ABSTRACT: Survival after out-of-hospital cardiac arrest requires an integrated system of care (chain of survival) between the community elements responding to an event and the healthcare professionals who continue to care for and transport the patient for appropriate interventions. As a result of the dynamic nature of the prehospital setting, coordination and communication can be challenging, and identification of methods to optimize care is essential. This 2019 focused update to the American Heart Association systems of care guidelines summarizes the most recent published evidence for and recommendations on the use of dispatcher-assisted cardiopulmonary resuscitation and cardiac arrest centers. This article includes the revised recommendations that emergency dispatch centers should offer and instruct bystanders in cardiopulmonary resuscitation during out-of-hospital cardiac arrest and that a regionalized approach to post–cardiac arrest care may be reasonable when comprehensive postarrest care is not available at local facilities.

This 2019 focused update to the American Heart Association (AHA) guidelines on systems of care for dispatcher-assisted (DA) cardiopulmonary resuscitation (CPR) and cardiac arrest centers (CACs) is based on the systematic reviews commissioned by the International Liaison Committee on Resuscitation (ILCOR) to identify the evidence supporting the use of DA-CPR and CACs. Additional information can be found in the “2019 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations” summary on these topics published by ILCOR, in the web-based Consensus on Science With Treatment Recommendations on dispatcher instruction in CPR for adults, and in the web-based Consensus on Science With Treatment Recommendations on CACs.

The expert writing group for this 2019 systems of care focused update reviewed the studies and analysis of the 2019 Consensus on Science With Treatment Recommendations evidence summaries and carefully considered the ILCOR consensus recommendations in light of the structure and resources of the out-of-hospital and in-hospital resuscitation systems and the providers who use these guidelines. In addition, the writing group determined Classes of Recommendation and Levels of Evidence according to the most recent recommendations of the American College of Cardiology/AHA Task Force on Clinical Practice Guidelines (Table) by using the process detailed in the “2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.”

This 2019 systems of care focused update includes only recommendations for the use of dispatcher instructions in CPR and for the use of specialized CACs. These
updated recommendations are intended to supplement “Part 4: Systems of Care and Continuous Quality Improvement” in the 2015 AHA guidelines update. All other recommendations about DA-CPR in the “2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care” remain the official recommendations of the AHA Emergency Cardiovascular Care Science Subcommittee and writing groups.

DISPATCHER INSTRUCTION IN CPR—UPDATED 2019

A variety of terms have been used to identify the individuals at an emergency telephone call center who are charged with answering the call, interacting with the caller, and assigning the needed care providers to the incident scene (traditionally called dispatchers). Terminology is similarly varied for the process the dispatcher uses to provide real-time CPR instructions to bystanders who are at the scene of an out-of-hospital cardiac arrest (OHCA). To remain consistent with the ILCOR evidence review, the term DA-CPR (dispatcher-assisted CPR) is used to describe such coaching in this update, recognizing that other terms (such as telecommunicator CPR and telephone CPR) could be substituted.

The ILCOR systematic review analyzed the published evidence about the effectiveness of DA-CPR from 3 perspectives. The first included studies comparing outcomes of patients for whom emergency calls were
Evidence Review—Updated 2019

Comparing Outcomes in OHCA Handled by Dispatch Centers Offering DA-CPR With Outcomes Handled by Dispatch Centers Not Offering DA-CPR

The ILCOR systematic review identified no randomized controlled trials comparing clinical outcomes when emergency calls were directed to dispatch centers offering DA-CPR with outcomes from centers not offering such instruction.1 Evidence for such an association was derived from 16 observational and cohort studies,10–25 with the overall certainty of effect rated as very low for all clinical outcomes. Because the evidence is limited to observational studies, any outcomes reported can be noted only to be associated with the treatment (ie, DA-CPR versus no DA-CPR) rather than caused by the treatment.

Six observational studies evaluated the association of DA-CPR and survival with favorable neurological outcome, defined as a Cerebral Performance Category 1 to 2,26 at time points that ranged from hospital discharge to several months after cardiac arrest.11,14,15,20,21,25 Two studies found an association between offering DA-CPR and increased survival with favorable neurological outcome at 1 month after discharge, even after adjustment for multiple variables (adjusted odds ratio [AOR], 1.47 [95% CI, 1.03–2.09]),15,20 Two additional studies reported an association of increased survival with favorable neurological outcome at hospital discharge when DA-CPR was offered (odds ratio, 1.70 [95% CI, 1.21–2.37])11,14 that persisted in the study that adjusted for multiple variables (AOR, 1.67 [95% CI, 1.13–2.47]).11 A fifth study reported unadjusted favorable neurological outcome at 1 month in association with offering DA-CPR,25 and a sixth study described the association between offering DA-CPR and improved survival with Cerebral Performance Category 1 to 2 at 90 days.21

Three studies found an association between improved survival to either hospital discharge11 or 1 month15,20 when OHCA calls were handled by centers that offered DA-CPR compared with OHCA outcomes when calls were handled by centers that did not. Nine observational studies that provided only unadjusted analyses did not report improved outcomes in centers offering DA-CPR.10–13,15–17,20,21

A meta-analysis of 8 observational studies reported an association of DA-CPR availability and an increased likelihood of return of spontaneous circulation in unadjusted analysis,11,13–15,21–23,25 but this association did not persist in the single study that adjusted for confounding variables.15 The 6 studies reporting survival to hospital admission found no difference associated with systems offering DA-CPR.11,13–15,22,23

Nine studies evaluated the association between DA-CPR availability and the actual provision of bystander CPR,10–13,15,18,19,21,24 as well as the promptness of its initiation.20 In adjusted analyses, DA-CPR availability was associated with a >5-fold increase in likelihood of bystander CPR (AOR, 5.74 [95% CI, 2.4–13.72])11,20,22 and CPR was initiated 7 minutes sooner when DA-CPR was offered.20

Prompt initiation of CPR is hypothesized to delay the degeneration of a shockable rhythm to a nonshockable rhythm. Therefore, OHCA populations receiving prompt DA-CPR may demonstrate a higher incidence of a shockable rhythm on arrival of professional responders compared with patients not receiving DA-CPR. Unadjusted data from 5 observational studies found an association between a higher proportion of initial shockable rhythms for calls handled at centers where DA-CPR was offered.11,13,15,20,25

Clinical Outcomes in OHCA When DA-CPR Was Provided Versus No Bystander CPR

The ILCOR systematic review identified no randomized controlled trials comparing clinical outcomes of patients receiving bystander DA-CPR with outcomes of those not receiving bystander CPR. The available evidence for these comparisons is from observational and cohort studies, so outcomes reported here can be described only as associated with receiving bystander DA-CPR or no bystander CPR.19,20,24,25,27–31 The certainty of evidence in these studies was rated as very low.

Three studies reported an association between outcomes of those who receive DA-CPR (versus no bystander CPR) and improved survival with favorable neurological outcome at hospital discharge (AOR, 1.54 [95% CI, 1.35–1.76]) and at 1 month (AOR, 1.81 [95% CI, 1.23–2.67]); this association persisted in the study that adjusted for multiple variables.20 DA-CPR also was associated with higher survival to hospital discharge27,28,30–32 and survival at 1 month.20

Receiving DA-CPR was associated with a higher likelihood of sustained return of spontaneous circulation compared with no bystander CPR.24 There were insufficient data to address the association of DA-CPR (versus no bystander CPR) and the likelihood of an initial shockable rhythm at emergency medical services arrival.
or the likelihood of reduced time interval to initiation of bystander CPR.

**Clinical Outcomes in OHCA When DA-CPR Is Provided Versus Bystander CPR Without Dispatcher Assistance**

The ILCOR systematic review identified no randomized controlled trials comparing clinical outcomes of patients receiving bystander CPR performed with dispatcher assistance (ie, DA-CPR) and those receiving bystander CPR that was performed without dispatcher assistance. The available evidence for these comparisons consists of (nonrandomized) observational and cohort studies. The certainty of effects in these studies was rated as very low. In addition, the prognostic features of patients who received bystander CPR with and without dispatcher assistance differed markedly in these observational studies, so the ILCOR Task Force and this writing group considered only adjusted outcomes in this evidence evaluation.

There was no difference in survival with good neurological function at hospital discharge or at 1 month between patients who received bystander DA-CPR and those who received bystander CPR performed without dispatcher assistance. Although receiving bystander DA-CPR (versus unassisted CPR) was associated with increased survival at 1 month, no significant differences were observed in survival to hospital discharge between those receiving DA-CPR and those receiving unassisted CPR.

Receiving bystander DA-CPR was associated with increased survival to hospital admission compared with receiving bystander CPR without dispatcher assistance. However, no significant differences in the frequency of shockable rhythms were associated with DA-CPR. No studies addressed differences in the time interval to initiation of bystander CPR in these patients.

**Recommendations—Updated 2019**

1. **We recommend that emergency dispatch centers offer CPR instructions and empower dispatchers to provide such instructions for adult patients in cardiac arrest (Class 1; Level of Evidence C-LD).**

2. **Dispatchers should instruct callers to initiate CPR for adults with suspected OHCA (Class 1; Level of Evidence C-LD).**

The writing group acknowledges that the strong recommendations for DA-CPR are accompanied by relatively limited evidence. Although clear outcome benefits from DA-CPR were not demonstrated in all reviewed trials, it is unlikely that a rigorous randomized controlled trial on DA-CPR will be performed. Thus, the recommendations were based on the overwhelming preponderance of existing evidence from tens of thousands of patients from a number of countries indicating an association between DA-CPR and improved clinical outcomes after OHCA. The writing group also noted the similarity in outcomes when bystander CPR was provided with dispatcher assistance (ie, DA-CPR) and when CPR was provided by a bystander who was sufficiently skilled to initiate CPR spontaneously (ie, without dispatcher assistance), suggesting that dispatcher instruction can serve to support the effectiveness of CPR performed by a bystander who is unskilled in CPR. Considering these findings with the reported association of DA-CPR with a >5-fold likelihood of bystander CPR (a recognized predictor of improved survival), the writing group agrees that the overall benefit from DA-CPR merits a strong endorsement. Although not specifically addressed by this evidence review, the writing group also believes there is merit in dispatchers not only initiating CPR instruction but also continuing to coach callers in delivering high-quality CPR until the arrival of professional rescuers and their assumption of patient care.

This evidence review focused on comparing clinical outcomes of dispatch systems that provide DA-CPR with those that do not and comparing outcomes of OHCA patients receiving DA-CPR with those who did not. This review did not address issues pertaining to the experience of the bystander performing CPR, the ability of dispatchers to recognize OHCA, the protocols or verbiage used to instruct callers to perform CPR, or the quality of CPR ultimately provided. This review also did not address the impact of providing DA-CPR instructions to lay rescuers previously trained in CPR. Furthermore, the educational components of a DA-CPR program such as its curriculum, frequency of training, and potential challenges in recognizing cardiac arrest or dealing with caller distress and language barriers were not included in any of the comparisons evaluated. System-based factors such as call routing and volumes, staffing, and response plans also fell outside the scope of this evidence evaluation. These areas represent important knowledge gaps for further research.

**TRANSPORT TO SPECIALIZED CACs**

For purposes of this focused update, the term CAC (cardiac arrest center) is used to indicate a specialized center that provides contemporary and comprehensive evidence-based resuscitation and post–cardiac arrest care, including emergent cardiac catheterization, targeted temperature management, and multimodal prognostication. A variety of terms have been used to identify these specialized centers, including cardiac arrest receiving centers, comprehensive cardiac centers, and cardiac resuscitation centers. For the sake of consistency with the terminology used during the ILCOR evidence review, the term CACs is used in this document.
Evidence Review—Updated 2019

Adjusted analyses from 2 observational studies (45,956 patients) found that treatment at CACs was not associated with increased survival to 30 days with favorable neurological outcome. However, admission to a CAC was associated with improved survival to hospital discharge with good neurological outcome in 2 studies (AOR, 2.22 [95% CI, 1.74–2.84]).

In subjects with ongoing CPR at the time of hospital arrival, adjusted and unadjusted data from 2 observational studies involving 41,447 adults with OHCA showed no difference in rates of return of spontaneous circulation for patients cared for at CACs compared with those cared for at non-CACs.

Subgroup analyses based on initial presenting rhythm (shockable versus nonshockable) and direct transport versus secondary transfer to a CAC were prespecified. There were insufficient data to perform either of the preplanned pooled subgroup analyses.

Eight studies reported outcomes associated with treatment at CACs stratified by shockable or nonshockable rhythms. Heterogeneity in the data prevented a meta-analysis. In patients with shockable rhythms, 5 studies reported better outcomes at CACs, whereas 3 studies reported no difference. In patients with nonshockable rhythms, CACs were associated with improved outcomes in 1 study and no difference in 2 others.

Four studies examined outcomes in patients with OHCA who were transferred to a CAC from a non-CAC. Two of the studies reported no difference in outcomes; a third study reported better survival associated with direct transport to a CAC compared with secondary transfer; and the fourth study reported better survival associated with secondary transfer to a CAC compared with remaining at the original receiving facility. There were insufficient data to perform a pooled analysis for direct comparison.

Recommendation—Updated 2019

1. A regionalized approach to post–cardiac arrest care that includes transport of resuscitated patients directly to specialized CACs is reasonable when comprehensive post–cardiac arrest care is not available at local facilities (Class 2a; Level of Evidence C–LD).

Evidence-based, comprehensive post–cardiac arrest care, including the availability of emergent cardiac catheterization, targeted temperature management, hemodynamic support, and neurological expertise, is critically important for resuscitated patients with cardiac arrest. Important considerations in this decision-making process must include the stability of the resuscitated patient and the transport time required to arrive at a distant center offering comprehensive services. Although supportive evidence for comprehensive post–cardiac arrest interventions remains largely observational (particularly when they are administered together as “bundled care” at specialized centers), they may nonetheless represent a logical clinical link between successful resuscitation and ultimate survival. Taken together with experience from regionalized approaches to other emergencies such as trauma, stroke, and ST-segment-elevation acute myocardial infarction, the consensus of the writing group is that when a suitable complement of post–cardiac arrest services is not available locally, direct transport of the resuscitated patient to a regional center offering such support may be beneficial and is a reasonable approach to ongoing care when feasible and possible to accomplish in a timely manner.

ARTICLE INFORMATION

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 July 19, 2019, and the American Heart Association Executive Committee on August 9, 2019. A copy of the document is available at https://professional.heart.org/statements by using either “Search for Guidelines & Statements” or the “Browse by Topic” area. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

Disclosures

Writing Group Disclosures

<table>
<thead>
<tr>
<th>Writing Group Member</th>
<th>Employment</th>
<th>Research Grant</th>
<th>Other Research Support</th>
<th>Speakers’ Bureau/Honoraria</th>
<th>Expert Witness</th>
<th>Ownership Interest</th>
<th>Consultant/Advisory Board</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashish R. Panchal</td>
<td>The Ohio State University Wexner Medical Center</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Katherine M. Berg</td>
<td>Beth Israel Deaconess Medical Center</td>
<td>NIH (cardiac arrest clinical trial grant [study drug is thiamine], not related to guidelines)*</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>José G. Cabañas</td>
<td>Wake County Emergency Medical Services</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Paul S. Chan</td>
<td>Mid America Heart Institute and the University of Missouri–Kansas City</td>
<td>NHLBI†</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Marina Del Rios</td>
<td>University of Illinois at Chicago College of Medicine</td>
<td>NIH (receives 6% salary support for hypertension research)*</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Michael W. Donnino</td>
<td>Beth Israel Deaconess Medical Center</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Mary Fran Hazinski</td>
<td>Vanderbilt University School of Nursing</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Karen G. Hirsch</td>
<td>Stanford University</td>
<td>American Heart Association (research support for post–cardiac arrest research)*</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Peter J. Kudenchuk</td>
<td>University of Washington Medical Center</td>
<td>NIH/NHLBI/NINDS (PI at University of Washington for SIREN Network)*</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Michael C. Kurz</td>
<td>University of Alabama at Birmingham</td>
<td>Zoll Medical Foundation†; Zoll Medical Corp†; NIH (research grants; both received and pending)†</td>
<td>None</td>
<td>Zoll Medical Corp†</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Mark S. Link</td>
<td>UT Southwestern Medical Center</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Peter T. Morley</td>
<td>University of Melbourne Clinical School, Royal Melbourne Hospital (Australia)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

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, which all members of the writing group 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 shares 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

<table>
<thead>
<tr>
<th>Reviewer</th>
<th>Employment</th>
<th>Research Grant</th>
<th>Other Research Support</th>
<th>Speakers’ Bureau/ Honoraria</th>
<th>Expert Witness</th>
<th>Ownership Interest</th>
<th>Consultant/Advisory Board</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonathan Byrnes</td>
<td>Cincinnati Children’s Hospital, University of Cincinnati</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Tomas Drabek</td>
<td>University of Pittsburgh</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Robert Malliet</td>
<td>University North Texas Health Science Center</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>William W. Sharp</td>
<td>The University of Chicago</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Robert A. Swor</td>
<td>William Beaumont Hospital</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

This table represents the relationships of reviewers 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. 

*Modest.

REFERENCES


Circulation. 2019;140:e895–e903. DOI: 10.1161/CIR.0000000000000733

December 10, 2019 e901


