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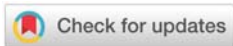
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Research Article

Witnessed Cardiac Arrest by Nigerian Health Workers; Improving the Outcomes

Abstract

Aim: To assess the involvement of health workers in Cross River State, Nigeria with CPR during witnessed sudden cardiac arrest and the resources available to them for intervention.

Settings and Design: The study was carried out in Cross River State, Southern Nigeria which has an international boundary with Cameroon in the East. It is a descriptive, Cross sectional study among health workers.

Methods and Material: Consenting health workers belonging to the various categories who met the eligibility criteria were selected using the non-probability method. They included; Doctors, Pharmacists, Nurses, Laboratory scientists, Physiotherapists, Optometrists, Radiographers and Anaesthetic Technicians. Those who declined to complete the questionnaire were excluded.

Statistical analysis used: Descriptive statistics (frequency proportions, means and standard deviation) was used to summarize variables. The level of significance was set at $P < 0.05$

Results: One hundred and eighty-two (52.8%) out of the 345 respondents surveyed, had witnessed and been involved in CPR for cardiac arrest. Common sites of witness were the ward (79, 43.4%), A & E unit (36, 19.8%), theatre (27, 14.8%), home (23, 12.6%) and ICU (17, 9.4%). Approximately half of respondents (50.5%) were involved in chest compressions for cardiopulmonary resuscitation (CPR), while 45.1%, 36.3%, 31.3%, 28.6% and 22.0% were involved in oxygen therapy, IV fluid therapy, rescue breathing, IV adrenaline therapy and transportation to hospital, respectively. Only 13.2% performed defibrillation as part of the CPR. Approximately half of respondents (48.9%) had participated in successful CPR. Contribution to successful CPR were attributed to immediate recognition (38.2%), prompt CPR (38.2%), oxygen therapy (30.3%), adrenaline administration (20.2%) and fluid therapy (19.1%).

Conclusion: Health workers will occasionally encounter SCA and participate in resuscitation. To improve resuscitation outcome, the triad of insufficient awareness, infrastructure and capacity building must be addressed. There is a critical need to make automated external defibrillators available especially in hospitals.

Introduction

Witnessed sudden cardiac arrest (SCA) managed promptly and correctly by a bystander increases the chance of survival [1]. It is a public health problem which can occur in the hospital, at home or public places like church, stadium, cinema hall, market and other meeting places. The presence of a skilled healthcare provider should be an added advantage to the victim. The triad of insufficient awareness, infrastructure and capacity building however, continue to pose a challenge to the performance of optimum cardiopulmonary resuscitation (CPR) even among healthcare workers [2].

In many low and medium income countries (LMIC),

prehospital care is under developed [3]. With this near absence of out of hospital (OOH) emergency medical service (EMS), and in line with the African culture, healthcare workers are frequently summoned in the neighbourhood to attend to any occurrence of SCA. They may be the first to arrive even where out of hospital emergency medical services exist. They have to be conversant with both the initial intervention as well as subsequent transportation of the victim to the hospital. In our locality, this is mostly through private arrangements using any available vehicle from family, friends or commercial taxis. It is a sharp contrast to what obtains in the western world where emergency dispatchers, first responders, Basic Life Support (BLS) or Advanced Cardiac Life Support (ACLS) ambulances are engaged [4,5].

The training curriculum of all cadres of health workers includes cardiopulmonary resuscitation at undergraduate and postgraduate levels. Doctors in Nigeria are trained for a minimum of 6 undergraduate years and those who wish to specialize spend additional 6 or more years in the National post graduate medical college or West African college of physicians or surgeons. Nurses are trained for 3 years in Schools of nursing for their Registered nurse (RN) certificate or 5 years in the universities for their Bachelor of Nursing Science (BNSc) degree. Those who choose to further their training spend at least 18 months in various post basic nursing specialties. The situation is similar in various other professional groups. A systematic review found that Resuscitation training in developing countries was well received and viewed as valuable training by the students and local counterparts [6]. It concluded that institution of training in trauma and newborn resuscitation in developing countries has significantly reduced mortality.

In practice, despite these training programs, the professionals require regular updates. This is in view of knowledge and skill decay as well as the advancement in resuscitation science with consequent revised resuscitation advisory statements. Solagberu [7] in his work reported a common statement made in mortality review meetings in our sub region 'all resuscitative efforts failed and patient certified dead'. A careful scrutiny of these resuscitative efforts reveals various deficiencies. While Solagberu [7], identified the need for resuscitation equipment, Tobi [8] and colleagues in another centre in Nigeria stressed the need for training and certification on BLS/ACLS as well as the establishment of cardiac arrest teams as a means of improving resuscitation outcomes. Zha [9] and colleagues on the other hand in a multi-centre study across Nigeria, corroborated the above findings and in addition stressed a need for quality improvement measures, application of real-time resuscitation documentation with structured meetings for continuous quality evaluation as low-cost, non-resource-intensive measures. These recommendations have the potential to identify areas of dysfunction, opportunities for improvement and problems to be addressed in all aspects of the resuscitation process.

The objective of this study was to assess the involvement of health workers in Cross River State with CPR during witnessed SCA and the resources available to them for intervention.

Subjects and Methods

This descriptive Cross sectional study was carried out in Cross River State, Southern Nigeria which has an international boundary with Cameroon in the East. The state has a projected population of 3,783,085 persons and 14.2 doctors per 100,000 population working in her public sector [10,11]. Less than 20% of the health workers serve in the State employment [11]. The majority are in the University of Calabar Teaching Hospital (UCTH) and The Federal Neuropsychiatric Hospital (FNH) which are Federal health institutions with better remuneration.

A selected sample of consenting health workers belonging to the various categories who met the eligibility criteria

participated. Selection was by the non-probability method. They were recruited from their work places and during meetings of healthcare providers. Doctors, Pharmacists, Nurses, Laboratory scientists, Physiotherapists, Others (Optometrists, Radiographers, Anaesthetic Technicians) were included.

Individuals who declined to complete the questionnaire were excluded.

Data was collected using a self-administered semi-structured questionnaire. The questionnaire was divided into sections:

Section A; Identification which included socio-demographic characteristics of the respondents,

Section B; Practice of CPR among Health Professionals

Section C; Equipment and Drugs Available for Resuscitation

Following data collection, the questionnaires were manually sorted out, coded before and cleaned following entry into SPSS version 20. Data analysis was done using descriptive statistics (frequency proportions, means and standard deviation) to summarize variables. The level of significance was set at $P < 0.05$

Results

Sociodemographic characteristics

Three hundred and forty-five healthcare workers were surveyed, out of which 182 (52.8%) had witnessed and been involved in CPR for cardiac arrest. Mean age of the witnesses was 41.3 ± 9.2 years, ranging from 19 to 62 years. Approximately half of subjects (50.6%) were within 31 and 50 years old, and female: male ratio was 1:0.53. Also, approximately half of respondents (48.9%) were nurses, and other cadres of workers were pharmacist (13.2%), medical doctor (12.6%) and physiotherapist (4.4%) (Table 1). There was significantly higher proportion of respondents that were nurses and pharmacists in government compared with private hospitals ($p < 0.00$).

Approximately half of respondents (51.6%) had more than 10 years of practice experience, but there was no significant difference in this proportion comparing respondents in government and private hospitals ($p > 0.05$). Also, approximately half of respondents (48.4%) had never had previous training on CPR. Significantly higher proportion of respondents in government compared with private hospitals, had had prior training on CPR ($p < 0.00$). Among respondents that had had previous training, most (87.2%) had the training within 10 years prior to the study. There was no significant difference in proportion that had training within 10 years, comparing respondents in government and private hospitals ($p > 0.05$, Table 1).

Witness and Involvement in cardiopulmonary resuscitation

Of the one hundred and eighty-two respondents that had witnessed cardiac arrest, common sites of witness were the ward (79, 43.4%), A & E unit (36, 19.8%), theatre (27, 14.8%),

home (23, 12.6%) and ICU (17, 9.4%). Except at home, witness of cardiac arrest at other sites was commoner among respondents from government compared with private hospitals, but statistical significance was found only for witness on the ward (Table 2).

Approximately half of respondents (50.5%) were involved in chest compressions for CPR, while 45.1%, 36.3%, 31.3%, 28.6%

and 22.0% were involved in oxygen therapy, IV fluid therapy, rescue breathing, IV adrenaline therapy and transportation to hospital, respectively (Table 3). Involvement in defibrillation, intracardiac adrenaline and cardiac pacing, were found in 13.2%, 9.3% and 4.9% of respondents, respectively. Involvement in chest compression, oxygen therapy, IV fluid therapy and IV adrenaline therapy was significantly commoner among respondents in government compared with private hospitals ($p < 0.05$, Table 3).

Table 1: Sociodemographic characteristics of respondents that witnessed CPR (N=182)

Variable	Govt. / Public Hosp. n (%)	Priv./NGO Hosp. n (%)	Total n (%)	Chi-square (p-value)
Gender				
Male	49 (32.2)	14 (46.7)	63 (34.6)	2.3 (0.13)
Female	103 (67.8)	16 (53.3)	119 (65.4)	
Total	152 (100)	30 (100)	182 (100)	
Age group (in years)				
≤20	2 (1.3)	0 (0.0)	2 (1.1)	Fisher's
21-30	40 (26.3)	10 (33.3)	50 (27.5)	Exact
31-40	38 (25.0)	14 (46.6)	52 (28.6)	(0.00)
41-50	38 (25.0)	2 (6.7)	40 (22.0)	
51-60	33 (21.7)	2 (6.7)	35 (19.2)	
>60	1 (0.7)	2 (6.7)	3 (1.6)	
Total	152 (100)	30 (100)	182 (100)	
Cadre of health care worker				
Nurse	87 (57.2)	2 (6.7)	89 (48.9)	Fisher's
Pharmacist	17 (11.2)	7 (23.3)	24 (13.2)	Exact
Medical doctor	18 (11.8)	5 (16.7)	23 (12.6)	(0.00)
Laboratory scientist	12 (7.9)	0 (0.0)	12 (6.6)	
Physiotherapist	6 (3.9)	2 (6.7)	8 (4.4)	
Others*	12 (8.0)	14 (46.6)	26 (14.3)	
Total	152 (100)	30 (100)	182 (100)	
Years of practice experience				
≤10	70 (46.1)	18 (60.0)	88 (48.4)	Fisher's
11-20	24 (15.8)	6 (20.0)	30 (16.5)	Exact
21-30	34 (22.3)	3 (10.0)	37 (20.3)	(0.29)
>30	24 (15.8)	3 (10.0)	27 (14.8)	
Total	152 (100)	30 (100)	182 (100)	
Previous training on CPR				
Yes	85 (55.9)	9 (30.0)	94 (51.6)	6.7 (0.01)
No	67 (44.1)	21 (70.0)	88 (48.4)	
Total	152 (100)	30 (100)	182 (100)	
Duration since last training (in years)				
≤10	74 (86.0)	8 (100)	82 (87.2)	Fisher's
11-20	11 (12.8)	0 (0.0)	11 (11.7)	Exact
>20	1 (0.2)	0 (0.0)	1 (1.1)	(0.53)
Total	86 (100)	8 (100)	94 (100)	

*Other healthcare workers include radiographer, health record, technicians and administrative staff

Perception of factors contributing to successful cpr

Approximately half of respondents (48.9%) had successful CPR (table 4). Contribution to successful CPR were attributed to immediate recognition (38.2%), prompt CPR (38.2%), oxygen therapy (30.3%), adrenaline administration (20.2%) and fluid therapy (19.1%). Except for immediate recognition and oxygen therapy, these factors were perceived to contribute to successful CPR by significantly higher proportion of respondents in government compared with private hospitals ($p < 0.05$, Table 4).

Discussion

Witnessed sudden cardiac arrest (SCA) offers the best chance of survival to the victim provided the rescuer has requisite skills and resources [1]. This study reveals that 52.8% of respondents had witnessed SCA either within or out of hospital.

Witnessed sudden cardiac arrest is relatively common among

Table 2: Place of witness and involvement in CPR among respondents (N=182)

Variable	Govt. / Public Hosp. n (%)	Priv./NGO Hosp. n (%)	Total n (%)	Chi-square (p-value)
Witnessed at home				
Yes	17 (11.2)	6 (20.0)	23 (12.6)	1.8 (0.18)
No	135 (88.8)	24 (80.0)	159 (87.4)	
Total	152 (100)	30 (100)	182 (100)	
Witnessed at A & E unit				
Yes	28 (18.4)	8 (26.7)	36 (19.8)	1.1 (0.30)
No	124 (81.6)	22 (73.3)	146 (80.2)	
Total	152 (100)	30 (100)	182 (100)	
Witnessed on the ward				
Yes	72 (47.4)	7 (23.3)	79 (43.3)	5.9 (0.02)
No	80 (52.6)	23 (76.7)	103 (56.6)	
Total	152 (100)	30 (100)	182 (100)	
Witnessed at theatre				
Yes	24 (15.8)	3 (10.0)	27 (14.8)	Fisher's
No	128 (84.2)	27 (90.0)	155 (85.2)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.41)
Witnessed at ICU				
Yes	16 (10.5)	1 (3.3)	17 (9.3)	Fisher's
No	136 (89.5)	29 (96.7)	165 (90.7)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.22)

health workers both in the workplace [12] and at home. In this study, among the respondents who witnessed SCA, 43.4% were witnessed on the ward. Higher figures were expected in critical areas such as operating theatres, intensive care unit (ICU), and Accident and Emergency (A&E). This was the case in a study of

Table 3: Participation / Involvement in cardiopulmonary resuscitation (N=182)

Variable	Govt. / Public Hosp. n (%)	Priv./NGO Hosp. n (%)	Total n (%)	Chi-square (p-value)
Involvement in chest compressions				
Yes	82 (53.9)	10 (33.3)	92 (50.5)	10.6
No	70 (46.1)	20 (66.7)	90 (49.5)	(0.00)
Total	152 (100)	30 (100)	182 (100)	
Involvement in rescue breathing				
Yes	49 (32.2)	8 (26.7)	57 (31.3)	0.4
No	103 (67.8)	22 (73.3)	125 (68.7)	(0.55)
Total	152 (100)	30 (100)	182 (100)	
Involvement in oxygen therapy				
Yes	75 (49.3)	7 (23.3)	82 (45.1)	6.8
No	77 (50.7)	23 (76.7)	100 (54.9)	(0.01)
Total	152 (100)	30 (100)	182 (100)	
Involvement in transportation to hospital				
Yes	31 (20.4)	9 (30.0)	40 (22.0)	1.4
No	121 (79.6)	21 (70.0)	142 (78.0)	(0.25)
Total	152 (100)	30 (100)	182 (100)	
Involvement in IV fluid therapy				
Yes	60 (39.5)	6 (20.0)	66 (36.3)	4.1
No	92 (60.5)	24 (80.0)	116 (63.7)	(0.04)
Total	152 (100)	30 (100)	182 (100)	
Involvement in defibrillation				
Yes	21 (13.8)	3 (10.0)	24 (13.2)	Fisher's
No	131 (86.2)	27 (90.0)	158 (86.8)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.57)
Involvement in IV adrenaline therapy				
Yes	49 (32.2)	3 (10.0)	52 (28.6)	Fisher's
No	103 (67.8)	27 (90.0)	130 (71.4)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.01)
Involvement in intracardiac adrenaline				
Yes	16 (10.5)	1 (3.3)	17 (9.3)	Fisher's
No	136 (89.5)	29 (96.7)	165 (90.7)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.22)
Involvement in cardiac pacing				
Yes	7 (0.5)	2 (6.7)	9 (4.9)	Fisher's
No	145 (99.5)	28 (93.3)	173 (95.1)	Exact
Total	152 (100)	30 (100)	182 (100)	(0.63)

Table 4: Contribution to successful cardiopulmonary resuscitation

Variable	Govt. / Public Hosp. n (%)	Priv./NGO Hosp. n (%)	Total n (%)	Chi-square (p-value)
Successful last CPR involved				
Yes	76 (50.0)	13 (43.3)	89 (48.9)	0.45
No	76 (50.0)	17 (56.7)	93 (51.1)	(0.50)
Total	152 (100)	30 (100)	182 (100)	
Immediate recognition contributed to success				
Yes	31 (40.8)	3 (23.1)	34 (38.2)	Fisher's
No	45 (59.2)	10 (76.9)	55 (61.8)	Exact
Total	76 (100)	13 (100)	89 (100)	(0.22)
Prompt CPR contributed to success				
Yes	33 (43.4)	1 (7.7)	34 (38.2)	Fisher's
No	43 (56.6)	12 (92.3)	55 (61.8)	(0.01)
Total	76 (100)	13 (100)	89 (100)	
Adrenaline administration contributed to success				
Yes	18 (23.7)	0 (0.0)	18 (20.2)	Fisher's
No	58 (76.3)	13 (100)	71 (79.8)	Exact
Total	76 (100)	13 (100)	89 (100)	(0.04)
Oxygen therapy contributed to success				
Yes	24 (31.6)	3 (23.1)	27 (30.3)	Fisher's
No	52 (68.4)	10 (76.9)	62 (69.7)	Exact
Total	76 (100)	13 (100)	89 (100)	0.54
Fluid therapy contributed to success				
Yes	17 (22.4)	0 (0.0)	17 (19.1)	Fisher's
No	59 (77.6)	13 (100)	72 (80.9)	Exact
Total	76 (100)	13 (100)	89 (100)	(0.05)

in-hospital cardiac arrests in a Saudi hospital which revealed most of the cardiac arrests as occurring in the intensive care unit and A&E [12]. It is possible that a larger percentage of our own study participants work in the wards in their various hospitals rather than the specialized areas of A&E, theatre, and ICU. Witnessed cardiac arrest at home was reported by 12.6% of respondents. This can be used as a surrogate for out of hospital cardiac arrest. Population based data are needed to compile the prevalence of out of hospital SCA in our locality. Health care workers are likely to observe SCA among their relatives or neighbours at home. Given the delay usually encountered in getting such victims to our emergency rooms, it is not surprising that only 19.8% respondents reported SCA witnessed in the accident and emergency unit. Many sudden cardiac arrest victims are usually brought in dead. Early recognition and call for help remains the first step in the chain of survival for basic life support [13]. It is imperative to have a government organised transportation for moving critically ill, accident and cardiac arrest victims rapidly to the hospital.

It is surprising that only 50.4% of respondents who witnessed SCA reported involvement in chest compression. High quality chest compression and rescue breathing are

the hallmarks of effective CPR [12,13]. High quality chest compression is defined as at least 2cm depth at a frequency of at least 100 per minute with adequate recoil and no interruption [14]. It is so important that chest compression only CPR is recommended where rescuers are unwilling to carry out expired air ventilation in the absence of barrier devices [15]. Studies have shown that appropriate prompt and high quality chest compression greatly enhances survival from sudden cardiac arrest [16]. Mechanical chest compression devices have been designed to improve the quality of chest compressions though not yet widely accepted nor approved by many resuscitation councils [17]. A study in Sweden found an increased rate of resuscitation when bystanders unwilling to perform expired air ventilation, were encouraged to carry out chest compression only CPR. The survival rate was not significantly different between this group and conventional CPR group [16].

An even smaller percentage 31.3% of our respondents were involved in rescue breathing. Rescue breathing during in-hospital CPR is expected to be higher than what was found in the study because self-inflating bags (SIBs) ought to be available for use. It is a sad reality that SIB's may not be readily available and accessible in every area of the hospital for emergency rescue breathing.⁹ Only 22% of respondents attested to the availability of SIBs in their various A&E units. This leaves victims to the willingness or otherwise of healthcare providers to carry out expired air ventilation. Mouth to mouth rescue breathing is not advisable where the possibility of transmission of deadly pathogens such as SARS [18] or Ebola exists.

Defibrillation either automated or manual is still rarely used during resuscitation following cardiac arrests in our locality. Victims of SCA having shockable rhythms are therefore not given the best possible chance to achieve return of spontaneous circulation (ROSC). Recent evidence is in favour of making defibrillation available to all victims of SCA who may have a shockable rhythm [13]. For this reason, automated external defibrillation has been recommended as part of BLS since the year 2000 [19]. Many countries now have public access defibrillators strategically positioned in public places [20]. In this study, use of AED was not listed among the reasons for successful resuscitation by any of the respondents. This situation is similar to a study by El Sayed [21] and colleagues in Lebanon where AED was used in only 1.5% of OOH cardiac arrests. Kitamura²⁰ and colleagues in Japan on the other hand, found improved outcomes when public access defibrillators were deployed for out of hospital cardiac arrest. A study in Bosnia revealed 82% prevalence of ventricular fibrillation among SCA victims.³Defibrillation is critical in treating adult SCA and LMIC should avail their citizens of this intervention for improved outcome. Surprisingly even in developed countries, delayed defibrillation is common and is associated with lower rates of survival after in-hospital cardiac arrest [22].

Although majority of respondents knew the recommended route of adrenaline administration to be intravenous, 9.2% of respondents still administer adrenaline through the intra-cardiac route. Intravenous adrenaline has been demonstrated in various studies as a positive prognostic factor during resuscitation [19,23,24]. The intra-cardiac route of

administering adrenaline and other obsolete practices can be corrected through CPR capacity building workshops. Studies have shown the need for regular refresher courses to improve skills [25]. There however, appears to be no strong evidence clearly defining frequency or intervals of these courses. Different countries adopt a position that safeguards the health of their citizenry. In Korea, first responders are expected to undergo CPR and AED training at least once a year [1]. This study reveals that only 51.9% of respondents had received CPR training and these were mostly public servants. A similar study in Spain revealed that public servants were four times more likely to be trained in defibrillation than the rest of the workers [26].

Despite the above findings, 48.7% of respondents have experienced successful outcome in terms of ROSC. The success was attributed to immediate recognition, prompt CPR, oxygen therapy and fluid therapy in that order. Other researchers have reported that witnessed arrests and shorter time of CPR were associated with higher survival rates when compared to unwitnessed arrests or a longer duration of resuscitation [27,28].

Conclusion

The willingness of health workers in LMIC to promptly attend to witnessed sudden cardiac arrest occurrences at home and in hospitals is highly commendable. To improve the outcome of these resuscitation attempts, however, the triad of insufficient awareness, infrastructure and capacity building must be addressed. Among other interventions, there is an urgent need to make automated external defibrillators available in every emergency room.

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