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Editorial

From community alert to provider response: the impact of turnout time on community responder systems

Out-of-hospital cardiac arrest is a major public health problem with resuscitation rates in the United States and Europe remaining quite low, ranging from 8 % to 10 %.[1–8] The "chain of survival" concept describes a system-based strategy for the resuscitation of out-of-hospital cardiac arrest (OHCA) and includes six key components: early recognition, activation of the response system, early defibrillation, high quality cardiopulmonary resuscitation (CPR), advanced life support care, and post–arrest management.[9] Lay rescuers can play a major role in the early care of victims of OHCA; in fact, the first four of these six components can be delivered by lay providers prior to arrival of EMS. This "prearrival care," provided by lay or off-duty trained rescuers before EMS arrival, includes CPR and AED application and can result in substantial improvements in survival and neurologic status among survivors.[10]

Once the emergency call for assistance has been made to the local emergency communications center (ECC), and EMS has been directed to the scene, the ECC dispatcher can activate a community "cardiac arrest' alert to lay and off-duty trained providers in the area. The community alert concept is an ECC dispatcher-directed activation of smartphones of volunteer lay and off-duty trained providers in the immediate vicinity of the cardiac arrest victim. This alert allows for earlier application of pre-arrival care and has been associated with increased frequency of early CPR and associated improved survival and functional status among survivors.[11,12]

In this edition of *Resuscitation*, Ganter and colleagues[13] have explored an important element in the use of smartphone-based community alerting systems, the turn-out time of the lay provider in the response to cardiac arrest. Turn-out time (ToT) is defined as the time interval between the initial alert and departure to the scene of the rescuer, as determined by global positioning system tracking. The authors performed a retrospective observational study of 4,138 activations of a community alerting system over an ~7.5 month period; the region studied, primarily rural with two small urban centers, is in Southwest Germany with an approximate population of 4.5 million persons. This alerting system is smartphone-based, activated by the regional ECC, and includes only volunteer responders who have at minimum "basic paramedic training or training in a healthcare profession" and are involved in resuscitation training. Once activated, the volunteer providers indicate their estimated time of arrival (ETA) to the scene; if this time is less than the reported ETA of EMS, then three off-duty providers are dispatched with notification of the closest AED – the two closest assigned to CPR and the third to the closest AED, if one exists in close proximity. The responders also report their mode of transport to the scene (i.e., by foot, bicycle, or vehicle).

The authors noted that the median ToT was 1 min 45 s with a broad range of 1 min 45 s–5 min 22 s; one-third of ToT was 1 min 45 s. Considering the distribution of ToT, 18 % of providers departed to the scene within 60 s, 42 % within 60–120 s, and 40 % over 2 min. The median time interval between departing and arriving on the scene was 3 min 18 s and the overall median response time from receiving the alert to arriving on the scene was 5 min 22 s. Of the factors impacting ToT, dispatch during the 11 pm–7 am period had the strongest influence with nighttime ToT being 2 min 22 s compared to daytime ToT of 1 min 42 s. The day of the week, holiday period, mode of transport to the scene, and assigned task (CPR or AED) had minimal impact on ToT. The authors concluded that the ToT period represents a significant portion of the total response time for off-duty volunteer responders dispatched via this community alerting system; in addition, they noted that night time was the only major influential factor which lengthened ToT. They suggest that EMS leaders must consider this important time interval in the overall response planning to OHCA.

The implications of this study focus on the recognition of this turnout time interval, awareness of its magnitude, and measures to shorten it whenever possible. First of all, it must be noted that a median response time of 5 min and 22 s is most impressive, particularly when one considers that these trained responders were off-duty; providing CPR and AED use early in the course of OHCA greatly increases the opportunity of meaningful survival. In addition, current smartphone-based dispatch systems often only consider travel time to the scene after departure, not pre-departure delays. The ToT in this study represented approximately one-third of the time from alert receipt to scene arrival, a substantial portion of the total response time. Fixed ToT assumptions are inadequate as variability among individuals is quite high, as seen in this study. Education of the potential responders aimed at awareness of the magnitude of this time interval is important; this heightened awareness could alter

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behaviors and potentially shorten the time interval, particularly during night hours. It must be noted, however, that the median turnout time of 1 min 45 s is quite impressive, particularly for off-duty providers.

This system is likely more sophisticated than other applications in use in other parts of the world. This specific community alert system only allows trained, off-duty providers, as opposed to lay providers who volunteer to assist. These trained providers' awareness of time urgency for cardiac arrest response is likely much higher than that of the lay public; other community cardiac arrest alerting systems allow lay providers to register and potentially respond. In addition, this particular system described by Ganter and colleagues[13] is advanced in at least two other features compared to other community alerting systems, including the time-based comparison of the off-duty providers estimated scene arrival time with that of the EMS unit estimated arrival time as well as the specific role assignments among the responders prior to arrival (i.e., CPR versus AED). Further, in any such community alert system, planners could incorporate historical responder behaviors, smartphone movement data, current volunteer provider location, device settings, and contextual factors (e.g. time of day, ongoing activity, etc.) to anticipate ToT in real-time, thus optimizing response. In addition, the use of individualized ToT added to response time predictions, would allow a sophisticated system to optimize responder selection.

While this study and the system it describes is most impressive, there are several limitations to consider if its findings are to be extrapolated to other dis-similar smartphone-based community alerting applications. The level of sophistication in this German system is notable and may not be replicable in other systems, particularly those applications which allow lay provider involvement. This system used off-duty providers with role assignment (i.e., CPR or AED). Other global smartphone alerting systems rely on untrained lay responders; the level of response and quality of response would likely be different in other systems and may not allow for role assignments. In other words, this study's findings may not translate into regions using lay person responders or with a different EMS infrastructure, regardless of how efficient the smartphone program may be. Furthermore, the study was done over a relatively shorter time period of 7.5 months; seasonal and/or weather variations could be limited. The retrospective nature also makes it more difficult to directly assess downstream outcomes such as time to CPR, time to defibrillation, or survival.

The study draws important attention to the value of ToT, an unstudied yet important determinant of response effectiveness in smartphone-based OHCA alerting systems. The data demonstrates that smartphone programs can be valuable in OHCA response, as well as that ToT should be carefully tracked as lay-person response can play a key role in the chain of survival. If we are to improve upon ToT, we must better understand how we can shorten the ToT, particularly at night. Generalizability of the study may be limited and future research should link ToT to actual patient-centered outcomes.

Pre-arrival care, delivered by either lay or off-duty trained providers, has a demonstrated, robust, positive impact on patient survival and neurologic status of OHCA survivors.[10] Studies such as that performed by Ganter and colleagues[13] allow community, EMS, and hospital leaders to better understand the modes and methods of pre-arrival care with the ultimate goal of further improving neurologically intact survival in patients with out-of-hospital cardiac arrest.

Conflict of interest statement

Neither Dr Brady nor Dr Muck have any conflicts of Interest to declare as related to this subject in general or the manuscript in particular.

CRediT authorship contribution statement

William Brady: Conceptualization, Formal analysis, Investigation, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Andrew Muck:** Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing.

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