

Community-level interventions for out-of-hospital cardiac arrests in Singapore: Yay or nay?

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Out-of-hospital cardiac arrest (OHCA) is a leading cause of mortality and a significant public health problem globally. In Singapore, OHCA affected 11,061 adults between 2011 and 2016.¹ Despite multiple pre-hospital and hospital-based interventions, survival rates remain low. Initiation of time-sensitive cardiopulmonary resuscitation (CPR) while waiting for emergency services arrival is an essential key to survival in patients with OHCA.

Traditionally, improving bystander CPR (B-CPR) rates has been confined to public education campaigns with limited effectiveness. In a bid to increase rates, 2 community-level interventions in Singapore—dispatcher assisted-CPR (DA-CPR) and myResponder—were launched. DA-CPR refers to over-the-phone instructions on CPR by the dispatcher, enabling the lay rescuer to perform CPR with guidance. myResponder is a mobile application (app) that links potential rescuers to OHCA cases. Both interventions were designed to allow B-CPR to be commenced prior to the arrival of paramedics. Theoretically, this would decrease no-flow time and improve prognosis in these critically ill patients.

A study on the impact of 2 community-level interventions. This issue of the Annals features a retrospective before-and-after study by Wong et al.,² which examined if these community-led interventions would increase the odds of receiving B-CPR and its impact on survival outcomes. They included more than 10,000 cases of OHCA from 2010 to 2017. Three periods were studied: prior implementation of interventions; after DA-CPR implementation; and finally, a period where both DA-CPR and myResponder were instituted. The study revealed that implementation of DA-CPR and myResponder had a positive correlation with B-CPR rates, albeit an increasing but plateauing trend. Interestingly, there was no significant statistical increase in survival with both interventions.

Notwithstanding the inherent limitations of its retrospective nature, this study was methodologically

robust. It included a national cohort consisting of a large sample size. The innovative segmented time-series design allowed temporal trends to be compared and understood. It should be noted that there were other ongoing initiatives to improve B-CPR rates concurrently such as Save-A-Life initiative and Dispatcher-Assisted first Responder (DARE) programme. The overlap of these interventions limit conclusions drawn from this study.

Groups in all time periods had varying baseline characteristics. While this should not have influenced the outcome of B-CPR rates, it would definitely have an impact on overall survival as well as Utstein survival. Patients in Periods II and III were older with more comorbidities, were more likely to have non-shockable initial rhythms, and had longer emergency medical service response times. In contrast, OHCA in later periods were more likely to have been witnessed arrests, which would favour higher rates of B-CPR. Taken together, baseline variables favoured improvement in the primary outcome of B-CPR rates and worse survival outcomes. Consequently, Wong et al. were careful not to overstate the study's findings.

Unassisted bystander CPR vs dispatcher-assisted CPR: Same same or different? Two registry studies had shown that DA-CPR was associated with improved survival and favourable neurological outcome.^{3,4} Consequently, we had hoped to see the higher rate of B-CPR translate to improved Utstein survival in Singapore. Interestingly, the adjusted odds ratio in this study did not show improved odds of Utstein survival despite the implementation of both interventions. There are 2 possible reasons.

Firstly, we assert that DA-CPR is likely to be of poorer quality than traditional, unassisted B-CPR, hence conferring less survival benefit. The authors allude to this in the paper but do not provide further metrics on the quality of DA-CPR administered.² In Singapore, given that most cardiac arrests occur in residential, non-public places, these bystanders could be the victim's elderly

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spouse or domestic helper, both of whom were unlikely to have received prior training. Inherently, the quality of CPR by a novice practitioner doing it for the first time with telephonic guidance would be poorer than a trained, confident bystander who volunteers to help. Impediments to good quality DA-CPR have been extensively documented in the literature. A Singapore study that analysed more than 1,000 audio recordings of DA-CPR showed that barriers were present in 37%, which led to lower proportion of CPR started and longer delay in CPR.⁵ Unfamiliarity with what quality CPR is, fear of harming the patient, and uncertainty in the diagnosis of cardiac arrest in patients with agonal breathing could all lead to poorer depth, rate and recoil in performing chest compressions. CPR cards have been disbursed to the public that could aid in ascertaining the quality of B-CPR. Future research should be directed to shed more light on the relationship between the quality of DA-CPR and survival.

This does not mean that we should throw out DA-CPR. We believe that some CPR is better than no CPR at all. The words and positive attitudes of dispatchers can help to positively influence lay bystanders towards better quality CPR.⁶ Prior exposure to CPR as well as formal CPR training for the public may further reduce barriers to DA-CPR.⁵ With continued focus on dispatcher training and further public education on CPR, the quality of DA-CPR will improve.

Secondly, volunteers activated by the myResponder app may not be arriving earlier than paramedics. Studies^{7,8} have shown that the time-to-first compression matters in improving survival. Unfortunately, this information was unavailable in the study by Wong et al. We will address myResponder further in the section below.

Mobile apps enable virtual volunteers to make in-person saves. Mobile CPR apps such as myResponder are not unique to Singapore. Other countries such as South Korea, Denmark and Sweden already have them in use. CPR apps represent a technological revolution in the way assistance is deployed to address and manage OHCA. A randomised controlled trial in Stockholm, Sweden showed that mobile app similar to myResponder was significantly associated with increased B-CPR rates.⁹ Unlike DA-CPR bystanders, volunteers on such apps are motivated individuals and would likely be better trained and more highly skilled in providing good quality CPR.

The reported myResponder's activations seem low when compared to the overall proportion of patients receiving B-CPR. The authors postulate that this is unlikely to be true and is more likely to be due to

under-reporting. There are two factors that support this. Registered number of users have been steadily increasing and average number of notifications sent by SCDF dispatch centre have been rising. The low uptake or reporting resulted in the authors using a segmented regression analysis to circumvent under-reporting.

To promote publicity and encourage use of myResponder, user-friendliness and various features can be addressed and updated, to promote its use and allow better data capture for future improvement. It will be beneficial to track time-to-first compression in myResponder and DA-CPR. We acknowledge the difficulties in collecting such information. CPR cards could be one way to overcome this challenge.

For existing volunteers, efforts should be directed at improving response times. As most OHCA occur in high-rise residences, this could involve priming volunteers to the addresses of blocks in their vicinity as well as locations of elevators and automated external defibrillators (AEDs). An opportunity exists for gamification and augmented reality to train myResponder volunteers to arrive earlier.

Elevating the plateau in B-CPR. Both community-level interventions would have improved public awareness of CPR, which in turn would lead to more bystanders being willing to participate in the resuscitation process, forming a virtuous cycle. However, Wong et al. had observed that the B-CPR rates appeared to be plateauing. As the opportunity for gains decreases, this phenomenon is not unexpected. Elevating the CPR rates further would not come easy.

For more gains in CPR rates, one strategy would be to focus education efforts on unique population subgroups that would be more likely to perform CPR. These include carers of patients at risk of OHCA who would perform DA-CPR such as nursing home staff,¹⁰ or groups likely to become myResponders such as tertiary students. Besides a mere increase in rates, education efforts to improve survival need to continue to emphasise good-quality CPR and encourage early usage of AEDs.

Singapore has come a long way from the time when B-CPR rates were at 23.1% in 2010, to 67.3% in 2017. Community-level interventions have undoubtedly played an important role in this massive improvement. Coupled with in-hospital advances in OHCA resuscitation such as the use of targeted temperature monitoring¹¹ and bedside ultrasound to guide resuscitation,¹² one is hopeful that OHCA survival rates can only improve.

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