

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION



Emergency Medical Service Dispatch Cardiopulmonary Resuscitation Prearrival Instructions to Improve Survival From Out-of-Hospital Cardiac Arrest : A Scientific Statement From the American Heart Association

E. Brooke Lerner, Thomas D. Rea, Bentley J. Bobrow, Joe E. Acker III, Robert A. Berg, Steven C. Brooks, David C. Cone, Marc Gay, Lana M. Gent, Greg Mears, Vinay M. Nadkarni, Robert E. O'Connor, Jerald Potts, Michael R. Sayre, Robert A. Swor, Andrew H. Travers and on behalf of the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation

Circulation. 2012;125:648-655; originally published online January 9, 2012;
doi: 10.1161/CIR.0b013e31823ee5fc

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2012 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://circ.ahajournals.org/content/125/4/648>

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the [Permissions and Rights Question and Answer](#) document.

Reprints: Information about reprints can be found online at:
<http://www.lww.com/reprints>

Subscriptions: Information about subscribing to *Circulation* is online at:
<http://circ.ahajournals.org/subscriptions/>

Emergency Medical Service Dispatch Cardiopulmonary Resuscitation Prearrival Instructions to Improve Survival From Out-of-Hospital Cardiac Arrest

A Scientific Statement From the American Heart Association

Endorsed by the Association of Public-Safety Communications Officials International, International Academies of Emergency Dispatch, National Academies of Emergency Dispatch, National Association of Emergency Medical Technicians, National Association of EMS Physicians, and National Association of State EMS Officials

E. Brooke Lerner, PhD, Chair; Thomas D. Rea, MD, MPH; Bentley J. Bobrow, MD; Joe E. Acker III, EMT-P, MPH; Robert A. Berg, MD, FAHA; Steven C. Brooks, MD, MHS, FRCPC; David C. Cone, MD; Marc Gay, BA, EMT-P; Lana M. Gent, PhD; Greg Mears, MD, FACEP; Vinay M. Nadkarni, MD, FAHA; Robert E. O'Connor, MD, MPH, FAHA; Jerald Potts, PhD; Michael R. Sayre, MD, FAHA; Robert A. Swor, DO; Andrew H. Travers, MD, MSc, FRCPC; on behalf of the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation

Each year, millions of people around the world experience out-of-hospital cardiac arrest (OHCA), a condition characterized by unexpected cardiovascular collapse.^{1,2} OHCA is a leading cause of death. The incidence of treated OHCA is \approx 50 to 60 per 100 000 person-years and is comparable throughout many parts of the world. Resuscitation of these patients is challenging and requires a coordinated set of rescuer actions termed the “Chain of Survival.” The links in the Chain of Survival are immediate recognition of cardiac arrest and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), rapid defibrillation, effective advanced life support, and integrated post-cardiac arrest care.³ These actions involve the participation of a spectrum of rescuers, including family members, bystanders, emergency medical service (EMS) dispatchers, pre-hospital care providers, and hospital-based personnel; each group of rescuers has specific motivations, responsibilities, and skills.

Unfortunately, in most communities in the United States and Canada, only 5% to 10% of all OHCA patients in whom resuscitation is attempted survive to discharge from the hospital. In contrast, survival rates can approach 20% (50% for witnessed ventricular fibrillation) in communities where the Chain of Survival is strong.⁴

Efforts to improve survival from OHCA should be aimed at strengthening each link in the Chain of Survival. An important underpinning of successful resuscitation is the interdependence of each of these links. Specifically, the early links, those involving bystanders (immediate emergency activation and early bystander CPR), are essential for the effectiveness of subsequent links. Thus, efforts that can improve early recognition of OHCA and increase bystander CPR are likely to improve survival from OHCA.

When a bystander calls the community emergency response number (eg, 911 in the United States) to request

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on October 12, 2011. A copy of the document is available at <http://my.americanheart.org/statements> by selecting either the “By Topic” link or the “By Publication Date” link. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

The American Heart Association requests that this document be cited as follows: Lerner EB, Rea TD, Bobrow BJ, Acker JE 3rd, Berg RA, Brooks SC, Cone DC, Gay M, Gent LM, Mears G, Nadkarni VM, O'Connor RE, Potts J, Sayre MR, Swor RA, Travers AH; on behalf of the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation. Emergency medical service dispatch cardiopulmonary resuscitation prearrival instructions to improve survival from out-of-hospital cardiac arrest: a scientific statement from the American Heart Association. *Circulation*. 2012;125:648–655.

Expert peer review of AHA Scientific Statements is conducted at the AHA National Center. For more on AHA statements and guidelines development, visit <http://my.americanheart.org/statements> and select the “Policies and Development” link.

Permissions: Multiple copies, modification, alteration, enhancement, and/or distribution of this document are not permitted without the express permission of the American Heart Association. Instructions for obtaining permission are located at http://www.heart.org/HEARTORG/General/Copyright-Permission-Guidelines_UCM_300404_Article.jsp. A link to the “Copyright Permissions Request Form” appears on the right side of the page.

(*Circulation*. 2012;125:648-655.)

© 2012 American Heart Association, Inc.

Circulation is available at <http://circ.ahajournals.org>

DOI: 10.1161/CIR.0b013e31823ee5fc

medical aid, the call creates an opportunity to improve both identification of OHCA and provision of bystander CPR. This telephone interaction is the initial interface between citizens at the scene and professional emergency responders and can serve as the catalyst for recognition of cardiac arrest and initiation of bystander CPR through formal interrogation of the caller and “just-in-time” education. Just-in-time education in the form of telephone CPR instructions, referred to as CPR prearrival instructions, can provide callers with step-by-step instructions on how to perform CPR. Unfortunately, prearrival instructions are not available to all callers who access the emergency response number. It is difficult to estimate the exact number of lives that could be saved by offering CPR prearrival instructions, but it has been shown that CPR prearrival instructions can potentially double the proportion of arrest patients who receive bystander CPR and in turn help communities achieve bystander CPR in the majority of arrest patients who collapse before EMS arrival.⁵ The survival effectiveness of CPR guided by prearrival instructions appears to approach that of CPR provided by previously trained bystanders.⁶ Therefore, based on the estimate that annually nearly 200 000 of the 300 000 OHCA that occur in the United States do not receive bystander CPR, more comprehensive implementation of CPR prearrival instructions has the potential to save thousands of additional lives each year.⁷

This scientific statement reviews the process of providing CPR prearrival instructions, identifies these instructions as integral to the Chain of Survival, and describes the framework for programmatic best practices for providing CPR prearrival instructions. The statement also emphasizes the importance of monitoring dispatcher performance and providing regular feedback. Specifically, this scientific statement makes 4 main recommendations:

1. Callers to community emergency response numbers (eg, 911) should be formally and systematically questioned to determine whether the patient may have had a cardiac arrest. When a potential cardiac arrest patient is identified, CPR prearrival instructions should be immediately provided to assist bystanders if CPR is not already ongoing.
2. CPR prearrival instructions should be provided in a confident and assertive manner and should include straightforward chest compression-only instructions to achieve early bystander Hands-Only CPR for the adult who suddenly collapses.
3. Individual dispatcher and organizational-level performance can be measured by using a modest set of metrics that can be ascertained through review of the audio dispatch recording.
4. These metrics should be incorporated into an integrated quality assurance program that includes cooperation and collaboration of EMS and hospital stakeholders. The program should provide feedback at the individual and organizational level.

Current American Heart Association Guideline for EMS Dispatch for an Adult Who Collapses Suddenly

The 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular

Care recommend that bystanders immediately call their local emergency response number anytime they find an unresponsive patient and that all dispatchers be appropriately trained to provide CPR prearrival instructions. To deliver effective CPR prearrival instructions, dispatchers should be specifically educated in helping the bystander recognize absent or abnormal breathing to identify the cardiac arrest condition and initiate CPR (Class I, Level of Evidence B). Furthermore, dispatchers should recommend CPR for unresponsive patients who are not breathing normally, because many are in cardiac arrest, and the frequency of serious injury from chest compressions in the nonarrest group is very low (Class I, Level of Evidence B). For adults with sudden cardiac arrest, dispatcher prearrival CPR instructions should consist of Hands-Only CPR (Class I, Level of Evidence B). However, CPR instructions should include rescue breathing when treating adult and pediatric patients with a high likelihood of an asphyxial cause of arrest (eg, drowning). Finally, the EMS system quality-improvement process should include a review of the performance of dispatcher CPR instructions (Class IIa, Level of Evidence B).⁸

Bystander CPR

Bystander CPR is a vital intervention for patients with OHCA. Although bystander CPR can more than double the patient’s chance of survival, in many communities fewer than one-third of OHCA patients receive this lifesaving action before the arrival of EMS.^{2,9} The low incidence of performance of bystander CPR contributes to poor survival rates in most communities. Despite large-scale training efforts, bystander CPR rates have historically remained low. The reasons for this low rate of bystander CPR include, but are not restricted to, difficulty in identifying cardiac arrest, fear of causing harm, the challenge of performing this complex psychomotor task, bystander emotional distress and panic, and bystander reluctance to engage in mouth-to-mouth contact because of perceived unpleasantness or fear of disease transmission.^{10–14} Because the impact of each of these factors may vary across communities, the most efficient and effective set of strategies to increase the performance of bystander CPR may be a coordinated community approach, including public awareness, frequent and ongoing public CPR training, and a structured CPR prearrival instruction program.

The interaction between a bystander who calls an emergency response number to request aid and the dispatcher who takes the call creates an opportunity for the dispatcher to help the caller provide aid and successfully guide the caller past many of the impediments to achieving early bystander CPR. The process includes guiding the caller to identify the arrest, easing the caller’s fear and panic, and directing the caller to begin and continue the psychomotor skills of CPR. CPR prearrival instructions cannot provide the details presented in a formal CPR training course, but they should provide the best balance of implementation and efficacy, especially when the alternative is no CPR.

Telephone Prearrival Instructions for Bystander CPR

Effective CPR prearrival instruction programs can nearly double the rate of bystander CPR performed.^{5,10,14} Even in

communities where the EMS response is exceptionally quick, a structured CPR prearrival instruction program can provide a measurable benefit.¹⁵ Importantly, bystander CPR that results from provision of prearrival instructions can offer a survival benefit comparable to that of unassisted bystander-initiated CPR.⁶

Because of its ubiquitous position in the emergency medical response system, EMS dispatch has an enormous opportunity to provide lifesaving CPR instructions to the public. In contrast to most other forms of resuscitation training and knowledge translation, dispatchers are in direct communication with actual bystanders to cardiac arrest. Dispatchers have a unique opportunity to provide a real-time, high-yield intervention that can have a direct and immediate impact on the survival of the patient with OHCA. Furthermore, the general public expects dispatchers to direct their actions while they wait for help to arrive.¹⁶

Not all EMS dispatch centers offer CPR prearrival instructions. The exact number of dispatch centers within the United States that provide CPR prearrival instructions or transfer callers to receive instruction is unknown.

Facilitating Bystander Recognition of a Patient With Cardiac Arrest

The first and most fundamental step in prearrival CPR instruction is for the bystander and dispatcher to recognize a potential cardiac arrest. Many patients with cardiac arrest do not receive bystander CPR because the arrest is not recognized. A patient's movements are often misinterpreted as signs of life; these are most commonly some form of respiratory effort.^{10,13,14,17} Although patients with cardiac arrest are uniformly unresponsive, up to half initially present with agonal gasps early after collapse.¹⁸ These gasps represent a brain stem response to ischemia and can persist for several minutes.¹⁸ Not surprisingly, callers/bystanders will describe gasping, deep snoring, or slow breathing, which may prevent the identification of cardiac arrest (www.heart.org/dispatchercpr). There are currently no scientifically proven methods for helping callers and dispatchers accurately identify agonal gasping, but the abnormal respirations associated with cardiac arrest may be characterized as any form of abnormal breathing in the unresponsive patient.⁸

Another condition that can make it difficult to recognize a cardiac arrest is brief seizurelike activity (shaking) that occurs immediately after collapse from cardiac arrest.¹⁹ Dispatchers should be aware of this presentation and its potential to inhibit the recognition of arrest.

One key to early recognition is for dispatchers to use a systematic, streamlined set of questions at the beginning of the call.^{19a} A 2-question approach can efficiently achieve this goal (Figure 1), although no single identification strategy will identify all cardiac arrests.²⁰ If the patient is determined to be unresponsive and not breathing or not breathing normally, then the presumptive diagnosis is cardiac arrest and CPR prearrival instructions should be provided to the caller. The initial emergency call receiver should provide CPR prearrival instructions whenever possible or transfer the call to other dispatch personnel who are responsible for this action and will provide instructions. CPR prearrival instructions should

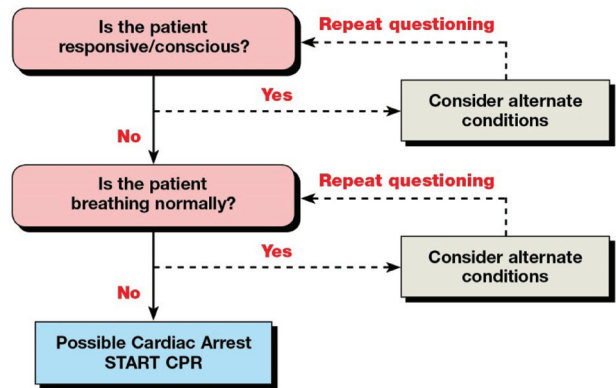


Figure 1. Sample algorithm for identification of a patient with possible cardiac arrest. CPR indicates cardiopulmonary resuscitation.

be provided by designated dispatch personnel with minimal delay.

In some instances, the caller may be uncertain when responding to whether the patient is responsive or breathing normally, or the caller may not know how to make these assessments. In such cases, the dispatcher will need to be prepared to direct the caller with instructions on how to determine responsiveness and assess for normal breathing. For example, the dispatcher may need to follow the question about responsiveness by telling the caller to tap the patient on the shoulder and shout to see if the patient responds. The dispatcher may also ask if the patient appears to be “awake.” To assess for normal breathing, the dispatcher may need to ask the caller to state each time the patient takes a breath to distinguish normal from abnormal (agonal) breathing. The dispatcher may ask if the patient's chest appears to be rising and falling normally, or the dispatcher may ask the caller to put the phone next to the patient so that the dispatcher can listen to the patient's breathing. In some cases of cardiac arrest, the caller may initially state that the patient is responsive and that breathing is normal; however, subsequent information may not be consistent. For example, the caller may state that the patient is conscious but later say that the patient is not breathing. Therefore, the dispatcher should continue to consider the possibility of cardiac arrest, especially when information is inconsistent or an alternative condition is not identified.

Asking questions about the patient's acute condition or long-term health history before asking questions meant to identify cardiac arrest may delay bystander actions by precious minutes and significantly reduce the likelihood of successful resuscitation. Therefore, dispatch protocols should be designed to identify cardiac arrest as early in the interrogation process as possible.

Engaging the Bystander to Provide CPR

CPR prearrival instructions can play a key role in engaging hesitant bystanders to provide CPR. Both the caller and dispatcher alike may be reluctant to initiate CPR because of the fear of causing injury, especially if their training is limited or if they are uncertain about whether the patient is in cardiac arrest.²¹

1. Bring the phone and get **NEXT** to the person if you can.
2. Listen carefully. I'll tell you what to do.
 - Place the person **FLAT** on his **back** on the **floor**.
 - **KNEEL** by the person's side.
 - Put the **HEEL** of your **HAND** on the **CENTER** of the person's **CHEST**.
 - Put your **OTHER HAND ON TOP** of **THAT** hand.
 - **PUSH DOWN FIRMLY, ONLY** on the **HEELS** of your hands, at least **2 inches**.
 - Do this **50** times, just like you're **PUMPING** the chest. Count **OUT LOUD: 1-2-3.....50** (correct rate if needed)
 - **KEEP DOING IT: KEEP PUMPING** the **CHEST UNTIL HELP TAKES OVER**. I'll stay on the line.

Ventilation instructions (for use after 30 compressions when suspected cardiac arrest is secondary to respiratory arrest):

PINCH the **NOSE**; with your other hand, **LIFT** the **CHIN** so that the head **TILTS BACK**. Completely **COVER** the person's **MOUTH** with your **MOUTH**. **GIVE 2 BREATHS** (come back to the phone).

Then go back to the compression instructions. Give cycles of **30 compressions and 2 breaths** until EMS arrives.

Other conditions, such as seizures, hypoglycemia, or intoxication, can be present with unresponsiveness and abnormal breathing. In nearly half of all cases in which dispatchers provide CPR prearrival instructions, the patient will not be in cardiac arrest.²² Serious injury from bystander CPR for people not in cardiac arrest is uncommon ($\approx 1\%–2\%$),^{22,23} but failure to provide bystander CPR to people who are in cardiac arrest can be lethal. Bystanders and dispatchers should be assured that the balance of benefit versus risk greatly favors an assertive approach to beginning CPR whenever a patient is determined to be unresponsive and not breathing or not breathing normally.²²

A major predictor of bystander action is the belief of bystanders that they can successfully perform lifesaving skills.²⁴ Confidence in performing CPR can be influenced by previous training and experience. The circumstances of cardiac arrest are typically unexpected, and bystanders may not have had training in responding to such circumstances, so they feel unprepared to act.²⁵ In addition, the bystander is frequently a family member of the patient, a circumstance that can add to the bystander's emotional distress. The key to overcoming bystander distress and uncertainty is for the caller to be engaged through CPR prearrival instructions that direct action and convey teamwork and assurance. For example, rather than asking the caller, "Would you like to try CPR?" the dispatcher should calmly and confidently state, "We need to start CPR. I will help you." Furthermore, if the caller is concerned about harming the patient, he or she should be told that CPR can only help and will not cause harm. The use of a communication strategy that conveys leadership and confidence may help the bystander focus on the task of CPR.²⁴

Core Content of CPR Prearrival Instructions

A related challenge to bystander CPR may be the difficulty of coordinating multiple psychomotor skills, especially when dispatcher assistance is required. A primary benefit of CPR for adults is the generation of blood flow to the brain and heart during cardiac arrest. Therefore, CPR prearrival instructions for adults who suddenly collapse should be for Hands-

Only CPR. That is, the caller should be instructed to provide rapid, forceful chest compressions with minimal interruptions (examples can be found at www.handsonlycpr.org or www.learn CPR.org). Three previously published randomized clinical trials compared CPR prearrival instructions consisting of dispatcher-assisted compression-only CPR with dispatcher-assisted conventional CPR among adult patients with cardiac arrest, and the results support this recommendation.^{26–28} These trials indicate that Hands-Only CPR provides at least comparable survival benefit overall and may be superior for adults who have a witnessed arrest of cardiac pathogenesis. CPR prearrival instructions for performing Hands-Only CPR enable the rescuer to start chest compressions on average a minute sooner than with conventional CPR and substantially simplifies CPR prearrival instructions and bystander action.¹⁷

Although the main objective of the dispatcher is to rapidly identify the patient with cardiac arrest and start chest compressions as soon as possible, some patients will likely benefit from the addition of rescue breaths to high-quality chest compressions performed with minimal interruptions. These groups predominantly include children (1 year of age until puberty) and adults with a high likelihood of an asphyxial cause of arrest (eg, drowning). On the basis of the interrogation, if the dispatcher suspects that there is a high likelihood that asphyxiation is the cause of the arrest, then conventional CPR (chest compressions plus rescue breaths) prearrival instructions can be provided,^{26–29} but significantly delaying the initiation of chest compressions while trying to determine the precise cause of the arrest is suboptimal. Any CPR is substantially better than no CPR, and Hands-Only CPR will provide at least comparable benefit in the large majority of arrest patients.^{27,30,31} Furthermore, for the majority of adults who suddenly collapse, the cause is cardiac related.

CPR prearrival instructions should direct the bystander to position the patient whenever possible on a firm surface on his or her back. The bystander should then be instructed in proper hand placement on the patient's chest and the proper method for giving chest compressions. Figure 2 provides an example of the steps that can be described to the caller.

Figure 2. Example of cardiopulmonary resuscitation prearrival instructions for an adult who has suddenly collapsed. EMS indicates emergency medical service.

Prerival instructions should convey to the bystander that they should push hard and fast on the patient's chest with the goal of compressing at a rate of at least 100 times per minute at a depth of at least 2 inches. The optimal word choice to achieve this CPR performance is not well established. For example, the instruction to count out loud for a total of 50 compressions shown in Figure 2 was derived from practical experience. The creators of this sample instruction set felt that having the bystander return to the phone after 50 compressions gives the bystander an explicit goal and an opportunity for the dispatcher to reassess patient responsiveness, reassure the bystander that he or she is helping the patient, and redirect the rescuer regarding technique (eg, to increase the rate of compressions). Case examples of CPR prerival instructions can be found at www.heart.org/dispatchercpr.

Measurement: The Key to a Successful CPR Prerival Instruction Program

The cornerstone of success in resuscitation from cardiac arrest is accurate and consistent measurement of each link in the Chain of Survival. Integration of EMS dispatch into this process is essential. The core of the evaluation process is ensuring that all callers who receive instructions on rendering first aid to cardiac arrest patients receive direct, clear, and consistent CPR instructions that help them recognize cardiac arrest and immediately begin and continue CPR until trained rescuers arrive on the scene.

An effective OHCA system of care should integrate CPR prerival instruction into the overall EMS system, which includes the public, trained EMS personnel, hospitals, and public health programs. In many communities, the OHCA system of care may also include public safety personnel such as law enforcement or other nonmedical first responders who frequently arrive at the patient's side before trained medical rescuers. This system integration ensures that all public safety providers work together with a common goal of rapidly identifying cardiac arrest patients and immediately initiating CPR (and early defibrillation if available) before EMS arrival. Ongoing measurement and improvement of each component of the system is essential to achieve optimal survival.³²

Metrics

Core metrics designed to evaluate and improve dispatch and CPR prerival instructions for cardiac arrest care include appropriate dispatch of EMS response, dispatch recognition of the arrest, and dispatcher-assisted CPR. Each of these categorical domains involves a time-sensitive component that becomes relevant on successful completion of the categorical measure (Table). The quicker the bystander starts CPR after collapse, the greater the patient's chance of survival, so time components are an important part of the metric.³³

Current evidence indicates that there are important opportunities for dispatch to increase early identification of arrest and provision of bystander CPR.¹¹ Best-practice benchmarks for the core metrics are not well established and are derived from a few dispatch centers with a concerted focus on improving dispatcher care for cardiac arrest. In such systems, up to 25% of all patients with cardiac arrest receive bystander CPR.⁵ It is also important to measure and try to minimize the

Table. Metrics for Evaluation of Dispatch and CPR Prerival Instructions

Categorical Measure	Time Component
Dispatch of appropriate EMS resources	Interval from receipt of call to EMS dispatch
Adherence to the identification algorithm	Interval from receipt of call to completion of algorithm
Recognition of arrest/provision of CPR prerival instructions	Interval from receipt of call to provision of CPR instructions
Performance of bystander CPR	Interval from receipt of call to performance of CPR
Primary obstacle to CPR	...

CPR indicates cardiopulmonary resuscitation; EMS, emergency medical services.

time from call receipt to arrest recognition and the initiation of CPR prerival instruction. Experienced dispatch centers have demonstrated that this interval can be reduced to ≈ 60 seconds.^{5,17} Tracking patients with cardiac arrest to determine which cases dispatchers accurately identified and which were "missed" is a key part of the evaluation process. Because resources and systems vary widely, each dispatch organization should establish local benchmarks and continuously strive for improvement. Although perhaps sensitive, public reporting of these dispatch measures may help efforts to improve care and maximize the lifesaving potential of CPR prerival instructions.

A vital aspect of review is to understand why bystander CPR is delayed or not initiated. Scene circumstances and bystander abilities are far ranging in cardiac arrest; in some instances, challenges to CPR may be nearly impossible to address, whereas in others there may be dispatch solutions. Careful review of local barriers to bystander CPR will provide insight into specific obstacles and aid in developing approaches to improve the process.^{10-12,17} Important examples of changes that have occurred in some dispatch centers as a consequence of regular case review include the appreciation that early identification must account for agonal gasping, that ventilation instruction and actual performance came at a cost of 1 to 2 minutes delay until chest compressions, and that bystanders are more likely to act when the dispatcher directs the caller, instead of asks the caller, to start CPR.

Dispatcher Feedback

Individual dispatchers need both recognition and feedback on their performance in responding to cardiac arrest. Feedback should include basic points about the call, such as (1) whether the dispatcher recognized the need for CPR early in the call, (2) if the instructions were clearly and promptly stated, and (3) if the bystander provided CPR. This feedback helps identify trends and the need for additional training and scripting. In addition, review of individual audio recordings of cases where CPR prerival instructions were or should have been provided is a valuable tool to assess the quality of verbal instructions and opportunities for improvement. Individual feedback should be complemented by organizational-level benchmarking that informs the dispatch center about the metrics of the program. Ideally, this information should be sup-

plemented with the ultimate metric, patient outcome data, so that dispatch organizations can measure and receive feedback about the effectiveness of their efforts.

Practical Considerations

An effective quality assurance program for CPR prearrival instructions requires the investment of resources. Each dispatch organization should determine the best programmatic approach to improve dispatch care for OHCA in its setting. Dispatch centers and EMS systems should work together to establish agreed-on CPR prearrival instruction protocols, training, measurement, and ongoing quality-improvement plans. Initial and ongoing CPR instruction training should review the practical challenges and tools to address these challenges. Such training would incorporate best practices derived from the local quality-assurance effort. Ideally, with medical direction oversight, the dispatch quality-assurance program would review all OHCA calls. Because in some instances dispatch cannot confirm OHCA, whenever possible, dispatch should use field EMS information to comprehensively identify OHCA cases. Field EMS organizations should collaborate with dispatch centers to share data and to measure and improve care. The most important source of information for EMS dispatch case review is the dispatch audio recording. Additional information from the EMS report or hospital outcome can also be useful. Dispatch leadership should provide organizational- and individual-level feedback about performance on the evaluated metrics. It is also important to acknowledge exceptionally good performance.³⁴

Knowledge Gaps

The most effective means of identifying OHCA and providing prearrival instructions over the telephone is an area that can be improved with additional research. Several knowledge gaps exist on the topics of bystander CPR and CPR prearrival instructions. The word choice and terminology of dispatcher questions may affect the sensitivity and specificity of identification of arrest. Additional evidence can help direct efforts to motivate callers to initiate CPR and overcome specific barriers (eg, language barriers³⁵) regardless of prior CPR training. Different instruction or word selection by the dispatcher may affect the timing and quality of bystander CPR. Investigation may also identify the best strategies to align the content of CPR (ie, addition of rescue breaths) with the patient’s physiological status. Research is required to determine if and how to optimally integrate public access defibrillation into emergency dispatch and the CPR instruction process.³⁶ Finally, programmatic efforts should evaluate the most effective quality-assurance approaches; to date, there is limited research on best practices and bench marks for quality assurance.

Summary

Dispatchers should systematically interrogate all callers to identify cardiac arrest. When a potential cardiac arrest is identified, CPR prearrival instructions should be provided. Dispatcher performance should be monitored and formal feedback provided. Implementing telephone prearrival CPR instructions can significantly strengthen the Chain of Survival and save lives from OHCA.

Disclosures

Author Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Ownership Interest	Consultant/ Advisory Board	Other
E. Brooke Lerner	Medical College of Wisconsin	None	None	None	None	Serves on the following advisory boards. I do not consider any of these to be relevant to this project. No financial support is received for any of these activities. Associate Editor: Prehospital Emergency Care* Associate Editor: Academic Emergency Medicine* Associate Board: Disaster Medicine and Public Health Preparedness* Medical Advisory Board Member: Brain Trauma Foundation, National Disaster Life Support Foundation, National Disaster Life Support Education Consortium Executive Committee*	None
Joe Acker 3rd	Birmingham Regional Emergency Medical Services System	None	None	None	None	None	None
Robert A. Berg	Children's Hospital of Philadelphia	AHA liaison to the NHLBI Resuscitation Outcomes Consortium† PI for the CHOP site of the NICHD-funded Collaborative Pediatric Critical Care Research Network†	None	Received funds as a speaker at Jean Luis Vincent's Critical Care Medicine meeting in Brussels*	Stock in companies run by money managers (eg, TIAA-CREF)†	None	None
Bentley J. Bobrow	Maricopa Medical Center Arizona Department of Health Services, Bureau of EMS & Trauma System	None	None	None	None	None	None
Steven C. Brooks	University of Toronto, Sunnybrook Health Sciences Centre, St. Michael's Hospital	Heart and Stroke Foundation of Canada Jumpstart Resuscitation Fellowship - peer-reviewed, unrestricted salary support for research on public access defibrillation†	None	None	None	None	None

(Continued)

Author Disclosures, Continued

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Ownership Interest	Consultant/ Advisory Board	Other
David C. Cone	Yale University School of Medicine	The National Academies of Emergency Dispatch provided an unrestricted research grant in the amount of \$3500. The topic of the study (using dispatch protocols to conserve first-responder resources) is unrelated to the topic of this project.*	None	None	None	None	None
Marc Gay	Centre de Communication Santé Estrie	None	None	None	None	None	None
Lana M. Gent	American Heart Association	None	None	None	None	None	None
Greg Mears	UNC Chapel Hill	None	None	None	None	None	None
Vinay M. Nadkarni	University of Pennsylvania School of Medicine, Children's Hospital of Philadelphia	None	None	None	None	None	None
Robert E. O'Connor	University of Virginia Health System	None	None	None	None	None	None
Jerald Potts	American Heart Association	None	None	None	None	None	None
Thomas D. Rea	University of Washington	Unrestricted research funding from nonprofit foundation to support a randomized trial comparing 2 types of dispatcher instruction: CPR with chest compression alone vs CPR with chest compression plus ventilation—for resuscitation of out-of-hospital cardiac arrest.* Grant from nonprofit foundation to develop dispatcher CPR training materials.*	None	None	None	None	None
Michael R. Sayre	Ohio State University	None	None	None	None	None	None
Robert A. Swor	William Beaumont Hospital	None	None	None	None	None	None
Andrew H. Travers	Emergency Health Services	None	None	None	None	None	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire that all writing group members are required to complete and submit. A relationship is considered to be "Significant" if (a) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "Modest" if it is less than "Significant" under the preceding definition.

*Modest.

†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Expert Witness	Ownership Interest	Consultant/Advisory Board	Other
Carolyn Cason	University of Texas at Arlington	None	None	None	None	None	None	None
Venugopal Menon	Cleveland Clinic	None	None	None	None	None	None	None
Raina Merchant	University of Pennsylvania	None	None	None	None	None	None	None

This table represents the relationships of reviewer that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire which all reviewers are required to complete and submit. A relationship is considered to be "Significant" if (a) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "Modest" if it is less than "Significant" under the preceding definition.

References

- Berdowski J, Berg RA, Tijssen JG, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. *Resuscitation*. 2010;81:1479–1487.
- Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP, Rea T, Lowe R, Brown T, Dreyer J, Davis D, Idris A, Stiell I; Resuscitation Outcomes Consortium Investigators. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA*. 2008;300:1423–1431.
- Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, Samson RA, Kattwinkel J, Berg RA, Bhanji F, Cave DM, Jauch EC, Kudenchuk PJ, Neumar RW, Peberdy MA, Perlman JM, Sinz E, Travers AH, Berg MD, Billi JE, Eigel B, Hickey RW, Kleinman ME, Link MS, Morrison LJ, O'Connor RE, Shuster M, Callaway CW, Cucchiara B, Ferguson JD, Rea TD, Vanden Hoek TL. Part 1: executive summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2010;122(suppl 3):S640–S656.
- Agarwal DA, Hess EP, Atkinson EJ, White RD. Ventricular fibrillation in Rochester, Minnesota: experience over 18 years. *Resuscitation*. 2009;80:1253–1258.
- Rea TD, Eisenberg MS, Becker LJ, Murray JA, Hearne T. Temporal trends in sudden cardiac arrest: a 25-year emergency medical services perspective. *Circulation*. 2003;107:2780–2785.
- Rea TD, Eisenberg MS, Culley LL, Becker L. Dispatcher-assisted cardiopulmonary resuscitation and survival in cardiac arrest. *Circulation*. 2001;104:2513–2516.
- Roger VL, Go AS, Lloyd-Jones DM, Adams RJ, Berry JD, Brown TM, Carnethon MR, Dai S, de Simone G, Ford ES, Fox CS, Fullerton HJ, Gillespie C, Greenlund KJ, Hailpern SM, Heit JA, Ho PM, Howard VJ, Kissela BM, Kittner SJ, Lackland DT, Lichtman JH, Lisabeth LD, Makuc DM, Marcus GM, Marelli A, Matchar DB, McDermott MM, Meigs JB, Moy CS, Mozaffarian D, Mussolino ME, Nichol G, Paynter NP, Rosamond WD, Sorlie PD, Stafford RS, Turan TN, Turner MB, Wong ND, Wylie-Rosett J; on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2011 update: a report from the American Heart Association. *Circulation*. 2011;123:e18–e209.
- Berg RA, Hemphill R, Abella BS, Aufderheide TP, Cave DM, Hazinski MF, Lerner EB, Rea TD, Sayre MR, Swor RA. Part 5: adult basic life support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2010;122(suppl 3):S685–S705.
- Sasson C, Rogers MA, Dahl J, Kellermann AL. Predictors of survival from out-of-hospital cardiac arrest: a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes*. 2010;3:63–81.
- Vaillancourt C, Verma A, Trickett J, Crete D, Beaudoin T, Nesbitt L, Wells GA, Stiell IG. Evaluating the effectiveness of dispatch-assisted cardiopulmonary resuscitation instructions. *Acad Emerg Med*. 2007;14:877–883.
- Lerner EB, Sayre MR, Brice JH, White LJ, Santin AJ, Billittier AJ, Cloud SD. Cardiac arrest patients rarely receive chest compressions before ambulance arrival despite the availability of pre-arrival CPR instructions. *Resuscitation*. 2008;77:51–56.
- Dami F, Carron PN, Praz L, Fuchs V, Yersin B. Why bystanders decline telephone cardiac resuscitation advice. *Acad Emerg Med*. 2010;17:1012–1015.
- Roppolo LP, Westfall A, Pepe PE, Nobel LL, Cowan J, Kay JJ, Idris AH. Dispatcher assessments for agonal breathing improve detection of cardiac arrest. *Resuscitation*. 2009;80:769–772.
- Bohm K, Stalhandske B, Rosenqvist M, Ulfvarson J, Hollenberg J, Svensson L. Tuition of emergency medical dispatchers in the recognition of agonal respiration increases the use of telephone assisted CPR. *Resuscitation*. 2009;80:1025–1028.
- Hallstrom AP, Cobb LA, Johnson E, Copass MK. Dispatcher assisted CPR: implementation and potential benefit. A 12-year study. *Resuscitation*. 2003;57:123–129.
- Billittier AJ, Lerner EB, Tucker W, Lee J. The lay public's expectations of prearrival instructions when dialing 9–1-1. *Prehosp Emerg Care*. 2000;4:234–237.
- Hauff SR, Rea TD, Culley LL, Kerry F, Becker L, Eisenberg MS. Factors impeding dispatcher-assisted telephone cardiopulmonary resuscitation. *Ann Emerg Med*. 2003;42:731–737.
- Bobrow BJ, Zuercher M, Ewy GA, Clark L, Chikani V, Donahue D, Sanders AB, Hilwig RW, Berg RA, Kern KB. Gasping during cardiac arrest in humans is frequent and associated with improved survival. *Circulation*. 2008;118:2550–2554.
- Clawson J, Olola C, Scott G, Heward A, Patterson B. Effect of a Medical Priority Dispatch System key question addition in the seizure/convulsion/fitting protocol to improve recognition of ineffective (agonal) breathing. *Resuscitation*. 2008;79:257–264.
- Heward A, Damiani M, Hartley-Sharp C. Does the use of the advanced medical priority dispatch system affect cardiac arrest detection? *Emerg Med J*. 2004;21:115–118.
- Garza AG, Gratton MC, Chen JJ, Carlson B. The accuracy of predicting cardiac arrest by emergency medical services dispatchers: the calling party effect. *Acad Emerg Med*. 2003;10:955–960.
- Coons SJ, Guy MC. Performing bystander CPR for sudden cardiac arrest: behavioral intentions among the general adult population in Arizona. *Resuscitation*. 2009;80:334–340.
- White L, Rogers J, Bloomingdale M, Fahrenbruch C, Culley L, Subido C, Eisenberg M, Rea T. Dispatcher-assisted cardiopulmonary resuscitation: risks for patients not in cardiac arrest. *Circulation*. 2010;121:91–97.
- Haley KB, Lerner EB, Pirrallo RG, Croft H, Johnson A, Uihlein M. The frequency and consequences of cardiopulmonary resuscitation performed by bystanders on patients who are not in cardiac arrest. *Prehosp Emerg Care*. 2011;15:282–287.
- Meischke HW, Rea TD, Eisenberg MS, Rowe SM. Intentions to use an automated external defibrillator during a cardiac emergency among a group of seniors trained in its operation. *Heart Lung*. 2002;31:25–29.
- Dwyer T. Psychological factors inhibit family members' confidence to initiate CPR. *Prehosp Emerg Care*. 2008;12:157–161.
- Hallstrom A, Cobb L, Johnson E, Copass M. Cardiopulmonary resuscitation by chest compression alone or with mouth-to-mouth ventilation. *N Engl J Med*. 2000;342:1546–1553.
- Rea TD, Fahrenbruch C, Culley L, Donohoe RT, Hambly C, Innes J, Bloomingdale M, Subido C, Romines S, Eisenberg MS. CPR with chest compression alone or with rescue breathing. *N Engl J Med*. 2010;363:423–433.
- Svensson L, Bohm K, Castren M, Pettersson H, Engerstrom L, Herlitz J, Rosenqvist M. Compression-only CPR or standard CPR in out-of-hospital cardiac arrest. *N Engl J Med*. 2010;363:434–442.
- Kitamura T, Iwami T, Kawamura T, Nagao K, Tanaka H, Nadkarni VM, Berg RA, Hiraide A; for the implementation working group for All-Japan Utstein Registry of the Fire and Disaster Management Agency. Conventional and chest-compression-only cardiopulmonary resuscitation by bystanders for children who have out-of-hospital cardiac arrests: a prospective, nationwide, population-based cohort study. *Lancet*. 2010;375:1347–1354.
- Hüpfel M, Selig HF, Nagele P. Chest-compression-only versus standard cardiopulmonary resuscitation: a meta-analysis. *Lancet*. 2010;376:1552–1557.
- SOS-KANTO Study Group. Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. *Lancet*. 2007;369:920–926.
- Kwok H, Rea T. Measure and improve. *Resuscitation*. 2011;82:645–646.
- Valenzuela TD, Roe DJ, Cretin S, Spaite DW, Larsen MP. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. *Circulation*. 1997;96:3308–3313.
- Standard Practice for Emergency Medical Dispatch Management F1560-94. *Annual Book of ASTM Standards*. West Conshohocken, PA: American Society for Testing and Materials; 1994.
- Bradley SM, Fahrenbruch CE, Meischke H, Allen J, Bloomingdale M, Rea TD. Bystander CPR in out-of-hospital cardiac arrest: the role of limited English proficiency. *Resuscitation*. 2011;82:680–684.
- Rea T, Blackwood J, Damon S, Phelps R, Eisenberg M. A link between emergency dispatch and public access AEDs: potential implications for early defibrillation. *Resuscitation*. 2011;82:995–998.

KEY WORDS: AHA Scientific Statements ■ resuscitation