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ORIGINAL RESEARCH

Effect of Educational Intervention on Healthcare Workers' Basic Life Support Knowledge and Practice in a Rural Tertiary Hospital in South Western Uganda

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Background: Basic Life Support (BLS) is critical for timely recognition and response to cardiac and respiratory arrest. However, BLS knowledge and practice remain low among healthcare workers in Uganda, especially in rural areas. Limited research has evaluated the effectiveness of structured BLS training intervention in such a setting. This study assessed the effect of an educational intervention on healthcare workers' BLS knowledge and practice at Kitagata Hospital in Sheema District, Uganda. The intervention involved face-to-face educational training combined with high-fidelity simulation. BLS knowledge was assessed using a 13-item questionnaire, while practice was evaluated using a 23-point simulation checklist. Pre- and post-intervention scores were compared using paired t-tests.

Methods: A quasi-experimental study using quantitative methods was conducted among 30 healthcare workers from Kitagata Hospital in Sheema district, Uganda. The intervention involved face-to-face educational training combined with high-fidelity stimulation. BLS knowledge was assessed using a 13-item questionnaire, while practice was evaluated using a 23-point stimulation checklist. Pre- and postintervention scores were compared using *t*-test. Data were analysed using STATA version 18. A paired *t*-test evaluated the training's effect, and ANOVA compared outcomes across health worker categories.

Results: The training intervention significantly improved BLS knowledge and practice among participants. The mean knowledge score was 4.87 (SD= 14.67) pretest and 12.47 (SD= 7.49) posttest, $p < 0.001$. The mean self-perceived self-practice score was 2.57 (SD= 17.76) pretest and 9.37 (SD= 7.65) posttest, $p < 0.001$; and researcher-observed practice improved by 11 (47.8%), SD 3.52, $p = 0.001$. Qualification level and experience had no significant impact on these outcomes.

Conclusion: Baseline BLS knowledge and practice among health workers at Kitagata Hospital were poor. The educational intervention significantly enhanced both knowledge and practice. Simulation-based training proved effective in improving practical skills. Hospital administrations should regularly conduct refresher BLS trainings, provide accessible guidelines in strategic hospital areas, and integrate BLS into health worker training curricula. Future research should explore healthcare workers' perceptions and attitudes toward BLS and identify barriers and facilitators to its application in clinical settings.

Keywords: basic life support, cardiopulmonary resuscitation, cardiac arrest

Background

Basic Life Support (BLS) plays a critical role in the early recognition and management of cardiac and respiratory arrests, critical emergencies that can lead to preventable deaths if not promptly addressed.[1] According to a World Health Organization (2020) report, as a result of inadequate access to timely resuscitation, 3.2 million people die from

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cardiopulmonary diseases.[2] Healthcare workers are often the first responders in clinical settings, yet evidence indicates persistent gaps in both knowledge and practice application, especially low resources setting, as more than 350,000 people in need of BLS each year go unidentified and untreated, resulting in preventable deaths.[3] The Centers for Disease Control (2020)[4] reported that if the BLS was well and timely considered, the over 600,000 annual deaths from heart diseases would be reduced, lowering the number of probable deaths. BLS reinstalls and maintains the vital organ functioning for patients in respiratory and cardiac arrest using various interventions, and is a survival determinant.[1] The rate of cardiac and respiratory arrest related mortality and morbidity can be reduced by healthcare workers having updated BLS knowledge and practice.[5] Having up-to-date knowledge and practice of BLS among healthcare professionals facilitates early detection of the need and early initiation for BLS.[2] This facilitates a reduction in the incidence of preventable deaths from in-hospital cardiac and respiratory arrests. In Uganda, Ministry of Health reports that more than 250,000 patients per year may require BLS as a result of traffic accidents, home accidents, or noncommunicable diseases.[6] However, healthcare workers frequently lack both updated BLS Training knowledge and practice competence, particularly in rural settings where emergency training opportunities are limited. These deficits contribute to increased morbidity, mortality, and prolonged intensive care stays due to complications from delayed resuscitation efforts,[7] This heralds the start of an effort to raise BLS awareness and promote its use. One critical aspect of raising awareness is education intervention on BLS, which is a model that promotes good knowledge and practices (Ngune et al, 2020). To this, efforts to improve the knowledge and practices of BLS are desired. An educational intervention on BLS is a critical approach to improving the knowledge and eventual practice for a life-saving intervention such as BLS.[8] This is premised on the presumed postintervention gain, which positively impacts the behavior. Further, the use of a healthcare workers training intervention model is instrumental to practicing gaps.[9] While knowledge gaps may portend societal practices, the education intervention eludes these deficits and expectedly augments desirable practices (Fielding, 2018). Despite the recognized importance of BLS in preventing avoidable mortality, Uganda has limited empirical data evaluating the actual effectiveness of BLS training interventions among healthcare workers. Most existing studies have assessed baseline BLS knowledge or attitudes using cross-sectional designs, primarily in urban or regional referral settings.[7,10] However, few studies have rigorously evaluated the impact of structured BLS educational interventions on both knowledge acquisition and practical application, especially in rural district hospitals where health care resources and training opportunities are scarce. This gap creates a critical need for research that not only measures knowledge improvement but also assesses practical BLS competencies post-training, using simulation-based approaches. Addressing this gap is essential for informing scalable, evidence- based training strategies in Uganda and similar low resource health care settings. Therefore, the present study assessed BLS educational intervention effects on healthcare workers' knowledge and practices at Kitagata hospital Sheema district.

Materials and Methods

Study Design

A descriptive quasi-experimental design with pre- and posttest was used in which a single group of participants was used to measure the degree of change occurring because of treatments or interventions. The quasi-experimental study was suitable for this study as the health education intervention required that healthcare workers are sensitized about BLS. This took a form of face-to-face interactive communication with small groups of healthcare workers. For this study, a single- group pretest and posttest approach was used. Participants' knowledge and practices of basic life support were assessed with a self-administered researcher-designed questionnaire. Then the study participant, based on the results of the educational pretest, received education and practice designed intervention, instructing the health workers on basic life support. A posttest was done 1 month after the intervention.

Study Setting

The research was carried out in Kitagata hospital, a government-owned district hospital located in the central business district of the town of Kitagata, in Sheema District, in the Ankole sub-region, in Western Uganda, about 62 kilometres southwest of Mbarara Regional Referral Hospital and about 111 kilometres north of Kabale Regional Referral Hospital.

Has a bed capacity of 100, OPD services, maternity services, paediatrics, HIV care, communicable and non-communicable diseases care, accident and emergency care. Sheema district has eight Health Centre IIIs, two Health Centre IVs, and one district hospital (Kitagata). Sheema District is located in Southwest Uganda and is bordered by Buhweju District to the north, Mbarara District to the east, Ntungamo District to the south, Mitooma District to the southwest, and Bushenyi District to the west. Kibingo, the district headquarters, is about 33 kilometres (21 miles) west of Mbarara, the Ankore sub-largest region's city. The district hospital was chosen because it serves as a referral for the entire district and therefore a bigger catchment area. It provides in- and out-patient services, maternity, laboratory services, paediatric services, an HIV clinic, immunization, and drug dispensing.

Study Population

The study included healthcare workers of all cadres, including nurses, doctors, midwives, anesthetic officers, and clinical officers, attached and posted by the district, as well as those seconded by non-governmental organizations (NGOs) and implementing partners. Selected staff members from departments were those responsible for the direct management of patients.

Sample Size Determination

The sample size was determined using Cohen's formula in situations where there is the uncertainty of specific information on the magnitude or extent of adoption of a particular intervention like the extent of the practice of BLS in Sheema district. The authors suggested that sample size calculations be done using standardized effect sizes for the studies done among two group means (Cohen, 1988, Allen Jr, 2011, Norman et al, 2012). The formula was $n = 16(1/(\text{effect size})^2)$, where n is the required sample size. Therefore, using a standard large effect size of 0.8 (Cohen, 1988), $n = 16(1/(0.8)^2) = 25$ participants. However, considering an attrition of 20%, = 20/100 = 0.2 = (0.2 x 25) = 5 participants. Therefore, the total sample size required was (25 + 5) = 30, approximately 30 participants. Also notable is that it has been proven that, for a planned paired *t*-test analysis, a prior power analysis gave a total sample size of 20 participants per group to detect a large effect (Buchner et al, 2009). Therefore, the final sample size for this BLS educational interventional project of 30 participants is adequate to measure the effect of the intervention.

Sampling Strategy

Given that the number of healthcare workers working in Kitagata hospital alternate in duties and some were off station due to different reasons including participation in out reaches, workshops, and meetings. A convenience sampling strategy was employed to recruit all eligible healthcare workers offering direct patient care.

Eligibility Criteria

Inclusion Criteria

Registered and licensed healthcare workers working at Kitagata hospital and Sheema district hospital were available at the time of the study.

Exclusion Criteria

- Healthcare workers under study placements.
- Nursing assistants
- Healthcare workers who are not directly involved in the care of patients.

Data Collection Tools

Data was collected using two tools, one questionnaire and one observation check list.

The questionnaire was in three sections. Section A captured the social-demographic characteristics of the healthcare workers including: gender; level of training; length of experience; prior training on basic life support; prior training on advanced life support; experience initiating or responding to cardiac and respiratory arrests; current area of practice; and duration of working in the current unit/ward. Section B assessed the knowledge of healthcare workers toward BLS, had 13 items and each item answered correct scored one mark, so the total was out of 13 marks. Section C assessed the self-

perceived practice of healthcare workers toward BLS and had 10 multiple choice questions/items, which each scored one mark when answered correct and zero when wrong. The observation checklist was the second tool that assessed hands on practice in a simulation scenario. It had 16 observations, that scored one point for each correctly done observation and seven penalty scores, making a total score out of 23. The questionnaire was adapted with permission from Munezero et al.[7] This questionnaire was used in the assessment of nurse's knowledge following cardiopulmonary resuscitation training at Mbarara Regional Referral Hospital in Uganda. It was derived from the American Heart Association (AHA) guidelines for basic life support. The observation checklist tool for healthcare workers practice on BLS was derived from the American Heart Association (AHA) guideline for basic life support 2020. This tool had been used by other authors in assessment of knowledge on BLS.[11] Higher scores above 50% indicate a better performance in both assessments.[12]

Data Collection Procedure

After approval from the nursing department, the proposal was submitted to the Faculty Research Committee (FRC) and Research and Ethics (REC) and issued REC-MUST-2023-1212 at MUST, and clearance was obtained from the hospital superintendent. The data collection procedure involved three phases: preintervention, intervention, and postintervention.

Preintervention Phase

A time was agreed upon with the Hospital administrators for the instruction (training). Each participant's consent was obtained before the program began. A simple and brief explanation of the objectives and background of the research was provided to the participants being recruited into the study. The data was collected by the principal investigator and trained research assistants, 1 week before the intervention and 1 month after the educational intervention was complete. The pre-intervention data was collected 1 week before the Intervention phase as this helped in modifying the teaching based on their baseline knowledge and practice. On the day of the instruction, a self-administered researcher designed pretest questionnaire was issued to each eligible consented respondent with explanations as necessary. The respondents answered the questionnaire in about 30 minutes without referring to any resources and handed it over to the researcher immediately upon completion.

Intervention

Knowledge on BLS

The education session aimed at enhancing the healthcare workers' knowledge and practices on basic life support. This phase was done 1 week after the preintervention phase.

Content

This content was developed from American Heart Association 2020 Guidelines.[11] Attached is my presentation in power point. A face-to-face teaching strategy was employed. The session included a group of 5–10 participants per session and it was a one-time session per group for a period of 3 weeks for all four wards and outpatient departments. The intervention was performed by combining two units at a time. The study participants consisted of different carders given that different carders were free at a particular period, and this enabled participation to be maximized. The teaching sessions were provided twice on the same day during the morning and afternoon after a discussion with the unit in-charges and heads of departments of its possibility so that all healthcare workers on different shifts can participate. The healthcare workers who agreed to participate were requested to attend after the changeover shift. For participants who were feeling tired after their duties, a special arrangement was made for them, especially on their off duties. This was to protect the participants from extra fatigue from their participation in this study. The teaching session was held for 1.5 hours per session. A PowerPoint presentation on the introduction to basic life support, assessment of cardiac and respiratory arrest, and management of cardiac and respiratory arrests was used during the teaching session. The PowerPoint was made available as handouts of slides and printed into hard copy. These hard copies were to facilitate learning for participant who had no electric gadget or electricity was not available for those who had the gadgets. Two short videos, each lasting at least 5 minutes, adapted from YouTube academic channels were shown to the participants after a thorough audit to reinforce understanding and practice of basic life support. In addition, patient case scenario with vital signs that was designed by the researchers after a comprehensive literature review was used to further enhance

healthcare workers' understanding of basic life support. Other materials, including a projector, flip charts, ink pens, notebooks, white board, and case study scenarios were made available to the participants during the study period.

Intervention for Basic Life Support Practice

For BLS practice, a high-fidelity simulation-based approach was used to instil and assess competencies of healthcare workers. The aim of this simulation strategy was to facilitate an objective assessment of the competency of the healthcare workers toward application of BLS in detection and response to cardiac and respiratory arrests among patients. This was to help to complement the results of their self-perceived competence. The reason was that studies have reported healthcare workers to overrate their self-perceived competencies.[13] Furthermore, simulation has demonstrated the ability to assess and enhance the practices of the healthcare workers toward basic life support.[14–17]

The simulation sessions were conducted at Kitagata hospital from a hospital skills room located within a female ward in Kitagata hospital. This was after permission had been granted from the hospital administrators. The skills room, being located within the study hospital, was convenient for the study participants. All the participants who participated in the knowledge training also participated in the simulation observation session for practice after providing informed consent.

The simulation sessions were performed separately for every two units. The study participants consisted of different carders given that different carders were free at a particular period and this enabled participation to be maximized. The session was provided twice on the same day during the morning and afternoon after a discussion with the unit in-charges heads of departments and participants themselves. The participants for simulation were those on their off duties only. The aim was to protect them from burnout resulting from taking on their normal ward duties after the simulation session and extra fatigue for those from their normal ward duties. This was not only to protect the participants from burnout but also allow an accurate finding to be achieved without being confounded by fatigue for those from normal duties. The healthcare workers who agreed to participate were requested to attend after the changeover shift. Participants who were free on their off duties were also requested to participate. The aim of all this flexibility was to ensure that the participation in this study does not interfere with the normal hospital/ward routine. The scenario was for a patient with signs and symptoms of cardiopulmonary arrest. The scenario was developed by the researcher and the relevance of the content was reviewed by simulation experts from Mbarara University of Science and Technology Simulation Center. It was only one scenario given to all cadres of healthcare workers since cardiopulmonary arrest can happen at any point of patient management/care in the hospital. A mannequin with good functioning of the cardiac and respiratory systems and a defibrillator for demonstration were borrowed from Mbarara University Simulation Center to cater for a real practice environment. A total of four participants per simulation session were considered. The entire simulation session was divided into three phases; prebrief, simulation, and debrief phases, as elaborated below:

Prebrief Phase

The prebrief phase included orienting the participants to the simulation room, including equipment for example for vital signs, like a clinical thermometer, blood pressure machine, stethoscope, pulse-oximeter, the patient's attendant, the consultation materials like the national clinical guideline and British national formulary, a phone to call any specialists outside the simulation, housekeeping rules (the dos and don'ts), writing materials and the updated Basic Life Support Guidelines was available in the skills room. It was generally to make the participants fully aware of the environment so as to mimic the actual practice environment. This process took a maximum of 10 minutes. The prebriefing phase was guided by a standard prebriefing guide.

Simulation or Scenario Phase

This phase included running the actual scenario. During this phase, the scenario facilitator read the scenario while giving brief information about the chief complaint of the patient to the participants and asking them participant to intervene and help the deteriorating patient. Participants were expected to ask for more information about the patient from the attendant actress/bystander who was at the bedside. To further mimic reality, relatively little information was provided, the participants were allowed to investigate freely, and the participants were given clinical information over time in accordance to a process-based information giving.[18] This approach was to help enhance the ecological validity of the simulation allowing the participants to exercise clinical thinking in a dynamic manner. In scenario, subtle deterioration

cues were present in the first 10 minutes, prior to more obvious and significant signs of deterioration during the final 10 minutes. Level of relevance of information provided and the predictability of perceived relationship were considered to achieve an effective and practical learning environment. For example, inadequate chest compressions and poor breaths to the patient lead to the poor patient outcome. An actress of a senior clinician/Doctor entered in the middle of the scenario and the participants were expected to communicate the patients' condition to the senior clinician/Doctor colleague. This enabled assessment of communication skills among the participants. Practice competency of the healthcare workers was assessed by observation against a checklist by two separate nonparticipant trained observers. This was to aid in harmonizing the level of agreement or disagreement to maintain the objectivity of the assessment. The observers for the practice of the health workers toward basic life support included nurses graduates with Masters of Science in Nursing in Critical care and are experienced in basic life support. This simulation phase lasted 20 minutes. The participants were observed for practice items in the management of patient situation.

Debriefing Phase

This phase followed the simulation phase. The debriefing phase was guided by the promoting excellence and reflective learning in simulation (PEARLS) tool.[19] A modified version of this tool by the Mbarara University of Science and Technology Simulation Department was used with permission. During the debriefing, more items of the competency, which are Reflection on the process of managing a rapidly changing patient situation and Extrapolation of knowledge from the reflection process to apply in managing future patient situations, were observed from the participants against the check list. This phase took a minimum of 45 minutes and was not prolonged so as to allow the participants to resume their normal duties. During this phase, the researcher facilitated instillation of appropriate practices to the participants through practical demonstration and return demonstration. This debriefing phase was guided by a standard debriefing guide.

Postintervention Phase

The postintervention data was collected with the same questionnaire and checklist used in the Pretest once a month after the educational interventions was completed. This period of data collection postintervention was based on guidance from other related studies.[7,16,17] For the researcher observed part of practices, another simulation session were organized postintervention. The postinterventional assessment was done for a period of 2 weeks.

For participants who exhibited low knowledge and practice with regards to basic life support after the training, basic life support guidelines and flow charts were availed in strategic places on the walls of the different units to be a reminder to them in regards to knowledge and skills toward basic life support. In addition, a recommendation was made and shared with the officers in charge of the different units and the hospital and district administration in general to ensure there are regular continuous professional development sessions regarding basic life support in the hospital. The data collection procedure is summarized in Figure 1.

The preintervention phase entailed collecting data on the baseline knowledge and practice of healthcare workers toward BLS. This lasted 45 minutes and took about 2 weeks to complete. The intervention phase involved delivering an educational intervention on BLS, hands-on practice of BLS with coaching, watching BLS videos, and doing a return demonstration on the manikin.

This phase took about 1 month to get completed. The final phase of this study was the post-intervention phase which was done 1 month after the intervention phase. This final phase involved postintervention data collection on the knowledge and practice of BLS.

Data Management

The collected data was checked for completeness and consistency in time, as well as the completion of the questionnaires. Before leaving the facility, any missing data was filled. Furthermore, the data collection process ensured that there are enough questionnaires for all participants and that individual interviews are administered to avoid shared responses while also maintaining confidentiality. The data was entered into MS Excel, and Epi info version 7.0 software in Epi info, it was cleaned and coded. Furthermore, knowledge of BLS was graded as good knowledge (score above the mean of 50%) or poor knowledge (score below the mean of 50%), as in Tadesse et al.[12] For knowledge and practice, a score of

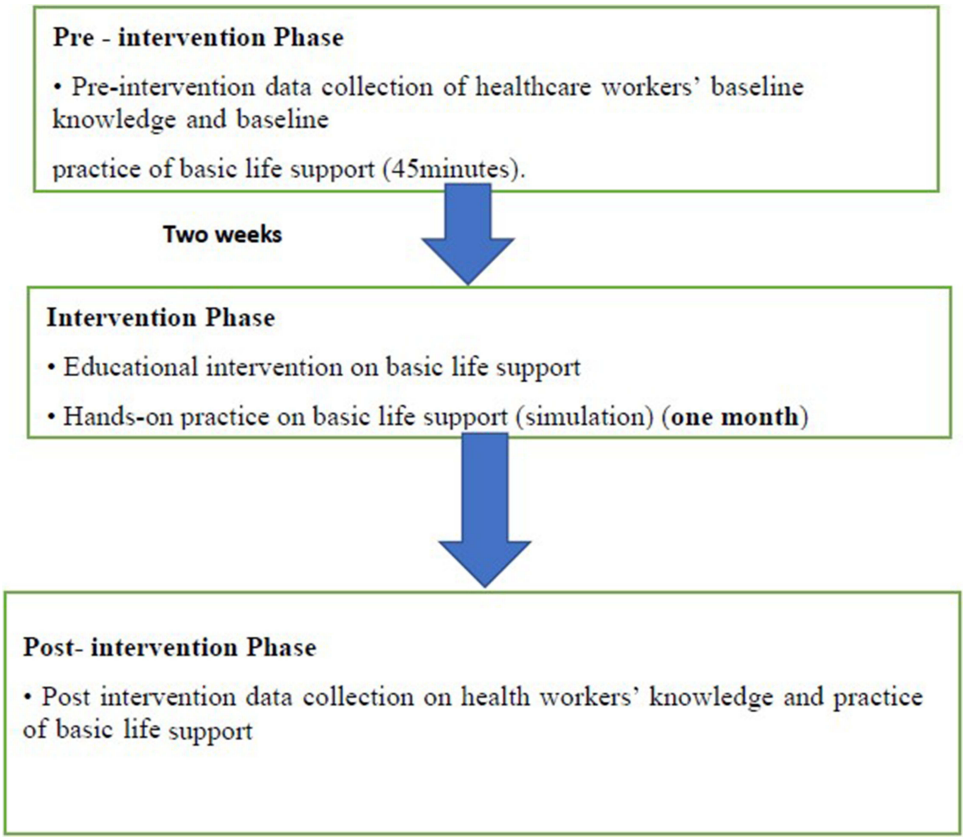


Figure 1 Study profile, illustrating the three phases of the research: Preintervention assessment, Educational Intervention (including simulation training), and Postintervention assessment.

"1" was given for questions answered correctly and "0" for questions answered wrongly. This facilitated obtaining of the overall mean score for knowledge and practice preintervention and postintervention.

Data Analysis

Data collected was entered in a MS Excel spread sheet and analyzed using Epi info version 7.0 software, exported into STATA version 18.0 for statistical analysis. Descriptive statistics in terms of mean and standard deviation were performed for continuous variables, and frequencies and percentages for categorical variables. These were done for demographic, preintervention, and postintervention data.

Objective One

The baseline level of knowledge was assessed using a paired *t*-test because the mean difference between the pre- and posttest scores was normally distributed, as assessed for Shapiro–Wilk test of normality and Box and Whisker plot. Then analysis of variance was done to compare performance in different categories.

Objective Two

Baseline level of practice was assessed using a paired *t*-test because the mean difference between the pre and post test scores was normality distributed as assessed for Shapiro–Wilk test of normality and Box and Whisker plot. Then analysis of variance was done to compare performance in different categories.

Objective Three

The effect of educational intervention on knowledge was assessed using a paired *t*-test because the mean difference between the pre- and posttest scores was normality distributed as assessed for Shapiro–Wilk test of normality and Box and Whisker plot. The effect size of the intervention was assessed by calculating the Cohen's d for the mean difference

between the pretest and posttest scores with a Cohen's d of 0.2 taken as a small effect size, 0.5 medium, and ≥0.8 large. Then analysis of variance was done to compare performance in different categories. Levene's test was used for equality of variances to confirm homogeneity of variances of knowledge scores across all the groups.

Objective Four

The effect of educational intervention on practice was assessed using a paired *t*-test because the mean difference between the pre- and posttest scores was normally distributed as assessed for Shapiro–Wilk test of normality and Box and Whisker plot. The effect size of the intervention was assessed by calculating the Cohen's d for the mean difference between the pretest and posttest scores with a Cohen's d of 0.2 taken as a small effect size, 0.5 medium, and ≥0.8 large. Then analysis of variance was done to compare performance in different categories. McNemar's test was used to assess the impact of the training on practice of each group step and action performed in sequence during basic life support, namely; correctly establishing unresponsiveness, calling for help, correctly checking for a pulse, and correct positioning. For all the analysis, the level of significance was set at 0.05 at a 95% confidence interval. Therefore, a *p*-value <0.05 was considered statistically significant. Data was presented using tables and graphs where applicable.

Quality Control Measures

The study employed validated tools to measure knowledge and practice of basic life support. The questionnaire was pretested among 5% of respondents in Itojo hospital located in Ntungamo District, southwestern Uganda. This was done a month before data collections, and changes were made based on the vague questions Two BLS experts from Mbarara Regional Referral Hospital/Mbarara University of Science and Technology were consulted before data collection to validate the data collection tool and confirm its reliability at a Cronbach alpha of 0.86,[20] pass mark of 86%, as recommended by Greif et al[21] and according to BLS for health care providers a document of resuscitation council of southern Africa (RCSA) for basic life support knowledge. The principal investigator closely monitored the data collection process to ensure timely corrections and guidance. The research assistants were trained before data collection.

Ethical Approval

The proposal was presented to the department of Nursing Mbarara University of Science and Technology. After approval from the Nursing department, it was submitted to the faculty research committee (FRC). Final submission after clearance from the FRC was made to the Mbarara University of Science and Technology Research and Ethics Committee, who also carried out periodic reviews of the study's progress. After approval from Research and Ethics (REC) at MUST with REC-MUST-2023-1212, administrative Clearance was obtained from the hospital superintendent. Further permission was sought from the managers of the different study units. Written informed consent was sought from the prospective participants after a detailed explanation on the aims and purpose of this study. They understood that the study had no potential harm and that they had the freedom to terminate their consent at any time they wished during the course of the study. They understood that such withdrawal had no effect on their profession or their care delivery to the patients. For confidentiality, unique numbers were allocated to the participants to maintain anonymity. The informed consent process included: Providing participants with an information sheet outlining the study purpose, potential risks, and benefits, allowing sufficient time for participants to read the consent document and ask questions, obtaining written informed consent from all participants before any data collection activities commenced, ensuring confidentiality by assigning anonymous codes to participants, and securely storing all data.

Results

Socio-Demographic Characteristics of the Participants

Most of the participants were females (18; 60%), the biggest number were diploma holders (19; 63.3%), had experience of work ranging from 6–10 years (12; 40%), were from a maternity ward (7; 23%), and had never trained in BLS (19; 63.3%). No one had a certificate in ACLS and only one (3.3%) had a certificate in BLS ; while a good number had ever had in-service training on BLS (10; 33.33%), 11 (37%) had never performed BLS on any patient and six (20%) perform it on a daily basis. The social demographic characteristic of the participants are shown in Table 1. Social-demographic characteristics of the participants.

Table 1 Social-Demographic Characteristics of the Participants

Socio-Demographic	n (%), n=30 (100)
Gender	
Male	12 (40.00)
Female	18 (60.00)
Qualifications	
Bachelors	6 (20.00)
Certificate	5 (16.67)
Diploma	1 9(63.33)
Experience in years	
< 5	4 (13.33)
6–10	1 (40.00)
11–15	7 (23.33)
16–20	2 (6.66)
21+	5 (16.66)
Department of work	
OPD	6 (20.00)
Maternity ward	7 (23.00)
Female ward	5 (13.66)
Male ward	3 (10.00)
Pediatric ward	2 (6.67)
Theater	4 (13.33)
All departments	3 (10.00)
Prior training in BLS	
BLS certificate	1 (3.33)
ACLS certificate	0 (0.00)
In-service BLS training	10 (33.33)
No prior BLS training	19 (63.33)
How often performed BLS	
Daily	6 (20.00)
Weekly	2 (6.67)
Monthly	3 (10.00)
Yearly	2 (6.67)
In more than a year	6 (20.00)
Never performed i.	11 (36.67)

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Pre- and Posttraining Knowledge Levels toward BLS

Before training the most well answered questions were regarding BLS in full (21; 70.00%), depth of compressions in adults during chest compressions (20; 66.7%), the location for chest compressions in infants (16; 53.3%), and the abbreviation of EMS (16; 53.3). The most poorly answered were, First response to a friend who starts expressing symptoms of choking but is responsive (2; 6.7%), response to someone who does not respond to voice and shaking (3; 10.00%), depth of compressions in neonates during chest compressions (5; 16.7), how to give rescue breathes in infants (8; 26.7%). After training the participants there were improvements in all the knowledge related questions performance as indicated in Table 1 to 100% in each group, this could have been due to the participants in the groups performing what each is perfect on and hence excellent performance. The knowledge performance of the participants toward BLS is summarized in Table 2.

Table 2 Participants Performance in BLS Knowledge Pre- and Post-raining

Variable	Before Training (Pretest)	After Training (Posttest)
BLS in full		
Correct	21 (70.00)	30 (100)
Wrong	9 (30.00)	0 (0.00)
First response to someone who needs BLS, in middle of the road		
Correct	13 (43.33)	27 (90.00)
Wrong	17 (56.67)	3 (10.00)
Response to someone who does not respond to voice and shaking		
Correct	3 (10.00)	27 (90.00)
Wrong	27 (90.00)	3 (10.00)
Location for chest compressions in adults		
Correct	9 (30.00)	27 (90.00)
Wrong	21 (70.00)	3 (10.00)
Location for chest compressions in infants		
Correct	16 (53.33)	27 (90.00)
Wrong	14 (46.67)	3 (10.00)
How to give rescue breaths in infants		
Correct	8 (26.66)	30 (100.00)
Wrong	22 (73.34)	0 (0.00)
Depth of compressions in adults during chest compressions		
Correct	20 (66.66)	29 (96.66)
Wrong	10 (33.34)	1 (3.34)
Depth of compressions in children during chest compressions		
Correct	10 (33.34)	29 (96.66)
Wrong	20 (66.66)	1 (3.34)

(*Continued*)

Table 2 (Continued).

Variable	Before Training (Pretest)	After Training (Posttest)
Depth of compressions in neonates during chest compressions		
Correct	5 (16.66)	29 (96.66)
Wrong	25 (83.34)	1 (3.34)
Rate of chest compression in adults and children during chest compressions		
Correct	9 (30.00)	29 (96.66)
Wrong	21 (70.00)	1 (3.34)
What abbreviation AED stands for.		
Correct	14 (46.66)	29 (96.66)
Wrong	16 (53.34)	1 (3.34)
What does abbreviation EMS stand for?		
Correct	16 (53.34)	29 (96.66)
Wrong	14 (46.66)	1 (3.34)
First response to a friend who starts expressing symptoms of choking but responsive		
Correct	2 (6.66)	29 (96.66)
Wrong	28 (93.34)	1 (3.34)

Practice of the Participants toward BLS

Self-Perceived Practice of the Participants toward BLS

In the practice questions before training the most well answered questions were, Inclusive of critical characteristics of high-quality chest compressions (16; 53.3%), where should one attempt to perform a pulse check in adults (13; 43.3%), the initial Basic Life Support (BLS) steps for adults (10; 33.3%). The most poorly performed were, how often should 2-rescuer CPR breathes be administered in adults with an advanced airway in place? **(**2; 6.7%), The five links in the adult Chain of Survival include all of the following EXCEPT (4; 13.33%), the compression to ventilation ratio for the lone rescuer giving CPR to victims of any age is? (5; 16.7%) after training the performance in self-perceived practice improved as indicated by all the performance per question in above table The self-perceived practice of the participants towards BLS is shown in Table 3.

Table 3 Participants Performance in BLS Self-Perceived Practice Pre- and Posttraining

Variable	Performance in n (%) Before Training	Performance in n (%) After Training
The 5 links in the adult Chain of Survival include all of the following EXCEPT:		
Correct	4 (13.33)	26 (86.66)
Wrong	26 (86.67)	4 (13.34)

(*Continued*)

Table 3 (Continued).

Variable	Performance in n (%) Before Training	Performance in n (%) After Training
How often should rescuers switch roles when performing 2-rescuer CPR?		
Correct	5 (16.66)	29 (96.66)
Wrong	25 (83.34)	1 (3.34)
The initial Basic Life Support (BLS) steps for adults are:		
Correct	10 (33.33)	26 (86.66)
Wrong	20 (66.67)	4 (13.34)
Where should you attempt to perform a pulse check in adult?		
Correct	13 (43.33)	30 (100.00)
Wrong	17 (56.67)	0 (0.00)
The compression to ventilation ratio for the lone rescuer giving CPR to victims of ANY age is:		
Correct	5 (16.66)	30 (100.00)
Wrong	25 (83.34)	0 (0.00)
The proper steps for operating an AED are:		
Correct	6 (20.00)	26 (86.66)
Wrong	24 (80.00)	4 (13.34)
The 2020 AHA Guidelines for CPR recommended BLS sequence of steps are:		
Correct	7 (23.33)	28 (93.33)
Wrong	23 (76.67)	2 (6.67)
Signs of severe airway obstruction include all of the following EXCEPT?		
Correct	8 (26.66)	29 (96.66)
Wrong	22 (73.34)	1 (3.34)
In an adult with an advanced airway in place during 2-rescuer CPR, breaths should be administered how often?		
Correct	2 (6.66)	27 (90.00)
Wrong	28 (93.34)	3 (10.00)
Inclusive of critical characteristics of high-quality CPR		
Correct	16 (53.33)	29 (96.66)
Wrong	14 (46.67)	1 (3.34)

Health Workers Observed Practice on BLS Using Researcher Observation Guide

Observed practice was performed in groups of four for five groups and five for two groups; a total of seven groups were observed for practice. A total of seven groups of 4–5 participants were observed because BLS is done as a team where a team is available. All of the participants groups performed well on Compressions started (from the time unresponsiveness was noted) and check of pulse (7; 100%) followed by patient positioning and Backboard placed/resuscitation bed/on floor (4; 57.1%). None of the participants group paused CPR for less than 10 seconds and only one group did BVM attached to oxygen, opened the airway (removed the pillow), or placed pads for AED before training them. After training all the groups improved in performing BLS, with 100% of the groups performing all the tasks well. The results for the researcher observed health workers practice towards BLS are summarized in Table 4 for both before and after training.

Effect of Educational Intervention on Health Workers Knowledge toward BLS

Overall, before intervention, the mean score on the 13 item knowledge assessment questionnaire was 37.5%, calculated from the total sum score of all the 30 participants from the 13 questions assessing for knowledge divided by 30 participants. The range, that is the difference between the highest score and the lowest score, in pretest performance was

Table 4 Results of Health Workers Observed Practice toward BLS Using Researcher Guide

Variable	Before Training (Pretest) n (%)	After Training (Posttest) n (%)
Establishes unresponsiveness		
Correct	2 (28.57)	7 (100.00)
Wrong	5 (71.43)	0 (0.00)
Calls for help (code)		
Correct	2 (28.57)	7 (100.00)
Wrong	5 (71.43)	0 (0.00)
Checks the pulse		
Correct	7 (100.00)	7 (100.00)
Wrong	0 (0.00)	0 (0.00)
Patient positioned		
Correct	4 (57.14)	7 (100.00)
Wrong	3 (42.86)	0 (0.00)
Backboard placed/resuscitation bed/on floor		
Correct	4 (57.14)	7 (100.00)
Wrong	3 (42.86)	0 (0.00)
Removal of the gown		
Correct	2 (28.57)	7 (100.00)
Wrong	5 (71.43)	0 (0.00)
Accurate hand position		
Correct	5 (71.43)	7 (100.00)
Wrong	2 (28.57)	0 (0.00)

(*Continued*)

Table 4 (Continued).

Variable	Before Training (Pretest) n (%)	After Training (Posttest) n (%)
Compressions started (from the time unresponsiveness was noted)		
Correct	7 (100.00)	7 (100.00)
Wrong	0 (0.00)	0 (0.00)
Adequate rate of compressions		
Correct	2 (28.57)	7 (100.00)
Wrong	5 (71.43)	
Adequate depth		
Correct	4 (57.14)	7 (100.00)
Wrong	3 (42.86)	0 (0.00)
Adequate recoil		
Correct	4 (57.14)	7 (100.00)
Wrong	3 (42.86)	0 (0.00)
Pads placed for the AED*		
Correct	1 (14.29)	7 (100.00)
Wrong	6 (85.71)	0 (0.00)
CPR paused for no more than 10 seconds		
Correct	0 (0.00)	7 (100.00)
Wrong	7 (100.00)	0 (0.00)
Opens the airway (removes the pillow)		
Correct	1 (14.29)	7 (100.00)
Wrong	6 (85.71)	0 (0.00)
Applies the BVM to the patient		
Correct	2 (28.57)	7 (100.00)
Wrong	5 (71.43)	0 (0.00)
BVM attached to oxygen		
Correct	1 (14.29)	7 (100.00)
Wrong	6 (85.71)	0 (0.00)

0–61.50%. The lowest participant scored 0% and the highest scored 61.5%. After the intervention, the mean score improved to 95.9% (range = 84.60−100%), representing a 58.4% (95% CI = 6.73–8.47) improvement in the level of knowledge on BLS.

A paired *t*-test was run to assess the impact of the training intervention on the level of knowledge on BLS. The difference in the mean scores in the pretest and posttest assessments had a normal distribution (Shapiro–Wilk test *p*-value = 0.93) and had no outliers, as assessed from a boxplot. There was a statistically significant improvement in the mean

knowledge assessment scores after the training, t(29) = 17.77, $p < 0.00$. The effect size of the intervention on change in knowledge levels was also very large; Cohen's d = 4.4 (95% CI = 3.50–5.40), with a point bi-serial correlate of r = 0.91. The results for the effect of education intervention on healthcare workers knowledge on BLS are summarized in Table 5.

Variation in Knowledge of Healthcare Workers toward BLS across the Social Demographic Characteristics

A one-way Analysis of Variance (ANOVA) was performed to compare the knowledge levels between the different categories of staff in the preintervention and postintervention phases of the study. Levene's test for equality of variances confirmed homogeneity of variances of knowledge scores across all the groups. There was no significant difference in the baseline level of knowledge on BLS among the different staff by qualification of graduate, diploma, and certificate during the pretest (p= 0.69) and subsequently in the postintervention assessments ($p = 0.29$). Similarly, there was no significant difference in level of knowledge on BLS among those who had worked for less than 5 years, 5–9 years, and 10 or more years in the pre- ($p = 0.73$) and postintervention assessments ($p = 0.47$).

Effect of Education Intervention on Healthcare Workers Self-Perceived Practice toward BLS

There has been an improvement in self-perceived practice, as indicated by the difference in mean of 6.80 (68.67%). The mean in Table 6 was achieved by the total score from 10 self-perceived practice questions of 30 participants divided by 30 participants, this was done for both pre- and posttests. The difference was made by subtracting the pretest mean from the posttest mean, which showed us the effect by mean of education intervention on self-perceived BLS practice (6.80; 68.67%). Paired *t*-test was run to test for the effect of education intervention comparing pre- and posttest performances, and the *p* value was 0.00, which is less than 0.05 and thus a significant finding. The results for the effect of education intervention on healthcare workers self-perceived practice toward BLS are summarized in Table 6.

Effect of Education Intervention on Healthcare Workers Observed Practice on BLS

The participants practice during BLS was assessed by direct observation during simulated scenarios before and after the training intervention after dividing them into seven groups. The mean scores for all the groups before intervention was 40.4% (95% CI = 22.6%–58.2%) and after training improved to 87.6% (95% CI = 83.4%–91.2%). A paired *t*-test was run to compare the performance of the groups during simulated situations showed the intervention significantly improved the practice of the groups by 47.25% (95% CI = 31%–63.4%), t(6) = 7.1496, $p = 0.004$, with a large effect size, Cohen's d of 3.4 (1.7–5.0), and Point-Biserial r = 0.88. McNemar's test was used to assess the impact of the training on practice of each individual step and

Table 5 Effect of Educational Intervention on Knowledge toward BLS

Scores	Obs	Mean	Range	95% CI	SD	T	*p*-value
Posttest	30	12.47 (95.90%)	84.60–100.00%	93.10–98.69	0.97 (7.49)	17.77	< 0.00
Pretest	30	4.87 (37.50%)	00.00–61.50%	31.96–42.91	1.91 (14.67)		
Diff		7.60 (58.40%)	84.60–38.50%	51.73–65.19	2.34 (18.02)		

Note: "Diff" refers to the difference in mean scores pre- and postintervention. Knowledge scores are based on a 13-item assessment (maximum score = 13).

Table 6 Effect of Education Intervention on Self Perceived Practice toward Bls

Scores	Obs	Mean -/10(-/100)	SD	95% CI	T	Paired t test *p*-value
Posttest	30	9.37 (93.67)	0.76 (7.65)	90.81–96.52	17.54	<0.00
Pretest	30	2.57 (25.00)	1.79 (17.76)	18.37–31.63		
Diff		6.80 (68.67)	2.12 (19.25)	61.48–75.85		

Note: Self-perceived practice scores are based on a 10-item questionnaire (maximum score = 10).

action performed in sequence during basic life support, namely; correctly establishing unresponsiveness, calling for help, correctly checking for pulse, correct positioning of the patient, placing the patient on a proper surface or use of a backboard, removal of gown, accurate hand positioning, compression techniques, pause time and use of resuscitation devices like AED, bag valve mask and oxygen. Results are shown in Table 8 . Exact McNemar's *p*-values are reported because of the small sample size. The participants practice during BLS was assessed by direct observation during simulated scenarios before and after the training intervention after dividing them into seven groups. The results for the effect of education intervention on researcher observed health workers practice toward BLS are summarized in Table 7.

Observed Practices of Groups Before and After Training

The steps in which the groups had most challenges in performing correctly which subsequently significantly improved after the training were correct placement of AED pads, not pausing CPR for more than 10 seconds, remembering to open the airways during bagging, including removal of the pillows from the back of the patients, and remembering to attach the bag valve mask to oxygen. The results are summarized in Table 8.

Table 7 Effect of Education Intervention on Healthcare Workers Observed Practice toward BLS

Scores	N	Mean (%)	95% CI	T	Paired t test*p*-value	Cohen's d
Pretest	30	9 (40.40%)	(22.60%: 58.20%)	7.15	0.00	3.40 (1.70–5.00)
Posttest	30	20 (87.60%)	(83.40%: 91.20%).			
Diff		11 (47.25%)	(31.00%: 63.40%)			

Note: Observed practice scores are based on a 23-item simulation checklist (maximum score = 23).

Table 8 Observed Practices of Groups Before and After Training

Action	Before Training, n (%)	After Training, n (%)	*p*-value
1. Establish unresponsiveness	2 (28.57)	7 (100)	0.06
2. Call for help (code)	2 (28.57)	7 (100)	0.06
3. Check the pulse correctly	7 (100.00)	7 (100)	0.06
4. Correct patient positioning	4 (57.14)	7 (100)	0.25
5. Backboard placed/resuscitation bed/on floor	4 (57.14)	7 (100)	0.25
6. Removal of the gown	2 (28.57)	7 (100)	0.06
7. Accurate hand positioning	5 (71.43)	7 (100)	0.50
8. Timely initiation of compressions	7 (100.00)	7 (100)	1.00
9. Adequate rate of compressions	2 (28.57)	7 (100)	0.06
10. Adequate depth of compressions	4 (57.14)	7 (100)	0.062
11. Adequate recoil	4 (57.14)	7 (100)	0.25
12. Correct placement of pads for the AED	1 (14.29)	7 (100)	**0.03**
13. CPR paused for no more than 10 seconds	0 (0.00)	7 (100)	**0.01**
14. Open the airway (remove pillow)	1 (14.29)	7 (100)	**0.03**
15. Apply the BVM to the patient	2 (28.57)	7 (100)	0.06
16. Attach BVM to oxygen	1 (14.29)	7 (100)	**0.03**

Table 9 Summary of Outcomes Knowledge, Self-Perceived Practice, and Observed Practice, with Pre/Post Values and Effect Sizes

Outcome	Preintervention Mean (SD)	Postintervention means (SD)	Mean Difference	*p*-value	Effect Size (Cohen's d)
Knowledge Score (0–13)	4.9 (1.6)	12.5 (0.6)	7.6	<0.001	4.4
Observed Practice (0–23)	9.3 (2.5)	20.1 (1.9)	10.8	0.004	3.4
Self-Perceived Practice (0–10)	4.2 (1.3)	8.8 (0.7)	4.6	<0.001	3.9

Note: Higher scores indicate better performance. Mean difference is calculated in absolute not in percentages.

The intervention improved BLS knowledge (mean increase from 4.9 to 12.5, $p < 0.001$, Cohen's d = 4.4), observed practice (mean increase from 9.3 to 20.1, $p = 0.004$, Cohen's d = 3.4), and self-perceived practice (mean increase from 4.2 to 8.8, $p < 0.001$, Cohen's d = 3.9), as shown in Table 9.

Discussion

The main aim of the study was to assess the effect of education intervention on healthcare workers' knowledge and practice toward BLS working in the departments of pediatrics, male and female outpatient, theater, and maternity of Kitagata hospital, Sheema district, Uganda. We found that healthcare workers knowledge before training was at a mean of 4.87 (37.5%) and practice at 9 (40.4%,) and factors associated with such level of knowledge were, possibly lack of BLS policies in place, lack of regular CMEs at the hospital, and lack of in-service training of health workers on BLS. After training, average score on knowledge increased to 12.47 (95.9%) and practice to 20 (87.6%). These findings show that BLS knowledge and practice can be improved with education intervention using simulation, videos, lecturing, and observation methods of teaching.

Level of Knowledge on Basic Life Support among the Healthcare Workers

Primarily this study measured the healthcare workers knowledge on BLS from different departments of Kitagata hospital, including female, male, pediatrics, maternity, OPD, and theater departments in Sheema district, western Uganda. Though different measures of BLS were used in similar studies, in this study 17 (56.7%) did not look for safety as the first step in BLS, comparable to a study done in Saudi Arabia,[22] where 42.00% of respondents did not look for safety as the first step for BLS. Both studies were done in a hospital setting, This similarity could be due to the hospital setting always looking safer for procedures compared to when one does the procedure outside the hospital like along the road and in people's homes. From this regard this study recommends continuous medical education to be done in health centers quarterly to keep health workers updated. In this study healthcare workers average level of knowledge toward BLS was at 4.87 (37.5%) and this could be due to a lack of consistent and BLS related trainings, which hs comparable to a study conducted in North Kerala that consistently reported a mean score of 44.5% among healthcare workers[23] and 45.8% in the United Arab Emirates.[24] Another study, conducted in Nepal, revealed that the knowledge of the staff, including medical doctors, paramedics, and nursing staff, on basic life support was inadequate; very few of the participants were aware of the signs of cardiac arrest and the correct method of checking the pulse. According to research conducted in Nepal, nearly half of the adults could correctly identify the correct location of the hands for chest compression as the center of the chest between two nipples; the compression rate is 100/min. Furthermore, the compression-to-ventilation ratio is 30:2.[25] This study therefore recommends continued training of health workers in BLS for in-service trainings.

In this study, 21 (70%) of the healthcare workers were aware of BLS by being able to answer BLS in full, being the most well answered question on knowledge about BLS, and this could be due to BLS being a part of many studies in health settings, though all the participants scored below average in knowledge on BLS, which could be due to lack of constant reminders such as CMEs (continuous medical education), comparable to 58.3% of healthcare workers who were reportedly unaware of BLS in Pakistan[26] and only one healthcare worker received a perfect score.[26] In the same study, healthcare

workers lacked adequate BLS knowledge; 67.1% of medical officers, 35% of dentists, and 22.9% of nurses reporting adequate BLS knowledge.[26] Moreover, according to a study conducted in Pakistan to compare the three categories of health professionals (doctors, dentists, and nurses) from five institutes, nurses' knowledge of BLS was low.[26] According to a study conducted at the Hospital of Nepal, more than half of the respondents (55%, N = 55) had moderate knowledge, 32% had inadequate knowledge, and only 12% of healthcare workers had adequate knowledge of BLS.[25]

In a similar study conducted in Amara regional state hospitals in Gondar and Bahirdar, more than half of the respondents did not know how to perform BLS. The question about the abbreviation of BLS received the most correct answers,[27] while a study conducted in Ethiopia found that 59.50% of healthcare workers were unfamiliar with BLS.[28]

Level of Self-Perceived Practice of BLS among the Healthcare Workers

In this study, five participants did not answer any question correctly regarding self-perceived practice toward BLS; this is comparable to a study conducted in Yemen, where only 16.30% answered correctly on the next step where a pulse is not present in a cross-sectional exploratory study.[29] In this study, a good number of participants (11; 36.7%) had never practiced BLS, comparable to a study done in Rawalpindi Medical University in Pakistan, where only 6.6% had practiced BLS, the majority (65.7%) were unable to perform CPR independently, and 87.2% were dissatisfied with their level of practical knowledge.[30] This could have been due to the incompetence of the health workers on the procedure, this study recommends formation of an emergency response team in the hospitals so that they pioneer others in such procedures.

In this study 19 (63.3%) participants never had prior training on BLS and had never witnessed it being done, which is comparable to a descriptive cross-sectional study conducted in Nepal, where the majority of respondents (86%) had witnessed CPR being performed, and more than half of the respondents (58%) had performed CPR.[31]

In this study, only five (16.7%) of the participants knew how often rescuers should switch roles when performing 2-rescuer CPR, comparable to a quantitative, quasi-experimental study conducted at three Botswana hospitals which revealed significantly deficient CPR skills among nurses who indicated that they did not know the majority of BLS steps and when to switch roles during CPR.[32] All the participants in this study had low levels of self-perceived BLS practice (0–50%), and this is in line with findings in the study conducted in Rwanda, which found that 79% of participants had low levels of practical skills, while only 21% reported having practice skills in BLS.[33] This is also similar to another study conducted in Rwanda where 11.80% of the respondents were capable of handling RTA victims at the scene or hospital.[34] In this study, self-perceived practice had an average of 2.57 (25.7%) among the participants, which is far below average compared to 46% according to a prospective pre/post-intervention design done in Uganda, at Mbarara regional referral.[7] This could be due to Kitagata being in local government setting which has limited exposure to carrier enhancement compared to Mbarara Regional Referral, which is in proximity with the university.

Effect of Educational Intervention on Healthcare Workers' Knowledge of BLS

There has been an improvement in both BLS knowledge and practice defined by the ranges in both knowledge and practice before and after training of participants as, 7.60 (58.5%) for knowledge and 6.80 (68%) for self-perceived practice, and 11 (47.8%) for researcher observed practice. This is comparable with studies done in Ethiopia which reported the level of knowledge of BLS at 44.0%[35] and 50.3%.[36] Relatedly, Eritrea revealed that the mean score of knowledge questions among study participants before and immediately after training was 9.58/20 and 15.9/20, respectively.[37] In East Africa, a study done in Kenya[38] reported improvement in both knowledge and skills in BLS. A study in Uganda discovered that nurses' knowledge of CPR before instruction was 53.8% and 82.5% after instruction.[7] The improvement observed is likely due to several factors. First, the use of simulation allowed healthcare workers to practice BLS skills in a controlled, realistic environment, bridging the gap between theoretical knowledge and actual performance. Second, face-to-face facilitation fostered active learning, immediate feedback, and correction of mistakes, which are critical for skills acquisition. This blended learning approach may have contributed to better retention of concepts and procedures.

Effect of Educational Intervention on Healthcare Workers' Practice toward BLS

The findings of this study demonstrate that an educational intervention had an effect on both the self-rated practices ($t = 17.54$, $p < 0.00$) and researcher observed practices in simulated patient scenarios ($t = 7.1496$, $p = 0.00$) using the paired t test. The

practices of the health workers significantly improved with the educational intervention. The findings of this present study on the improvement to health workers' practices upon an educational intervention are consistent with that of other related studies across the globe. For example, Abolfotouh et al[39] reported an improved practice, and this was measured in life saves among patients following a BLS health education intervention. That study further asserts that practice gaps were linked to inadequate knowledge such as the perceived risk of contracting infectious agents, especially in mouth-to-mouth resuscitation.[39] Also, post-intervention BLS training concluded that healthcare workers were ableand confident in their BLS practice.[40] The improved practice in this study meant that health education can change practice. In Uganda, the impact of health education intervention among healthcare workers not only improved BLS knowledge but was also associated with better beneficiary practices. This is especially important in Uganda's health system, where general practitioners (including intern doctors and medical officers) are the primary caregivers, owing to a scarcity of critical care specialists.[6]

Relatedly, Kose et al[41] highlighted the benefits of improved knowledge of BLS as this directly translated to better practice. Further, the practice of BLS was improved by individual characteristics including the commitment to professional behavior.[41] In this study, more professional attachment to the work improved healthcare workers' performance, as well as a scheduled healthcare intervention at least every 6 months.[41] In India, post-BLS training among healthcare workers significantly improved the practice of BLS to 77.3%.

Nursing Implications

Findings from this study will help hospital managers and trainers to have confidence and adequately plan future in-service education sessions to improve health workers' knowledge and practice toward basic life support, since evidence has shown that knowledge tends to decay with time. This will facilitate an improvement and maintenance of the quality of clinical practice and consequently improve the quality of care delivered to patients.

It will serve as an eye-opener for health workers in education to always put more emphasis on the application of basic life support in management of patients while training students both in theory and clinical areas.

Limitations of the Study

The first notable limitation for this study was the absence of an independent control group, that is the "non-interventional group". The variations of characteristics of the study units at Kitagata district hospital made selection of the non-intervention units that could be compared to the experimental wards/units difficult. However, the pre- and posttest design and follow-up after 1 month of intervention increased the robustness of the results. Although this design is acceptable and commonly used in healthcare education research, future studies should consider incorporating randomized controlled trials or matched comparison groups to enhance methodological robustness.

The second limitation of the study was the Hawthorne effect. The possible Hawthorne effect resulting from participants changing their practice during the simulated observation was addressed by developing rapport with the study participants so that they feel comfortable providing care at a normal pace despite being observed. This made the participants feel free and in control as a group and not feel supervised. This method of mitigating the Hawthorne effect in simulation studies has been used in other simulation studies with good results.[42] Secondly, the participants were assured that the purpose of the study was to improve patient care and not to pass judgment to their performance. This approach to minimizing the Hawthorn effect in simulation was proposed by Bk et al.[43] These mitigation measures for the Hawthorne effect were ensured during the prebriefing phase of simulation. In a nut shall the prebriefing phase of the simulation was underscored to ensure that the observers built a good relationship with the participants so that they were relaxed in their presence. Future research might consider real clinical scenario assessments or unobtrusive observational methods to further reduce this risk.

The study was conducted in a single rural district hospital in Uganda. While this provides critical insights into BLS training effectiveness in resource-limited settings, the findings may not directly translate to urban or private healthcare institutions. Further studies in varied healthcare environments are necessary to determine broader applicability.

The sample size (n = 30) was determined based on the expectation of a large effect size, which the study successfully detected. However, this small sample size limits the generalizability of the findings across diverse healthcare settings. Larger multi-center studies are recommended to validate these results and improve external validity.

The study assessed knowledge and practice 1-month postintervention, which is appropriate for evaluating short-term outcomes. However, the durability of knowledge and skill retention over longer periods remains unknown. Future research should incorporate long-term follow-up at 6 months or 1 year to assess retention and integration into routine practice.

Conclusion

The baseline knowledge and practice of the health workers toward the BLS at Kitagata hospital was poor. Education Intervention significantly improved health workers' knowledge and practices toward the BLS at Kitagata district hospital. The study further demonstrated that simulations can be used to enhance health workers' practice toward basic life support in Uganda.

While these findings are promising, they should be interpreted with caution due to the single-center design and small convenience sample. The results may not generalize to other hospitals, healthcare cadres, or lower-tier health facilities without further study. Additionally, the study did not assess the long-term sustainability of the observed improvements, emphasizing the need for periodic refresher courses and longitudinal follow-up to ensure a lasting impact.

Key Findings Summary:

Knowledge Scores: Improved from 4.9/13 pre-intervention to 12.5/13 post-intervention ($p < 0.001$; Cohen's d = 4.4), Observed Practice: Increased from 9.3/23 to 20.1/23 ($p = 0.004$; Cohen's d = 3.4), and Self-Perceived Practice: Rose from 4.2/10 to 8.8/10 ($p < 0.001$; Cohen's d = 3.8).

Recommendations

Practice Recommendations

Implement regular BLS simulation training sessions at district-level healthcare facilities to maintain skills.

Conduct periodic refresher courses to reinforce knowledge and skills retention.

Integrate simulation into routine CPD programs for healthcare workers, especially in rural settings.

Policy Recommendations

The Ministry of Health Uganda should incorporate structured BLS training into national emergency care guidelines.

Include BLS competencies in pre-service curricula for nurses, clinical officers, and other frontline providers.

Develop a national strategy for scaling up simulation-based training across rural and urban healthcare facilities.

Studies are also needed to understand the barriers and facilitators to the application of basic life support in practice.

The Ministry of Health Uganda considers integrating BLS training into national guidelines, preservice healthcare curricula, and regular continuous professional development (CPD) programs, especially for rural healthcare workers.

Future Research Directions

Future research should explore barriers to real-world BLS application, attitudinal or systemic factors influencing uptake, and cost-effectiveness or scalability of implementing widespread BLS training programs.

Assess long-term retention of BLS skills beyond 1 month.

Data Sharing Statement

Data from this study will be made available by the corresponding authors on reasonable request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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