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Clinical paper

Barriers to dispatcher-assisted cardiopulmonary resuscitation in Singapore☆

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ABSTRACT

Background: Dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) is effective in increasing bystander CPR in out-of-hospital cardiac arrests (OHCA). Singapore has recently implemented a DA-CPR program. We aimed to characterize barriers to commencement of chest compressions by callers in Singapore.
Methods: We analyzed dispatch recordings of OHCA cases received by the ambulance call center between July 2012 and March 2015. Audio recordings of poor quality were excluded. Trained reviewers noted the sequential stages of the dispatcher's recognition of CPR, delivering CPR instructions and caller performing CPR. Time taken to reach these milestones was noted. Barriers to chest compressions were identified.
Results: A total of 4897 OHCA occurred during the study period, overall bystander CPR rate was 45.7%. 1885 dispatch recordings were reviewed with 1157 cases qualified for dispatcher CPR. In 1128 (97.5%) cases, the dispatcher correctly recognized the need for CPR. CPR instructions were delivered in 1056 (91.3%) cases. Of these, 1007 (87.0%) callers performed CPR to instruction. One or more barriers to chest compressions were identified in 430 (37.2%) cases. The commonest barrier identified was "could not move patient" (27%). Cases where barriers were identified were less likely to have the need for CPR recognized by the dispatcher (94.9% vs. 99.0%, $p < 0.001$), CPR instructions given (79.3% vs. 98.3%, $p < 0.001$) and CPR started (67.9% vs. 98.3%, $p < 0.001$), while the time taken to reach each of these stages were significantly longer ($p < 0.001$).
Conclusion: Barriers were present in 37% of cases. They were associated with lower proportion of CPR started and longer delay to CPR.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death in Singapore, mirroring worldwide trends. In the Asia-Pacific, OHCA survival rates are generally low, ranging from 2 to 11%,[1] with the survival to hospital discharge rate in Singapore found to be 11.0% between 2010 and 2012.[2] Effective treatment of OHCA hinges on Cummins' "Chain of Survival" concept which describes the rapid commencement and seamless provision of a set of rescuer actions.[3] One crucial link in the chain is early commencement of cardiopulmonary resuscitation (CPR), which improves outcomes in OHCA.[4]

As OHCAs generally occur away from the immediate presence of healthcare providers, early CPR depends heavily on the recognition of cardiac arrest by bystanders as well as bystander CPR, which can more than double the patient's chance of survival.[5]

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In recent years, dispatcher-assisted CPR (DA-CPR) has emerged as an effective intervention to increase bystander CPR and hence OHCA outcomes.[6] DA-CPR functions on the notion that when a bystander calls emergency medical services (EMS), not only does the call provide dispatch service, it also creates the opportunity for the EMS to catalyze recognition of cardiac arrest and initiation of bystander CPR through systematic interrogation and "just-in-time" pre-arrival instructions.[6] Indeed, DA-CPR can nearly double the proportion of OHCA patients who receive bystander CPR.[7,8]

In Singapore, bystander CPR rate was low and remained relatively constant over the years, being 19.7% from 2001 to 2004 and 22.4% from 2010 to 2012.[2] This was despite a relatively high proportion of the population having been trained in CPR, with a figure of 31.4% found in a national population based survey.[9] DA-CPR was thought to be useful in such a setting to increase bystander CPR rate. We hypothesized that DA-CPR would be associated with a high rate of CPR performance by overcoming some of the barriers encountered by emergency callers.

As part of the Pan-Asian Resuscitation Outcome Study Phase II (PAROS-II), Singapore implemented a DA-CPR package in 2012,[10] which included a DA-CPR protocol, dispatcher training, systematic quality improvement (QI) through review of all dispatch calls and a public education campaign around DA-CPR.

This study aimed to provide a look into the barriers to DA-CPR in Singapore, in order to identify system-dependent or cultural-based barriers. Such data may inform the implementation of DA-CPR in the other developing EMS systems.

Materials and methods

Setting

Singapore is a highly-urbanized island city-state situated at the southernmost tip of the Malaysian peninsula with a population of 5.3 million over a land area of 715.1 square kilometers.[12] EMS is provided by the Singapore Civil Defence Force (SCDF), which operates a fleet of 46 ambulances and 15 first responders on motorcycles in a fire-based system activated by a centralized 9-9-5 dispatching system.[12] SCDF utilizes computer aided dispatch protocols, global positioning satellite automatic vehicle location systems and road traffic monitoring systems. SCDF paramedics (equivalent to North American emergency medical technician-intermediate) are trained in basic life support, automated external defibrillator usage and specific interventions including adrenaline administration. Mean time taken from call to arrival at scene was 9.9 min from 2010 to 2012.[2] EMS for a minority of emergency cases are provided by private operators that charge a fee whereby the caller can specify the hospital of conveyance. These are mainly used for inter-facility transfers and do not respond to '995'. The emergency ambulance services provided by calling 995 is free of charge to all users and supported through government taxes.[12]

Dispatcher-assisted cardiopulmonary resuscitation in Singapore

Singapore adopted a DA-CPR protocol in 2011[13]; however, due to the lack of systems for training and QI, CPR instructions were only given in less than 5% of cases. As part of the Pan-Asian Resuscitation Outcome Study Phase II (PAROS-II), Singapore was selected for implementation of a comprehensive DA-CPR package. This package consisted of (1) a standardized dispatch protocol, (2) a standardized training package for dispatchers, (3) a measurement tool to collect data on individual dispatcher and organization-level performance, (4) an integrated QI program and (5) a community education program.[11] The program was implemented in July 2012 with a planned 6 month "run-in" period. By Jan 2013, all dispatchers were able to provide DA-CPR. This package consisted of[11]

1. A standardized dispatch protocol that guides dispatchers to systematically question callers to accurately and rapidly determine whether the patient is in cardiac arrest. When a cardiac arrest patient is identified, the protocol guides the dispatcher to give CPR instructions to assist bystanders if CPR is not already ongoing.
2. A training package consisting of 1 day intensive training course both call-takers and dispatch center managers. It comprises didactic teaching as well as practical exercises and scenarios for dispatchers as well as supervisors/medical directors.
3. A standardized measurement QI tool to collect data on individual dispatcher and organizational level performance through review of the dispatch audio recordings. A sample of the QI tool is shown in Appendix 1.
4. An integrated quality improvement program that includes cooperation and collaboration of pre-hospital and hospital stakeholders. The program provides feedback at the individual and organizational level. It involved review of dispatcher CPR audio recordings and use of the QI tool mentioned in step 3.
5. A community education program known as Dispatcher Assisted First REsponder (DARE) program was developed to update the public on DA-CPR, how to recognize cardiac arrest, the importance of early activation of EMS and staying on the line to perform DACPR.

In SCDF, dispatchers are trained to adopt a streamlined, two-step question approach to identify the need for CPR. The caller is asked (1) "Is the victim conscious?" and (2) "Is the victim breathing normally?" If a negative response to both questions are received, the presumptive diagnosis is cardiac arrest and the dispatcher enters into a protocol to deliver CPR instructions.[14] Instructions for chest compression-only CPR are given, unless there are specific indications for telephone instructions on ventilations, like drowning or pediatric cardiac arrest.

The QI process involves having a team of four dispatch nurses review recordings of cardiac arrest calls every shift at the dispatch center. They randomly review calls either real-time or almost real-time for quality improvement, aiming for at least 20% of OHCA calls. At the end of each shift, dispatchers are given feedback on the specific DA-CPR cases they handled. Monthly, there is a sharing session where dispatchers, nurses and an emergency physician come together to discuss the cases from the preceding month.

Study population

We analyzed OHCA cases where a call was received by SCDF call center that subsequently received an EMS diagnosis of cardiac arrest on the ambulance run sheet between July 2012 and March 2015.

We excluded cases where audio recordings were incomplete (corrupted data) or of insufficient audio quality for analysis. We also excluded cases where bystander CPR was already ongoing at the time the call was received (Fig. 1).

Data collection and processing

Audio recordings of the calls received by the SCDF dispatch center for OHCA cases were retrospectively reviewed by four trained reviewers, each with nursing backgrounds. The reviewers are briefed on a set of parameters to gather.

The recordings were first examined for whether bystander CPR was already in progress when the call was received (Fig. 1). For