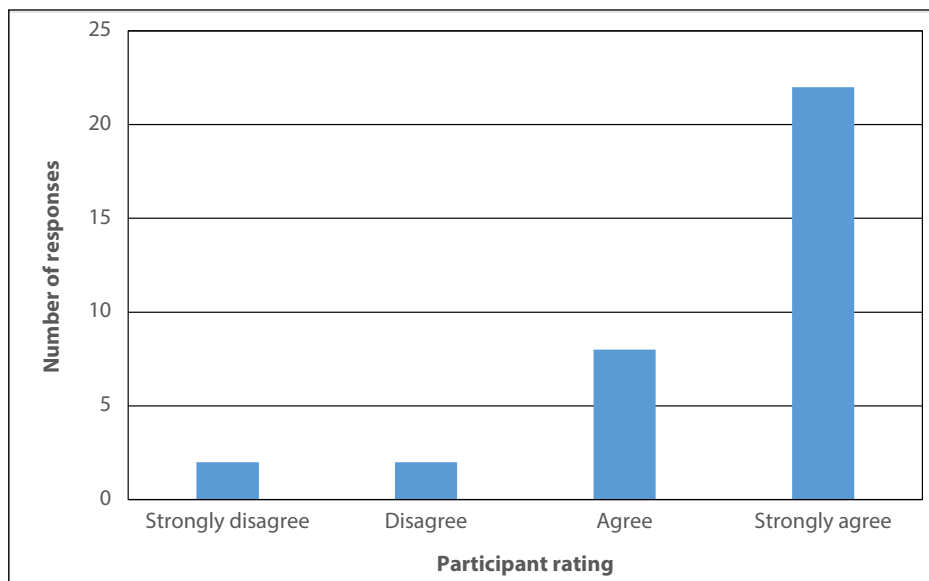


Figure. Clinical officer students' opinions on whether the college should continue offering the Fundamental Interventions, Referral and Safe Transfer (FIRST) course virtually in the future

The survey was anonymous, and participation was voluntary.

potentially replace, in-person skills training. Local public health and education officials should consider this when planning for the training of clinical workers both during and after the COVID-19 pandemic.

It is plausible that the students who took part in the hybrid FIRST course prior to taking the OSCE were in communication with the students who were studying independently. Knowledge from the hybrid course may have been transferred from the intervention group to the control group of students, as blocking communications between these 2 groups was not possible. It is likely that this would have acted to inflate the grades of the control group, with no discernible effect on the intervention students. Future studies would benefit from a fully controlled environment where there is no communication between the intervention and control student groups.

Most students expressed that by taking part in this course, they will be better prepared for patient care and management. Similarly, the instructors were a crucial source of feedback to improve the current course structure. Students and instructors recommended that this course be made more widely available to anyone participating in the FIRST OSCE. Through an iterative process, the instructors' and students' feedback will be incorporated into subsequent offerings of the hybrid course, which will benefit the next generation of students.

The hybrid structure of in-person and remote teaching is unique to the FIRST course; however, this can readily be adapted to other professional programmes that rely on skills training. For example, medical and nursing students would likely benefit from hybrid courses that allow for in-person instruction but also observe pandemic guidelines.[5]-[7] Furthermore, hybrid courses would enable instructors to

teach overseas without the need for travel or other costly expenses, such as visa procurement, thus proving to be a cost-saving measure.[8]

Virtual medical education is a new and rapidly changing field that will benefit from novel methods, such as those piloted in this study. The COVID-19 pandemic has acted as a catalyst for clinical instructors to adapt preexisting virtual modalities to allow for the ongoing instruction of students of the medical professions.[22] The field of global surgery has greatly benefited from the use of these methods, allowing for international collaboration and instruction to take place, despite pandemic travel restrictions and physical distancing recommendations.[23]

Limitations

This study had some limitations. The survey used to obtain feedback from the students is susceptible to response bias.[24] Nonetheless, the survey results were overwhelmingly positive, thus demonstrating the desirability of hybrid skills training courses in the context of the COVID-19 pandemic. Moreover, the Tanzanian instructors who were responsible for teaching the FIRST course were also responsible for administering and scoring the OSCE. No blinding measures were taken to ensure objectivity. However, given the rigid scoring guidelines for each of the OSCE stations, it is not likely that test integrity was substantially threatened by this lack of blinding.

Conclusions

COVID-19 has prompted adaptation on all levels of clinical training and education, but this adaptation may prove useful for the future once the pandemic has been resolved. In this study we demonstrate that a hybrid training course is a feasi-

ble and effective strategy for providing future clinicians with the skills needed for patient-centred care, particularly during a time when many colleges have delayed skills training for healthcare students. A large proportion of students are willing to receive virtual instruction through video teleconferencing platforms, like Zoom, and this can offset the burden of physical distancing requirements without sacrificing the quality of education provision. Multisite studies testing hybrid courses, along with cost–benefit analyses, should be conducted to further investigate this method of instruction. This could facilitate the scaling up of hybrid skills training to standardize and promote virtual education not only during the pandemic, but even after the COVID-19 era.

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