Effectiveness of Structured Training Programme Regarding Adult Basic Life Support on Knowledge of Nurses’ in Zoba Maekel and National Referral Hospitals, Eritrea, 2018

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Abstract

**Background:** In Eritrea nurses provide most of the health care in the primary, secondary and tertiary level health facilities. The rate of trauma and medical emergencies are on the increase so nurses should have adequate and updated knowledge on Basic Life Support in order to be able to implement effective interventions in cardiac arrest situations.

**Aim:** The objective of this study was to assess the effectiveness of structured training programme regarding Adult Basic Life Support on knowledge of nurses.

**Method:** A quasi-experimental single group, pretest-posttest and retest design was utilized. Forty (40) nurses’ participated in the study. Structured and modified questionnaire was used to collect data. Data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 22.0 program. Frequencies, percentages, mean and standard deviation was used to describe the data. One way repeated measures of ANOVA was used to check the possible change in knowledge of the nurses at preintervention, immediate and three months’ after intervention. A p-value < 0.05 was considered to be statistically significant.

**Results:** The findings showed an acquisition of Adult Basic Life Support knowledge among the study participants following a four hour Basic Life Support training programme. Before training, the mean score of the study participant on knowledge questions was 9.58/20 and none of the respondents got a pass mark. Immediately after the training the mean score of the study participants was increased to 15.9/20 and 55.0% of the study participant got a passing mark. Significant deterioration from the immediate training score was found three months following Basic Life Support training as score was decreased to 14.9 and 40% of the respondents got a pass mark. Nurses’ knowledge was improved from their pre-training scores, which clearly indicated a positive retention in Basic Life Support knowledge after training.

**Conclusions:** The study findings present strong evidence that support the critical role of structured training programme about Adult Basic Life Support in improving nurses knowledge.

**Keywords:** Basic Life Support; Cardiopulmonary Resuscitation; Knowledge; Nurses; Training

**Abbreviations:** ACLS- Advanced Cardiac Life Support; ALS- Advanced Life Support; AHA- American Heart Association; BCLS- Basic Cardiac Life Support
Support; BLS- Basic Cardiac Life Support; BSN- Bachelor of Science in Nursing; CPR- Cardio Pulmonary Resuscitation; EMS- Emergency Medical Service; MoH- Ministry of Health; ICN- International Council of Nurses; ICU- Intensive Care Unit; ERC- European Resuscitation Council.

Background

In the last 45 years, BLS has elevated from experimental technique to a clinically universal life saving procedure. As a result all health care professionals are expected to know and be proficient with the steps [1]. Many countries have guidelines on how to provide basic life support (BLS) which are formulated by professional medical bodies in those countries. The guidelines outline algorithms for the management of a number of conditions, such as cardiac arrest, choking and drowning. The American Heart Association and European Resuscitation Council establish the standards for BLS and are actively involved in teaching Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) to health professionals. The American Heart Association recommends that nurses and physicians working with patients be certified in BCLS and ACLS. Certification involves attending formal classes and passing cognitive and motor skill tests. Basic life support is a first line of response to a cardiac arrest in the interim before defibrillation and advanced life support are available and it’s timely provision can save a precious life [2,3]. Both the European Resuscitation guidelines and the American Heart Association recommend that all hospital staff with patient contact should have regular resuscitation training. However, in Eritrea, there is no regulatory mandate for nurses to attend BLS instruction or re-certification programmes. This situation is unique and therefore, it is conceivable, that nurses may be receiving the majority of their BLS training during the early stages of an educational programme. In the clinical setting, nurses are the first people to see cases of cardiac arrest therefore, they should be the first to initiate and perform BLS without losing time [4]. It was considered amongst the duties of all healthcare team members to possess BLS knowledge and skills [5, 6]. Having the cognitive knowledge that is necessary for the effective performance of BLS in cardiac arrest situations makes someone to be competent in BLS [7], this study further defines BLS competency as encompassing both the acquisition and retention of CPR cognitive knowledge. Health care professionals have varied level of BLS knowledge even in the developed countries. Inadequate level of BLS knowledge amongst nurses was found in studies conducted in United States of America (USA) [8], the United Kingdom (UK) [7], Finland [9] and Ireland [3]. Similar trend was also observed in countries like Bahrain [10], Greece [11], Nigeria [12] South Africa [13] and Ethiopia [14] but to our knowledge no previous study has been conducted in Eritrea to determine the effect of BLS training on the knowledge of nurses. Studies conducted to assess the effect of training on the knowledge of nurses’ towards BLS showed improvements in the cognitive knowledge of nurses [1, 3, 12, 15]. From the literature it is also clear that the cognitive knowledge of BLS cannot be acquired or retained easily by nurses. Studies report different levels of cognitive knowledge in individual BLS knowledge and skill components that vary dramatically along a continuum from 0% to 100% [1, 3, 4, 16]. BLS retention is defined as retaining the cognitive knowledge that helps to perform BLS effectively at a certain point in time after BLS training [17]. The retention of CPR knowledge is a key factor in determining BLS competence [7]. However, there is universal evidence to suggest that BLS knowledge is poorly retained across populations [1, 3, 7, 16, 18]. A review of studies on CPR retention revealed that there was a significant deterioration in the level of knowledge of nurses from the immediate after training [1, 3, 19]. The purpose of this study was to evaluate the effectiveness of structured training programme regarding adult basic life support on knowledge of nurses’ in Zoba Maekel and the two national referral hospitals, Eritrea, 2018, with the following objectives: [I] to assess nurses knowledge toward Adult BLS before taking the course, [II] to determine the effect of attending adult BLS course on the knowledge of nurses towards adult BLS [III] to evaluate the level of retention of the cognitive knowledge.

Study Setting

The study was conducted in all Zoba Maekel Health facilities and the two National Referral Hospitals (ORROTTA and HALIBET).

Zoba Maekel is one of the six zones of Eritrea and is found in the center of the country. In Zoba Maekel there are 37 health facilities that range from zonal referral hospitals to health station. Orotta and Halibet hospitals are national referrals which provide medical and surgical services to patients from all zones of Eritrea.

Study Design

A quasi-experimental single group pretest intervention posttest and retest after three months was done.

Study Subjects

The target population comprised all nurses (degree nurse, diploma nurse and associate nurses) working in all Zoba Maekel health facilities and the two National Referral Hospitals.

Sample Size and Sampling Technique

The sample size was calculated using G*power software after considering the effect size (medium=0.25), type I error (0.05), power (0.80), correlation among measurements (0.55), and sphericity (ε=0.5) of one group followed up at three time points. Depending on those parameters the calculated sample size was 40 nurses. After sample size was calculated, strata were formed by virtue of the level of health facilities (National Referral Hospitals, Zonal Referral Hospitals, Community
Hospitals, Health center and Health Station). Finally, samples were randomly selected from each stratum, proportionately distributed as per nurses’ level (Degree, Diploma nurse, and Associate nurse). All nurses who were willing and randomly selected were included in the study.

Data Collection Tool

Structured questionnaire was used to collect data. The questionnaire was adopted [1,3] and was modified. The questionnaire contains two parts. Part one has demographic characteristics such as age, gender, marital status, work experience, academic qualifications, work department, frequency of Basic Life Support done in their setting and any formal BLS training attended. Part two is a written examination containing 20 multiple choice questions with a single best answer for each and a minimum score of 17(85%) is required to pass the examination [1,3,20].

Reliability and Validity

The 2015 Guidelines of BLS specified by the European Resuscitation Council was followed. The content validity of the instrument was enhanced through evaluation by two nurse researchers, two anesthetists, critical care clinical specialist and a statistician.

Data Collection Procedure

During the pre-test phase first, each respondents completed multiple-choice questionnaire. After this, certified BLS instructors provided a four-hour BLS training session [1]. The post-test was conducted immediately after the BLS training. Then the re-test was conducted three months after the first training. This time frame was considered as an appropriate delay between intervention and re-testing as it was previously used in a similar study [1, 3, 20]. The CPR training programme consisted of a 4 hours theory and practical course based on the European Resuscitation Council 2015 guidelines. This included theory class on heart disease, risk factors and epidemiology of heart disease, the steps in adult Basic Life support one-rescuer and demonstrations of the steps in adult Basic Life support.

Data Management

Data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 22.0 program. Frequency, percentages, mean and standard deviation was used to describe the data. To investigate the effect of training on the changes in knowledge, scores of the nurses at pre, immediate post and 3 months after intervention, repeated measures ANOVA was utilized. A p-value < 0.05 was considered to be statistically significant in all the analysis.

Ethical Consideration

Permission to collect data was granted from the Ministry of Health research committees; Eritrea, from Zoba Maekel branch office, from the two National Referral hospitals and from the Research and Ethics Committee of the College of Health Sciences. A covering letter was attached to each questionnaire, explaining the details of the study. Participation was voluntary and informed written consent was provided by each participant. The right to decline or to withdraw from the study at any stage without incurring any penalty was explained. All data were coded and kept locked up, accessible only to the researchers and the statistician.

Results

Demographic Characteristics of Study Participants

Table 1 shows the demographic characteristics of the study participants. Female nurses contributed 62.5% (n=25) of the sample while male nurses contributed 37.5% (n=15) of the sample. The mean age of the respondents was 32.7 years (SD=6.8) and half (n=20) of the respondents were less than 30 years, followed by 27.5% (11) nurses of ages between 30 to 39, and 22.5% (9) were 40 years old or older. Most of the study participants, (40%, n=16) were from national referral

| Variable                          | Number | Percent |
|----------------------------------|--------|---------|
| Gender                           |        |         |
| Male                             | 15     | 37.5    |
| Female                           | 25     | 62.5    |
| Age (Mean=32.7, SD=6.8, Min.=23 and Max.=52) | | |
| Less than 30                     | 20     | 50      |
| 30 to 39                         | 11     | 27.5    |
| Greater or equal 40              | 9      | 22.5    |
| Place of Work                    |        |         |
| National Referral Hospital       | 16     | 40      |
| Zonal Referral Hospital          | 8      | 20      |
| Community Hospital               | 8      | 20      |
| Health Center                    | 6      | 15      |
| Health Station                   | 2      | 5       |
| Qualification                    |        |         |
| Associate Nurse                  | 16     | 40      |
| Diploma Nurse                    | 15     | 37.5    |
| Degree Nurse                     | 9      | 22.5    |
| Work Experience median=6, IQR=6  |        |         |
| Less than 4 years                | 14     | 35      |
| 5 to 10 years                    | 17     | 42.5    |
| Greater or equal to 11 years     | 9      | 22.5    |
| Department                       |        |         |
| Adult                            | 27     | 67.5    |
| Pediatric                        | 6      | 15      |
| Maternity                        | 7      | 17.5    |

Abbreviations: SD- Standard Deviation; Min- Minimum; Max-Maximum; IQR- Interquartile Range.
Knowledge of Study Participants on the Domain Related to General Knowledge about Basic Life Support

Before intervention, 42.5% of the respondents correctly knew CPR abbreviation and only 5% of the respondents correctly identified the steps in initiating CPR. However, the percentage of knowledge for both CPR abbreviation and steps in initiating CPR steadily increased to 95% immediately after intervention, even though, slight decline had occurred 3 months later. Considerable improvement in the knowledge of the respondents immediately after intervention on brain survival without oxygen (55% to 97.5%), how to recognize someone in need of CPR (67.5% to 85%), and best way to give mouth to mouth ventilation (67.5% to 82.5%) was observed. Even though much difference in percentage was not observed immediately after intervention, increase in proportion of respondents regarding the knowledge of the goal of CPR (72.5% to 90%), and about the maneuver not used to open the airway (62.5% to 95%) was observed 3 months after the intervention. Paradoxically, immediate after training, a decrease in percentage was observed on respondents who correctly knew the benefit of minimizing interruptions during compression.

Knowledge of Respondents on the Domain Related to Steps on BLS

Before intervention more than 50% of study participants failed to answer what the next step is after patient lie unconscious (52.5%), what to do next if patient has no response (75.0%), what to do next after 30 compressions and two breaths (62.5%) and fail to arrange steps in correct order (90.0%). Immediate after intervention, marked improvement was recorded in identifying next step after 30 compressions and two breaths (37.5% to 95.0%), what to do next after patient lie unconscious (47.5% to 82.5%) and what to do if patient has no response (25.0% to 57.5%) even though there was some reduction three month after intervention. On putting the steps on correct sequence, even though marked improvement was seen after intervention (10.0% to 45.0%) still less than half of the study participants can correctly order it. Before intervention the number of respondents who knew on what to do if patient is breathing but unresponsive was 62.5% and after intervention it was increased to 87.5%. After training, slight decrease was observed in the number of respondents who knew what to do if no scene of danger (55.0% to 52.5%).

Knowledge of Study Participants on the Domain Related to Compression During BLS

Before intervention more 65.0% of the respondents correctly knew the compression to ventilation ratio, but on the position of hand during compression, depth of compression, rate of compression, and maximum interruption during compression, the number of respondents who correctly knew were 42.5%, etc.
Immediate after training, on all items that assess respondents’ knowledge on compression, good improvement was seen in the number of participants who responded correctly. Three month after intervention, slight decrease was observed in the number of participants who responded correctly to most of these items.

### Overall Knowledge Status

The pass mark for the knowledge is a score of 85% or above. Accordingly, none of the study participants got a passing mark on knowledge about Basic Life Support before the intervention. However, 55.0% (n=22) and 40% (n=16) of the participants got a passing mark right after intervention and 3 months later, respectively.

### Effect of Intervention on Knowledge of Study Participants Through Time

A one way repeated measures ANOVA was conducted to look over the contribution of an educational intervention on the knowledge scores of the study participants through time. Total of 40 participants were taken in the study and no missing data was found at the three time periods. The average knowledge scores at time 1 (prior to the intervention), Time 2 (following the intervention) and Time 3 (three month later) respectively were 40.0%, 20.0% and 30.0% respectively.

### Table 3: Responses of study participants on domains related to general knowledge about Basic Life Support (n=40).

| General Knowledge | Pre-intervention n (%) | Immediate Post n (%) | 3 months later n (%) |
|-------------------|------------------------|----------------------|---------------------|
| CPR Abbreviation  | Correct 17(42.5%)      | 38(95%)              | 36(90%)             |
|                   | Incorrect 23(57.25%)   | 2(5%)                | 4(10%)              |
| Brain survival without oxygen | Correct 22(55%) | 39(97.5%) | 31(77.5) |
|                   | Incorrect 18(45%)      | 1(2.5%)              | 9(22.5%)            |
| The organ that cannot survive without oxygen | Correct 25(62.5%) | 29(72.5%) | 31(77.5) |
|                   | Incorrect 15(37.5%)    | 11(27.5%)            | 9(22.5%)            |
| The goal of CPR   | Correct 30(75%)        | 29(72.5%)            | 36(90%)             |
|                   | Incorrect 10(25%)      | 11(27.5%)            | 4(10%)              |
| Steps for initiating CPR | Correct 2(5%)  | 38(95%) | 29(72.5) |
|                   | Incorrect 38(95%)      | 2(5%)                | 11(27.5%)           |
| How to recognize someone in need of CPR | Correct 27(67.5%) | 34(85%) | 29(72.5) |
|                   | Incorrect 13(32.5%)    | 6(15%)               | 11(27.5%)           |
| Benefit of minimizing interruptions during compression | Correct 31(77.5%) | 22(72.5%) | 23(67.5) |
|                   | Incorrect 22(25.5%)    | 18(72.5%)            | 17(42.5%)           |
| Best way to give mouth to mouth ventilation | Correct 27(67.5%) | 33(82.5%) | 32(80%) |
|                   | Incorrect 13(32.5%)    | 7(17.5%)             | 8(20%)              |
| Maneuver not used to open the airway | Correct 22(55%) | 25(62.5%) | 38(95%) |
|                   | Incorrect 18(45%)      | 15(37.5%)            | 2(5%)               |

### Abbreviations: CPR- Cardiopulmonary Resuscitation.

### Table 4: Knowledge of respondents on the domain related to steps on Basic Life Support (n=40).

| Steps on BLS | Pre-intervention n (%) | Immediate Post n (%) | 3 months later n (%) |
|--------------|------------------------|----------------------|---------------------|
| What you will do next if no scene of danger | Correct 22(55%) | 21(52.5%) | 20(50%) |
|             | Incorrect 18(45%)      | 19(47.5%)            | 20(50%)             |
| What you will do next if patient lie unconscious in safe place | Correct 19(47.5%) | 33(82.5%) | 27(67.5) |
|             | Incorrect 21(52.5%)    | 7(17.5%)             | 13(32.5%)           |
| Putting in correct sequence | Correct 4(10%) | 18(45%) | 21(52.5) |
|             | Incorrect 36(90%)      | 22(55%)              | 19(47.5%)           |
| What will you do next if patient do not have response | Correct 10(25%) | 23(57.5%) | 16(40%) |
|             | Incorrect 30(75%)      | 17(42.5%)            | 24(60%)             |
| What will you do next after 30 compression and 2 breaths | Correct 15(37.5%) | 38(95%) | 34(85%) |
|             | Incorrect 25(62.5%)    | 2(5%)                | 6(15%)              |
| what will you if victim starts breathing but is unresponsive | Correct 25(62.5%) | 35(87.5%) | 38(95%) |
|             | Incorrect 15(37.5%)    | 5(12.5%)             | 2(5%)               |

### Table 5: Respondents knowledge on the domain related to compression during BLS (n=40).

| Compression | Pre-intervention n (%) | Immediate Post n (%) | 3 months later n (%) |
|-------------|------------------------|----------------------|---------------------|
| Hand position during compression | Correct 17(42.5%) | 35(87.5%) | 36(90%) |
|             | Incorrect 23(57.5%)    | 5(12.5%)             | 4(10%)              |
| Compression to ventilation ratio | Correct 26(65%) | 40(100%) | 38(95%) |
|             | Incorrect 14(35%)      | 0(0%)                | 2(5%)               |
| Depth of chest compression | Correct 16(40%) | 32(80%) | 32(80%) |
|             | Incorrect 24(60%)      | 8(20%)               | 8(20%)              |
| Rate of chest compression | Correct 8(20%) | 38(95%) | 35(87.5) |
|             | Incorrect 32(80%)      | 2(5.0%)              | 5(12.5%)            |
| Maximum interruption during compression | Correct 12(30%) | 29(72.5%) | 28(70.0) |
|             | Incorrect 28(70%)      | 11(27.5%)            | 12(30.0%)           |
after intervention) were 9.58 (SD±2.81), 15.9 (SD±3.53), and 14.88 (SD±3.63) respectively (Table 6). Mauchly’s test indicated that there was an evidence of sphericity (Mauchly’s W=0.88, p=0.089). Hence, assuming sphericity, significant effect for time (p<0.001) was found using univariate ANOVA. Moreover, significant effect for time (Wilks’ Lambda=0.189, F (2, 38) = 81.3, p<0.001), was observed using multivariate ANOVA (Multivariate partial eta squared =0.811).

Furthermore, Bonferroni post-hoc test revealed that the knowledge of study participants have significantly higher at immediate post intervention than pre-intervention (p<0.001), 3 months later than pre-intervention (p<0.001), and immediate post intervention than 3 months later (p =0.025). In addition, a significant linear trend in the level of knowledge was observed across the three time periods (p<0.001).

As shown in figure 2, immediate after intervention there was marked improvement in knowledge of study participants while three months after intervention it shows slight decrement.

**Discussion**

Knowledgeable nurses can implement effective BLS interventions to save patients’ lives. This study’s findings emphasize on the importance of increasing the BLS knowledge of nurses, as no one passed the BLS pre-test and significant deterioration was seen three months after the training.

**Knowledge of Study Participants on Basic Life Support**

In this study, as it is shown in table 3, less than half of the study participants correctly answered CPR abbreviation and steps to initiate CPR before training was given. This clearly indicate that majority of the nurses were not familiar with the resuscitation procedure. In contrast to this, a study done in Nigeria by [12] on dental students, found that all the respondents knew the full abbreviation of CPR. As reflected in table 5, more than one third of the respondents failed to know the position of the hand during compression and depth of compression. This could be because the study participants were not updated with the latest resuscitation protocols as the guideline is updated every five years. As shown in table 5, the pre-test knowledge of the study participants indicated that majority of the respondents did not know the correct compression/ventilation ratio, the compression rate, maximum interruption during compression, when to start compression and what to do next after 30 compression and 2 breaths. These are critical skills for increasing the survival rate of patients because the primary determinant of a successful neurological outcome is the maintenance of adequate circulatory and respiratory support during prolonged cardiac arrest – something that is only achieved by continual chest compressions. Ignorance about these steps reduces the patient’s chances of survival during resuscitation [1].

Following the CPR training program, as shown in figure 2, immediate after intervention there was marked improvement in knowledge of study participants while three months after intervention it shows slight decrement.

**Table 6:** Comparison of participants’ level of knowledge at Time 1, Time 2 and Time 3 (n=40).

| Time Period       | N  | Mean (SD) | Test of Sphericity | Wilk’s Lambda | RANOVA p-value |
|-------------------|----|-----------|--------------------|---------------|----------------|
| Time 1 (pre-intervention) | 40 | 9.58(2.81) | Mauchly’s W=0.88 | 0.189         | F(2,38)=81.3   |
| Time 2 (Post intervention) | 40 | 15.9(3.53) | p=0.089            | <0.0001       | <0.001         |
| Time 3 (3-month followup) | 40 | 14.88(3.63) | partial eta squared=0.811 |               |                |

**Table 7:** Post-hoc comparison for the knowledge of study participants (n=40).

| Post-hoc Comparison | Mean Difference (95% CI) | p-value | p-value for Trend |
|---------------------|--------------------------|---------|------------------|
| Immediate post and pre-intervention | 6.33(5.08-7.57) | <0.001 | <0.001 |
| 3 months later and pre-intervention | 5.30(4.07-6.53) | <0.001 |         |
| Immediate post and 3 months later | 1.03 (0.10-1.95) | 0.025 |         |

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and were old age) following the training programme, which may have negatively influenced respondents’ performance. Three month after training, as indicated in figure 1, significant deterioration was seen in the respondents’ CPR cognitive knowledge as the number of respondents who got a passing mark reduced from 55% to 40%. Other related studies also documented similar findings [1, 3, 7, 15]. As shown in table 6, a significant effect of intervention on knowledge of the respondents was shown through time. When the mean score between the pre-test & immediate post-test, immediate post & retention test and pretest & retention test was compared statistically significant difference was found. These findings indicate that it is imperative for the respondents to receive regular, periodic in-service CPR courses, updating nurses on the latest CPR techniques, technologies and developments. The ability of nurses to perform BLS and to maintain their CPR skills and knowledge are indispensable professional requirements of all nurses working in healthcare settings [21].

**Strengths and Limitations**

The major limitations of this study were the small population and sample size, in addition to the study being conducted in one geographical location, in Zoba Maekel. This prevents making inferences about similar populations of nurses in Eritrea.
Conclusion

The acquisition and retention of BLS knowledge is largely dependent on training and frequency of CPR instruction [20] and the findings from this study strongly supports this. Ultimately, the goal is to prepare nurses who are competent and confident in the event of a cardiac related emergency. It is recommended that the provision of an ongoing structured programme of basic life support is necessary. This is particularly fundamental in the critical years of an undergraduate nursing programme and critical to Eritrean nurses due to lack of mandatory requirements for CPR instruction.

Declarations

Ethics Approval and Consent to Participate

This study was approved by the Ministry of Health ethical committee. Participation in this study was voluntary. Written consent was sought. Submission of responses to the questionnaire was considered to constitute implied consent. The voluntary nature of participating in the research was made explicit and unambiguous in the cover letter. The investigators did not coerce or entice anyone to complete the questionnaire. Any participant could decline to return the questionnaire.

Consent for Publication

Not applicable.

Availability of Data and Materials

Most of the data supporting our findings is contained within the manuscript, and all others, excluding identifying/confidential respondent data should, will be shared upon request.

Competing Interests

The authors declare that they have no competing interests.

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Authors’ Contributions

GAF contributed to concept development, proposal writing, data collection analysis and interpretation, manuscript drafting and preparation and final writing, WGG contributed to concept development, proposal writing, analysis and interpretation. All authors read and approved the final manuscript.

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