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Lay first-responders alerted to out-of-hospital cardiac arrest by smartphone app – not so novel any longer, and it's time to do more.

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In this issue of *Resuscitation* researchers from Switzerland and Italy investigated the actual route distance taken by lay first-responders alerted to a nearby out-of-hospital cardiac arrest (OHCA) victim via a smartphone application (1). In common with a number of other app-based lay first-responder systems (2,3), when a cardiac arrest is suspected by call-handlers at the emergency dispatch centre, an alert is sent to lay first-responders in parallel with the usual Emergency Medical Services (EMS) response.

The authors present the actual route (via paths or roads etc.) taken and the speed at which lay first-responders travelled to the scene. Over three-and-a-half years (1st June 2014 – 31st December 2017), lay first-responders were activated to 484 out of 1331 (36%) suspected OHCA. The authors provided information on cases which were ultimately not OHCA, which is important as this diagnosis is not known for certain at the time of an alert. To exclude this data would risk over-estimating the overall utility of the system. This notwithstanding, a high proportion of these calls (1130/1331, 85%) were subsequently confirmed as OHCAs.

Of particular note, the authors report that *every* lay first-responder that was activated to one of the 1130 confirmed OHCA subsequently reached the patient. This has not been reported in the literature about similar app- or text-message based lay first-responder systems. It is likely explained by the fact that, in this system, all lay first-responders receive an alert when an OHCA is suspected, but only those indicating that they are available and whom the system determines will arrive before EMS are subsequently 'activated'. The additional time delay that this might add to a lay response, and the proportion of lay first-responders that actually arrived before any EMS response were not explicitly described.

Lay first-responders did travel reasonably long distances (a median of 1196m) to reach OHCA patients, and a median speed of 24.8km/h suggested that the majority travelled using motorised vehicles. It took lay first-responders who travelled directly to an OHCA patient a median of 197 seconds to reach them. Such time estimates do not include a number of factors – time to identification of cardiac arrest by an emergency call-handler, time spent by the lay first-responder deciding to accept an alert and time spent negotiating access to the patient once on scene – but do provide optimism that life-saving interventions could be started within a reasonable time-frame.

Further, in this system, the nearest public-access Automated External Defibrillators (AEDs) were a considerable distance away from both the patient (median 1598m) and the lay first-responder at the time of alert (median 416m). Perhaps unsurprisingly then, the time taken by lay first-responders to get to an OHCA patient was significantly longer if they retrieved an AED en-route rather than travelling directly to them. However, this difference was only 78 seconds (median 275 seconds via AED vs 197 seconds direct-to-patient). This seems counterintuitively small given how far away the AEDs were from the patient, and how far the lay first-responders travelled. When stratified by travel modality, however, those lay first-responders that travelled on foot following an alert took more than nine minutes (555 seconds) longer to reach the patient if they retrieved an AED en-route rather than travelling directly there.

There are a number of things that this study does not report. We do not know what proportion of lay first-responders travelled directly to the patient and how many travelled via an AED. There is also no comment on the actual accessibility and availability of the public-access AEDs, which has an important bearing on effective OHCA coverage (4). A considerable delay caused by retrieving an AED first, particularly in systems or areas where it might be anticipated that lay first-responders would travel to the scene by foot, would reduce both the opportunity and motivation to utilise public-access AEDs in lay first-responder systems.

There are many examples of how lay first-responder schemes can be improved. Improved recruitment of lay first-responders and targeted advertisement of groups with the appropriate skills would increase the opportunity for a given OHCA victim to receive a timely response from a lay first-responder. Better strategic placement of AEDs increase the opportunity for them to be used: bystander defibrillation rates fall markedly if the OHCA event occurs more than 100m from a public-access AED (5).

In systems which can count on multiple lay first-responders to respond to an alert, it may be prudent to send some directly to the patient and others via the nearest AED – this is currently being investigated by other researchers (6). In the current study (1) an average of 1.5 lay first-responders attended each confirmed OHCA. There is an understandable reticence about directing lay first-responders to retrieve an AED first because, as demonstrated here, it would increase the time an OHCA patient spends without any intervention if there are no other bystanders on scene performing CPR. Linking lay first-responder systems with simultaneous dispatch of AEDs to the scene (for example using AED custodians, taxis or unmanned aerial vehicles) is a potential avenue that could be explored to improve AED use without compromising time to CPR.

Modelling work could help determine the optimum alerting distance for lay first-responders, maximising coverage for OHCA victims whilst avoiding demotivation among those who are asked to respond too far and too often. In the current study (1) lay-first responders were asked to respond in only 36% of OHCA cases, with the system determining whether or not a lay first-responder could arrive before EMS based on them responding at 'walking speed'. However, the authors subsequently determined that many people responded in motorised vehicles, and so there may have been other cases where lay first-responders could have been the first resource to arrive at the patient's side.

Crucially, there are no patient outcomes reported in this study, and this information is hard to find in the published literature. In a Dutch system, OHCA patients attended by text-message-alerted lay first-responders were 2.8 times more likely to survive compared to those patients for whom an text-message alert was sent but lay first-responders did not arrive on scene (7). This is an impressive finding but overestimates the utility of this scheme as a whole, as lay first-responders did not attend in more than 30% of cases after being alerted.

Smartphone app-based lay first-responder schemes are becoming increasingly well-established, and so it is past time for all such schemes to provide meaningful clinical outcome data. The potential for these schemes to reduce the time to CPR and AED use is clear, and it is logical that they should improve patient survival by doing so. If they are not, or if the survival benefits are lower than anticipated, then there is an urgent need to investigate why. This often requires an in-depth look at system organisation and the behaviours of the lay first-responders using the system. Only by taking a systematic approach to identifying and overcoming barriers to successful implementation can we make something that all the available evidence suggests *should* work, actually work (8).

Conflict of Interest Statement

The author is a National Institute for Health Research (NIHR) Doctoral Research Fellow and has a volunteer role at the Resuscitation Council (UK).

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