

**ORIGINAL ARTICLE****OUT OF HOSPITAL CARDIAC ARREST IN KUALA LUMPUR: INCIDENCE; ADHERENCE TO PROTOCOL; AND ISSUES: A MIXED METHOD STUDY**Mohd Said Nurumal<sup>1</sup> & Sarah Sheikh Abdul Karim<sup>2</sup><sup>1</sup>Department of Critical Care Nursing, Kulliyah of Nursing, International Islamic University Malaysia, 25710 Kuantan Pahang<sup>2</sup>Department of Emergency and Trauma, Sungai Buloh Hospital, 47000 Sungai Buloh Selangor**ABSTRACT**

Information regarding out of hospital cardiac arrest incidence including outcomes in Malaysia is limited and fragmented. This study aims to identify the incidence and adherence to protocol of out of hospital cardiac arrest and also to explore the issues faced by pre-hospital personnel in regards to the management of cardiac arrest victim in Kuala Lumpur, Malaysia. A mixed method approach combining qualitative and quantitative study design was used. Two hundred eighty five (285) pre-hospital care data sheet for out of hospital cardiac arrest during the year of 2011 were examined by using checklists to identify the incidence and adherence to protocol. Nine semi-structured interviews and two focus group discussions were performed. Based on the overall incidence for out of hospital cardiac arrest cases which occurred in 2011 (n=285), the survival rate was 16.8%. On the adherence to protocol, only 89 (41.8%) of the cases adhered to the given protocol and 124 did not adhere to such protocol. All the relevant qualitative data were merged into few categories relating to issues that could affect the management of out of hospital cardiac arrest performed by pre-hospital care team. The essential elements in the handling of out of hospital cardiac arrest by pre-hospital care team was to ensure increased survival rates and excellent outcomes. Measures are needed to strengthen the quick activation of the pre-hospital care service, prompt bystander cardiopulmonary resuscitation, early defibrillation and timely advanced cardiac life support, and also to address all other issues highlighted in the qualitative results of this study.

**Keywords:** pre-hospital care, out of hospital cardiac arrest, incidence, protocol, mixed method research

**INTRODUCTION**

In pre-hospital settings, the indicator for outcome performance is used to measure the incidence of out of hospital cardiac arrest, as this is the leading cause of death among adults worldwide<sup>1-4</sup>. The incidence figures showing a decrease for out of hospital cardiac arrest could possibly be used to assess the entire acceptable performance of a pre-hospital care service. An out of hospital cardiac arrest is defined as the cessation of cardiac mechanical activity, which is confirmed by the absence of signs of circulation outside a hospital setting. It can occur due to multiple causes such as trauma, drowning, overdose, asphyxia, electrocution, primary respiratory arrest, uncontrolled glycemia, hyper/hypokalemia, thrombosis, acidosis, and other non-cardiac etiologies. It has been reported that 70-85% of such event had a cardiac etiology<sup>5-8</sup>.

The incidence of out of hospital cardiac arrest had been reported in the literature particularly in the United States and Europe using systematic assessment. In the United States, the Emergency Medical Service (EMS) treatment of sudden cardiac arrest was approximately 55 per 100 000 person-years for all rhythm arrests. It was 21 per 100 000 person-years for ventricular fibrillation arrests, with survival estimates of 8% for all rhythm arrests and 17% among ventricular fibrillation arrests<sup>9</sup>. In Europe, a total of 18 105 of all rhythm EMS cardiac arrest occurred during 48 million person-years of observation, resulting

in an overall incidence for all rhythm arrests of 37.72 per 100 000 person-years. The incidence of ventricular fibrillation arrest was 16.84% per 100 000 person-years. The survival rate was 10.7% for all rhythm and 21.2% for ventricular fibrillation cardiac arrests. Therefore, approximately 275 500 persons would experience all rhythm cardiac arrest treatment by an EMS with 29 000 persons surviving to a hospital discharge<sup>10</sup>. In Hong Kong, a small study measured out of hospital cardiac arrest and its management by voluntary ambulance service. It was revealed that out of 61 cases (45 cases of asystole, 5 cases of pulseless electrical activity, and 11 cases of ventricular fibrillation), only 5 patients had evidence of return of spontaneous circulation after resuscitation, but only 1 patient survived to a hospital discharge. They concluded that two serious issues needed to be highlighted and required urgent improvement: 1) bystander CPR; and 2) response time<sup>11</sup>.

The “chain of survival” has been proven to improve outcomes from out of hospital cardiac arrest. This has been proposed by the American Heart Association. Performance measures are needed to strengthen the quick activation of pre-hospital care service, prompt bystander cardiopulmonary resuscitation, early defibrillation and timely advanced cardiac life support<sup>10,12-13</sup>. A study by Herlitz et al<sup>14</sup> on 16, 712 patients who fulfilled their study inclusion criteria found that patients who had an out of hospital cardiac arrest and who did not receive defibrillation had a low chance of survival. This is

because the chain of survival includes four directives and each of these must be robust to ensure maximum survival rate. The directives for the chain are: 1) early access to emergency medical services; 2) early cardiopulmonary resuscitation; 3) early defibrillation; and 4) early advanced life support<sup>15,13</sup>. On considering the chain, patients with acute myocardial infarction or trauma could also benefit from this approach to emergency cardiac care, particularly in the community setting. Thus, the protocol for managing out of hospital cardiac arrest is derived from the fundamental of 'chain of survival'. In the Malaysian context, the existing protocol is mainly for pre-hospital personnel to adhere to when dealing with sudden cardiac arrest cases. Basically, the protocol provides step-by-step procedures for the intervention and the assessment to be carried out after each intervention plus the measures for the outcome.

In Malaysia, EMS is controlled by the Medical Emergency Coordinator Center (MECC) since early 2008 after the endorsement by the parliament. It is under the full purview of the Ministry of Health and funded by the federal government. Prior to this, EMS in Malaysia relied on non-profit organizations and was not controlled centrally. In order to facilitate the system effectively, the government had created a universal phone number which is 999 for public access. One of the major roles of MECC is to coordinate and provide excellent service to cardiac arrest victims by providing instructions to the bystander including Telephone CPR.

Currently in Malaysia, information regarding out of hospital cardiac arrest incidence including its outcomes is limited and fragmented. There are few studies dealing with EMS performance, but only focused on the response time. Unfortunately, response time indicator might not have captured the quality of EMS, which could pave the way for improvement. Moreover, this formal service is newly developed and is still in its infancy. The demand for this service will greatly increase, particularly in urban areas, such as the Kuala Lumpur region, where approximately 150 calls per day have been received. This present study is also important because dissatisfied stakeholders are raising issues relating to the betterment of the service<sup>16</sup>.

Generally, out of hospital cardiac arrest epidemiology or incidence can be measured using an Utstein style template. The Utstein style encourages the use of core data and supplementary data. Core data are raw data used otherwise comparisons would be difficult or meaningless. These data are generally easier to collect and, in some systems, are routinely collected. Supplementary data (demographic status, for example) are more comprehensive and more specific, and should be reported

whenever possible. Such data permit more detailed comparisons and more precise analysis of outcomes. However, they are generally more difficult to collect and tend to be less precise than core data<sup>13</sup>. The great advantages of this template are that both incidence and adherence to medical protocols for cardiac arrest can be examined. Thus, it makes easier for out of hospital cardiac arrest deaths to be examined. In this study, the template has been modified based on the research objective.

This study aims to identify the incidence and adherence to protocol of out of hospital cardiac arrest and also to explore the issues faced by EMS personnel in regards to managing cardiac arrest victim in Kuala Lumpur, Malaysia. In this study, out of hospital cardiac arrest incidence is defined as the cases of both traumatic and medical emergency victims who have no palpable pulse and sign of life at the scene as recorded in the pre-hospital care run sheet. For example, the incidence was calculated by the number of cases occurring in the year 2011 where the denominator was the rate of out of hospital cardiac arrest and the numerator was the rate of patient experiencing out of hospital cardiac arrest but who survived upon arrival at the emergency and trauma department. Adherence to protocol is an evaluation of the steps of intervention/treatment. This includes the medical directions given to EMS personnel for carrying out procedures in life threatening cases of out of hospital cardiac arrest (both of cardiac & non cardiac origin) based on MECC guidelines. If the first six of the nine steps/intervention/treatment procedures were done, then it can be classified as an adherence to the protocol. The evaluation was done based on the pre-hospital care run sheet record.

## METHODOLOGY

This is a descriptive study using a mixed-method approach where qualitative data were used as supplementary data to support quantitative findings. By using a study design with two different methods, a researcher can gain perspectives from different angles on issues pertaining to out of hospital cardiac arrest. Thus in this study, qualitative methods would enable the researcher to explain the phenomenon in a real setting arising from the quantitative methods<sup>17-18</sup>.

The study was conducted at Kuala Lumpur MECC. It is the biggest MECC in central Klang Valley, which controls three (3) tertiary hospitals and three (3) ambulance service centers. It receives approximately 150 calls a day and 3000 calls a month. For the year 2011, Kuala Lumpur MECC received 34 041 calls and dispatched 28 631 calls. The reason for choosing the biggest center was because it has higher number of cases and the data were well documented for the year

2011 and for other MECC developing the database for the future study. The duration of the study was from December 2012 to June 2013. The researcher used pre-hospital care datasheet for out of hospital cardiac arrest as an instrument to measure the incidence and adherence to protocol. The researcher formulated a checklist from the pre-hospital care data sheet for measuring the adherence into dichotomous option (*Yes for done or No for not done*). The checklist had 11 items of which items number 2 to 7 are compulsory and labelled as an adherence to the out of hospital cardiac arrest protocol (Appendix 1). The pre-hospital care data sheet was developed based on MECC out of hospital cardiac arrest guidelines. A total of 285 pre-hospital care data sheet were analysed to answer the incidence and adherence to protocol. As for the qualitative study, purposive sampling techniques were used for the selection of informants. The key informants consisted of the national head of the emergency physicians, emergency physicians, the head nurse/assistant medical officer and nurse/assistant medical officer. The inclusion criteria for key informants were being able to express their personal thoughts and opinions regarding issues arising from managing out of hospital cardiac arrest in pre-hospital care context. There were three components of instruments used in the qualitative approach, namely: the researcher himself; semi-structured interviews and focus group discussion guidelines; and tape recording of interviews. All the data were collected by the researcher himself, assisted by the technical staff whenever necessary. Informants were given a cover letter and consent form and their signatures were required before the interview session. Prior to recording the material, the researcher sought permission from the informants and explained the purpose of the recording which was to transcribe conversations for analysis. The interviews were not longer than an hour, unless the informant wished to share more. Interviews and discussions were conducted in the preferred language of the informant, which was Malay, English or both. This research was approved by the Clinical Research Center of Kuala Lumpur MECC and the National Medical Research Registry of Malaysia.

Prior to auditing the checklist content, it was first tested by five experts with a Content Validity Index score of 1.00. The inter-rater reliability tested by the researcher and his

colleague of 15 checklist forms was 1.00. The trustworthiness of the data was maintained by following the tenets established by Lincoln and Guba<sup>19</sup>. The credibility was affirmed through member-checking with five informants for the transcribing of the verbatim, open coding and categories. Rich descriptions were undertaken to increase the potential transferability of the findings to other settings and situations. To establish dependability, the preliminary categories were compared and discussed within teams in this study. The raw data, reflexive journals of the data analysis used enhanced the trustworthiness and conformability of the data.

The data were analysed using both quantitative and qualitative techniques. The quantitative data were computed using SPSS version 21.0 for the analysis of descriptive statistics. The researcher analysed the qualitative data using his own standards, closely guided by the research team. For quality data-management and analysis, the researcher followed the Graneheim and Lundman<sup>20</sup> content-analysis approach, including the techniques of 'coding', and identifying emerging 'categories',

## RESULTS

### *Out of Hospital Cardiac Arrest Incidence*

For out of hospital cardiac arrest incidence, there are two tables explaining the findings. Table 1 describes the characteristics of patients with out of hospital cardiac arrest including the response time on scene. Table 2 further shows in detail the rate of survival.

Table 1 shows the characteristics of clients with out of hospital cardiac arrest in the Kuala Lumpur MECC for year 2011. It also includes the response time on the scene as one of the indicators for measuring performance (14.75 minutes). Based on 213 cases, the mean age for out of hospital cardiac arrest was 57.32(16.99). There were three times more male patients than female patients who required the pre-hospital care service during life threatening events. Comparing ethnic groups, Malay (47.4%) was the highest to receive pre-hospital care, followed by Chinese (28.6%) and Indian (17.4). Those of cardiac origin were the most cases which received pre-hospital care service in 2011. There were 54 cases in which the cause of cardiac arrest was unknown.

**Table1 Characteristics of Patients Experiencing out of Hospital Cardiac Arrest in Kuala Lumpur MECC for the year 2011. (n=213)**

Characteristics	n	(%)	Mean	(SD)
Age			57.32	(16.99)
Gender				
Male	174	(81.7)		
Female	39	(18.3)		
Ethnicity				
Malay	101	(47.4)		
Chinese	61	(28.6)		
Indian	37	(17.4)		
Others	14	(6.6)		
Types				
Cardiac Origin	91	(42.7)		
Respiratory	18	(8.45)		
Diabetes	17	(7.98)		
Electrocution	1	(0.45)		
Poisoning	11	(5.16)		
Trauma	21	(9.86)		
Unknown	54	(25.4)		
Response time (min)			14.75	(5.62)

Table 2 shows the survival rate for the out of hospital cardiac arrests which sought pre-hospital care service in the Kuala Lumpur MECC for 2011. The survival rate was defined as the percentage of patients who were still alive upon arrival at the trauma and emergency department. Overall, the survival rate was 22.5%

of the 213 cases. Based on these data, the range of out of hospital cardiac arrest cases was from 10 to 24 per month. On the other hand, if the calculation of the survival rate was based on the overall out of hospital cardiac arrest cases occurring in 2011 (n=285), the survival rate was only 16.8%.

**Table 2 Survival and Mortality Rates of Out of Hospital Cardiac Arrest (OHCA) in Kuala Lumpur MECC for 2011**

Month	Number of Survival n(48)	Number of OHCA n(285)*	Number of OHCA n(213)**
January	3	26	20
February	2	16	10
March	3	21	15
April	3	23	17
May	5	28	22
June	5	30	24
July	2	17	11
August	4	22	16
September	7	27	21
October	8	26	20
November	2	22	16
December	4	27	21
Total number of survival (%)	48(22.5) of 213 cases 48(16.8) of 285 cases		

\* Total number of OHCA cases of both obvious death (before calling to the MECC) and experiencing cardiac arrest.

\*\* Total number of OHCA cases that was only experiencing cardiac arrest and death occurring during the ambulance journey on the way to the scene, after arrival of ambulance at the scene, or before arrival at definitive care center.

**Adherence to Out of Hospital Cardiac Arrest Protocol**

The 285 pre-hospital care data sheets for out of hospital cardiac arrest during the year 2011 were

examined by using a checklist. Seventy -two cases were excluded from analysis due to obvious deaths at the scene, and 213 were included and of these,191 cases were non-trauma and 22 cases

were trauma. From the total of 213 cases, only 89 (41.8%) of the cases adhered to the given protocol and 124 did not adhere to such protocol. This was mainly due to incomplete interventions or not following the steps of the protocol. There were five steps to follow for non-shock cases and six steps for shock cases. From the findings, 181(85.0%) cases were dispatched within 3 minutes as this is the key performance indicator for cardiac arrest cases. Of the 213 cases, 126 (59.2%) performed CPR and 102 (47.9%) cases applied AED and analyzed the rhythm, and of these, 73 cases required AED shock, where in only 39 (18.3 %) cases, the shocks were delivered. Further, in 94 (44.1%) cases, an advanced airway was inserted, 38 (17.8%) cases needed secure intravenous lines and at least 1 mg adrenaline was administered. From the run sheet, 165 (77.4%) cases were terminated from using CPR at the scene and 48 (22.5%) cases were brought to the emergency department on the return of spontaneous circulation. Out of 89 cases that adhered to protocol, only 41(46.1%) of the cases survived upon arrival at the trauma and emergency department. On the other hand, 7(5.64%) out of 124 cases which did not adhere to the protocol still had spontaneous circulation upon arrival.

#### **Issues relating to Out of Hospital Cardiac Arrest**

From the interview and focus group discussions, there were several meaningful points of views made by the administrators and staffs in regards to out of hospital cardiac arrest, particularly in the Klang Valley context. Only 41.8% from the total 213 cases of out of hospital cardiac arrest adhered to the prehospital care personnel protocol. The following were the categories which emerged from the data, that probably accounted for this. They also provided some realistic suggestions on how the matter of adherence could be improved.

##### ***Ineffective audit and supervision***

From the administrative perspectives, it was claimed that the lack of supervision and inconsistent or random audit might possibly be the causes for staff to not completely adhere to the given protocol. .... *but this thing (pre-hospital care form) sounds irrelevant to some and when we chase for the report from them, only we could see how they try to gather the data.... sometimes it is too late. I think things are getting better after a few reminders were given to them*

(Senior Emergency Physician)

*We are very straight when it comes to adherence issues, but we still face limitations because in many cases due to that we sometimes have no time to review all the cases unless if we got to*

*know by chance that they (the nurses or medical assistants) did not adhere.*

(Emergency Physician 3)

*At that time, during my audit, if I see that they don't adhere to the protocol, I will correct the staff.... but many of my colleagues could not monitor this due to being away from the time of the incident, when they do later there are too many already and they have to do randomly which is less effective.*

(Senior Head 1)

##### ***Difficulty in following the protocol leading to a dilemma***

On the other hand, many items have been spotlighted by the staff itself about the issues of protocol to be implemented by them in pre-hospital settings. For instance, at present, they found that it is hard to follow the protocol even when the algorithm is given and it is not easy to be done outside or in a person's house. *Just imagine at the scene the public demand you to resuscitate the case but in reality there are no sign of life and you were informed this happened about an hour ago and on top of that your protocol clearly spells not to carry a dead body, but again the public insists you to bring the patient to the hospital...not all the police case are there.*

(Nurse Z, FGD 1)

*You will be blamed for why you did not make the right interventions or steps when they reviewed your pre-hospital form. Again the family does not want to have any active resuscitation because they do not want to harm their beloved due to old age. We only have a consent form for not agreeing to bring them to hospital but we don't have a form to be signed for not agreeing to perform CPR.*

(Nurse B, FGD 1)

##### ***Staff attitudes and poor reasoning skills***

Other issues of not adhering to the protocol include the attitude of the staff when they thought that they were more knowledgeable and could make the best decision without relying on the algorithms. This possibly resulted in poor outcomes for the patient.

*The protocol is meant for the lay person and these people are medically trained. So they have their own view, how to manage, they think they know better based on their experiences....*

(Senior Emergency Physician)



*The algorithm is very good if it is followed by everyone, the chances of survival are high... we base it on current evidence. But I don't understand why some of my senior staff just show that they are unskillful in reading the protocol.... may be too much influence of their hospital experience.*

(Head Nurse 1)

*Our team went and claimed that the patient is dead and returned back to the MECC with a report of no spontaneous breathing and peripherally cold.... but after an hour we received the same call back from relatives saying the patient is gasping ... so the clear answer is that the respective earlier staff did not follow the protocol.*

(Nurse T, FGD 2)

### **Strategies to increase adherence to the protocol**

It was very informative to hear from both focus groups on how to ensure that all of them can easily follow the protocol. Most agreed and explained that they prefer to be involved together when planning in the initial phase. This was so that they could contribute their ideas and share their experience about the cultural context *per se* and not only from global practice.

*I think the top management needs to involve our representative groups to think of all the feasible matters in the algorithm. Giving the complete protocol and asking us to follow is a not a good idea without prior getting of our input.*

(Nurse F, FGD 1)

*A series of pilot tests is needed before it is completely valid to be used by us. So we could tell the loopholes in the algorithms and improvement can take place.*

(AMO J, FGD 2)

*I think forcing us to sign the memo and asking to use the protocol is a very autocratic way of doing it and it shows that we are not valuable in their view, our voices need to be heard too so we can have harmonious ideas*

(Nurse B, FGD 1)

*We need to sit and work closely from both parties, the administrators and the ground level staff need to have a series of discussion include comprehensive planning and provide education (demo how to use) prior to implementing the updated protocol.*

(Nurse T, FGD 2)

### **Educating and motivating bystanders to perform CPR**

There are other factors to consider besides the strategies given by the key personnel in pre-hospital care in regards to adhering to the protocol. The National Head of Trauma and Emergency expressed the need for public co-operation to increase the survival rate for out of hospital cardiac arrest or life threatening conditions. Her concern was that not many bystanders could be effective and are willing to take part in CPR at the scene, even if a telephone-guided CPR is given to them.

*If I say my staff adhere 100% to OHCA protocol, but the society never take their roles as a bystander, it is still not meaningful. I can know the possible outcomes of survival if only one side is working very hard. I often get responses from MECC that Telephone-CPR is not favorable to them. We need a lot of work to overcome this.*

(National Head of Trauma & Emergency, MOH)

### **DISCUSSION**

This study provides an overview on out of hospital cardiac arrest in Kuala Lumpur MECC. Generally, the survival rate is close to 10% for all the rhythm and around 20% for the ventricular fibrillation cases which have been reported around the globe<sup>9-11</sup>. In this study, only 22.5% were reported to have survived after the arrival at the care center. It is of interest that during the months of September and October, there were drastic increases in the survival of out of hospital cardiac arrest, which were 33.3% and 40.0% respectively. These were a mixture of all types of rhythms that were still breathing upon seeking the service. On the other hand, the survival rate would have been 16.8% if all the cases including obvious death were taken into account. There is still a need to consider that obvious death may also affect the performance if the service has rapid access or the public could activate the service after noticing signs of sudden cardiac arrest. Even though the survival rate of this study was higher compared to previous studies, the response time on-scene was 14.75±5.62 minutes when a rapid response of less than 8 minutes is essential as recommended<sup>4</sup>. Furthermore, only 213 cases were analysed compared to other countries where much larger populations were analysed. With regards to increasing the survival rate, Berdowskiet al<sup>21</sup> provides a very interesting information in their study on the importance of the first link in the chain of survival. The study compared that when the out of hospital cardiac arrest was recognized and a telephone CPR was delivered, the survival rate increased from 5% to 14%. Indeed the percentage was still in the range of 10% to 20% as

mentioned above, but it proves the effectiveness of the steps taken. Malaysia's MECC also practices telephone CPR, but only recently, thus this study could not capture how many of the bystanders performed CPR among the 213 cases.

There is the notion that chances of survival could decrease 7-10% for every minute without CPR<sup>22</sup>. Thus, bystander CPR is possibly a serious factor in the out of hospital cardiac arrest context. A bystander practicing CPR is not a local problem and it is, indeed, a global problem which includes the developed nations. A study by Vadeboncoueur and colleagues<sup>23</sup> indicated only 25% bystander CPR rates in Arizona, USA. In Asian countries, a recent study indicated that Japan has a rate of 45% bystander CPR and it is the highest in the world followed by Korea at 34%. However, the survival rates for these two countries are not known<sup>24</sup>. Hence, MECCs need to surmount the barriers to bystanders performing CPR.

A previous study indicates that all pre-hospital care personnel has the knowledge and skill on basic life support in Kuala Lumpur MECC<sup>25</sup>. However, the percentage that performed CPR at the scene was only 59%. The possible factors for not performing CPR from qualitative data findings were old age, refusal by relatives, suffering from illness and late arrival at the emergency scene. Many previous studies also explained that adherence to pre-hospital protocol is not appropriately done or followed<sup>1,26-27</sup>. From this present study, the protocol covers elements of the staff's responsible for managing general cardiac arrest. In contrast, in managing out of hospital cardiac arrest for cardiac origin such as ST elevation myocardial infarction, many previous studies highlighted that aspirin, 12 lead ECG acquisition and interpretation, and primary percutaneous coronary intervention or fibrinolytic are required, thus the implications for the shortest destination and clear medical direction are required<sup>28-31</sup>. It follows that Klang Valley's MECC needs to focus the protocol for every specific illness and the direct medical direction need to guide complex cases.

In conclusion, the researcher's point of view is that improving the competency of the staff and adherence to regular audit are needed. Involving bystanders for CPR and revision of the protocols are of paramount importance, with the involvement of the end user. The qualitative findings provide a direction for the strategies to improve the survival rate for out of hospital cardiac arrest.

## CONCLUSION

One of the essential elements in the out of hospital cardiac arrest handling by pre-hospital care is to ensure increased survival rate and excellent outcomes by adhering to given

protocols based on international standard benchmarks. These are to provide the best care outside to shortening the time thus avoiding further complications or death. Nevertheless, out of hospital cardiac arrest care is very challenging to personnel for adhering to the given protocol. This is because the protocol is not easy to follow because of other underlying factors, which also need to be understood before initiating the care as revealed in the findings of qualitative data. However, measures are needed to strengthen the quick activation of pre-hospital care service, prompt bystander cardiopulmonary resuscitation, early defibrillation and timely advanced cardiac life support as well as to confront all the issues highlighted in the qualitative results.

## Conflict of interest

There is no conflict of interest in this research work.

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**APPENDIX 1**

**Adherence to Medical Protocol: Out of Hospital Cardiac Arrest**

ID: \_\_\_\_\_

<b>1. Suspected causes of cardiac arrest</b>					
Cardiac Origin		Respiratory			
Trauma		Drowning			
Electrocution		Poisoning			
Uncontrolled blood sugar		Unknown			
<b>2. Ambulance dispatch within 3 minutes after activation</b>				Yes	No
<b>3. Pre-hospital personnel perform CPR</b>				Yes	No
<b>4. AED applied</b>				Yes	No
<b>5. First rhythm analysis</b>				Yes	No
<b>6. Defibrillation done, <i>If require</i></b>				Yes	No
<b>7. Advanced airway inserted</b>				Yes	No
<b>8. IV line secured*</b>				Yes	No
<b>9. Drug administered to patient (medical direction)*</b>				Yes	No
<i>If Yes,</i>					
Adrenaline		Atropine		Amiodarone	
Bicarbonate		Lidocaine		Dextrose	
<b>10. Was CPR terminated at the scene</b>				Yes	No
<i>If Yes, CPR termination reason</i>					
Return of circulation		Obvious death			
<b>11. Return of spontaneous circulation prior to hospital arrival</b>				Yes	No

*\*optional*

**No 2 - No 7 is a must steps unless clear obvious death**