



Clinical paper

A before–after interventional trial of dispatcher-assisted cardio-pulmonary resuscitation for out-of-hospital cardiac arrests in Singapore[☆]



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ABSTRACT

Aim: To evaluate the effects of a comprehensive dispatcher-assisted CPR (DACPR) training program on bystander CPR (BCPR) rate and the outcomes of out-of-hospital cardiac arrest (OHCA) in Singapore.

Methods: This is an initial program evaluation of a national DACPR intervention. A before–after analysis was conducted using OHCA cases retrieved from a local registry and DACPR information derived from audio recordings and ambulance notes. The primary outcomes were survival to admission, survival at 30 days post-arrest and good functional recovery.

Results: Data was collected before the intervention (April 2010 to December 2011), during the run-in period (January 2012 to June 2012) and after the intervention (July 2012 to February 2013). A total of 2968 cases were included in the study with a mean age of 65.6. Overall survival rate was 3.9% (116) with good functional recovery in 2.2% (66) of the patients. BCPR rate increased from 22.4% to 42.1% ($p < 0.001$) with odds ratio (OR) of 2.52 (95% confidence interval [CI]: 2.09–3.04) and ROSC increased significantly from 26.5% to 31.2% ($p = 0.02$) with OR of 1.26 (95%CI: 1.04–1.53) after the intervention. Significantly higher survival at 30 days was observed for patients who received BCPR from a trained person as compared to no BCPR ($p = 0.001$, OR = 2.07 [95%CI: 1.41–3.02]) and DACPR ($p = 0.04$, OR = 0.30 [95%CI: 0.04–2.18]).

Conclusion: A significant increase in BCPR and ROSC was observed after the intervention. There was a trend to suggest improved survival outcomes with the intervention pending further results from the trial.

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Introduction

Out-of-hospital cardiac arrest (OHCA) refers to sudden cessation of a heartbeat that happens outside the hospital, as evidenced by the absence of signs of circulation. Mortality is high with OHCA and it is a major public health issue affecting approximately 275,000 people in Europe,¹ and between 350,200 and 368,200 people in the

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United States each year.² Singapore currently has about 1500 OHCA yearly³ with the survival-to-hospital-discharge rate of only 3.0%.⁴ This is significantly lower than the 16.3% reported survival rates in Seattle, United States, as well as the 8.4% median survival rates in North America.⁵

Survival in OHCA depends heavily on a set of sequentially coordinated resuscitative interventions known as the Chain of Survival.⁶ Early Bystander Cardio-Pulmonary Resuscitation (BCPR) clearly improves the survival in OHCA.^{7–9} However, the current reported BCPR rate of 20.3% in Singapore¹⁰ is much lower than the rates of 31–55% reported in other parts of the world.^{11–13} This is despite widespread efforts in community education and CPR training. It has been shown that some of the barriers that discourage bystanders from performing CPR include difficulty in identifying a cardiac arrest, fear of causing injuries, emotional distress, and reluctance to perform mouth-to-mouth resuscitation.¹⁴ While such issues can be addressed with large-scale continual recertification programs, it is labor and cost intensive.

A new interventional strategy to improve the BCPR rate and OHCA survival has emerged in recent years. Such an intervention is known by several names such as telephone-assisted CPR, telephone-guided CPR or dispatcher-assisted CPR (DACPR). DACPR allows for early recognition of cardiac arrest and timely provision of BCPR through the questions asked and CPR pre-arrival instructions by a trained dispatcher. The 2010 American Heart Association (AHA) Guidelines for CPR and Emergency Cardiovascular Care suggest that bystanders should immediately call their local emergency response number when they find an unresponsive patient and that all dispatchers should be trained to provide CPR pre-arrival instructions.¹⁵ The 2010 International Liaison Committee on Resuscitation and European Resuscitation Council guidelines concurred with AHA's recommendation on dispatcher's recognition of cardiac arrest and providing CPR instructions before arrival of ambulance.^{16,17} DACPR has also been made simpler with the change in recommendations to perform compression-only CPR for adults.

With a compression-only protocol, DACPR has also been shown to cause less delay in starting CPR, higher participation rate and better outcomes in early cardiac arrest.¹⁸ There is minimal risk associated with DACPR even when it is performed on collapsed patient who does not have a cardiac arrest. In a study done in Seattle, among 247 non-cardiac arrest patients who received DACPR, 2% had a rib fracture and none had any internal organ injury.¹⁹ In Ontario, Canada, implementation of DACPR has been successful in nearly doubling the rate of BCPR,²⁰ which is the single most important modifiable factor influencing the survival in OHCA.²¹ In Singapore, where the population is served by a single dispatch centre of about 40 dispatchers, providing DACPR training to the group of dispatchers can have a far reaching impact on the population.

In this study, we perform an initial program assessment to measure the impact of a comprehensive DACPR training program, which is targeted at the dispatchers, on the rate of BCPR in Singapore. The secondary objectives for this study were to assess impact on survival, and compare the outcomes of patients who received DACPR to those who received conventional BCPR without dispatcher's assistance. We hypothesize that the implementation of the comprehensive DACPR training program will significantly increase the rate of BCPR for OHCA patients in Singapore compared to historical controls in a before–after analysis.

Methods

This is an initial program assessment to measure the impact in Singapore of implementing a comprehensive national DACPR

training program on BCPR rates. The DACPR intervention is also part of an ongoing international multi-center trial.²² A before–after analysis was conducted to compare the various outcomes before and after the implementation of a comprehensive DACPR training program that consists of:

- (1) A standardized dispatch protocol that will guide 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 will guide the dispatcher to give CPR instructions to assist bystanders if CPR is not already ongoing. A sample of this protocol is attached in [Appendix A](#).
- (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 quality improvement (QI) tool to collect data on individual dispatcher and organizational-level performance through review of the dispatch audio recordings.
- (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.

The results from our local DACPR intervention will be included as part of a larger international trial, starting from 2012 in 32 sites of various countries in Asia-Pacific including Singapore, Korea, Japan, Taiwan, United Arab Emirates, Thailand and Malaysia. As a participating site, Singapore contributes towards the target sample size of 30,000 OHCA cases needed for the study. Institutional Review Board approval was obtained from SingHealth and National Healthcare Group for the study.

Singapore is a city-state with a land area of 718.3 square kilometres and a multi-racial population of about 5.4 million in size.²³ It is served by a single EMS dispatch centre that is run by the Singapore Civil Defence Force (SCDF) and is accessible through the emergency number '995'. The dispatchers are made up of fire-fighters (majority) and 1 paramedic embedded in each shift. The majority of DACPR was instructed by fire-fighters. The centre handled more than 144,000 calls in the year of 2013 and commands a fleet of 50 ambulances located on 15 fire stations and 16 satellite fire posts around the nation.²⁴ Ambulances are manned by trained paramedics with qualification roughly equivalent to North American emergency medical technician (EMT) intermediate.²⁵ Motorcycle paramedics with AED capability, called the Fast Responder Paramedics (FRP), are sometimes simultaneously dispatched with an ambulance to avoid delay due to heavy traffic.²⁶

This report is based on an initial program evaluation conducted for the stakeholders. For the purpose of this study, the period from January 2012 to June 2012 will be categorized as the RUN-IN period while the AFTER period will be from July 2012 to February 2013. The period between April 2010 and December 2011 will be considered as the baseline control or BEFORE period. BCPR rates and OHCA outcomes from the AFTER period are compared against the historical control from the BEFORE period. The

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