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Introduction of WHO BEC course for nurses at Bugando Medical Center in Mwanza, Tanzania

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ABSTRACT

Introduction: The Basic Emergency Care (BEC) course is an open-access training designed for frontline providers in low resource settings which focuses on recognizing and managing emergent conditions. This study describes the implementation of the BEC course for nurses at Bugando Medical Center (BMC) in Mwanza, Tanzania in March 2020 as part of an educational initiative to improve nurses' knowledge and confidence in providing emergency care.

Methods: This is a 2-week educational intervention with pre-post measurements. 12 nurses (cohort 1) received BEC training from in-country facilitators over the course of 4 days. A training-of-trainers (ToT) course followed immediately and the 5 newly trained facilitators then taught the BEC course to 12 additional nurses (cohort 2). Pre- and post-BEC knowledge was assessed with a standardized 25-question multiple choice (MCQ) exam; confidence levels were evaluated using a 4-point Likert scale survey; and qualitative feedback obtained was examined by thematic analysis.

Results: 24 participants completed the BEC course, 5 of which completed a ToT to become BEC facilitators. For the combined group, knowledge assessment scores improved significantly from 63.8% to 85.2% with a mean difference of 21.5% ($t_{(24)} = 9.3$, $p < 0.0001$). Similar improvements were seen when cohort 1 and cohort 2 were analyzed separately. Analysis comparing the results across different demographic groups demonstrated a significant improvement in post-course score for each group. Confidence levels increased significantly across all domains. Main qualitative feedback themes were: quality of teaching; method of teaching; applicability of training to daily nursing practice; more time allotment; and the need to expand the course to other healthcare providers and to rural sites.

Conclusion: Implementation of the BEC course at BMC led to an improvement in nursing emergency care knowledge and self-confidence. The course was well received and the ToT model was successful, giving the nurses the ability to train additional local nurses.

African relevance

- In many countries, nurses are the backbone of healthcare delivery, required to identify and manage emergency medical diseases with little formal training in emergency care.
- The World Health Organization (WHO) and International Committee of the Red Cross (ICRC) created the open-access Basic Emergency Care course to train frontline providers (including nurses) in low resource countries, to assess and intervene in emergency conditions using the ABCDE approach.

- This paper describes the application of the Basic Emergency Care course at Bugando Medical Center, using in-country trainers and reports on the educational outcomes of participants.

Introduction

Emergency medical diseases (EMDs), defined as conditions which require interventions within minutes to hours to improve health outcomes, contribute to about half of all deaths globally [1]. The burden of EMDs in low-income countries is 4.4 times that of high-income countries [1]. It is suggested that over half the deaths in low-resource settings

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could potentially be avoided by improvements in emergency care [2]. By ensuring timely access to life-saving treatments, emergency care greatly reduces the morbidity and mortality associated with a range of medical, surgical, pediatric and obstetric conditions [3]. However, the majority of people around the world remain without access to essential emergency care services, and this results in enormous disparities in health outcomes [3].

In Tanzania, as is true in much of Sub-Saharan Africa (SSA), nurses form the backbone of healthcare delivery, comprising more than 50% of the healthcare providers and providing the bulk of direct patient care [4]. Often as the first point of contact for patients, nurses are required to identify and manage emergency conditions as well as monitor patients and assess for change in condition throughout their hospital stay. In rural areas, where more than 80% of the Tanzanian population live [5], oftentimes nurses are the only provider available and become responsible for managing critically-ill patients while waiting for transport to a higher level of care. However, while nurses provide the majority of emergency care, most nurses are not properly trained in the management of EMDs [4,6]. Emergency medicine (EM) is a relatively new specialty in Tanzania and although EM projects are ongoing in varying scales throughout the country, currently EM residency training and specialized emergency nursing training programs are only available at Muhimbili National Hospital (MNH) in Dar es Salaam [7]. Additionally, most nursing school curriculums include limited exposure to basic emergency care skills and once qualified, nurses have few opportunities for professional development [4].

In 2015, the World Health Organization (WHO), International Committee of the Red Cross (ICRC), and International Federation for Emergency Medicine (IFEM) developed the open-access *Basic Emergency Care: Approach to the acutely ill and injured* (BEC) course, focused on training frontline providers to assess and intervene in emergency conditions, specifically in low resource settings. The BEC curriculum teaches a systematic approach to managing trauma, breathing conditions, shock, and altered mental status [8]. The course is delivered over 4 to 6 days, using a multi-modal teaching strategy involving didactics, interactive workbook questions, case scenarios, and hands-on skill sessions. The course targets a wide audience including students, nurses, physicians, pre-hospital providers, and other locally appropriate providers. The BEC course has been implemented in numerous SSA countries including Ethiopia [9], Uganda [6,10,11], Tanzania [10–12], Nigeria [13], Zambia [11,14], and Sierra Leone [15]. Following course completion, participants endorsed increased confidence, preparedness, and skills in managing emergency conditions and demonstrated improvements in knowledge-based test performance [10–15].

Given the opportunity for emergency care to improve the outcomes of time-sensitive illnesses and injuries, and the significance of nurses in low-resourced settings, such as Tanzania, emergency medicine training of nurses is greatly warranted. This study describes the implementation of the BEC course for nurses at Bugando Medical Center (BMC) in Mwanza, Tanzania in March 2020 as part of an educational initiative to improve nurses' knowledge and confidence in providing emergency care.

Methods

Study design

This was an educational intervention using participant surveys, pre- and post-examination results and participant feedback to evaluate the impact of the BEC course on nurses' knowledge and confidence in providing emergency care.

Setting

The BEC course was delivered at BMC in Mwanza, Tanzania in March 2020. BMC is a tertiary referral, research and teaching hospital that is

affiliated with the Catholic University of Health and Allied Sciences (CUHAS). The hospital serves a population of 16 million in the Western and Lake Zone region of Tanzania and provides a wide range of medical and surgical specialties. BMC has approximately 780 nurses.

Participants

A total of 24 nurses received BEC training over the course of 2 weeks with 12 nurses trained during the first week (cohort 1) and 12 nurses trained during the second week (cohort 2). All participants were nurses at Bugando Medical Center, except for 3 nurses from BMC-affiliated hospitals (Nyamagana District Hospital, Bukumbi Hospital and Sekou-ture RRH). Nurses from the emergency medicine department (EMD), intensive care units (ICU), high dependency units (HDU) and inpatient floors were selected by their nurse managers based on work schedule and availability to participate in the course. Participant nurses included enrolled nurses (ENs), assistant nurse officers (ANOs) and nurse officers (NOs). In Tanzania, ENs complete a 2-year nursing certificate and must work under the supervision of ANOs and NOs. ANOs receive a nursing diploma after completing 3 years of training, while NOs receive a nursing degree after 4 years of nursing training. Both ANOs and NOs are able to practice independently in collaboration with other health professionals [16].

Course Structure

The BEC training was delivered as a 4-day course. With the assistance of the Emergency Medicine Association of Tanzania (EMAT), cohort 1 was trained by master BEC facilitators from MNH with the support of attending emergency medicine physicians from MNH, BMC and Mount Sinai Morningside/West. The master facilitators were nurses from MNH who became certified BEC trainers in 2015 when the BEC course was first piloted. Following the BEC training of cohort 1, a 1-day training of trainers (ToT) covering teaching methodology and delivery mechanisms for key BEC concepts, was conducted with 5 nurses from cohort 1 who had demonstrated proficiency in understanding the BEC content and leadership ability. The 5 nurses were selected based on their BEC knowledge scores, feedback from their BEC instructors and clinical supervisors and willingness to teach future courses. During the second week, the newly-trained facilitators from cohort 1, supervised by the master facilitators and U.S instructors, taught the BEC course to 12 additional participants (cohort 2). Courses were conducted in both English and Swahili.

As per the pre-established WHO BEC requirements, to complete the course, participants had to attend all sessions, complete all activities in their workbooks, pass all skills test by correctly performing critical actions, successfully outline the management of one case scenario and pass a post-test knowledge examination with a score of $\geq 75\%$ [8,11]. Participant knowledge was assessed using a pre- and post-course 25-question MCQ exam provided by the WHO. Confidence levels in regards to the provision of emergency care and skills were assessed using a 10-item pre- and post-course survey with a Likert scale of 1 ("not confident at all") to 4 ("very confident"). Feedback was collected on the final day of the course. Successful participants were awarded a certificate by IFEM and EMAT.

Data analysis

Simple descriptive statistics were used to describe participants' demographics. Differences in participant demographics between cohort 1 and cohort 2 was assessed using fisher exact test. Despite small sample sizes, assumption of normality was satisfied for all data (Shapiro-Wilk test, $p > 0.05$) and therefore analyses were conducted using parametric testing. Paired sample t-test was used to compare mean pre- and post-course knowledge scores. Subgroup analysis comparing differences between cohorts and nurses of different demographic groups was

performed using independent t-tests. For the pre- and post-course self-confidence assessments, McNemar’s exact test for paired proportions was used to compare the difference in the proportion of participants who reported “very comfortable” in each skill before and after the course, to keep consistent in reporting with prior studies [11,13–15]. Differences in pre-course and post-course confidence scores between cohort 1 and cohort 2 were evaluated using fisher exact test. Data from pre- and post-course examinations and confidence surveys were analyzed using SAS OnDemand for Academics. P-value of <0.05 was considered significant. Qualitative feedback collected as free text was descriptively analyzed by content and frequency of responses. Only the most frequent feedback themes were reported.

Ethics

This study was approved by the Catholic University of Health and Allied Sciences Bugando (CUHAS/BMC) Research and Ethical Committee and was determined exempt by the Mount Sinai Icahn School of Medicine Institutional Review Board. Informed written consent was obtained from all participant nurses.

Funding

Funding for this study was provided by the Mount Sinai Global Health fund.

Results

Demographics

A total of 24 nurses were trained over the course of 2 weeks. 21 of the nurses were from BMC while 3 of the nurses were invited from BMC-affiliated hospitals. The majority of the nurses were assistant nurse officers (67.7%), followed by nursing officers (29.2%) and enrolled nurses (4%). 14 nurses (58%) were from the EMD, 6 nurses (26%) from adult ICU/HDU, 3 nurses (13%) from the wards and 1 (4%) from the outpatient department. 14 (58%) of the nurses had taken a prior introductory emergency care course. Finally, the group of nurses was fairly experienced with 41.7% having 2-5 years of clinical experience and 37.5% having 5-10 years of experience (Table 1). There were no significant differences in participant demographic characteristics between cohort 1 and cohort 2.

Table 1
Participant demographics for combined (cohort 1 and 2), cohort 1 and cohort 2

Participants	Combined (n= 24)	Cohort 1 (n= 12)	Cohort 2 (n= 12)	P*
Position				0.3707
Nursing officer	7 (29.2%)	5 (41.7%)	2 (16.7%)	
Assistant nurse officer	16 (67.7%)	7 (58.3%)	9 (75.0%)	
Enrolled nurse	1 (4.2%)	0	1 (8.3%)	
Department				0.2893
EMD	14 (58.3%)	6 (50.0%)	8 (66.7%)	
AICU/HDU	6 (25.0%)	5 (41.7%)	1 (8.3%)	
Ward	3 (12.5%)	1 (8.3%)	2 (16.7%)	
Outpatient	1 (4.2%)	0	1 (8.3%)	
Years of experience				0.2172
<1 year	0	0	0	
1-2 years	2 (8.3%)	0	2 (16.7%)	
2-5 years	10 (41.7%)	7 (58.3%)	3 (25.0%)	
5-10 years	9 (37.5%)	3 (25.0%)	6 (50.0%)	
>10 years	3 (12.5%)	2 (16.7%)	1 (8.3%)	
Prior emergency course				0.6802
Yes	14 (58.3%)	8 (66.7%)	6 (50.0%)	
No	10 (41.7%)	4 (33.3%)	6 (50.0%)	

* P-value: Fisher exact test used to compare demographic characteristics between cohort 1 and 2. p<0.05 represents a significant difference

Written exam

a) Combined results

All 24 participant nurses attended the 4 days of training and completed the pre- and post- course knowledge MCQ examination. The overall mean MCQ score improved from 63.8% (95% CI: 58-69.7%) pre-course to 85.2% (95% CI: 81-89.3%) post-course, with a mean difference of test scores of 21.5% (95% CI: 16.6%-26.1%; paired t-test, $t_{(24)} = 9.3$, $p < 0.0001$) (Table 2). 2 participants failed the post-course MCQ exam, scoring less than 75%. These participants were given a chance to rewrite the test and both participants passed during remediation. Only their original test scores were included in the analysis.

b) Cohort 1 vs Cohort 2

For cohort 1, the initial group of 12 nurses that received the BEC training, the mean pre-course MCQ score was 68% (95% CI: 60.9%-75.1%), mean post-course score was 86% (95% CI: 81.7%-91%) with a mean difference in scores of 18.3% (95% CI: 12%-24.7%) ($t_{(12)} = 6.3$, $p < 0.0001$). For cohort 2, the mean pre-test score was 59.7% (95% CI: 49.8%-69.5%), mean post-test score was 88% (95% CI: 82.5%-93.5%) and mean difference in scores was 28.3% (95% CI: 20.6-36.1%) ($t_{(12)} = 8.0$, $p < 0.0001$) (Fig. 1, Table 2). Comparison between cohort 1 and cohort 2 test results showed no observed difference in mean pre-test scores ($t = 1.51$, $df = 22$, $p = 0.1450$), mean post-test scores ($t = 0.57$, $df = 22$, $p = 0.5726$) and mean difference of scores ($t = -1.33$, $df = 22$, $p = 0.1971$) (Table 3).

c) Knowledge results by demographic group

Post-hoc subgroup analysis was performed to compare the results of nurses from different demographic groups: position (Assistant Nursing Officer, Nursing Officer), department (EMD, inpatient), years of experience (< 5 years, ≥ 5 years) and having taken a prior emergency medicine (EM) course or not. The category of enrolled nurse was not included in analysis of nurse position due to small sample size (n=1). There was a statistically significant improvement in post-course score for each group (Table 2). Additionally, there was no statistically significant difference in mean pre-course, post-course and difference in scores between the following groups: assistant nurse officers and nurse officers; nurses from the EMD and inpatient nurses; nurses who have taken a prior EM course and those who had not (Table 3). However, nurses with less than 5 years of experience performed significantly better on pre- and post-course tests than nurses with 5 or more years of experience, although there was no difference in the mean difference of scores between the 2 groups (Table 3).

Self- Confidence

23 (95.8%) participants completed the pre -and post- self-confidence assessments, with 22 (91.7%) participants completing all 10 questions. There was a statistically significant improvement post-course in the proportion of participants who reported being “very comfortable” in managing emergent conditions across all domains (Table 4). For Cohort 1, statistical improvement was seen in 5 (50%) of the confidence areas: “ability to assess and manage an airway;” “ability to assess and manage breathing problem;” “ability to assess and manage hemorrhage;” “ability to assess and manage altered mental status (AMS)”. Cohort 2 demonstrated statistically significant improvement in 4 (40%) of the domains: “ability to assess and manage an acutely ill adult;” “ability to assess and manage an acutely ill child;” “ability to assess and manage hemorrhage;” and “ability to assess and manage AMS” (Table 4). There was no statistical difference between cohort 1 and cohort 2 in the proportion of participants reporting “very comfortable” per question pre-course as well as post-course with the exception of the post-course “ability to assess and manage an acutely ill child” in which cohort 2 scored significantly better than cohort 1 (Table 5).

Table 2

Comparing pre- and post-course knowledge assessment using parametric paired t-test for analysis given near-normal distribution of data (Shapiro-Wilk test, $p > 0.05$)

	N	Mean pre-course score (95% CI)	Mean post-course score (95% CI)	Mean difference (95% CI)	Test statistic (t)	P-value
Combined	24	63.8% (58%-69.7%)	85.2% (81%-89.3%)	21.3% (16.6%-26.1%)	9.3	<0.0001
Cohort 1	12	68% (60.9%-75.1%)	86.3% (81.7%-91%)	18.3% (12%-24.7%)	6.3	<0.0001
Cohort 2	12	59.7% (49.8%-69.5%)	88% (82.5%-93.5%)	28.3% (20.6%-36.1%)	8.0	<0.0001
Assistant Nursing Officer *	16	65.3% (59%-71.5%)	85.5% (79.8%-91.2%)	20.3% (15.2%-25.3%)	8.6	<0.0001
Nurse Officer*	7	65.7% (53.7%-77.8%)	85.7% (78.1%-93.4%)	20% (9.1%-30.9%)	4.5	0.0041
EMD nurses	14	66% (59%-73%)	88% (82.6%-93.4%)	22% (17%-27%)	9.5	<0.0001
Inpatient Nurses**	10	59.6% (48.9%-70.3%)	81% (74.5%-88%)	21.6% (11.9%-31.3%)	5.1	0.0007
< 5 years of experience	12	69.7% (62.1%-77.2%)	91.7% (87.5%-95.8%)	22% (14.5%-29.5%)	6.4	<0.0001
≥5 years of experience	12	58% (49.3%-66.7%)	78.7% (73.4%-83.9%)	20.7% (13.7%-27.7%)	6.5	<0.0001
Prior EM course	14	66.6% (58.6%-74.6%)	86% (80.8%-91.2%)	19.4% (14.6%-24.2%)	8.8	<0.0001
No prior EM course	10	60% (50.2%-69.8%)	84% (75.9%-92.1%)	24% (13.6%-34.4%)	5.2	0.0005

* The category of enrolled nurse was not included in analysis of nurse position because of small sample size (n=1)

** Inpatient nurses group includes (nurses from adult ICU and HDU units, floor/wards and outpatient department)

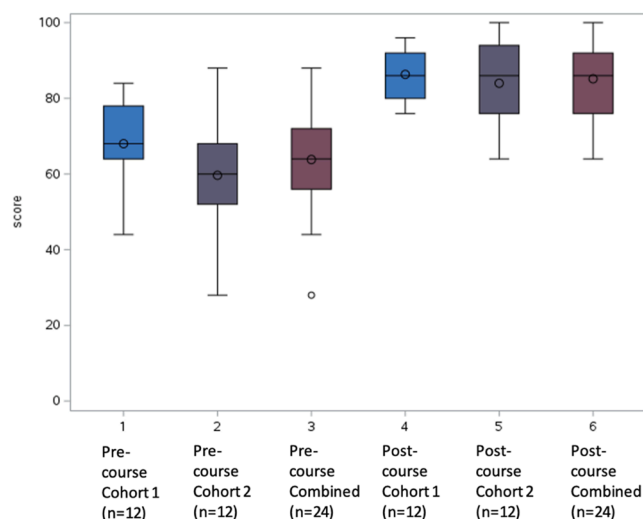


Fig. 1. Box-plots of pre- and post-course knowledge assessments scores

Feedback

Post-course open-ended feedback regarding the strengths and limitations of the course was obtained from 23/24 (95.8%) of the nurses. Positive feedback themes primarily focused on the method of teaching, applicability of training to daily nursing practice and quality of teaching, comprising 30.4%, 30.4% and 17.4% of the positive responses, respectively. Most suggestions for improvement concentrated on increasing the duration of the course and dissemination of course to other healthcare workers, especially those in rural hospitals, constituting 47.8%, 39.1% and 13%, respectively, of the comments eliciting course limitations. Please see [Table 6](#) for representative quotes from participants.

Discussion

Implementation of the WHO BEC course for nurses at BMC resulted in a statistically significant improvement in the participant nurses' emergency care knowledge and confidence in assessing and managing

emergent conditions. This was the first BEC implementation in the Western Zone of Tanzania, and despite small sample sizes, our results are similar to other BEC implementations in Tanzania [10–12], and across SSA [6,9,10,13–15]. In other adoptions of the BEC course in SSA, pre-course knowledge scores ranged from 50%-73% and post-course scores ranged from 74%-87%, with the number of participants varying from 24-32 participants in single-site studies [12,13] and 31-210 participants in multi-site studies [6,10,11,14,15].

While other BEC implementations included nurses among other frontline providers, this is the only implementation to focus exclusively on nurses. This project was developed in response to the requests of providers and hospital management at BMC to strengthen nursing skills, particularly in the area of basic emergency care, in order to improve patient care and decrease hospital mortality rates. We felt that the BEC course was ideal to meet this mandate as the course was designed for a variety of frontline providers with no formal emergency care training, in limited resource settings, who must respond to and treat acutely ill-patients [8,11]. The course introduces essential emergency care concepts, using a simple systematic ABCDE and SAMPLE history approach to managing acute life-threatening conditions encountered by providers in both emergency units and inpatient settings [11,15]. Furthermore, the course is tailored to the adult learner, with intentional repetition ingrained in the curriculum and interactive components to reinforce key principles. We believe that these design features are why our nurse participants performed similarly to the participants in other BEC implementations, as stated above, and why we saw no statistically significant difference in knowledge scores between nurses based on position (ANO vs NO), department (EMD vs inpatient) and participation in prior EM course.

To our knowledge, this is the only BEC study to compare the results of participants trained by experienced, “master” trainers to the results of participants taught by newly trained, “provisional” facilitators. Comparisons between cohort 1 and cohort 2 performance on knowledge and confidence assessments, demonstrated that the two groups achieved similar results suggesting that the ToT was successful and the new facilitators were equally effective in teaching the BEC material. We believe that selecting facilitators who not only performed well on the BEC knowledge exams but were also enthusiastic about teaching and demonstrated leadership abilities was critical to their success in teaching the subsequent course. ToT interventions are a well-known method of

Table 3

Parametric independent t-tests comparing mean pretest, posttest and mean difference knowledge scores by cohort, nurse position, department, years of experience and participation in prior EM course given near-normal distribution of data (Shapiro-Wilk test, $p > 0.05$)

Group comparison	N	Test	Mean difference	Test statistic (t)	P-value
Cohort comparison					
Cohort1	12	pretest	8.3	1.51	0.1450
Cohort 2	12				
Cohort1	12	posttest	2.3	0.57	0.5726
Cohort 2	12				
Cohort 1	12	mean difference	-6	-1.33	0.1971
Cohort 2	12				
Nurse position comparison *					
Assistant Nurse	16	pretest	-0.46	-0.08	0.9335
Officer	7				
Nursing Officer					
Assistant Nurse	16	posttest	-0.21	-0.05	0.9630
Officer	7				
Nursing Officer					
Assistant Nurse	16	mean difference	0.25	0.05	0.9571
Officer	7				
Nursing Officer					
Nurse department comparison					
EMD nurses	14	pretest	6.4	1.15	0.2606
Inpatient nurses	10				
EMD nurses	14	posttest	6.8	1.74	0.0953
Inpatient nurses	10				
EMD nurses	14	mean difference	0.4	0.09	0.9303
Inpatient nurses	10				
Years of experience					
<5 years experience	12	pretest	11.7	2.23	0.0363
≥5 years experience	12				
<5 years experience	12	posttest	13	4.39	0.0003
≥5 years experience	12				
<5 years experience	12	mean difference	1.3	0.28	0.7784
≥5 years experience	12				
Prior emergency course					
Prior EM course	14	pretest	6.4	1.15	0.2619
No Prior course	10				
Prior EM course	14	posttest	6.8	0.48	0.6338
No Prior course	10				
Prior EM course	14	mean difference	0.4	-0.98	0.3366
No Prior course	10				

* The category of enrolled nurse was not included in analysis of nurse position because of small sample size (n=1)

increasing healthcare workforce capacity in LMICs and strongly predict sustainability because of their potential for training the workforce rapidly, cheaply and exponentially by developing local educators [17]. Unfortunately, the timing of our intervention coincided with the start of the Covid-19 pandemic and therefore further expansion of BEC trainings at BMC was delayed as funding and resources initially dedicated to training more nurses was diverted to the local pandemic response. BEC trainings have since resumed for nurses at BMC as of January 2023, after the facilitators received a refresher BEC and ToT course. Feedback from the initial implementation has been taken into account for subsequent trainings. Overall, the course was well received with feedback themes emphasizing the quality of teaching, method of teaching and applicability of training to daily nursing practice. The need for more time to complete the training and to expand the course to other healthcare providers and to rural sites was also highlighted. These feedback themes were comparable to feedback responses obtained by Kivelhan et al.

Table 4

Self-confidence scores as number and percentage of participants reporting "very comfortable" pre- and post-course for combined groups, cohort 1 and cohort 2, McNemar's exact chi-square

Question	Combined Groups		Cohort 1		Cohort 2		χ ²	P
	n	Pre-course N (%) "very comfortable"	n	Pre-course N (%) "very comfortable"	n	Pre-course N (%) "very comfortable"		
A (ability to assess and manage acutely ill adult)	23	4 (17.4)	11	2 (18.2)	12	2 (16.7)	5	.0625
B (Ability to assess and manage an acutely ill child)	23	6 (26.1)	11	4 (36.4)	12	2 (16.7)	1	1
C (Ability to assess and manage an airway)	23	9 (39.1)	11	4 (36.4)	12	5 (41.7)	6	0.0313
D (ability to assess and manage breathing problems)	23	13 (56.5)	11	4 (36.4)	12	9 (75)	6	0.0313
E (Ability to assess and manage fluid status)	23	10 (43.5)	11	4 (36.4)	12	6 (50)	*	*
F (Ability to assess and manage hemorrhage)	23	3 (13.0)	11	1 (9.1)	12	2 (16.7)	6	0.0313
G (Ability to assess and manage AMS)	22	3 (13.6)	11	1 (9.1)	11	2 (18.2)	6	0.0313
H (Ability to assess and manage traumatic injuries)	22	2 (9.1)	11	0	11	2 (18.2)	*	*
I (prepare and administer emergency drugs)	23	7 (30.4)	11	4 (90.9)	12	3 (25)	4	0.125
J (team work and effective communication)	23	13 (56.52)	11	4 (90.9)	12	9 (75)	*	*

*Unable to calculate p-value due to uniformity in responses

Table 5

Comparing the difference in the proportion of participants reporting “very comfortable” pre-course and post-course between cohort 1 and cohort 2 using fisher’s exact test

Question	Pre-Course Confidence			Post-Course Confidence		
	Cohort 1	Cohort 2	P	Cohort 1	Cohort 2	P
	N (%) "very comfortable"	N (%) "very comfortable"		N (%) "very comfortable"	N (%) "very comfortable"	
A (ability to assess and manage acutely ill adult)	2 (18.2)	2 (16.7)	1	7 (63.6)	11 (91.7)	0.1550
B (Ability to assess and manage an acutely ill child)	4 (36.4)	2 (16.7)	0.3707	5(45.5)	11 (91.7)	0.0272
C (Ability to assess and manage an airway)	4 (36.4)	5 (41.7)	1	10 (90.9)	10 (83.3)	1.0
D (ability to assess and manage breathing problems)	4 (36.4)	9 (75)	0.0995	10 (90.9)	10 (83.3)	1.0
E (Ability to assess and manage fluid status)	4 (36.4)	6 (50)	0.6802	11 (100)	11 (91.7)	1.0
F (Ability to assess and manage hemorrhage)	1 (9.1)	2 (16.7)	1.0	7 (63.6)	10 (83.3)	0.3707
G (Ability to assess and manage AMS)	1 (9.1)	2 (18.2)	1.0	7 (63.6)	10 (90.9)	0.3108
H (Ability to assess and manage traumatic injuries)	0	2 (18.2)	0.4762	7 (63.6)	7 (63.6)	0.3949
I (prepare and administer emergency drugs)	4 (90.9)	3 (25)	0.6668	8 (72.7)	9 (75)	1.0
J (team work and effective communication)	4 (90.9)	9 (75)	0.0995	11 (100)	10 (83.3)	0.4783

Table 6

Post-course feedback

Positive feedback	Constructive feedback
“Facilitators were very competent during teaching session. Explained very well that made us understand the course.”	“Add more time because the course is too broad to tackle for a short time.”
“The facilitators were very clear, audible and very supportive in practical skills.”	“More days for more demonstrations of skills. Up to 5 days.”
“Method of teaching.”	“If possible, the course should enroll greater in number of participants so as to increase level of knowledge concerning basic emergency care.”
“This course is relevant to our daily practice and it is practical based, so very interesting.”	“The District and Regional Hospital workers should be taught about this course. If they get training at peripheral hospitals can reduce mortality rate”
“I really like everything because it helps me to give appropriate care to the patient according to the situation/condition.”	

(2021) and Tenner et al. (2019) in which participants had also suggested more allotted time for trainings, and to expand the trainings for all healthcare workers [10,11]. The BEC courses currently being delivered at BMC are being conducted over 5 days instead of 4 days. In addition, to our delight, the Ministry of Health has begun offering the BEC course to frontline providers in district and regional hospitals throughout Tanzania as they prioritize strengthening the emergency care system.

Strengths

Strengths of this study include 100% attendance, the recruitment of local healthcare providers to teach the course and use of low-fidelity equipment. To begin, all participants attended every training session and completed all BEC course requirements (workbook activities, skill tests, case scenario, pre- and post- course knowledge tests) and all but one nurse completed the pre- and post- course confidence surveys and feedback survey. This is remarkable considering nurses were not compensated for taking the course or study participation.

Another strength, was the ability to recruit in-country master facilitators to teach the BEC course. In coordination with EMAT, nurse facilitators from MNH in Dar es Saleem were flown into Mwanza to deliver the first BEC training and ToT course. This bolstered sustainability, permitted for the course to be modified to local practice patterns and allowed for the content to be delivered in both English and Swahili. Finally, low-fidelity mannikins which were purchased for the trainings were donated to BMC for continued BEC training, further promoting sustainability.

Limitations

There were several limitations in this study. Firstly, the number of participants in this implementation was low, affecting the power of the analyses. In the future, we plan to continue the BEC trainings at BMC such that every nurse will have the opportunity to take the BEC course and this will increase the cohort size for future evaluations.

Secondly, some of the participant nurses had limited fluency in English. Although the facilitators were local and were able to deliver the didactic portions of the course in both English and Swahili, the BEC workbook and written examination were only available in English. The 2 participants who failed their post-course examination cited that they had difficulty understanding the written questions in English and during remediation, when the exam was verbally translated into Swahili, the participants corrected their answers to the appropriate responses. This was also evident in some of the written feedback received which did not appear to correspond with the questions being asked.

Finally, this study did not look at long-term retention of knowledge and skills or impact of the course on clinical care. In the investigations by Friedman et al. (2022), nurses demonstrated a greater improvement in immediate post-course knowledge scores compared to other frontline providers but also exhibited a more significant loss of knowledge and self-efficacy at 6 months post-course evaluation. Nursing retention was thought to be affected by less clinical training, lower levels of education and fewer opportunities for skill and knowledge application [6]. As trainings continue at BMC, it will be important to measure retention as well as introduce longitudinal supplementary activities to prevent knowledge loss.

Conclusion

Implementation of the WHO BEC course at BMC led to improvement in nursing emergency care knowledge and self-confidence. The course was well received among participant nurses and the train-the-trainer model was successful. The BEC course has the potential to strengthen nursing capacity and prospective efforts should focus on disseminating the BEC course to the existing nursing workforce as well as implementing BEC trainings into nursing school curriculums. Future research should focus on assessing the impact of this course on clinical practice and patient outcomes.

Dissemination of results

Results from this study was shared with staff members at the data collection site through an informal presentation.

Authors’ contributions

Authors contributed as follow to the conception or design of the

work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: NA contributed 65%; SS, RS, YS contributed 10% each; and AMA contributed 5%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest.

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