

Time to Compress the Time to First Compression

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Out-of-hospital cardiac arrest (OHCA), often described as *the* most time-sensitive and life-threatening medical condition, remains a major public health problem.¹ Survival remains low in most settings, with enormous variation in community outcomes.²

Although several event characteristics are associated with good neurological outcomes after OHCA, the most critical *modifiable* element is the time from collapse to cardiopulmonary resuscitation (CPR) and defibrillation.^{3,4} Prearrival bystander CPR potentiates success in the links of care that follow by generating a small, but essential, amount of blood flow to the heart and brain. This reduces the risk and degree of brain injury and prolongs the time window for successful defibrillation and advanced care.^{5,6}

New clinical data, reported in this issue of the *Journal of the American Heart Association (JAHA)* by Goto et al from the All-Japan National OHCA registry, advance our understanding of the relationship between the emergency medical service (EMS) response interval, prearrival bystander resuscitation efforts, and neurologically intact survival after cardiac arrest.⁷ Their observational study of 553 426 adults with OHCA found a significant independent association between EMS response time (EMS call receipt to arrival of ambulance at site of arrest) and decreased 1-month neurologically intact survival. Specifically, they found that each 1-minute increase in EMS response time was associated with a 10.7% (95% confidence interval, 10.0%–11.4%) decrease in favorable neurological outcome. Their findings corroborate those from a previous smaller study⁸ and allow for more robust multivariate analysis

of factors associated with neurologically intact survival after OHCA.

The importance of time from event onset to bystander action and to arrival of EMS is not a new theme in cardiac resuscitation. In fact, we can trace the origin of contemporary EMS response standards (and much of EMS in general) to the 1960s in Belfast, Ireland, where Pantridge and Geddes showed that rapid response of trained personnel with a defibrillator to the scene of OHCA could improve outcomes.⁹

In King County, Washington, in 1979, Eisenberg and colleagues were the first to report that survival from witnessed prehospital adult cardiac arrest of a medical origin was maximized if the times from collapse to CPR and defibrillation were 4 and 8 minutes, respectively.¹⁰

Although these early studies established a time-outcome relationship for OHCA, the idea of an 8-minute response time benchmark became an inviolable standard in many jurisdictions. In most EMS systems today, meeting the 8-minute advanced life support response in a minimum of 90% of calls is *the* benchmark of EMS quality¹¹ and is frequently tied to reimbursement. The evolution of this benchmark no doubt reflects the need of municipalities to quantify EMS quality, justify resources, and meet public expectation.

Challenging the Usefulness of the 8-Minute Response Standard

The term “response interval” lacks a universal definition. Just as there are countless EMS system configurations, there are numerous definitions to quantify EMS response times.

In this case, what seems simple can actually be complex. The total response interval includes many components defined in different ways: time from collapse to recognition of the arrest; time until calling 9-1-1 (or the local emergency access number); time until the 9-1-1 call is answered at a primary service answering point; time until the call is transferred to a secondary primary service answering point; time until the telecommunicator confirms the incident location; time for the telecommunicator to process the call; time for the telecommunicator to provide prearrival instructions to lay rescuers; time for trained rescuers to access and start emergency response vehicles; time to leave the station; time to travel to the scene; time to reach the patient’s side; time to

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assess the patient; and, finally, time to start treatment. In addition to these subintervals, there are multiple transport intervals before patients finally arrive at a hospital.¹²

The entire response interval is rarely (if ever) accurately measured. EMS systems traditionally report the time from call receipt at the secondary primary service answering point to ambulance arrival at arrest location. Some systems include other elements, but with so many components and no universal definition, we are unable to reliably compare response intervals across communities. Thus, the reported intervals are at best incomplete. At worst, they are false reassurances of quality of care. This may be one of the reasons so many communities observe low or stagnant OHCA outcomes over time.

How Can We Improve This Situation?

As Albert Einstein famously said, “Not everything that counts can be counted, and not everything that is counted counts.”

It is not that EMS response intervals are necessarily irrelevant; they remain an entrenched and important aspect of EMS care delivery. Yet, we believe the time has come to emphasize a marker that measures proficiency earlier in the chain of survival and more closely addresses what matters most in the physiological aspects of cardiac arrest: the time from collapse to the initiation of CPR and defibrillation.^{11,13,14}

Studies worldwide speak to the value emergency medical telecommunicators can bring to facilitating bystander CPR.^{15–19} If properly trained, these professionals can promptly recognize OHCA over the telephone and direct callers to start and continue CPR until professional rescuers assume care. The time elapsed from call receipt to first compression is a single discrete interval that lends itself to universal definition. Although it does not capture the time from collapse to 9-1-1 call, the interval measures care far closer to event onset than does EMS response time. In addition, it can be reliably assessed through 9-1-1 audio recordings, compared across agencies, and benchmarked for improvement within them. These recordings also allow us to reliably measure the time to first shock in those cases in which bystanders defibrillate patients.

The interval from call receipt to first compression, if publicly reported, would no doubt increase the visibility and reinforce the life-saving value and need for prearrival bystander action. This prospect holds great promise for 3 reasons. First, at least 5 studies across the globe demonstrate independent associations between the provision of telecommunicator-directed bystander CPR and improved patient outcomes.^{15–19} Second, 4 of these studies show that emergency call centers can improve their provision of care. Third, such improvements can be made at *almost no capital*

expense to the emergency call centers themselves because the necessary communication infrastructures already exist.

The potential value of measuring and publicly reporting this “first” interval, then, comes to a focal point: by measuring, we improve a means of care wherein a single telecommunicator can become an entire citizen rescue force, directing callers who witness or encounter OHCA to start and continue rapid forceful chest compressions, saving life after life at no capital expense to the community itself.

The value of reporting this more relevant call receipt to first compression time interval could galvanize the kind of training and quality-improvement programming associated with improved OHCA outcomes across the globe. One guideline-based program reduced the time to first telecommunicator-directed bystander compression by 44 seconds.¹⁸ The relative costs of such efforts are vanishingly small compared with the capital outlays needed to reduce EMS response intervals by similar duration. In addition, a small part of the funds that communities invest to improve EMS response and quality of care could be used to optimize emergency call centers and community response plans that could dramatically expand and improve prearrival bystander CPR.

We believe the time has come to move toward a more patient-centered view of OHCA response and to standardize a *simpler, more reliable, more comparable, and more physiologically relevant* measure: the time from 9-1-1 call receipt to first chest compression. In analyzing the associations between EMS response intervals, prearrival resuscitation efforts, and neurological outcomes, Goto et al⁷ remind us of a significant opportunity: to maximize bystander CPR rates and compress the precious time to first compression in OHCA.

Disclosures

None.

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