



Online article and related content  
current as of March 30, 2009.

## Surviving Cardiac Arrest: Location, Location, Location

Arthur B. Sanders; Karl B. Kern

*JAMA*. 2008;300(12):1462-1463 (doi:10.1001/jama.300.12.1462)

<http://jama.ama-assn.org/cgi/content/full/300/12/1462>

Correction	<a href="#">Contact me if this article is corrected.</a>
Citations	<a href="#">This article has been cited 1 time.</a> <a href="#">Contact me when this article is cited.</a>
Topic collections	Pacemakers/ Defibrillators; Medical Practice; Medical Practice, Other; Critical Care/ Intensive Care Medicine; Adult Critical Care; Public Health; Cardiovascular System; Public Health, Other; Prognosis/ Outcomes; Arrhythmias; Cardiovascular Disease/ Myocardial Infarction; Emergency Medicine; Cardiovascular Intervention <a href="#">Contact me when new articles are published in these topic areas.</a>
Related Articles published in the same issue	Regional Variation in Out-of-Hospital Cardiac Arrest Incidence and Outcome <a href="#">Graham Nichol et al. <i>JAMA</i>. 2008;300(12):1423.</a>  Prehospital Termination of Resuscitation in Cases of Refractory Out-of-Hospital Cardiac Arrest <a href="#">Comilla Sasson et al. <i>JAMA</i>. 2008;300(12):1432.</a>
Related Letters	Termination of Cardiopulmonary Resuscitation for Out-of-Hospital Cardiac Arrest <a href="#">Comilla Sasson et al. <i>JAMA</i>. 2009;301(7):722.</a>  In Reply: <a href="#">Arthur B. Sanders et al. <i>JAMA</i>. 2009;301(7):722.</a>

Subscribe  
<http://jama.com/subscribe>

Permissions  
[permissions@ama-assn.org](mailto:permissions@ama-assn.org)  
<http://pubs.ama-assn.org/misc/permissions.dtl>

Email Alerts  
<http://jamaarchives.com/alerts>

Reprints/E-prints  
[reprints@ama-assn.org](mailto:reprints@ama-assn.org)

# Surviving Cardiac Arrest

## Location, Location, Location

Arthur B. Sanders, MD

Karl B. Kern, MD

**O**UT-OF-HOSPITAL CARDIAC ARREST (OHCA) IS A devastating syndrome that has a dismal prognosis in many communities.<sup>1,2</sup> However, the magnitude of the problem in the United States and Canada is such that even small improvements in survival translate into thousands of lives saved. Out-of-hospital cardiac arrest remains a major public health issue, prompting the American Heart Association to suggest that it be designated a reportable disease.<sup>3</sup>

Out-of-hospital cardiac arrest is primarily a systems problem of local communities. It is important that clinicians advocate in their communities to establish an optimal response and treatment system for patients to have a reasonable chance of resuscitation. Survival is generally a reflection of the emergency medical services (EMS) and acute care hospital systems implementing the "chain of survival," including access to EMS, bystander cardiopulmonary resuscitation (CPR) training, early defibrillation programs, early advanced life support, and optimal hospital postresuscitation care.<sup>4(pp19-34)</sup>

In this issue of JAMA, 2 articles highlight cardiac arrest as a community public health problem. The study by Nichol and colleagues<sup>5</sup> from the Resuscitation Outcomes Consortium (ROC) reports the incidence of OHCA regardless of whether resuscitation was attempted. Even though the study sites were not selected to reflect the populations in the United States and Canada, the sites chosen reflect some of the best-organized EMS systems, and the data reported represent a population of more than 21 million people and more than 20 000 OHCA's.<sup>5</sup>

It is remarkable that 42% of the nontraumatic cardiac arrests were not treated with CPR or defibrillation by the EMS rescue personnel because of an advance directive, extensive history of terminal illness or intractable disease, or request from the patient's family. Overall, only 4.6% of all patients who experienced cardiac arrest were discharged from the hospital alive. Among patients for whom resuscitation was attempted, 7.9% of all patients with cardiac arrest and 21% of patients with ventricular fibrillation survived to hos-

pital discharge. There were significant regional differences in the incidence and outcome of OHCA. The adjusted incidence of cardiac arrest ranged more than 2-fold among the sites, whereas rates of survival to discharge for treated patients with cardiac arrest varied significantly for all cardiac arrests (from 3% in Alabama to 16.3% in Seattle) and for patients with ventricular fibrillation (from 7.7% in Alabama to 39.9% in Seattle).<sup>5</sup>

This wide variability in outcome emphasizes the pressing need for each community to first "know its numbers," then concentrate on improving survival rates by focusing on locally identified problem areas within the chain of survival. In a small study from rural Wisconsin, Kellum et al<sup>6</sup> implemented an EMS protocol consisting of an initial series of uninterrupted chest compressions, passive oxygen administration with no active ventilation, rhythm analysis with a single shock, 200 immediate post-shock chest compressions before pulse check or rhythm reanalysis, and delayed endotracheal intubation. In comparison of data for 3 years before (n=92 cardiac arrests) and after (n=89 cardiac arrests) the protocol change, neurologically intact survival for patients with witnessed shockable rhythms improved from 15% to 39%, comparable with the best site in the ROC study.<sup>6</sup> Improvements from EMS protocol changes have also been documented in Arizona and Seattle.<sup>7,8</sup> These data show that protocol and technique can be more important than location for survival of OHCA. Focused attention and improvements to identified local issues within the chain of survival can significantly influence survival.

The variability of survival rates in different EMS systems raises important questions regarding the attempt to assess the futility of continuing resuscitation, as evaluated in the study in this issue of JAMA by Sasson and colleagues<sup>9</sup> from the Cardiac Arrest Registry to Enhance Survival (CARES). The investigators evaluated 2 proposed rules for termination of resuscitation (TOR) for OHCA without transport to the hospital. The 2 TOR rules include one for basic life support (BLS) personnel and the other for advanced life support (ALS) personnel. The BLS TOR rule includes 3 crite-

**Author Affiliations:** Departments of Emergency Medicine (Dr Sanders) and Internal Medicine (Dr Kern), Sarver Heart Center, University of Arizona, Tucson.

**Corresponding Author:** Arthur B. Sanders, MD, Department of Emergency Medicine, University of Arizona Health Sciences Center, PO Box 245057, Tucson, AZ 85724-5057 (art@aemrc.arizona.edu).

See also pp 1423 and 1432.

ria: event not witnessed by EMS, no automated external defibrillator/manual shock in the field, and no return of spontaneous circulation in the field. The ALS rule adds 2 more criteria: event not witnessed by a bystander and no bystander CPR.<sup>10,11</sup>

Overall, 7.1% of 5505 OHCA patients included in the study database survived to hospital discharge. Use of the BLS rule would have resulted in 47% of patients being pronounced dead in the out-of-hospital setting. However, 70 patients meeting criteria for TOR survived to admission and 5 to hospital discharge. Use of the more rigorous ALS TOR rule would have resulted in 24 patients being admitted to the hospital but none discharged alive. The ALS rule would have resulted in increasing the termination of resuscitation efforts in the out-of-hospital setting from 17.2% at baseline to 21.7%.<sup>9</sup>

The 2005 guidelines from the American Heart Association clearly allow for pronouncing as dead those patients who experience OHCA and are unresponsive to advanced life support treatment. The guidelines state, "The resuscitation team must make a conscientious and competent effort to give patients a trial of CPR and ACLS [advanced cardiac life support] . . . Emergency medical response systems should not require field personnel to transport every victim of cardiac arrest to a hospital or emergency department . . . if ACLS care in the field cannot resuscitate the victim, ED [emergency department] care will not resuscitate the victim."<sup>4</sup>(pp61-62)

Although the authors have conducted a rigorous assessment of the prognostic factors associated with poor outcome that are included in the TOR rules, the key issue is whether TOR rules are desired and needed. Do such rules best serve patients who have cardiac arrest? Clinical rules for terminating treatment have a way of becoming a self-fulfilling prophecy.

Resuscitation science is active, with promising new approaches to improve outcomes.<sup>6-8</sup> If the cities in the CARES database improved OHCA outcomes to the level of the best ROC site (7% to 16% survival), the TOR rules may no longer be valid. Furthermore, other prognostic factors, such as total arrest time, total resuscitation time, comorbid diseases, presumed etiology of the cardiac arrest, time to EMS arrival, and the 5 TOR factors described, may be taken into account by clinicians. If the problem is that too many patients are being transported to hospitals, education of base station physicians, medics, and EMS directors about what can and cannot be done in the hospital may be preferable to a rule to forgo resuscitation efforts.

In addition, significant progress has been made in postresuscitation care. For instance, in the study by Sasson et al, only 5 of 70 patients meeting the TOR rules and admitted to the hospital survived to discharge.<sup>9</sup> In a recent

study of patients who received aggressive postresuscitation care, including therapeutic hypothermia, percutaneous coronary intervention, and control of hemodynamics, glucose levels, and ventilation, Sunde et al<sup>12</sup> reported improvement in favorable neurologic outcome from 26% (among 58 patients in the preintervention period) to 56% (among 61 patients in the postintervention period). Thus, improvements in the science of resuscitation and postresuscitation care can quickly render a specific decision rule obsolete.

Finally, it is time to recognize the importance of EMS systems to the health of a community. Physicians and the public should demand data on survival from cardiac arrest from every community. Publications and organizations should use these survival data when rating cities for livability and health indices, and businesses and individuals should take these public health data into account when deciding whether to relocate or expand to a new city. It is time to work to overcome barriers in each community, devote appropriate resources, and optimize survival of all patients so that location by city becomes a minor factor in survival of cardiac arrest.

**Financial Disclosures:** None reported.

## REFERENCES

1. Dunne RB, Compton S, Zalenski RJ, Swor R, Welch R, Bock BF. Outcomes from out-of-hospital cardiac arrest in Detroit. *Resuscitation*. 2007;72(1):59-65.
2. Eckstein M, Stratton SJ, Chan LS. Cardiac arrest resuscitation evaluation in Los Angeles: CARE-LA. *Ann Emerg Med*. 2005;45(5):504-509.
3. Nichol G, Rumsfeld J, Eigel B, et al. Essential features of designating out-of-hospital cardiac arrest as a reportable event: a scientific statement from the American Heart Association Emergency Cardiovascular Care Committee; Council on Cardiopulmonary, Perioperative, and Critical Care; Council on Clinical Cardiology; and Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation*. 2008;117(17):2299-2308.
4. ECC Committee, Subcommittees, and Task Forces of the American Heart Association. 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2005;112(24)(suppl):IV1-IV203.
5. Nichol G, Thomas E, Callaway CW, et al. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA*. 2008;300(12):1423-1431.
6. Kellum MJ, Kennedy KW, Barney R, et al. Cardiocerebral resuscitation improves neurologically intact survival of patients with out-of-hospital cardiac arrest. *Ann Emerg Med*. 2008;52(3):244-252.
7. Bobrow BJ, Clark LL, Ewy GA, et al. Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. *JAMA*. 2008;299(10):1158-1165.
8. Rea TD, Helbock M, Perry S, et al. Increasing use of cardiopulmonary resuscitation during out-of-hospital ventricular fibrillation arrest: survival implications of guideline changes. *Circulation*. 2006;114(25):2760-2765.
9. Sasson C, Hegg AJ, Macy M, Park A, Kellermann A, McNally B; CARES Surveillance Group. Prehospital termination of resuscitation in cases of refractory out-of-hospital cardiac arrest. *JAMA*. 2008;300(12):1432-1438.
10. Morrison LJ, Visentin LM, Kiss A, et al. Validation of a rule for termination of resuscitation in out-of-hospital cardiac arrest. *N Engl J Med*. 2006;355(5):478-487.
11. Morrison LJ, Verbeek PR, Vermeulen MJ, et al. Derivation and evaluation of a termination of resuscitation clinical prediction rule for advanced life support providers. *Resuscitation*. 2007;74(2):266-275.
12. Sunde K, Pytte M, Jacobsen D, et al. Implementation of a standardized treatment protocol for post resuscitation care after out-of-hospital cardiac arrest. *Resuscitation*. 2007;73(1):29-39.