EVALUATION OF CPR SKILLS OF DOCTORS AFTER RESUSCITATION TRAINING IN A TERTIARY HOSPITAL IN LAGOS NIGERIA- DOES SPECIALTY MATTER?

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ABSTRACT
**Aim of Study**

Many doctors in Nigeria have no further training in CPR besides what they learnt in medical school. Different specialties have varied exposure to cardiac arrest depending on their clinical work and resuscitation skills are often inadequate. We investigated whether specialty influenced acquisition of knowledge and skill after CPR training in a teaching hospital in Nigeria.

**Methods**

The knowledge and skills of doctors who attended a 2-day resuscitation training programme between December 2007 and April 2009 were studied. They were scored on knowledge of Basic Life Support, Advanced Life support and performance at 5 skill stations (airway maintenance/assessment of breathing, chest compressions, bag-mask ventilation, advanced airway insertion and AED use). A pass mark was awarded for a score ≥ 75% in the post-test and a pass in all skill stations.

**Results**

136 doctors from 8 specialties were studied. The mean pre-test score was 53.75 ± 15.90% (range 30 – 91.8%), which improved to a mean post-test score was 88.24 ±6.99% (range 54.6 – 94%)(p=0.001). A significant difference existed in the mean pre-test scores between specialties (p<0.001) but not with the post-test scores (p=0.511). Differences existed within specialties in knowledge of cardiac arrest diagnosis (p=0.033), drug therapy (p=0.001) and performance of chest compressions. (p=0.006). 93.3% passed the post-test with a non-significant difference between the specialties (p=0.621).

**Conclusion**

Specialty did not affect the overall performance in knowledge and skill acquisition after resuscitation training. There is a need to investigate retention of knowledge after the course.

Key words: cardiopulmonary resuscitation (CPR), training, manikin

**INTRODUCTION**

Resuscitation training is not synchronised in Nigeria as there is presently no resuscitation council in the country. Guidelines are adopted by individual hospitals from the European Resuscitation Council (ERC) or Resuscitation Council (UK). There are no cardiac arrest teams in many of our hospitals and initial resuscitation is performed by the doctors present at the time of the arrest.

A large proportion of doctors in Nigeria have had no further resuscitation training besides what was taught in medical school. They therefore lack the knowledge, skill and confidence to manage a cardiac arrest. Successful outcome after a cardiac arrest depends on prompt initiation of cardiopulmonary resuscitation (CPR) and early defibrillation. This requires knowledge of the ABC of resuscitation and the ability to apply this knowledge on a practical basis.

When CPR is aggressively taught and standards maintained by examination and recertification, the CPR is effective and the outcome is good. Majority of cardiac arrests in our hospitals are attended by anaesthetists who provide the advanced life support (ALS) equipment and drugs. It is assumed that by the nature of their job, there are well apt to do
this. Yet previous research in our institution showed that even anaesthetists did not adhere to existing guidelines during peri-operative cardiac arrest.2 In order to improve management and outcome of patients who suffer a cardiac arrest, as well as the skill and confidence of doctors performing CPR, the Lagos University Teaching Hospital established mandatory resuscitation training for all doctors in the institution.

Prior to commencement of training, the hospital procured 4 adult, 4 paediatric and 4 infant half torso manikins as well as 2 airway management and 2 AED training manikins. Instructors were consultants who had ALS, Advanced Paediatric Life Support (APLS) training or an interest in resuscitation. This is the first resuscitation training carried out by any tertiary hospital in Nigeria with the hope of training all their doctors in resuscitation. There is abundant literature about performance of specialist doctors in BLS and ALS skills but a search of the literature has revealed very little work done in the West African sub-region that compares the performance of different specialist doctors after resuscitation training. Local research has confirmed that doctors in general have poor knowledge in resuscitation and that there is a great need for training in CPR in Nigeria.3,4

The aim of this study was to evaluate whether specialty influenced the acquisition of knowledge and skill in performing CPR after resuscitation training in a teaching hospital in Nigeria.

METHODS

This was a prospective study carried out at the resuscitation training programme of the Lagos University Teaching Hospital, Lagos, Nigeria between December 2007 and April 2009. The programme was based on the 2005 resuscitation guidelines of the Resuscitation council (UK). All participants attended the 2-day programme held at the hospital. Day 1 of the programme commenced with a pre-test (MCQ and Open-ended responses) at the end of which course materials were distributed to the participants. Lectures were then given on; (1) Diagnosis and causes of cardiac arrest, Patients at risk of cardiac arrest, The cardiac arrest team, (2) Basic Life Support, (3) Advanced Life Support, Cardiac arrest trolley, (4) Peri-arrest arrhythmias, (5) Post-resuscitation care and (6) Ethics of Resuscitation. This was augmented by demonstration on manikins. Each lecture was followed by an interactive session.

Day 2 commenced with film shows depicting BLS, ALS with AED and standard defibrillator use. Participants were then divided into small groups for BLS practice and ALS practice both on manikins and the Microsim (Laerdal Medical) interactive simulator CD-Rom. Airway management involved practice on oro- and naso-pharyngeal airway insertion, tracheal intubation, laryngeal mask airway and combitube insertion as well as bag-mask ventilation. There were no facilities for cricothyrotomy or femoral vein cannulation.

At the end of the 2nd day, a post-test was carried out and all participants then went through 5 skill stations; opening of the airway (plus assessment of breathing), chest compressions in adult, paediatric and infant manikins, bag-mask ventilation, advanced airway insertion and AED use.

A pass mark was awarded to participants who scored ≥75% in the post-test and passed all
skill stations. To pass the advanced airway station, the participant had to insert a correctly sized advanced airway device of choice within 30 seconds or re-establish bag-mask ventilation if unable to do so. They were then expected to succeed at the second attempt. The pre and post-test were divided into BLS (Diagnosis, pulse check, airway maintenance, compression: ventilation –adults and paediatrics) and ALS (Rhythm recognition, defibrillation and drug therapy) sections. Each section was awarded 10 marks. The skill stations were scored as pass or fail. Data collected included speciality and cadre of participant and year of medical qualification. All data collected were analysed using SPSS version 15 and Epinfo version 6.0. Numerical data was expressed as mean ± SD and categorical data as frequencies. The mean pre- and post test scores were compared using paired sample t-test. Chi-square was used to compare the frequencies while analysis of variance was applied to determine the difference in means of the various specialties. A p-value < 0.05 was considered significant.

RESULTS

One hundred and thirty-six doctors have participated in 6 two-day training sessions so far. The mean number of years since medical qualification was 10.52±6.69 years (range 1 – 28 years). Table I shows the distribution of the specialties of the participants. Doctors classified in the ‘Non-clinical’ group were from Radiology and Haematology / Blood transfusion departments. The mean pre-test score was 53.75 ± 15.90% (range 30 – 91.8%), while the mean post-test score was 88.24 ± 6.99% (range 54.6 – 94%). This represented a highly significant change (p <0.001). The mean percentage change from pre-test to post-test was 78 ± 51.73% with a range in improvement of scores of 1.12 – 209.51%. All specialties except anaesthesia made a mean increase in score of over 80% in the post-test with the highest mean increase of 133% occurring in Obstetrics. The mean pre and post-test scores according to specialties is displayed in Table I. With 75% as the pass mark, only 10 participants (7.3%) passed the pre-test, all of whom were anaesthetists. There was a significant difference in the mean pre-test scores between specialties (p<0.001) which disappeared after training with the mean post-test scores being non-significantly different between specialties (p =0.511).

Table I. Pre and Post-test scores according to specialties of participants

<table>
<thead>
<tr>
<th>Medical Specialty</th>
<th>Pre-test score (mean ± SD)</th>
<th>Post-test score (mean ± SD)</th>
<th>Difference in results (mean ± SD)</th>
<th>Percentage change in score (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>51.22±10.72</td>
<td>90.18±4.28</td>
<td>38.23±9.47</td>
<td>81.70±38.54</td>
</tr>
<tr>
<td>Specialty</td>
<td>(n)</td>
<td>BLS Mean Score</td>
<td>ALS Mean Score</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
<td>----------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td>17</td>
<td>48.60±8.93</td>
<td>87.44±6.51</td>
<td></td>
</tr>
<tr>
<td>Anaesthesia</td>
<td>26</td>
<td>71.56±11.82</td>
<td>90.91±5.33</td>
<td></td>
</tr>
<tr>
<td>Paediatrics</td>
<td>14</td>
<td>45.82±8.15</td>
<td>87.27±7.88</td>
<td></td>
</tr>
<tr>
<td>Obstetrics</td>
<td>13</td>
<td>38.01±8.33</td>
<td>86.00±6.46</td>
<td></td>
</tr>
<tr>
<td>Dentistry</td>
<td>21</td>
<td>48.50±10.67</td>
<td>88.53±6.29</td>
<td></td>
</tr>
<tr>
<td>Non-clinical</td>
<td>24</td>
<td>45.48±11.12</td>
<td>86.62±9.93</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>136</td>
<td>53.75±15.90</td>
<td>88.24±6.99</td>
<td></td>
</tr>
</tbody>
</table>

Analysis of the post-test BLS questions showed a significant difference existed only in the mean scores to questions on diagnosing cardiac arrest between the different specialties (p<0.033). Dentist had the lowest mean score (7.9) while anaesthetists and surgeons had the highest scores of 9.91 and 9.05 respectively. Analysis of post-test ALS questions revealed a significant difference only in the answers.
to questions on drug therapy (p=0.001) with anaesthetists scoring the highest mean score of 9.33 followed by internal medicine physicians with 8.7. The Obstetricians had the lowest mean score of 7.8.

Only the performance of chest compressions scored significantly different between specialties (p=0.006) in the skill stations. 92% of paediatricians correctly performed cardiac compressions at the correct site, rate, depth and coupling with ventilation compared with 47.6% of doctors in the ‘Non-clinical’ group. 111 participants were able to insert an advanced airway within 30 seconds of which 63 (56.8%) inserted a tracheal tube, 35 (31.5%) a laryngeal mask airway and 13 (11.7%) successfully intubated the manikin at the second attempt after re-establishing effective bag-mask ventilation. Sixty-seven participants (49.3%) passed the knowledge-based and performance-based aspects of the post-test at first attempt. Internal medicine physicians and paediatricians had the highest pass rates of 61.9% and 57.1%, while anaesthetists and ‘Non-clinical’ doctors had the lowest with pass rates of 38.5% and 33.3% respectively (Fig 1). This difference was not statistically significantly (p=0.312).

After re-training at performance stations, a total of 127 doctors (93.3%) passed the test. There was no significant difference in overall pass in the various specialties (p=0.621).

**Fig. 1 Number of Participants who passed at first attempt according to Specialty**

![Graph showing number of participants who passed at first attempt according to specialty.]

**DISCUSSION**

Doctors in different specialties have varied amount of exposure to resuscitation training and practice. Some doctors by reason of the nature of their clinical practice e.g. anaesthetists and critical care physicians, provide CPR more frequently than other specialties. Others however, have no further exposure to CPR training other than what was taught during their undergraduate training. The mean time since medical qualification in our study was 10 years, during which resuscitation guidelines had changed twice. It was therefore essential that re-training on the new guidelines was done. Also knowledge retention has been demonstrated to be low with longer period since graduation.5 In teaching resuscitation, Zideman6 emphasised that no assumptions should
therefore be made for any previous clinical knowledge. Our participant population were drawn from eight different specialties. Radiology though not a purely clinical specialty, must still be proficient in CPR as contrast media which can lead to anaphylactic reaction and cardiac arrest are often injected. It is essential that doctors commencing BLS in whatever location are knowledgeable and skilful enough to make a difference, as successful outcome depends on prompt and effective initial response.

Courses in resuscitation are supposed to not just instruct, but also test acquired skills. Our 2-day course was sufficient to produce a highly significant improvement of 78% in the mean post-test scores. Similar success has been documented in Turkey. There was no significant difference in the mean post-test scores within the various specialties studied. It was not unexpected that anaesthetists had the lowest mean percentage increase as they scored highly in the pre-test. Anaesthetists are more exposed to resuscitation techniques as they provide ALS support to cardiac arrests in our hospital and CPR features prominently in their postgraduate training programme. By the virtue of the nature of their job, they are therefore are expected to maintain their skill and knowledge. Obstetricians had the highest mean increase in the post-test scores. This improvement in knowledge is encouraging as their initial knowledge based on the pre-test was very poor. Other authors have also reported poor resuscitation knowledge amongst obstetricians. This may be because an obstetric cardiac arrest is very rare. Most in this environment occur in the peri-operative period as a result of massive haemorrhage, eclampsia etc and anaesthetists are usually at hand to participate in resuscitation. It might be that the obstetricians leave the resuscitation to the anaesthetists and therefore have not been able to retain their knowledge and skill because of lack of practice.

In Knowledge of BLS, specialty resulted in significant difference only in diagnosis of cardiac arrest (p=0.033) where dental surgeons scored the lowest mean while anaesthetists scored the highest. Drug therapy was the only category in knowledge of ALS that produced a significantly different score between the various specialties (p=0.001). Anaesthetists and physicians scored the highest mean scores while obstetricians scored the lowest. This trend is similar to that demonstrated when Cohen assessed the knowledge of CPR of pregnant women among anaesthetists, emergency physicians and obstetricians. Filgueiras-Filho in his study observed that cardiologists scored significantly higher when compared to other specialties, but identified that this could be because more cardiologists had attended ACLS courses than the other specialties. We however did not separate internal medicine physicians into their various sub-specialties. On the other hand, a report from the Middle East demonstrated no significant difference in test-scores in BLS and ALS amongst surgeons and physicians. Drug therapy and rhythm recognition are an integral part of internal medicine yet surprisingly, most other specialties scored higher that medicine in questions on rhythm recognition. The reason for this is not immediately clear.

We observed that non-clinical specialties had the lowest mean scores in questions relating to airway maintenance, cardiac arrest rhythms and defibrillation. Tapping in a questionnaire survey identified that defibrillation-related questions had the lowest percentage of correct answers amongst radiologists and that they did better in BLS-related questions. Only 76.9% of anaesthetists were able to open-up the airway satisfactorily in the skill station. This was an unexpected observation as a mainstay of
anaesthesia is maintaining a patent airway. This could be a reflection of over-confidence in their ability to perform this ‘mundane’ technique or the difficulty of working with a manikin compared to real patients in theatre. It was obviously not a reflection of their clinical ability as 96.2% were able to successfully ventilate with a bag-mask apparatus; a technique that involves maintaining a patent airway. Bell et al14 assessed the ‘on-the-spot’ resuscitation skills of trainee anaesthetists using manikins and observed that only 60% correctly assessed the airway and 53% gave adequate ventilation. We were able to achieve better results as our test was done after training.

A significant difference existed in the number of our participants in the various specialties who could correctly perform chest compressions and synchronise with bag-mask ventilation. More paediatricians were able to perform this. Quan15 demonstrated significant improvement in the number of paediatric residents who were able to bag-mask ventilate, intubate and defibrillate immediately after a paediatric advanced life support course. More of our participants were able to insert an advanced airway within 30 seconds compared to results from Brazil where only a third of their physicians could intubate within the same time frame.11 This may be because our participants were given an option of tracheal tube, laryngeal mask airway or combitube which are all accepted advanced airway devices in cardiac arrest. Anaesthetists accounted for the lowest number of participants who could safely and correctly use the AED. Hunt et al16 in their study demonstrated that residents who had either defibrillated a patient or manikin were more likely to defibrillate at any point in time. The performance of anaesthetists at this skill station could result from the fact that the defibrillators available for use in our theatre and ICU are manual defibrillators which may have led to a less than acceptable score here for them. It is hoped that the practice gained in this training programme would encourage doctors to be more confident to defibrillate patients whenever the need arises. Though more anaesthetists and dentists had to re-do some aspect of the skill stations, in the overall score, no difference existed in the percentage of doctors from various specialties who passed. A study from Brazil emphasised the impact of resuscitation course in improving knowledge and skill regardless of specialty as also demonstrated by our findings.11

We were unable to impart skills of cricothyrotomy and femoral vein cannulation during our training programme as our institution did not have the necessary manikins to do so. It is hoped that with the success of this programme they will be encouraged to do so.

CONCLUSION

We have demonstrated that locally organised resuscitation training improved knowledge and skill of our doctors in cardiopulmonary resuscitation. The overall pass rate was 93.3% which was not influenced by the various specialties of the participants. Similar success with locally organised resuscitation training have also been documented in other developing countries with limited resources.17 It has been suggested that variations in protocols of established international resuscitation training programmes may benefit patient outcome in less developed countries who may not have the recommended drugs and equipments.18 It only remains to see how well this knowledge and skills are retained.
CONFLICT OF INTEREST STATEMENT
There was no conflict of interest in the preparation of this manuscript

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