

# Bystander CPR and survival

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## ABSTRACT

**Despite years of medical advances, bystander cardiopulmonary resuscitation (CPR) remains the most important factor in the saving of out-of-hospital cardiac arrest victims. However, the prevalence of bystander CPR remains low. New international recommendations, which aim to increase bystander CPR prevalence, allow for hands-only CPR under certain circumstances. More should be done to increase the awareness and training of CPR in Singapore as well as encourage the public to perform bystander CPR.**

**Keywords: bystander cardiopulmonary resuscitation, cardiocerebral resuscitation, hands-only cardiopulmonary resuscitation, sudden cardiac death**

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## INTRODUCTION

“Anyone, anytime, can now initiate cardiac resuscitative measures. All that is needed are two hands”.<sup>(1)</sup> These words by Kouwenhoven et al in 1960 were the first to describe closed chest cardiac massage, which was then considered a novel technique of performing cardiac massage without thoracotomy. Four short years later, cardiopulmonary resuscitation (CPR) was put in the hands of the community.<sup>(2)</sup> Today, after five decades of medical advances, bystander CPR remains the most crucial component in saving the lives of out-of-hospital cardiac arrest (OHCA) victims.

## EPIDEMIOLOGY OF BYSTANDER CPR IN SINGAPORE

The prevalence of bystander CPR in Singapore is about 15.0%–22.9%,<sup>(3-7)</sup> as compared to 28%–46% in other developed cities.<sup>(8,9)</sup> Owing to the large number of CPR training centres in Singapore, the exact number of trained CPR providers here is unclear. Among the participants in a mass CPR event held in Singapore in 1999, 57% had never learnt CPR. A further 16.3% had never heard of CPR.<sup>(10)</sup>

## BYSTANDER CPR SAVES LIVES

Numerous studies have found that bystander CPR increases the survival rates of OHCA victims by two to three times.<sup>(8,11,12)</sup> This measure of success would still be considered limited if the quality of life of survivors

was poor. Any such doubts should be put to rest with the finding by Stiell et al that among survivors of OHCA in Canada, bystander CPR was independently associated with a “very good quality of life” (Health Utilities Index Mark III score > 0.90, odds ratio [OR] 2.0, 95% confidence level [CI] 1.2–0.34).<sup>(13)</sup>

In Singapore, bystander CPR was the only independent predictor of survival in adult OHCA survivors (OR 3.60, 95% CI 1.03–12.50) in a prospective observational study of 2,428 patients.<sup>(14)</sup> Among paediatric cardiac arrests, bystander CPR was one of three factors associated with survival to hospital discharge in bivariate analysis, although it was not found to be an independent predictor in multivariate analysis.<sup>(7)</sup>

Bystander CPR was found to be more effective when (a) there was only a short delay to its onset; (b) both chest compression and ventilation were provided, rather than just either; (c) CPR was provided by a non-layperson; (d) there was a long delay before the arrival of the ambulance; (e) it was performed on an elderly person; and (f) if the arrest took place at home.<sup>(15)</sup> Interestingly, a prospective observational study from Germany has found that physician-initiated resuscitation compared to that by Emergency Medical Services (EMS) personnel or laypersons did not improve survival rates.<sup>(16)</sup>

## SO WHY AREN'T MORE PEOPLE DOING BYSTANDER CPR?

Given the overall low prevalence of bystander CPR, the removal of obstacles to performing CPR has been an important consideration in the development of international guidelines.<sup>(17,18)</sup> Concerns about disease transmission during mouth-to-mouth ventilation has remained one of the most oft-quoted reasons for non-performance of CPR among healthcare providers and laypersons,<sup>(19,20)</sup> although in one study,<sup>(21)</sup> that concern was not prominent. In Singapore, CPR instructors were 2.7 times more likely than laypersons to fear disease transmission.<sup>(10)</sup> Poor skills retention,<sup>(22)</sup> a lack of confidence<sup>(10,21)</sup> and a fear of litigation<sup>(10)</sup> also contribute to the problem.

The silver lining is that at least when the arrest occurs in a healthcare facility in Singapore, bystander CPR is more likely to be performed ( $p < 0.01$ ).<sup>(23)</sup> This group of patients also had better rates of return of spontaneous circulation, survival to hospital admission and discharge.

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## HOW CAN MORE PEOPLE BE ENCOURAGED TO PERFORM CPR?

Over a decade ago, the issue of mouth-to-mouth ventilations as a requirement for saving lives and yet as an obstacle to providing CPR was examined by Becker et al.<sup>(24)</sup> In an effort to increase bystander CPR rates, the American Heart Association released a controversial recommendation on hands-only CPR<sup>(18)</sup> (also known as cardiocerebral resuscitation<sup>(25)</sup>) in April 2008, bringing new meaning to Kouwenhoven et al's original quote.<sup>(1)</sup> This science advisory for the public was a 'Call to Action' aimed at increasing the number of people providing bystander CPR. By omitting the ventilation component of conventional CPR, hands-only CPR would address several concerns, notably concerns about disease transmission, poor skills retention and provision of high-quality compressions, and reduce the time to commencement of CPR in dispatcher-assisted CPR.<sup>(18)</sup> It was hoped that this would encourage more bystanders to "take action", which was the spirit of the recommendation.

## EVIDENCE FOR HANDS-ONLY CPR

A series of animal studies have found that the addition of ventilation to bystander CPR did not improve survival in ventricular fibrillation (VF)<sup>(26)</sup> and myocardial infarction<sup>(27)</sup> models. This was likely due to the high level of oxygen in the blood during the initial phase of cardiac arrest. Therefore, the priority at that point would be to circulate the oxygenated blood with chest compressions.<sup>(28)</sup> However, keeping ventilations in CPR has been shown to improve survival in paediatric<sup>(29)</sup> and asphyxiation<sup>(30)</sup> models. In addition, if ventilations were added after four minutes of hands-only CPR, neurological outcome was also found to be superior to that of conventional and hands-only CPR.<sup>(31)</sup>

Human experiences vary with regard to hands-only CPR. While some have found it to be superior<sup>(9)</sup> or similar<sup>(32,33)</sup> to conventional CPR, others have found it to be inferior but better than not having any CPR at all, even if it were poorly performed.<sup>(34)</sup> Specifically, a subgroup analysis by the SOS-KANTO group<sup>(9)</sup> showed that hands-only CPR may be better for VF arrest, although it may be argued that the bystander would not be able to identify VF in a victim prospectively.

Consistent with the findings of Sander's animal study,<sup>(31)</sup> Iwami<sup>(33)</sup> also found that for prolonged cardiac arrest, conventional CPR was superior to hands-only CPR, demonstrating a need for ventilations to be started when the blood oxygen levels become low. However, regarding skills retention, Heidenreich et al found that instructions for hands-only CPR were easier to remember than those for conventional CPR.<sup>(35)</sup> In EMS systems, where dispatchers

give pre-arrival instructions to callers for performing CPR, complete instructions were more likely to be given to the group randomised to hands-only CPR.<sup>(36)</sup>

## DISCUSSION

It is clear that there are strengths and weaknesses in both conventional and hands-only CPR, and under different circumstances, both approaches can be effective in saving lives. Sayre et al's<sup>(18)</sup> carefully worded conclusion that "*bystanders can use either hands-only CPR or conventional CPR to achieve the goal of providing effective chest compressions to adult victims of out-of-hospital sudden cardiac arrest*" reiterates this point. They also added that "*this 'Call to Action' for bystanders does not apply to unwitnessed cardiac arrest, cardiac arrest in children, or cardiac arrest presumed to be of noncardiac origin*".

However, the bystander who attends to an OHCA victim will not likely be able to differentiate what might be an arrest of cardiac or noncardiac origin, or remember which approach is applicable for witnessed or unwitnessed arrest or for paediatric arrest. Decision-making may become more complex, hence, paradoxically, making it less simple for the bystander to respond. Thus, the 2011 Singapore Basic Cardiac Life Support guidelines state that trained rescuers should provide standard 30:2 CPR, unless they are unable or unwilling to perform rescue breathing. Hands-only CPR is recommended for telephone-guided instructions given by dispatchers to untrained bystanders responding to an OHCA. Given the current available evidence, conventional CPR remains the gold standard approach for OHCA, while hands-only CPR may be considered an effective alternative, both in clinical efficacy and in increasing bystander performance of CPR.

## CONCLUSION

Bystander CPR saves lives. The pressing need to increase the participation of communities in saving lives has to be coupled with an increase in the numbers of trained CPR providers. To these ends, the public should be continually encouraged to acquire CPR skills. Novel initiatives such as public service messages, corporate and institutional programmes and government incentives may help to achieve these aims. Everyone, anytime, should initiate cardiac resuscitative measures when the need arises. All that is needed are their two hands.

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