A COMPARISON OF CARDIOPULMONARY RESUSCITATION COMPETENCE BETWEEN TWO GROUPS OF ADVANCED PRACTICE STUDENT NURSES AT A MEDICAL TRAINING COLLEGE IN KENYA

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ABSTRACT

The aim of this study was to describe and compare the cardiopulmonary resuscitation (CPR) competence of advanced practice student nurses at a medical training college in Kenya, who had undergone two different levels of CPR training, namely Advanced Life Support (ALS) and Basic Life Support (BLS) training. The study utilised a comparative, descriptive design to collect data from a sample of advanced practice student nurses (n = 71), who were invited and who agreed to participate. Participants were assigned to two groups based on the CPR training they had received; group I had received ALS training (n = 23) and group II, BLS training (n = 48). Students were assessed based on the American Heart Association (AHA, 2005) criteria. Only five students (7.04%) obtained a competency score of 90%. The mean scores for group 1 and group 11 were 12.3 (SD = 1.42) and 7.7 (SD = 2.38) respectively. There was a statistically significant difference in performance between the groups with a t-test p = 0.00001 and ANOVA P = 0.03. The null hypothesis was thus rejected. The study showed that CPR skill performance and competence are determined by the level of CPR training students received. Registered nurses who received ALS training performed better in CPR than those who received BLS training. Thus, ALS training is recommended for all nurses who enrol for advanced nursing courses.

KEYWORDS: advanced life support (ALS), advanced practice nurses (APNs), basic life support (BLS), cardiopulmonary resuscitation (CPR), nurses' competence, Kenya

INTRODUCTION AND BACKGROUND

Cardiopulmonary resuscitation (CPR) has been identified as a core emergency skill in which all health care professionals should be proficient. Nurses, by the very nature of their work, are often the first to initiate CPR when an emergency occurs. As the role of the nurse continues to expand, the boundaries between what is considered to be nursing interventions and what is considered to be medical interventions will become more blurred (Terzi, 2008:17). With an expanded role come more responsibilities that require nurses to have a high standard of knowledge and skills, specifically in CPR. However, research and related literature has shown that nurses have varying levels of competence in CPR and that CPR skills deteriorate over time (Alspach, 2005:8; Josipovic, Webb & Mc Grath, 2009:58). These research findings refer mostly to developed countries and study samples constitute mainly qualified nurses and student nurses undertaking basic training. This study focused on registered nurses, undertaking advanced nursing courses in different specialties and who had undergone two different levels of CPR training at a medical training college in Kenya. The aim of the study was to describe and compare CPR competence of two groups of advanced practice student nurses, namely: group I who had undergone Advanced Life Support (ALS) training, and group II who had received Basic Life Support (BLS) training.

The need for standardisation has become necessary because, at first, the conduct of CPR was empirical and idiosyncratic and was led by medical officers who were not formally trained in the required CPR skills (Vincent 2003:673). Since the advent of modern CPR, however, several countries in collaboration with professional bodies, the European Resuscitation Council, the American Red Cross, the American Heart Association (AHA), the Australian Resuscitation Council, the Heart and Stroke Foundation of Canada and the Resuscitation Council of Southern Africa, have devised standardised guidelines and/or algorithms for conducting CPR. Such efforts came about mainly because of variations in the approach to CPR, which have the potential of creating confusion in resuscitation teams. These collaborative efforts resulted in the publication of an advisory statement by the Basic Life Support Working Group of the International Liaison Committee on Resuscitation (ILCOR) with a view to standardising CPR (Handley, Becker, Allen, Van Drenth, Kramer & Montgomery, 1997:2175).

Standard guidelines were seen as a means not only of putting together best practice for any scenario or setting, but also to remove doubt in decision-making by those who resuscitate. These efforts were aimed at equipping health care professionals with the necessary knowledge and skills for safe and effective CPR.

Basic life support (BSL) refers to basic non-invasive life-saving procedures, which involve maintaining the airway, breathing and circulation of a patient who has had a cardiac or pulmonary arrest. Basic resuscitation comprises the following components: initial assessment; airway maintenance; expired air ventilation; and closed chest compression, which collectively is called CPR. Advanced life support (ALS) consists of invasive life-saving procedures that include, advanced airway management, intravenous therapy, defibrillation, diagnostic tests and advanced perfusion support.

Some studies have been done in South Africa to assess CPR competence as part of a broader skills set in district hospitals (De Villiers & De Villiers, 2006:16) and in theatre recovery rooms (Van Huyssteen & Botha, 2004:11–12), while a plethora of studies have been conducted in developed countries. It can be argued that the issues around CPR competence in Africa are the same as those which exist in developed countries or, even worse, due to limited or unsophisticated training resources. In Kenya, middle level colleges offer post-secondary courses to nurses and other professionals, leading to a certificate, diploma or higher diploma. These colleges and universities that offer nursing courses are required by the licensing body, the Nursing Council of Kenya, to include BSL training in their programmes. However, the implementation of BSL and ALS guidelines in training colleges is not uniform. This is problematic in that students graduate from these colleges with differing levels of competence. It is important to note that very few hospitals in Kenya, both in the public and the private sector, offer in-house CPR training or retraining of staff.

PROBLEM STATEMENT

The role of the nurse in CPR is critical for patient survival following cardiopulmonary arrest. Nurses who have been trained as APNs are expected to function at a higher level in order to provide leadership to junior nurses during resuscitation interventions. However, registered nurses undergoing post basic training as APNs at the participating medical training college in Kenya, receive different levels of CPR training according to their clinical elective; those studying intensive care nursing receive ALS training, while those studying midwifery, and ophthalmic, psychiatric or community health nursing receive BLS training only. This has the potential of creating differences in the level of competence, yet both groups are being prepared as APNs. It was hypothesised that advanced practice student nurses who received ALS training will perform better in CPR than those who received BLS training only. The null hypothesis, therefore, was that there will be no difference in CPR competence between the two groups.

STUDY AIM AND OBJECTIVES

The aim of this study was to describe and compare CPR competence of advanced practice student nurses who had undergone two different levels of CPR training at a medical training college in Kenya. Group I comprised those who received ALS training, and group II comprised those who received BLS training only. The study objectives were to: determine and describe the demographic profile of advanced practice student nurses in this study setting; assess advanced practice student nurses' level of CPR competence and examine the differences in CPR competence between the two groups of advanced practice student nurses.

Definition of variables

Cardiopulmonary resuscitation (CPR) is the application of emergency artificial ventilation and external cardiac compression in victims with cardiopulmonary arrest to provide adequate circulation to support life (AHA, 2005). In this study it refers to the performance of one rescuer adult CPR on a Resusci Anne Simulator (manikin).

Competence, in this study, refers to an advanced practice student nurse's ability to perform CPR effectively in a given situation, and to achieve a competency score of at least 90%, measured against the standards of the AHA (2005).

Basic life support (BSL) is operationally defined as maintaining a patient's airway, supporting breathing and circulation without the use of equipment other than a simple airway device or protective shield.

Advanced life support (ALS) is operationally defined as emergency medical care for sustaining life that includes: defibrillation, airway management and drug administration. ALS presumes that basic CPR is administered.

An **advanced practice student nurse** is operationally defined as a registered nurse, enrolled at the participating medical training college in Kenya in a 1-year diploma in advanced nursing that leads to registration as an advanced practice nurse (APN).

DESIGN AND METHODS

This study utilised a comparative, descriptive design, chosen on the basis of naturally occurring groups of advanced student nurses according to their level (basic or advanced) of CPR training and nursing speciality. This design allowed for comparison of the two groups of students and to test the research hypothesis.

Study population and sample

The target population comprised all registered nurses (N = 97) undertaking advanced nursing studies at the participating medical training college. Since these were naturally occurring groups based on the type of CPR training received, no specific sampling method was used to determine group assignment. A total of 71 students (n = 71) participated in the study and were distributed as follows: group I consisted of students specialising in Intensive Care Nursing (n = 23) who had received ALS training and group II consisted of students specialising in Midwifery, Community Health Nursing, Psychiatric Nursing, Neonatal Nursing and Ophthalmic Nursing (n = 48) who had undergone BLS training.

Potential study participants were approached once permission had been obtained from the college administration and after the study had been approved by the Ethics Committee of the university and the hospital affiliated with the college. Participation was voluntary and subject to individual consent; an information sheet outlining the study and its procedures was provided to the participants. Their right to decline or to withdraw from the study at any stage without penalty was explained in the information sheet.

Data collection

The data were collected through direct observation by the researcher and a trained research assistant in the CPR skills laboratory of the college during February 2007. Both observers had undergone BLS and ALS courses and were certified as competent in BLS and ALS. In the presence of the observers, each participant was required to demonstrate one rescuer adult CPR on a manikin based on a scenario given. As participants performed one rescuer adult CPR, the observers gave prompts, which are standard and form part of the checklist.

CPR competence was assessed using a standard 15-item checklist derived from the AHA (2005) guidelines. Part one of the checklist comprised structured questions that captured participants' demographic data; part two contained 15 items related to performance criteria for one rescuer adult CPR. Participants were awarded one mark if they performed the CPR item correctly, and zero if they did not perform the item or performed it incorrectly. The lowest possible score was zero and the highest possible score was 15.

Instrument reliability and validity

A pilot study was conducted using ten final year undergraduate student nurses ($n = 10$) to test for inter-rater reliability between the observers (the researcher and research assistant). For adequate inter-rater reliability the level of agreement was set at 0.70 (Polit & Beck, 2004:420). Pearson's correlation coefficient was computed; an adequately high correlation ($r = 0.77$) was found between the observers. An earlier South African reliability study to measure the internal consistency of 14 items of the checklist produced a Cronbach's alpha of 0.89 (Brennan, Braslow, Batchellor & Kaye, 1996:87).

Content validity of the instrument was assured by using, as performance criteria, the guidelines for training and assessment of CPR by the AHA (2005), developed by a panel of resuscitation experts. In 2010, and after this research, these guidelines were reviewed based on an evidence evaluation process completed by 356 resuscitation experts from 29 countries (Dukelow, 2011:1). These guidelines were expected to be ready for implementation in 2011.

Data analysis

Data were captured on an EPI-INFO data base spread sheet, checked and cleaned; descriptive and inferential statistics, with a STATA version 9 computer statistical package, was used to analyse the data. The t-test, Fisher's Exact test and analysis of variance (ANOVA) were used to test the significance of differences (set at 0.05) between CPR performance scores and the mean scores of the two groups. Other tests used included the Shapiro-Wilk test for normality and Bartlett's test for equality of variances.

RESULTS

Sample characteristics

Of the target population of 97 advanced practice student nurses, 71 (73.2%) gave their consent and participated in the study. The majority were female (71.8%; n = 51); approximately one third of the participants were between 25–29 years (32.4%; n = 23) and 30–34 years of age (29.6%; n = 21). Only ten (14.1%) were between 20–24 years of age.

Most participants (71.8%; n = 51) were midrank registered nurses in the first nursing officer (NO-1) and second nursing officer (NO-11) ranks; 17 (33.3%) were in group I as compared to 34 (66.7%) in group II. Only one participant was a senior nursing officer (SNO) and 19 (26.8%) were in the rank of NO-111, the most junior job rank.

Participants' work experience ranged from 1–20 years. The majority (74.6%; n = 53) had work experience of between 5–14 years, 15.5% (n = 11) had worked for a period equal to or less than 4 years and 9.9% (n = 7) had worked for more than 15 years. Distributions in groups I and II and in combined groups for sex, age, rank and years of work experience can be seen in table 1.

Table 1: Distribution of sample characteristics (n = 71)

	Combined groups f (%)	Group I f (%)	Group II f (%)
Sex			
Female	51(71.8)	19(82.6)	32(66.7)
Male	20(28.2)	4(17.4)	16(33.3)
Age (Years)			
20–24	10(14.0)	2(8.7)	8(16.7)
25–29	23(32.4)	7(30.4)	16(33.3)
30–34	21(29.6)	7(30.4)	14(29.2)
35–39	11(15.5)	6(26.1)	5(10.4)
≥ 40	6(8.5)	1(4.4)	5(10.4)

	Combined groups f (%)	Group I f (%)	Group II f (%)
Rank			
SNO	1(1.4)	1(4.4)	0(0.0)
NO-I	29(40.8)	6(26.1)	23(47.9)
NO-II	22(31.0)	11(47.8)	11(22.9)
NO-III	19(26.8)	5(21.7)	14(29.2)
Work experience (Years)			
≤ 4	11(15.5)	4(17.4)	7(14.6)
5–9	28(39.4)	9(39.1)	19(39.6)
10–14	25(35.2)	8(34.8)	17(35.4)
≥ 15	7(9.9)	2(8.7)	5(10.4)

CPR performance scores

The performance on individual CPR items for the sample as a whole was analysed in accordance with the second research objective. The highest proportion of participants (83.1%) met the criterion – opening the airway using the head-tilt, chin-lift manoeuvre – with the majority being in the ALS group. Despite this high number only 39.4% (n = 28) – the lowest proportion – remembered to perform this airway manoeuvre between every set of compressions. Close to 60% of all participants did not call for help as indicated by the combined score of 40.8% (n = 29) and proceeded with opening the airway. Checking for breathing was adequately performed by 62.0% (n = 44); those who did not, omitted to either listen or to feel for breathing, spending less than the required time to assess breathing. Participants struggled with land-marking the heart for compression both at the beginning of CPR (47.9%) and between compressions (43.7%). On completion of four cycles, 81.7% (n = 58) reassessed for circulation; almost all participants (95.6%) in the ALS group met this criterion compared to 75% in the BLS group. CPR skill performance, item by item, is presented in table 2.

Table 2: Proportion of participants who performed each CPR item (sub-skill)

Performance criteria	Participants who performed the item		% for groups I & II combined
	Group 1 f (%)	Group II f (%)	
1. Checks unresponsiveness by tapping shoulders and calling aloud	20 (87.0)	27 (56.3)	66.2
2. Calls for help or indicates that help should be called	13 (56.5)	16 (33.3)	40.8
3. Opens airway using head-tilt, chin-lift manoeuvre	21 (91.3)	38 (79.2)	83.1
4. Checks breathing for at least 5 seconds (look, listen and feel)	17 (73.9)	27 (56.3)	62.0
5. Gives two slow breaths such that the chest rises at least once; performs head-tilt, chin-lift manoeuvre if does not rise and tries again	20 (87.0)	33 (48.4)	74.7

Performance criteria	Participants who performed the item		% for groups I & II combined
	Group 1 f (%)	Group II f (%)	
6. Checks carotid pulse for a minimum of 5 seconds	19 (82.6)	19 (39.6)	53.5
7. Locates compression position by feeling and land marking	13 (56.5)	21 (43.7)	47.9
8. Performs 15 compressions	19 (82.6)	33 (48.4)	60.5
9. Opens airway using head-tilt, chin-lift manoeuvre	21 (91.3)	18 (37.5)	54.9
10. Gives two slow breaths such that the chest rises twice and not more	19 (82.6)	27 (56.3)	64.8
11. Repeats items 7, 8, 9 and 10 at least 3 more times	21 (91.3)	22 (45.8)	60.6
12. Opens airway between every set of compressions using head-tilt, chin-lift manoeuvre	18 (78.3)	10 (20.8)	39.4
13. Gives two slow breaths such that the chest rises twice between every set of compressions	20 (87.0)	19 (39.6)	54.9
14. Locates compression position between every set of compressions	19 (82.6)	12 (25.0)	43.7
15. Re-assesses for circulation at the end of four cycles.	22 (95.6)	36 (75.0)	81.7

Participants' CPR performance scores ranged from 3 to 15, with 64.8% (n = 46) obtaining a score of eight or more and 35.2% (n = 25) obtaining a score of seven or less. Only five students (7.0%) scored 14 marks out of 15 and obtained a competency score of 90%. The rest (93.0%; n = 66) had a score of less than 14 and were thus not competent in CPR (see table 3).

Table 3: Distribution of scores for the two groups and score range for the sample as a whole

Score	Group I f (%)	Group II f (%)	Score range	Number of participants within score range f (%)
0	0(0)	0(0)	0-5	8(11.3)
1	0(0)	0(0)		
2	0(0)	0(0)		
3	0(0)	1(2.1)		
4	0(0)	3(6.3)		
5	0(0)	4(8.3)		
6	0(0)	9(18.8)	6–10	35(49.3)
7	0(0)	7(14.6)		
8	0(0)	3(6.3)		
9	1(4.4)	918.8)		
10	0(0)	6(12.5)		

Score	Group I f (%)	Group II f (%)	Score range	Number of participants within score range f (%)
11	5(21.7)	3(6.3)	11–15	28(39.4)
12	9(39.1)	2(4.2)		
13	3(13.0)	1(2.1)		
14	3(13.0)	0(0)		
15	2(8.7)	0(0)		
Total	**23(100)**	**48(100)**		**71(100)**

In the process of testing the null hypothesis that data are normally distributed, performance scores were subjected to the Shapiro-Wilk test in order to determine whether the sample came from a normally distributed population. For the combined groups a p-value of 0.298 was obtained which showed that the data were from a normally distributed sample. The null hypothesis that the scores are normally distributed was thus not rejected. The histograms in figure 1 depict the scores for the two groups. The first histogram (group I) is negatively skewed with the majority of the scores between 9 and 15. The second histogram (group II) follows a normal curve distribution with the majority of scores clustered around the mean. The results of the test for group I ($p = 0.298$) and group II ($p = 0.810$) indicated that the scores were normally distributed.

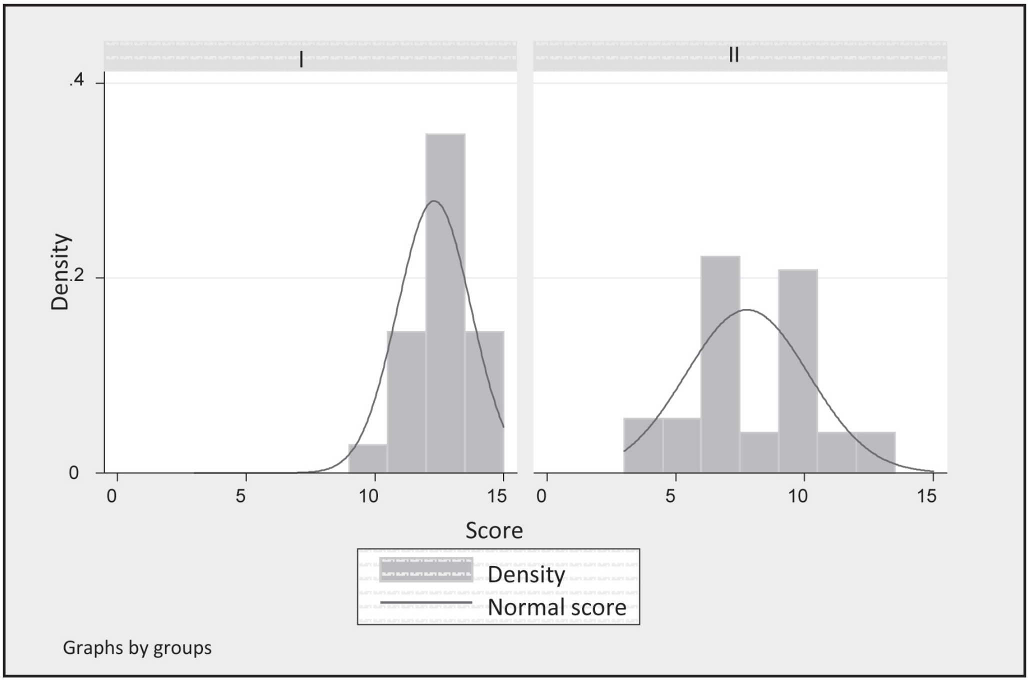

Figure 1: Normal curve showing score distribution for the two groups

The performance scores of the sample as a whole were subjected to the t-test to determine whether the variables age, gender, work experience and rank had an effect on their mean scores. The results showed that age (p = 0.092), gender (p = 0.230), work experience (p = 0.095) and rank (p = 0.075) had no significant effect on their CPR performance.

When scores were compared with rank there was no significant difference in CPR performance between the nursing ranks. The rank of nursing officer I had the lowest mean of 8.34, while that of nursing officer II had the highest mean of 10.23. The most senior rank had the highest mean score of 15, but it should be noted that there was only one student in this category. The mean score for all the ranks combined was 9.16. The scores of the combined ranks were subjected to ANOVA and Bartlett's test, which showed no significant difference between groups' CPR performance according to rank (F = 2.69 and p = 0.075), as shown in table 4.

Table 4: ANOVA test comparing ranks versus score between groups 1 and 11

Comparisons	SS	Df	Ms	F	Prob > F
Between groups	44.3297523	2	22.1648761	2.69	0.0755
Within groups	552.941676	67	8.25286084		
Total	597.271429	69	8.65610766		

Bartlett's test for equal variances: $X^2 = 1.5493$; P = 0.461

Comparisons between group I and group II

In line with the third objective, between-group comparisons of competency scores and mean performance scores were made to determine whether CPR performance was significantly different. Five students (7.0%) in group 1 (ALS) and none in group 11 (BLS) obtained a competency score of 90%. The vast majority (93.0%; n = 66) obtained a score of < 90%; of these 18 (27.27%) and 48 (72.73%) were in group 1 and group 11 respectively. The results of the one-sided Fisher's exact test for the two groups, comparing their competency scores yielded a p-value of 0.003, indicating a statistically significant difference between the ALS and BLS groups on their CPR competency scores.

The mean score for group I was 12.3 (SD = 1.42) with the mode and median both at 12. Group II had a mean score of 7.77 (SD = 2.38) and a median of 7.5. The score distribution for this group was bimodal at six and nine. The ANOVA and t-test were applied to determine whether the differences in the mean scores were statistically significant. The t-test yielded a p-value of 0.00001 which indicates a significant difference in the mean score between group 1 and group 11. The ANOVA results were as follows: F = 3.15 and P = 0.03, indicating statistical significance. The ANOVA test results were as shown in table 5. Since the samples were not equivalent, Bartlett's test was done after the ANO-

VA. The results derived from Bartlett's test was p = 0.46, indicating that although the samples were not equal in size, this difference did not influence the difference in scores as derived from the ANOVA.

Table 5: ANOVA result for difference between two groups means

Source	SS	Df	MS	F	Probability
Between groups	77.9879012	3	25.9959671	3.15	0.0306
Within groups	552.941676	67	8.25286084		
Total	630.929577	70	9.01327968		

DISCUSSION

More than 60% of the sample (n = 54) were aged between 25 and 34 years. Males made up a small proportion of the sample (28.2%) which was an expected finding, in keeping with estimates of the population of male nurses in Kenya. In South Africa, statistics from the South African Nursing Council (SANC) in 2010, indicated that less than 10% of the country's registered nurses were male (SANC 2010).

The majority of registered nurses (71.8%) were in mid-rank: 40.8% in the NO-I rank followed by 31.0% in the NO-II rank. The majority (74.6%) had work experience ranging from 5 to 14 years, which corresponded more or less with the most common age range. Age, gender, work experience and rank had no significant effect on CPR performance. Work experience in medical, surgical, casualty, intensive care, midwifery wards or other speciality areas did not improve registered nurses' performance in CPR. This is in agreement with the early findings by Broomfield (1996:1016) that participants who had worked in ICU where CPR is done frequently, did not perform any better than those who worked in areas where resuscitation is less likely to be utilised. There are no recent studies to confirm or refute this finding other than confirming that a decline in CPR performance happens in all categories and levels of health care professionals (Alspach, 2005:8). The same author proposed the rethinking of CPR training and assessment, suggesting that individuals who have internalised and developed procedural memory for CPR cannot be expected to unravel its constituent parts to demonstrate CPR competency (Alspach, 2005:11). This suggests that key patient outcomes should be established and assessed rather than itemised behaviours that are loaded with detail.

With reference to competency in CPR, only five participants attained a competency score of 90%; all were from group I (ALS). The remaining 66 (93%) advanced practice student nurses failed the competency test and cannot be trusted to carry out safe and effective CPR. Poor performance by the vast majority is an indication of the deterioration of skills, which arises if skills are not practised or if retraining does not take place regularly. This finding is consistent with those of previous studies that there is poor retention and deterioration of skills, beginning from the second week post training (Alspach, 2005:7; Madden, 2006:218; Mailloux, 2008:3). Retraining and selftraining have been found to be significant in nurses' acquisition of CPR knowledge and psychomotor skills (Madden, 2006:219).

Calling for help was one of the performance criteria/CPR items that was not attained by the majority in groups 1 and 11 combined as shown by the low proportion of 40.8%. This may be attributed to the lack of a developed emergency ambulance/emergency call service in Kenya. Participants had the alternative of shouting for help, which is standard practice for summoning help in the hospital setting but they did not. Regardless of resource constraints a decline in "calling for help" has been shown to occur in a well resourced environment too (Einspruch, Lynch, Aufderheide, Nichol & Becker, 2007:476). The other items that were not well performed included: compression location, pulse check and opening the airway before giving rescue breaths in between the cycles of compressions. Most of the participants in both groups were slow in performing CPR; time was lost during the students' assessing the manikin and trying to remember what step to do next, and when alternating between compressions and giving rescue breaths.

Opening the airway was the best performed aspect by both groups. Participants who did not get a mark for this item either did not perform the step at all or performed a manoeuvre that was not acceptable. Participants who did not assess breathing either omitted this step or attempted rescue breaths without the chest rising or did fewer than two slow breaths. The majority who had failed the first attempt of head-tilt, chin-lift managed to give two successful rescue breaths after repositioning the head using the head-tilt, chin-lift manoeuvre for the second time.

Just over half (53.5%) could check the carotid pulse correctly; participants who did not check the carotid pulse correctly either checked other peripheral pulses or went ahead with the performance of subsequent steps. Almost 50% could not locate the correct compression position; some land-marked the compression position either too far up the sternum or too low, while others chose the position on the left rib cage just above the anatomical position of the heart. A good understanding of human anatomy is clinically relevant for all health professionals and is essential for palpation, percussion and auscultation (Behnke, 2006:147). Knowledge of cardiothoracic anatomy is essential to identify land markings for the heart and related structures. From these results it is evident that the majority of registered nurses did not know surface anatomy in order to locate the position of the heart for external compression.

According to the AHA (2005) score guidelines, 13 to 17 compressions were acceptable per cycle. Participants who performed compressions in the wrong position were penalised. The majority of participants (60.5%) performed 15 successful compressions at the first attempt – those who did not, spent time repositioning their hands and landmarking before proceeding. Adequacy of compressions could not be assessed objectively in this type of manikin. However, the literature suggests that inadequate compressions relating to slow rate and inadequate depth, continues to be problematic (Josipovic et al., 2009:59; Wik, Myklebust, Auestad & Steen, 2005:28). Participants who did not repeat items 7, 8, 9 and 10 at least three more times (39.4%) were either not sure of the number of cycles to perform before performing the first re-assessment or performed fewer compressions.

There was a general decline in the performance for both groups in all CPR items, but more so for the BLS group. This decline is possibly associated with rescuer fatigue as explained by Heidenreich et al. (2006:1022) who suggested that the quality of chest compressions and rescue breaths decline from the first minute and by the fifth minute exhaustion is evident. Most students performed CPR in this time frame. The more worrying aspects were that students proceeded with CPR without first assessing for response and lacked order in the conduct of CPR; some participants omitted steps or performed steps earlier or later than expected. Omissions and not following the correct sequence when performing CPR can have a detrimental effect on the success of resuscitation. This problem was identified in the early 1990s by Lewis, Kee and Minick (1993:2663) who cited the following errors in CPR: failure to follow the correct sequence; missing critical steps; performing faulty compressions; giving inadequate ventilations; taking too much time during resuscitation; not attaining the recommended ventilation compression ratio; and failing to integrate physiology into practice. The lack of order in the demonstration of CPR is of some concern. The International Liaison Committee on Resuscitation stresses the importance of the 'sequence in action' when conducting CPR (Handley et al., 1997:2175). The results of this study showed persistence in the problem of students missing critical steps in CPR, performing faulty chest compressions and giving inadequate rescue breaths.

Between-group comparison of CPR performance

The best performed items by group I were opening the airway (91%), response check and locating compression position between every set of compressions (87%). The worst performed item for this group was calling for help and performing chest compressions correctly (56.5%). The performance of this group, although better than that of group II, was very low with 93% failing to meet the competency score. In group II the best performed items were opening the airway (79.2%), response check and giving the first two rescue breaths (56.3%). The overall performance of this group was very poor; all (100%) failed to achieve competency and cannot be trusted to perform safe and effective CPR successfully.

The mean CPR performance for group I (12.3) was significantly better than group II (7.77) and can thus be attributed to the advanced CPR training group 1 had received. However, the low proportion (7.0%) who received a competency rating is of concern. The inverse relationship between the retention of CPR skills and time of training has been well documented in the literature over the years (Davies & Gould, 2000:401; Einspruch et al., 2007:10; Nyman & Sihvonen, 2000:179; Wik et al., 2005:28). Professional development and re-training patterns have not been established in this study and thus cannot be assumed to have any bearing on CPR competence. Since training of these groups was recent, but BLS training was different, this variation was considered a key factor in advanced practice student nurses' CPR competence. The null hypothesis was thus rejected, concluding that better performance by group 1 was related to the ALS training that they had received.

CONCLUSION

The study confirmed that the differences in CPR competence between two groups of advanced practice student nurses at the participating medical training college in Kenya can be attributed to the type of life support training received. The group who had received training in ALS was significantly better in performing CPR than those who had received BLS training. ALS training is thus recommended for all registered nurses enrolled in advanced nursing programmes at colleges and universities regardless of their elective or area of specialisation. Institutional policy in emergency and life support training for registered nurses studying towards the same nursing qualification must be reviewed to avoid disparate levels of competence. In view of the low proportion of student nurses in the ALS group who were competent in CPR, it is further recommended that the teaching and learning of CPR be investigated to determine the reasons for students' poor performance. Once students graduate and return to clinical service, regardless of their specialty, they are expected to provide leadership when emergencies arise by virtue of the advanced training they had received. The validity of advanced training in CPR is thus important. Equivalence in emergency care and life support standards will also, in the future, validate nurses' registration as APNs with the Nursing Council of Kenya.

Limitations

The study was done at one medical training centre, thus the findings cannot be generalised to students at other nursing colleges in Kenya. Time and resource constraints precluded a longitudinal study, which would be more useful to determine the effect of time and specialisation experience on APNs' CPR performance.

It was not easy to quantify the adequacy of tidal volume when giving rescue breaths because the manikin used lacked technological sophistication to measure this. Thus, a participant was judged to have given adequate tidal volume if the volume of breath given caused the manikin's chest to rise.

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