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Cardiopulmonary resuscitation skills profile and knowledge of nurses working in an academic hospital

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ABSTRACT

Introduction and aim: Cardiopulmonary arrest can occur unexpectedly and has a high mortality. Nurses are often the first responders to in-hospital arrest and are expected to initiate cardiopulmonary resuscitation (CPR). It has been identified in the literature that nurses lack the knowledge and the skills of resuscitation. The aim of the study was to determine the CPR skills profile and knowledge among nurses in selected areas at Chris Hani Baragwanath Academic Hospital.

Materials and methods: The study was descriptive, prospective and contextual. A self-administered questionnaire, based on the 2010 American Heart Association CPR Guidelines, was used to determine the nurses CPR knowledge. A minimum score of ≥80% was regarded adequate.

Results: Total of 133 nurses were recruited; 61 in theatre, 40 in ICU and 32 from the surgical wards. The nurses' median score (range) for theoretical knowledge was 21% (0% - 79%). No participant achieved ≥80%. No correlation was found between nurses' knowledge and years of experience (r=0.036, p=0.697). Comparison between knowledge scores and area of work (p=0.060) and accreditation status (p=0.444) were not statistically significant.

Conclusion: The knowledge of CPR was found to be poor among nurses and has shown the need for ongoing CPR training to ensure effective resuscitation of patients. Dedicated funding and time to train nurses in CPR should be motivated for. SAHeart 2021;18:40-46

INTRODUCTION

Cardiopulmonary resuscitation (CPR) is the urgent delivery of chest compressions and rescue breathing that is delivered to the victims who are presumed to have cardiac arrest.[1] The survival rate following in-hospital cardiac arrest remains poor despite the development of basic life support (BLS).[2,3] All healthcare providers in contact with patients should be competent at BLS, particularly nurses who are often the first responders to an in-hospital cardiac arrest.[3,4] Successful outcomes are dependent on the time taken to initiate resuscitation as well as the efficiency and quality of CPR provided.[2,5]

Cardiac arrest is a major cause of mortality worldwide annually. According to the literature, 350 000 to 700 000 people suffer cardiac arrest each year in the United States of America[6] and more than 700 000 in Europe.[7] The South African mortality rate following cardiac arrest could not be identified in the literature.

The survival following in-hospital cardiac arrest should be high, however, the literature shows low survival rates despite the introduction of CPR more than 50 years ago.[2,5,8] The performance of CPR has an important position in the chain of survival of adult cardiac arrest. The 5 links in the chain of survival are immediate recognition of cardiac arrest, early CPR, rapid defibrillation, effective advanced life support and integrated post cardiac arrest care.[9]

It is important to acquire and maintain CPR knowledge and skills and to remain up to date with the latest CPR guidelines. The American Heart Association (AHA) and European Resuscitation Council Guidelines have been regarded as a "gold standard" for the treatment of cardiac arrest and other life threatening emergencies.[10] The 2005 AHA Guidelines for CPR were changed in 2010. These changes included changes in the sequence A-B-C (airway, breathing and compression) to C-A-B for adults. It also emphasises the need for high quality CPR and includes compressions at a rate of at least 100 per minute

and compression depth of at least 5cm in adults (change from a range of 4cm - 5cm) allowing complete chest recoil after each compression and minimising interruptions between compressions. The "look, listen and feel for breathing" step was eliminated, routine use of cricoid pressure is not recommended and there is a de-emphasis on checking for a pulse.[11]

Low quality of CPR and the lack of resuscitation skills among nurses in BLS have been identified as a contributing factor to poor outcomes in the cardiac arrest victim. Sandroni, et al.[2] concluded that more people in the general wards did not survive CPR when compared to those in speciality areas such as the intensive care unit (ICU), especially if the cardiac arrest team arrived more than 3 minutes after the arrest. A study by Abella, et al.[5] showed that although CPR was performed by well-trained hospital staff, the quality of CPR parameters was not consistent with, nor did it meet that of the AHA Guidelines.

A number of studies have been carried out to assess the resuscitation knowledge and skills of nurses and the results are not encouraging.[4,12-14] CPR training of all healthcare workers is essential[9] and it is a skill at which all healthcare workers should be proficient.[15] It is also of the utmost importance that knowledge and skills are maintained as extensive research has shown a decline over time.[40]

Marzooq and Lyneham[16] found that 22% of registered nurses recruited had no CPR certification and 61% of those who did, had not renewed their certification. The mean score for the CPR knowledge test was 42%. A study by de Lima, et al.[17] reported that pre-training knowledge on BLS and ALS was poor among nursing professionals since no further training had been done since attaining their qualification. After an 8-hour training session, the level of knowledge improved significantly.[17] Shrestha, et al.[18] in a study conducted in Nepal, established that 69% of healthcare workers recruited had no CPR training and 23% had never been involved in a resuscitation. Bukiran, et al.[19] found that only 15.6% of nurses tested on the 2005 AHA CPR guidelines passed the pre-test assessment.

The retention of knowledge is crucial in life support training. To retain BLS knowledge and skills, frequent simulation drills are necessary. A number of studies have demonstrated a decrease in BLS knowledge without frequent training[20,21] and frequent training programmes have shown improved retention of knowledge.[22,23]

At Chris Hani Baragwanath Academic Hospital (CHBAH), anaesthetists hand over postoperative patients to nurses in theatre, ICU and the wards without knowing the CPR skills profile of the nurses to whom they entrust patients. Furthermore, they are often called upon to assist with resuscitation efforts and are also approached by nurses to teach CPR. It is not known if these nurses have adequate theoretical knowledge of the 2010 AHA CPR Guidelines.

The aim of this study was to determine the CPR skills profile and knowledge among theatre, ICU and surgical wards nursing staff working at CHBAH.

MATERIAL AND METHODS

A prospective, descriptive and contextual study was conducted. Participation was completely voluntary and confidential. The study was approved by the University of the Witwatersrand Human Research Ethics Committee (M140845) and permission was obtained from the relevant authorities. The ethical principles outlined in the Declaration of Helsinki[24] were upheld in conducting this study.

This study population consisted of nurses working in theatre, ICU and the surgical wards at CHBAH at the time the study was conducted. A convenience sampling method was used. The sample size was calculated in consultation with a biostatistician. Assuming a population size of about 120 nurses in both the speciality areas and the surgical wards and the proportion of nurses with adequate knowledge will be 10%, the minimum overall sample size was calculated as 44 nurses with approximately equal numbers in each group i.e., a minimum of 22 nurses from speciality areas and 22 nurses from the surgical wards.

The questionnaires were based on the 2010 AHA CPR Guidelines. To ensure face and content validity, an ICU nurse who was an educator and an accredited AHA CPR instructor reviewed the questionnaire; no changes were suggested. The questionnaire was divided into 2 sections: the first dealt with the demographic profile of the participants and the second section tested their clinical knowledge of CPR. Knowledge was tested by means of 10 multiple choice questions each with 1 correct answer only. A minimum score of ≥80% or more was defined as adequate knowledge as used in another South African study testing theoretical CPR knowledge.[25]

The questionnaires were distributed by 1 author (MR) to nurses in the different working areas of the hospital namely theatre,

ICU and surgical wards, over a period of 3 days during working hours. The author remained in the working area while the nurses completed the questionnaires to answer any questions and to prevent data contamination. The completed questionnaires were placed in unmarked envelopes which were sealed and placed into a sealed data collection box to ensure anonymity and confidentiality.

All captured data were analysed using the Statistica™ 13 programme (Statsoft, USA). Categorical and continuous variables were annotated in frequency tables. Descriptive statistics was used. Categorical data was summarised using numbers and percentages. Continuous variables that were normally distributed were summarised using means and standard deviations and variables that were not normally distributed were summarised using medians and interquartile ranges. Knowledge and years of experience were correlated using Spearman's rank correlation. Area of work and accreditation status was compared to knowledge using either the Students t-test or the Mann-Whitney Test. A p-value of <0.05 was considered statistically significant.

RESULTS

Data were collected from eligible nurses during September 2015. Of the 171 questionnaires distributed to participants, only 133 were completed and returned, giving a response rate of 78%. Of these 133 participants, 61 were nurses working in theatre, 40 in ICU and 32 working in the surgical wards.

The mean (SD) age of nurses was 42.3 (10.2) years. Of the nurses, 61 (45.8%), worked in theatre, 96 (72.2%) were registered nurses, and 68 (51.1%) did not have a speciality qualification. Only 65 (48.9%) registered nurses had speciality qualifications and 1 had 2 speciality qualifications. The nurses were predominantly female, 114 (86.3%), and 62 (46.6%) had more than 10 years of experience. The median (IQR) number of years of experience among the nurses was 12 (6 - 24). Table I shows demographics of nurses who participated in the study.

Regarding the nurses' CPR training profile, 92 (69.2%) had done a BLS accredited resuscitation course. Twelve nurses acquired more than 1 course, resulting in the number of courses adding up to more than the number of nurses. Of the 92 nurses who had done accredited resuscitation courses, only 32 (34.8%) were currently accredited. Just under one third of the nurses had no formal training in resuscitation.

TABLE 1: Demographics of the nurses.

Demographics	n	%
Work area (n=133)		
Theatre	61	45.8
ICU	40	30.1
Surgical wards	32	24.1
Professional designation (n=133)		
Registered nurse	96	72.2
Enrolled nurse	29	21.8
Student nurse	8	6.0
Speciality qualification (n=133)		
Yes	65	48.9
No	68	51.1
Speciality qualification (Registered nurses only, n=97)		
Theatre	17	17.5
ICU	38	39.2
Other	11	11.3
None	31	32.0
Gender (n=132)		
Female	114	86.3
Male	18	13.6
Experience in years		
<1	1	0.8
1 - 5	23	17.3
5 - 10	31	23.3
>10	62	46.6
Missing data	16	12.0

The nurses' experience and confidence with resuscitation were described. Eighteen nurses (13.5%) indicated that they had never been involved in a resuscitation and 34 (25.6%) indicated that on average they were not involved with a resuscitation each year. Over 50% of nurses had been involved in resuscitation in the last 6 months and 34.6% were involved in more than 5 resuscitations per year. Most nurses, 73 (54.9%), reported an average level of confidence during their last resuscitation. The nurses' CPR accreditation status, resuscitation experience and confidence level are shown in Table II.

The nurses' median (IQR) score for theoretical knowledge of the 2010 AHA CPR Guidelines was 21% (14% - 29%). In this study, no participant achieved the minimum pass score of ≥80%. The knowledge scores ranged from 0% - 79%.

The 5 questions least correctly answered were: inclusion of "look, listen and feel" for breathing in CPR sequence; incorrect compression rate, incorrect compression depth, incorrect sequence of CPR and incorrect switching of roles in 2-rescuer CPR. The most correctly answered questions were compression

to ventilation ratio in 1-rescuer CPR; no interruption of compressions during CPR; correctly identified time allowed for assessment of pulse; correct number of rescue breaths per cycle and minimising of interruptions during CPR. Table III shows a summary of correct responses for each question.

No correlation was found between nurses' knowledge of the AHA CPR Guidelines and years of experience (r=0.0359, p=0.697). A comparison of the knowledge scores of nurses working in different areas was not statistically significant (p=0.0595). Comparison of knowledge and accreditation status of nurses was not statistically significant (p=0.444)

DISCUSSION

Our study highlighted that the nurses' knowledge of the 2010 AHA CPR Guidelines at CHBAH was poor. The average score achieved on the questionnaire was 21% with no participant achieving the minimum score of ≥80%. Although the literature also reports poor knowledge among nurses and other healthcare workers,[3,13,30,32] the actual scores are not always reported making direct comparisons with our study difficult. Doctors were found to have similarly poor results with only 4.6% achieving the minimum score in a study by Ragavan, et al.[25]

Nurses working in the emergency unit and ICU and those with more years of experience were found to have significantly higher knowledge scores regarding CPR in a study by Bukiran, et al.[19] In a 2009 South African study, Keenan, et al.[4] reported that ICU nurses had lower scores than nurses from general wards. In our study a higher median score (29%) was found among the nurses in the surgical ward and area of work did not influence knowledge in our study.

Nurses in our study had an average of 12 years of experience. However experience was not found to be correlated with knowledge, in contrast to findings in another study.[19] It is a concern that another South African study[22] identified nurses working in speciality areas had knowledge that was the same or less than nurses in general wards. It would be expected that these nurses would have a higher level of knowledge than general ward nurses.

TABLE II: Nurses CPR accreditation status, resuscitation experience and confidence level.

Nurses	n	%
Accredited resuscitation courses		
BLS	92	63.4
None	41	28.3
ACLS	11	7.6
PALS	1	0.7
Currency of accreditation		
Never updated	10	10.9
Within last 2 years	32	34.8
>2 years ago	50	54.3
Last resuscitation		
<6 months	67	50.4
6 - 12 months ago	22	16.5
>12 months ago	25	18.8
Never	18	13.5
Missing data	1	0.8
Average resuscitations per year		
None	34	25.6
1 - 5	53	39.8
6 - 10	23	17.3
>10	23	17.3
Confidence level		
Poor	20	15.0
Average	73	54.9
Good	38	28.6
Missing data	2	1.5

TABLE III: Summary of correct responses for each question.

Number	Question description	Correct responses n (%)
1	Chest compression rate	15 (11)
2	Chest compression depth	18 (14)
3	Correct sequence	21 (16)
4	Chest compression to ventilation ratio with one rescuer	62 (47)
5	Rescue breaths per minute	40 (30)
6	Switching roles in cardiac compression in two-man rescue	30 (23)
7	Cardiac compression not to be interrupted for how long	52 (39)
8	CPR cycles before re-assessing patient	18 (14)
9	Allowed to assess for pulse	41 (31)
10a	Complete chest recoil after chest compression	35 (26)
10b	Minimum interruption to chest compression	36 (27)
10c	Excessive ventilation	36 (27)
10d	Defibrillate as soon as possible	32 (24)
10e	Look, listen and feel for breathing	1(1)

Almost 70% of participants had completed a BLS course with only 34.8% currently accredited and 54.3% had accreditation that had expired. Other studies have found far lower completion rate of a resuscitation course[16,18] and lower current accreditation status.[16] Our study found no correlation between accreditation status and knowledge. Bukiran, et al.[19] have found that completion of relevant courses and recent qualification improved knowledge among healthcare workers.

Lack of continuous education and training programmes in institutions,[17,26] lack of guidance[16] and lack of resuscitation courses in developing countries[18] have been cited as reasons for this. Marzooq and Lyneham[16] concluded that nurses were not interested and lacked motivation to train in CPR. Shrestha, et al.[18] however found that despite lack of knowledge among participants, they demonstrated a positive attitude towards gaining knowledge. Our study did not investigate the barriers to refresher courses and reaccreditation in CPR or the nurses' attitudes towards training in CPR. Financial and time constraints in a busy hospital environment may contribute to nurses not maintaining their CPR accreditation.

Almost three-quarters of the participants had been involved in at least one resuscitation and 67.4% had been involved in a resuscitation in the last 6 months. Despite the poor knowledge found among participants, more than half the nurses reported average confidence regarding CPR. It would be expected that nurses would have adequate theoretical knowledge pertaining to CPR considering the exposure to and participation in resuscitation in their areas of work. Marzooq and Lyneham[16] reported that the majority of nurses felt confident with their knowledge and found that it was easy to recall. Similarly, to our study, this did not translate into adequate knowledge scores when tested.

On analysis of the answers to theoretical questions, the questions least correctly answered were predominantly those pertaining to the changes in the updated 2010 AHA CPR Guidelines. Conversely, the questions most correctly answered were from the part of the guidelines that had remained unchanged from 2005. This indicates a lack of continuous learning and updating of old knowledge.

Subsequent to this study, the AHA CPR guidelines were further updated in 2015.

CHBAH is a tertiary, academic hospital and the largest in the Gauteng Province. South Africa has several accredited training centres and resuscitation courses available. It is incumbent on heads of the relevant departments and professional councils to enforce regular training programmes for staff to ensure that knowledge and skills in resuscitation remain current, particularly because South African hospitals do not have dedicated resuscitation teams. Any member of staff therefore may be called upon to participate in or initiate a resuscitation and it has been found that training positively impacts knowledge.[8] Literature has shown that knowledge declines over time reiterating the fact that continual updating of knowledge is necessary.[15]

Resuscitation skills are as important as knowledge and will influence outcomes in cardiac arrest patients.[22] Use of the video-based format introduced by the AHA allows for an accredited expert to train a number of healthcare providers simultaneously.[22] This can easily be implemented in the hospital context to train several nurses in each unit at once which may be more cost-effective and less time-consuming. The use of a non-lecture-based method of training may also make knowledge easier to grasp and retain and may enhance CPR skills. We did not investigate skills in resuscitation among the nurses or retention of knowledge and skills after training. This can direct future research in this field.

Several studies have shown that nurses' knowledge in CPR is lacking. Our findings are consistent with other studies in that nurses' knowledge in CPR is very poor[4,17,19,20] and interventions are needed in order to improve nurses knowledge of CPR.

The contextual nature of the study is a potential limitation as data were collected in specified work areas at a single academic centre. Our study did not assess performance of resuscitation skills among nurses nor the retention of knowledge post-training. The reason for nurses not regularly updating their knowledge and skills and their attitude pertaining to CPR was also not investigated. It is difficult to compare results of knowledge assessments from different studies as all were not based on the AHA CPR Guidelines.

A strength of this study is that it investigates knowledge in 3 different work areas of the hospital and gives an idea of the CPR knowledge set of the nursing staff at CHBAH. It was also based on the latest guidelines available at the time and thus examined current knowledge of the staff.

CONCLUSION

Our study has highlighted a gap in knowledge pertaining to CPR among nurses at CHBAH. Despite exposure to resuscitation, years of experience, and confidence regarding CPR, theoretical knowledge was poor among participants. Ongoing educational training is imperative to ensure knowledge remains current, thus ensuring better outcomes among cardiac arrest patients. This information can be used in conjunction with outcome measures in cardiac arrest patients to motivate for dedicated funding and time to train nursing staff both theoretically and practically in this field.

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Conflict of interest: none declared.

MULTIPLE CHOICE QUESTIONS

1. What is the correct sequence in the Adult Chain of Survival?

A. Recognition, Call EMS, Advanced Life Support, Defibrillate, Post-Cardiac Arrest Care.

B. CPR, Recognition, Call EMS, Defibrillate, Advanced Life Support.

C. Recognition, Defibrillation, CPR, Call EMS, Advanced Life Support.

D. Recognition, Early CPR, Defibrillate, Advanced Life Support, Post-Cardiac Arrest Care.

2. Which of the following is NOT a core component of CPR?

A. Compressions at a rate of 100 per minute.

B. Checking for a central pulse.

C. Compression depth of 5cm in adults.

D. Allowing for full chest recoil between compressions.

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