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Original Research Article

Examining the impact of dispatch-assisted CPR on bystander CPR performing

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ABSTRACT

Background: Dispatcher-assisted CPR involves emergency medical dispatchers (EMD) delivering real-time CPR instructions to callers during emergencies. This method aims to enable timely bystander CPR before the arrival of emergency medical services, improving survival rates and neurological outcomes of out-of-hospital cardiac arrest (OHCA). This study evaluates the effectiveness of telephone-guided CPR instructions using retrospective audio data.
Methods: A retrospective study analyzed OHCA incidents in Mahasarakham, Songkhla, and Prachinburi within a metropolitan EMS system. Audiotapes from emergency calls between January and December 2021 were reviewed. Included were OHCA patients who called the dispatch center and were transported to the hospital by EMS. Exclusions included cardiac arrests in nursing homes, doctors' offices, and jails, as well as cases where EMS witnessed the OHCA or callers initiated CPR before receiving instructions.
Results: The study analyzed 280 patients, with 146 callers (52.1%) agreeing to perform CPR. Among the provided DA-CPR instructions, 18 items were significantly associated with bystander CPR performance. Five items that could be omitted to reduce OHCA recognition time delay include the introduction, requesting contact numbers, inquiring about the number of patients, assessing scene safety, and advising tilting the patient in case of vomiting.
Conclusions: To reduce the delay in identifying cardiac arrest and promptly initiating chest compressions during OHCA, it is suggested to employ a video call system for early detection of abnormal breathing and unconsciousness. Additionally, integrating automatic geolocation can expedite EMS response.

Keywords: Bystander CPR, Dispatched assisted CPR instruction, Emergency medical dispatchers, Out-of-hospital cardiac arrest

INTRODUCTION

Cardiac arrest claims thousands of lives worldwide, serving as a significant cause of mortality.[1] In the United States alone, it contributes to over 395,000 annual out-of-hospital deaths.[2] Similarly, in Europe, approximately 700,000 people experience cardiac arrest annually.[3] Out-of-hospital cardiac arrest (OHCA) ranges from 20 to 140 cases per 100,000 population and constitutes approximately 50-70% of all cardiac arrests.[4] In Thailand, cardiovascular diseases stand as the primary cause of mortality accounting for 21-27% of the disease.[5-6]

Cardiopulmonary Resuscitation (CPR) encompasses interventions aimed at sustaining vital functions of the heart and brain in unconscious individuals, thereby enhancing their chances of survival.[7] Reducing the time elapsed between cardiac arrest and prompt medical intervention is crucial in mitigating the fatalities associated with cardiac events.[8] When initiated promptly by bystanders at the scene, CPR can double the likelihood of survival.[9-10] However, CPR success rates remain relatively low, with less than 6% outside hospitals and under 24% within hospital settings.[11] In Asian nations, only 10.5-40.9% of patients received CPR before the arrival of emergency teams outside the hospital setting.[12] In Thailand, out of a total of 1240 OHCA cases, only 3.4% of patients survived and were discharged alive after 30 days. This included 22 (8.6%) from regional centers, 8 (3.0%) from suburban-capital centers, and 12 (1.7%) from urban-capital center.[13] However, a recent observational study revealed that CPR effectiveness varied significantly depending on certain factors: witnessing the arrest, the bystander having education beyond high school, CPR training of the bystander, and the occurrence of the arrest in a public setting.[14] Regrettably, the majority of OHCA occurred in residential settings, and bystander CPR rates for OHCA incidents were notably lower in low-income neighborhoods.[13,15] Hence, dispatcher-guided assistance and compression-only CPR for untrained bystanders have been shown to elevate bystander CPR rates and improve survival to hospital discharge.[16]

Dispatcher-assisted CPR (DA-CPR) involves dispatchers providing real-time CPR instructions to emergency callers over the phone. This approach aims to facilitate prompt bystander CPR before the arrival of emergency medical services, thereby enhancing survival rates and better neurologic outcomes than no bystander CPR.[17-18] Nevertheless, dispatchers might encounter challenges in identifying cardiac arrest due to various atypical presentations, such as agonal gasps or seizure-like activity.[19] The American Heart Association (AHA) recommends providing pre-arrival CPR instructions to callers if the patient is unresponsive and not breathing or breathing abnormally.[20] This study aimed to assess the efficacy of CPR instructions provided via telephone guidance for community members, using retrospective data collected from audiotapes.

METHODS

Setting and participants

A retrospective observational study on OHCA incidents within a major metropolitan EMS system across three regions: Mahasarakham (Northeast), Songkhla (South), and Prachinburi (Central) was conducted. The audiotapes captured during emergency calls for suspected OHCA cases spanned from January to December 2021. The inclusion criteria involved OHCA patients who sought assistance by calling the dispatch center and were later transported to the hospital by emergency medical providers. Exclusions were made for cardiac arrest incidents in nursing homes, doctors' offices, jails. Additionally, cases were excluded if the emergency medical providers witnessed the OHCA and also the callers initiated CPR before receiving CPR instructions.

Data collection and instruments

In this study, tools consistent with the dispatched assisted CPR protocol developed by the National Institute of Emergency Medical Services, Thailand, were used. The protocol includes questions about identifying and providing assistance, clarifying the location of the incident, assessing the patient's condition, and obtaining the caller's name and contact number. It also involves evaluating the surrounding risks before assessing the emergency by asking about consciousness or abnormal breathing. If abnormalities are detected, EMDs inquire if anyone at the scene knows CPR and provide instructions to start CPR. The caller is instructed to place the phone on speaker mode and follow the guidance, including laying the patient on a flat surface, kneeling beside the patient, placing the heel of one hand on the center of the chest, interlocking the fingers, and performing chest compressions to the appropriate depth and rate, with 30 compressions performed and counted aloud. EMDs do not end the call and dispatch an emergency response team. While waiting for the medical team, if the patient begins to regain consciousness or vomits, the caller is advised to remove any foreign objects and assist with breathing.

The DA-CPR protocol stipulates compression-only CPR for adult arrests, with Emergency Medical Dispatchers (EMDs) expected to provide CPR instructions upon reports of unconsciousness, apnea, or agonal breathing. A total of 280 participants met the inclusion criteria for OHCA cases over one year, from January 2021 to December 2021. The authors defined DA-CPR as CPR instructions initiated by EMDs, prompting bystanders to start chest compressions. Data was collected from checklists of cardiac arrest instructions provided by EMD outside hospitals. Every item was logged to determine its completion status. Descriptive statistics were used to define the characteristics of OHCA cases. Subsequently, Chi-square analysis was employed to identify and exclude items that were not significantly related to bystander CPR. The study was approved by the Mahasarakham University for Research Ethics Committee for Research involving human subjects.

RESULTS

The study encompassed 280 patients in total, with Table 1 depicting the demographics of out-of-hospital cardiac arrests (OHCAs). Out of these, only 146 callers accepted to perform CPR at 52.1%. Interestingly, female OHCA victims appeared to receive bystander CPR less frequently than males, highlighting a significant gender

disparity. Additionally, the majority of OHCAs occurred in residential settings, with bystander CPR often administered by relatives of the victims.

As depicted in Table 2, bystanders in each case received DA-CPR protocols from dispatchers. Among the 23 items assessed within the DA-CPR protocol, 18 were deemed significant in effectively guiding bystanders to administer CPR by the provided instructions.

Table 1: Characteristics of OHCA.

OHCA characteristics	OHCA n=280 (%)	Bystander CPR n=146 (%)	P value
Gender			
Male	197 (70.4)	93 (63.6)	0.011
Female	83 (29.6)	53 (36.4)	
Age (years)			
<60	107 (38.2)	57 (39)	0.074
60-69	57 (20.4)	29 (19.8)	
70-79	60 (21.4)	24 (16.4)	
80 up	56 (20)	36 (24.6)	
Place			
Resident	231 (82.5)	138 (94.5)	0.000
Public	49 (17.5)	8 (5.5)	
Relation to the callers			
Relative/parent	203 (72.5)	130 (89)	0.000
Other bystanders	77 (27.4)	16 (11)	

Table 2: The impact of adhering to DA-CPR instructions.

Dispatch-assisted CPR instructions	Adviced 280 (%)	Bystander performed CPR (%)	P value
1. Introducing themselves and offering service with pleasure	268 (95.7)	142 (52.9)	0.182
2. Inquire about the location of the incident with specific details	272 (97.1)	146 (53.7)	0.003
3. Ask about the nature of the incident	276 (98.6)	146 (52.9)	0.035
4. Inquire about the name of the caller, their contact number	272 (97.1)	142 (52.2)	0.902
5. Ask about the number of patients	256 (91.4)	134 (52.3)	0.826
6. Inquire about safety	256 (91.4)	134 (52.3)	0.826
7. Ask about the patient's condition regarding breathing or consciousness	276 (98.6)	146 (52.9)	0.035
8. Does anyone over there know CPR? (even if trained but not regularly practicing, they should still follow instructions.)	138 (49.3)	98 (71)	0.000
9. If so, bring the phone close to the patient or move the patient closer to the phone, then open the speaker phone if possible	150 (53.6)	138 (38.7)	0.000
10. Please pay attention. I'm going to tell you what you need to do. Lay the patient flat on their back on the ground. Unbutton/unfasten the shirt to expose the patient's chest. Kneel beside the patient's knees	178 (63.6)	146 (25.8)	0.000
11. Observe whether the patient is moving or breathing normally. If so, tilt the patient's head and monitor their breathing. If not, please pay attention, I will tell you what to do next	199 (71)	142 (97.5)	0.000
12. Place the heel of your hand on the center of the patient's chest, between the nipples	146 (52.1)	138 (94.5)	0.000
13. Place your other hand on top of the first hand	146 (52.1)	142 (97.3)	0.000
14. Push down hard and fast, compressing the chest by 5 centimeters or 2 inches, using only the heel of your hand	146 (52.1)	142 (97.3)	0.000
15. Do this 30 times, as if you are pumping the patient's chest	110 (39.3)	110 (100)	0.000
16. Count loudly so I can hear you, for example, like this: 1 and 2 and 3 and 4 …	138 (49.3)	138 (100)	0.000
17. Make sure your hand is positioned in the center of the patient's chest	126 (45)	126 (100)	0.000

Continued.

Dispatch-assisted CPR instructions	Adviced 280 (%)	Bystander performed CPR (%)	P value
between the nipples, then start pumping 30 times. Let's begin together. 1 and 2 and 3 and 4 ….			
18. Perform 30 chest compressions followed by 2 breaths into the patient's lungs	54 (19.3)	54 (100)	0.000
19. Continue doing this until the emergency unit arrives	142 (50.7)	138 (97.2)	0.000
20. I'll be here to listen and guide you over the phone at all times. If you have any questions, ask immediately	90 (32.1)	86 (95.6)	0.000
21. I will coordinate with the rescue unit to arrive as quickly as possible. If I'm coordinating with the rescue unit, please do not hang up	82 (29.3)	74 (90.2)	0.000
22. If the caller reports that the patient has vomited, instruct the caller to tilt the patient to one side	25 (8.6)	12(48)	0.826
23. Use your fingers to clear anything from the patient's mouth before continuing to give breaths	9 (3.2)	8 (88.9)	0.006

DISCUSSION

The findings from Table 1 reveal a notable gender disparity in OHCA cases, with a predominance of males, mirroring similar observations in other studies[21]. Furthermore, these incidents predominantly occur at home, with assistance primarily provided by relatives who are often the ones discovering the event, leading to distinct patterns of assistance. This trend is consistent with research from South Korea. However, the outcomes for OHCA in residential groups were less favorable compared to those involving Public-Trained responders. This implies that OHCA incidents happening in private settings with family or layperson bystanders necessitate a fresh approach. One potential strategy could involve dispatching trained responders to the scene to enhance CPR outcomes.[22]

Although dispatched-assisted CPR provided after the dispatch boosted bystander CPR rates during OHCA and reduced the time from recognizing the cardiac arrest to initiating chest compressions, table 2 illustrates that 18 out of 23 significant elements of post-CPR performance were identified.[23] Specifically, crucial aspects of dispatcher-assisted CPR include (1) assessing the consciousness of the victim and (2) evaluating their breathing pattern. Traditionally, suppose the caller indicates negative responses to both inquiries. In that case, CPR instructions are given (Is the victim conscious? → No → Is the victim breathing normally? → No → Dispatch ambulance provides instruction to initiate CPR). However, this 'no-no-go' approach might overlook certain cardiac arrest incidents in the dispatch setting[24]. Nevertheless, it has been observed that improvements in the emergency medical communication system, particularly in identifying the incident location (question 2) and the caller's phone number (question 4), could greatly reduce questioning time. Similar to a previous study, the implementation of automatic geolocation facilitated EMS response by significantly shortening the time to localize incidents (34.7 vs. 71.7 seconds, $p<0.001$). Moreover, the geolocation system resulted in a significantly faster time to the first thoracic compression (83.0 vs. 122.6 seconds; $p<0.001$).[25] Furthermore, in inquiries concerning the safety of the incident location (number 3rd and number 6th) and the patient's symptoms (number 7), if the emergency medical system can develop a video call system during notification, it would enable the EMD to assess the safety of the incident location and the patient's symptoms visually, both during the call reception and through immediate video assessment because the primary challenge in initiating bystander CPR stemmed from the struggle to identify OHCA, as agonal gasps were often mistaken for regular breathing. This issue is expected to be even more pronounced in South Africa, given the varying levels of education and the diverse array of languages spoken among the population.[26] This would greatly enhance the EMD's ability to rapidly and accurately assess the safety of the incident location and the patient's condition, as well as efficiently coordinate emergency medical team response preparedness.

CONCLUSION

Since most out-of-hospital cardiac arrest (OHCA) cases occur at home, bystanders are typically family members who are eager to help. However, the proportion of bystanders trained in CPR is quite low. Although improvements have been made in guidance protocols, it is still uncertain whether callers can correctly position their hands or apply the appropriate depth and rate of compressions as instructed. Therefore, it is essential to enhance public knowledge of CPR alongside the development of CPR guidance protocols to reduce instruction time and increase survival chances.

Recommendations

As the data was collected from recorded tapes of cardiac arrest incidents and emergency health hotline calls, it was

not possible to pinpoint specific obstacles to following the guidance. To improve telephone CPR instructions in the future, conducting a prospective observational study is essential.

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