Accepted in *Resuscitation* 11/01/2018

Improving bystander defibrillation for out-of-hospital cardiac arrest: capability, opportunity and motivation

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Word Count: 978

In this issue of *Resuscitation* Sondergaard et al [1] report that the likelihood of receiving bystander defibrillation decreases quickly as the distance from an out-of-hospital cardiac arrest (OHCA) to the nearest Automated External Defibrillator (AED) increases. Bystander automated external defibrillation – when performed – saves lives. The best available data from a recent systematic review and meta-analysis [2] reports that the chances of survival (odds ratio 1.73; 95% confidence interval 1.36-2.18) and favourable neurological outcome (odds ratio 2.12; 95% CI 1.36-3.29) double when defibrillation is undertaken by a bystander.

Despite the unequivocal efficacy of bystander defibrillation it is an intervention that overall is infrequently used in OHCA [1] [3] [4]. There are many barriers to bystander defibrillation [5]. These can be systematically classified as barriers to a bystander's Capability, Opportunity and Motivation to perform defibrillation, according to the well-validated Behaviour Change Wheel conceptual framework [6] (Figure 1).

Opportunity (accessibility and location)

Sondergaard and colleagues [1] highlight the importance of accessibility and location on bystander defibrillation. The authors analysed 12,253 OHCA from the Danish Cardiac Arrest Registry where resuscitation attempts were made by either bystanders or Emergency Medical Services (EMS). They identified the location of the cardiac arrest and compared it to the nearest available AED registered with the Danish AED Network. The first major finding was that 2252 (18%) of cardiac arrests occurred within the vicinity of an AED that was not "accessible" due to the opening hours or availability of the defibrillator. This is a sizeable reduction in out-of-hours AED accessibility that represents an important missed opportunity for many OHCA victims, and it has been reported previously by this research team [7]. Efforts to encourage organisations, businesses and charities who purchase AEDs to make them visible and available to members of the public outside of business hours could substantially improve an AED's utility. e.g. by placing the AED on a building's accessible exterior walls in an alarmed cabinet.

The second major finding relates to the distance from the location of a cardiac arrest relative to the location of the nearest AED. Unlike several previous studies, the researchers calculated the distance between OHCA and AEDs using the shortest available route (i.e. path, road) rather than just calculating a simple radius. This actual travel distance gives a far more realistic indication about whether or not an AED is close enough to be retrieved and used by a bystander quickly enough to be of potential benefit. The researchers classified AEDs that were located more than 2km from the location of the cardiac arrest as impractical to retrieve, resulting in the exclusion of 2503 (20%) cases. From the remaining 6971 cases the median distance from an OHCA to the nearest accessible AED was 800m. The authors eloquently illustrate the inverse relationship between distance to the nearest AED, the probability it will be used and 30 days survival. They show the chance of bystander defibrillation was

31.0% if the AED was immediately available (0m), 12.5% if route distance was 100m and 5.9% if route distance was 200m. The corresponding probability of 30-day survival was 28.2% (95% CI 22.8-33.5) at 0m, 22.2% (95% CI 19.3-25.2) at 100m, and 17.1% (95% CI 14.9-19.2) at 200m.

In total, fewer than 5% of OHCA occurred within 100m of an accessible AED (and fewer than 10% within 200m), although there was a significant increase in this figure (1.2% to 8.5%) across the study period. Increasing the opportunity for AED use by reviewing the location and accessibility might add value to current approaches. OHCA and AED registries can be used to identify areas of high cardiac arrest incidence to help planners to more effectively position AEDs and increase their utility [8] [9].

Capability and Motivation (knowledge, education and persuasion)

Poor knowledge of AED location is another significant barrier [5]. Providing bystanders with information on the location of the nearest AED enhances their capability to use them. For this to work effectively AED registries need to be kept up-to-date with reliable information on AED locations [10] [11]. EMS call operators need access to this information and to guide bystanders to retrieve them [10] [12] [13].

The impact of app-based digital technology on bystander defibrillation for OHCA was identified as a key research priority by the International Liaison Committee on Resuscitation (ILCOR) [14] [15]. App-based volunteer first-responder systems such as GoodSAM [16], Pulsepoint [17] and FirstAED [18] integrate with EMS and notify registered volunteers via smartphone if they are within a certain distance of an OHCA. The pool of bystanders willing to intervene can be increased and, in theory, this can improve the likelihood that a nearby AED is retrieved and attached to an OHCA victim. This being said, data about the effect of such systems on patient outcomes is so far lacking.

Outcomes are similar whether bystander defibrillation is achieved with or without EMS assistance [10] [11]. Motivating bystanders to use AEDs requires education and persuasion. Although bystanders can use AEDs effectively without prior training, even brief training may reduce the time to first shock [19]. Consideration should be given to including AED familiarisation as part of major CPR campaigns [20] [21]. AED signage is useful for helping bystanders to find an AED but might also play a role in motivating bystanders to use the device. The current internationally recognised AED sign may deter some bystanders from using an AED but an alternative sign, which is designed to empower bystanders to use an AED, has been launched in the UK [22]. Evaluation of whether or not this facilitates more bystander defibrillation is awaited.

Proximity to an accessible AED will remain a key determinant of whether or not bystander defibrillation is attempted and is also associated with patient outcome [1]. It is important that we find ways to make AEDs more accessible and more strategically located, as well as implementing strategies to enhance the opportunity, capability and motivation for successful bystander defibrillation.

Funding

No funding was received for this article.

Conflict of interest statement

CMS is a National Institute for Health Research (NIHR) Doctoral Research Fellow and has a volunteer role at the Resuscitation Council (UK). GDP is a NIHR Senior Investigator and is supported by research grants from NIHR, Resuscitation Council (UK) and the British Heart Foundation.

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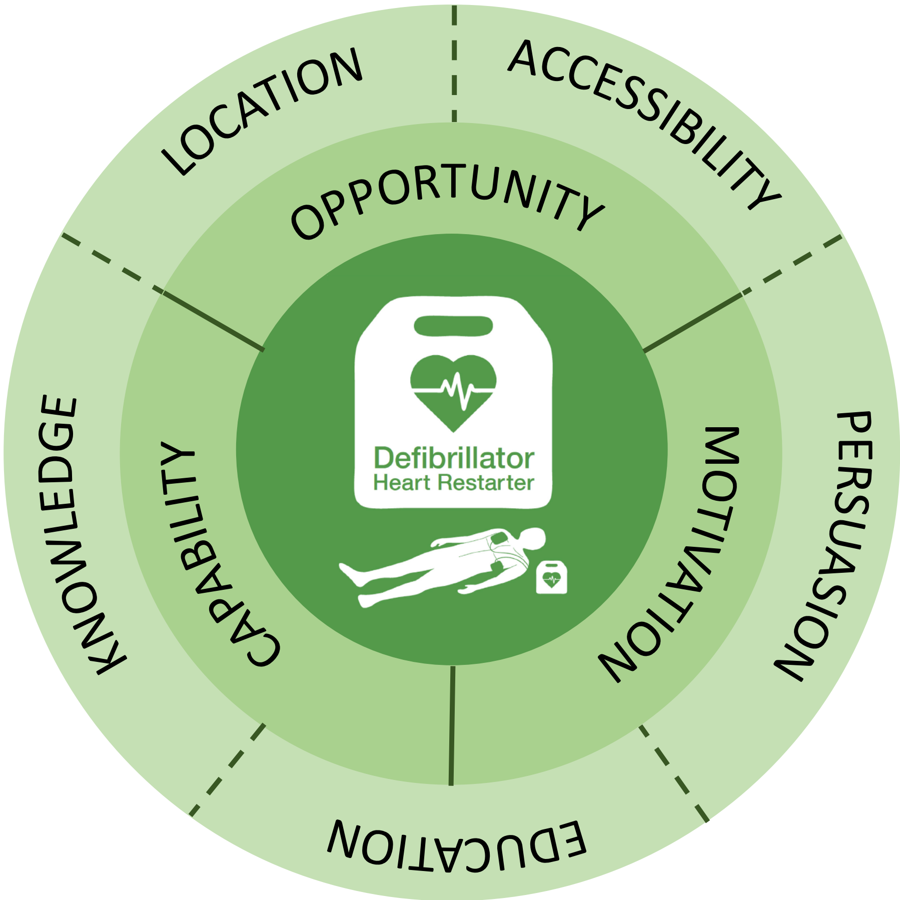
Figure 1: Barriers to Bystander Defibrillation – Key Themes

(modified from the Behaviour Change Wheel (6))


LOCATION
ACCESSIBILITY
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KNOWLEDGE
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Defibrillator
Heart Restarter
MOTIVATION
PERSUASION
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