Circulation

AHA FOCUSED UPDATE

2019 American Heart Association Focused Update on Pediatric Basic Life Support

An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

ABSTRACT: This 2019 focused update to the American Heart Association pediatric basic life support guidelines follows the 2019 systematic review of the effects of dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) on survival of infants and children with out-of-hospital cardiac arrest. This systematic review and the primary studies identified were analyzed by the Pediatric Task Force of the International Liaison Committee on Resuscitation. It aligns with the International Liaison Committee on Resuscitation's continuous evidence review process, with updates published when the International Liaison Committee on Resuscitation completes a literature review based on new published evidence. This update summarizes the available pediatric evidence supporting DA-CPR and provides treatment recommendations for DA-CPR for pediatric out-of-hospital cardiac arrest. Four new pediatric studies were reviewed. A systematic review of this data identified the association of a significant improvement in the rates of bystander CPR and in survival 1 month after cardiac arrest with DA-CPR. The writing group recommends that emergency medical dispatch centers offer DA-CPR for presumed pediatric cardiac arrest, especially when no bystander CPR is in progress. No recommendation could be made for or against DA-CPR instructions when bystander CPR is already in progress.

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This 2019 focused update to the American Heart Association (AHA) pediatric basic life support (PBLS) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care is based on the systematic review of dispatcher instruction in CPR (pediatrics)[1] and the resulting Consensus on Science With Treatment Recommendations (CoSTR) from the Pediatric Task Force of the International Liaison Committee on Resuscitation (ILCOR). A draft pediatric CoSTR was posted online for public comment,[2] and a summary document containing the final CoSTR wording has been published simultaneously with this document.[3]

AHA guidelines and focused updates are developed in concert with ILCOR's systematic review process. In 2015, the ILCOR evidence evaluation process and the AHA development of guidelines and focused updates transitioned to a continuous, simultaneous process, with systematic reviews performed as new published evidence warrants or when the ILCOR Pediatric Task Force prioritizes a topic. The AHA science experts review new evidence and update the AHA PBLS guidelines as needed, typically on an annual basis. A description of the evidence review process is available in the "2017 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations Summary."[4]

Key Words: AHA Scientific Statements ■ cardiopulmonary resuscitation ■ children ■ emergency medical dispatcher ■ heart arrest ■ pediatrics

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Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated August 2015)*

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE‡
CLASS 1 (STRONG) — **Benefit >>> Risk** **Suggested phrases for writing recommendations:** • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B	**LEVEL A** • High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
CLASS 2a (MODERATE) — **Benefit >> Risk** **Suggested phrases for writing recommendations:** • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B	**LEVEL B-R (Randomized)** • Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
CLASS 2b (WEAK) — **Benefit ≥ Risk** **Suggested phrases for writing recommendations:** • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established	**LEVEL B-NR (Nonrandomized)** • Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
CLASS 3: No Benefit (MODERATE) (Generally, LOE A or B use only) — **Benefit = Risk** **Suggested phrases for writing recommendations:** • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other	**LEVEL C-LD (Limited Data)** • Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects
Class 3: Harm (STRONG) — **Risk > Benefit** **Suggested phrases for writing recommendations:** • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other	**LEVEL C-EO (Expert Opinion)** • Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

The ILCOR systematic review process uses the Grading of Recommendations Assessment, Development, and Evaluation methodology and its associated nomenclature to determine strength of recommendation and certainty of evidence for the CoSTR. The expert writing group for this 2019 PBLS focused update reviewed the studies and analysis of the 2019 ILCOR CoSTR summary[1,3] and carefully considered the ILCOR Pediatric Task Force consensus recommendations in light of the structure and resources of the out-of-hospital and in-hospital resuscitation systems and providers who use AHA guidelines. In addition, the writing group came to consensus regarding the Classes of Recommendation and Levels of Evidence according to the nomenclature developed by the American College of Cardiology/AHA recommendations for developing clinical practice guidelines (Table 1)[5] by using the process detailed in the "2015 AHA Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care."[6]

It is important to note that this 2019 PBLS focused update evaluates only the recommendations for the use of dispatcher-assisted CPR (DA-CPR) in pediatric out-of-hospital cardiac arrest (OHCA). All other recommendations and algorithms published in the 2017 focused update,[7] "Part 11: Pediatric Basic Life Support and Cardiopulmonary Resuscitation Quality" of the 2015 guidelines update,[8] and "Part 13: Pediatric Basic Life Support" of the "2010 AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care"[9] remain the official recommendations of the

 Circulation. 2019;140:e915–e921. DOI: 10.1161/CIR.0000000000000736

Table 2. Summary of Pediatric Studies on DA-CPR

Author	Country	Sample Size, n	Study Duration	Design	Primary Outcomes
Goto et al,[11] 2014	Japan	5009	January 2008–December 2010	Prospective cohort	Survival and favorable neurological outcome at 1 mo
Akahane et al,[16] 2012	Japan	1780	January 2005–December 2008	Prospective cohort	Survival and favorable neurological outcome at 1 mo
Chang et al,[13] 2018	Korea	1953	January 2012–December 2016	Cross-sectional	Survival and favorable neurological outcome at hospital discharge
Lee et al,[18] 2019	Korea	1013	January 2012–December 2013	Cross-sectional	Survival and favorable neurological outcome at hospital discharge
Ro et al,[17] 2016	Korea	1529	January 2012–December 2014	Cross-sectional	Survival and favorable neurological outcome at hospital discharge

DA-CPR indicates dispatch-assisted cardiopulmonary resuscitation.
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AHA Emergency Cardiovascular Care Science Subcommittee and writing groups.

DISPATCHER INSTRUCTION IN CPR

Effective bystander CPR is a key component of the chain of survival from OHCA.[10,11] Unfortunately, rates of bystander CPR remain low for both adults[12] and children[11–13] with OHCA. In adults with OHCA, the provision of CPR instructions by emergency dispatchers has been associated with increased rates of bystander CPR and improved patient outcomes.[1,14,15] However, bystander CPR rates for pediatric OHCA remain low, even when DA-CPR is offered.[16,17]

A variety of terms have been used to identify the personnel 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 at the scene of an OHCA. In this PBLS focused update, to remain consistent with the ILCOR evidence review, the term *DA-CPR* will be used to describe such coaching, recognizing that other terms (such as *telecommunicator CPR* and *telephone CPR*) could be substituted.

Evidence Summary—Updated 2019

There has been no previous review focusing specifically on the effect of DA-CPR instructions for pediatric OHCA, although the 2017 PBLS focused update[7] included registry data from systems that provided such instructions. The systematic review analyzed both adult and pediatric data (Table 2).[1] The ILCOR Pediatric Task Force and the AHA writing group reviewed the pediatric studies included in that systematic review that compared outcomes for patients who were offered DA-CPR.[11,13,16,19] Patients in a study from Korea[18] were not evaluated separately in the ILCOR review because they were included in another larger study from the same registry[13] involving overlapping years; in addition, the smaller study[18] did not compare patients offered DA-CPR with those not offered DA-CPR. Both adjusted and unadjusted study outcomes of the remaining studies were analyzed, with the caution that unadjusted outcomes could be confounded by several factors such as cause of arrest, location of arrest, changes in resuscitation guidelines over time, and differences in emergency medical services (EMS) protocols.[1]

An observational study from the All-Japan Utstein Registry reported the association of DA-CPR with increased survival at 1 month in 1780 children with OHCA enrolled between January 2005 and December 2008.[16] Results were adjusted for age, sex, bystander type, cause of cardiac arrest, and interval between the call to EMS and arrival. DA-CPR was offered in 28.4% of patients. Bystander CPR was performed for more than two-thirds (68.7%, 347 of 505) of patients when callers were offered DA-CPR but was performed for only 27.8% (354 of 1275) of patients when callers were not offered DA-CPR; thus, DA-CPR was associated with an almost 3-fold increase in the likelihood of bystander CPR, a known contributor to survival. DA-CPR offered by dispatchers was significantly associated with improved 1-month survival (odds ratio [OR], 1.46 [95% CI, 1.05–2.03]) but not with 1-month favorable neurological outcome.[16]

In a later study from the same All-Japan Utstein Registry, Goto and colleagues[11] examined the effect of DA-CPR on favorable 1-month neurological outcome and survival to 1 month in 5009 children with OHCA enrolled from 2008 through 2010. It is important to note that the patients with callers who were offered DA-CPR were younger (ie, infants) and more likely to have an unwitnessed arrest, a presumed cardiac cause of the arrest, and bystander CPR compared with those who were not offered DA-CPR. Outcomes were adjusted for age, sex, presumed cardiac cause, initial rhythm, witnessed versus nonwitnessed arrest, and call-to-response interval. Callers for 2698 patients (53.9%) were offered DA-CPR; of these, 2019 patients (74.8%) actually received bystander CPR. The bystander CPR consisted of chest compression–

only CPR for 54.5% (1101 of 2019), conventional CPR for 42.3% (855 of 2019), and rescue breaths only for 3.0% (63 of 2019). Offered DA-CPR was significantly associated with 1-month survival (adjusted OR, 1.43 [95% CI, 1.14–1.79]) but not with 1-month favorable neurological outcome. The provision of bystander CPR, with or without dispatcher instruction, was associated with improved odds of survival and survival with favorable neurological outcomes compared with no bystander CPR.[11]

The first of 2 Korean registry studies examined the association of bystander CPR, with and without dispatcher assistance, with survival to hospital discharge of children with OHCA between 2012 and 2014.[17] Data were adjusted for age, sex, location, cause of the arrest, witnessed or unwitnessed arrest, initial rhythm, and EMS response interval. Of 1529 patients, 502 (32.8%) had DA-CPR, 264 (17.3%) had bystander CPR provided without dispatcher assistance, and 763 (49.9%) had no bystander CPR provided. After multivariable analysis, both DA-CPR (OR, 2.14 [95% CI, 1.01–4.58]) and unassisted bystander CPR (adjusted OR, 3.52 [95% CI, 1.56–7.92]) were associated with increased likelihood of favorable neurological outcome at hospital discharge compared with no bystander CPR. When analyzed by patient age, survival in children 9 to 18 years of age more than doubled if the child received bystander CPR with or without dispatcher assistance. Children between 1 and 8 years of age had improved outcomes with unassisted bystander CPR but not with DA-CPR. In infants (<12 months of age), there was no difference in outcome between the bystander CPR and no bystander CPR groups.[17]

In a more recent study (between 2012 and 2015) of 2020 children with OHCA from the same Korean database, Chang and colleagues[13] examined the association of DA-CPR with survival to hospital discharge. They again noted the association of bystander CPR (versus no bystander CPR) with more than double the survival with favorable neurological function at hospital discharge, whether that bystander CPR was delivered with or without dispatcher assistance.

In the analysis of these 4 pediatric studies performed in the systematic review,[1] offering DA-CPR was not associated with significantly improved 1-month favorable neurological outcome but was associated with improved 1-month survival (OR, 1.46 [95% CI, 1.05–2.03]).[11] DA-CPR was also associated with significantly increased likelihood of bystander CPR and shortened time from arrest to delivery of CPR. For those patients who actually received bystander CPR, DA-CPR was associated with improved survival with favorable neurological outcome at 1 month compared with no bystander CPR (adjusted OR, 1.81 [95% CI, 1.23–2.67]).[11] However, as noted, patients in this large Japanese study who were offered DA-CPR were more likely to be infants, to have a presumed cardiac cause of arrest, and to have an unwitnessed arrest compared with those who were not offered DA-CPR. It is notable that the outcome of patients who received bystander DA-CPR was associated with a lower likelihood of favorable neurological outcome at 1 month after arrest (OR, 0.57 [95%, CI, 0.39–0.84]) compared with patients who received unassisted bystander CPR.

2019 Recommendations—New

There is no previous recommendation on this topic.

1. **We recommend that emergency medical dispatch centers offer DA-CPR instructions for presumed pediatric cardiac arrest (*Class 1; Level of Evidence C-LD*).**
2. **We recommend that emergency dispatchers provide CPR instructions for pediatric cardiac arrest when no bystander CPR is in progress (*Class 1; Level of Evidence C-LD*).**

There is insufficient evidence to make a recommendation for or against DA-CPR instructions for pediatric cardiac arrest when bystander CPR is already in progress.

Discussion

In making these recommendations, the writing group considered a number of factors influencing potential effectiveness of DA-CPR and bystander actions. Although the level and quality of evidence for DA-CPR in pediatric OHCA are low, we agreed with the ILCOR Pediatric Task Force that the likelihood of benefit from DA-CPR clearly outweighs the risk. Higher 1-month postarrest survival is associated with offered DA-CPR compared with arrests when DA-CPR was not offered.[11] In addition, there is an association with increased likelihood of secondary outcomes such as likelihood of bystander CPR and reduced time to CPR among systems offering DA-CPR.[1] The key point of these studies is that DA-CPR is associated with increased survival and the likelihood of bystander CPR. Bystander CPR, with or without dispatcher assistance, was associated with improved survival with favorable neurological outcome at hospital discharge[13] and at 1 month[11] compared with no CPR.

There is clear evidence that bystander CPR is an important positive prognostic factor in pediatric OHCA, and EMS systems that offer DA-CPR document higher bystander CPR rates. However, bystander CPR rates in pediatric OHCA, even with dispatcher assistance, remain low. More work needs to be done to improve bystander CPR rates for adults and children.[20–22]

The available evidence does not clarify the effect of the provision of DA-CPR when bystander CPR is already in progress. As noted, there is some low-quality (ie, observational/registry rather than randomized) evidence of an association between offering DA-CPR when bystander CPR is already in progress and worse 1-month neurological outcomes in pediatric patients with cardiac arrest. More research is needed to identify the reasons

for this finding. It is possible that most bystanders who begin CPR independently (ie, even before dispatcher instructions are offered) are trained and may be proficient in CPR, so the CPR provided may be of higher quality than that delivered by an untrained bystander after dispatcher instructions. The writing group weighed the association of potential harm (ie, worse 1-month neurological outcomes) with offering DA-CPR when bystander CPR was in progress, as well as the potential harm that could result by failing to offer DA-CPR when needed, and determined that there was insufficient evidence to support a recommendation at this time.

The writing group also recognizes that the data for this recommendation come from registry data from 2 very different EMS systems (Korea and Japan). Differences in how these EMS systems function may confound more global recommendations.

This review did not examine the content of the CPR instructions provided by dispatchers delivering DA-CPR. In the pediatric studies reviewed, the instructions provided by the dispatcher varied according to presumed bystander CPR skill level, cause of the arrest, and the patient's age. Only 1 study systematically examined the effects of the method of CPR suggested by dispatchers, with an improvement in favorable neurological outcome at 1 month associated with conventional CPR versus chest compression–only CPR.[11] Current AHA PBLS guidelines recommend that conventional CPR be provided for infants and children in cardiac arrest.[7] The current guidelines also recommend that if rescuers are unable or unwilling to provide rescue breaths for pediatric arrest, then they should provide compression-only CPR. Given the importance of conventional CPR in pediatric cardiac arrest, more research is needed to determine the quality and content of dispatcher-assisted conventional CPR and the outcomes of patients receiving dispatcher-assisted conventional CPR compared with dispatcher-assisted chest compression–only CPR. Finally, additional research is needed to determine if and when dispatchers should offer CPR instructions when bystander CPR is already in progress.

ARTICLE INFORMATION

The American Heart Association and the American Academy of Pediatrics make 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 document 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.

The American Heart Association requests that this document be cited as follows: Duff JP, Topjian AA, Berg MD, Chan M, Haskell SE, Joyner BL Jr, Lasa JJ, Ley SJ, Raymond TT, Sutton RM, Hazinski MF, Atkins DL. 2019 American Heart Association focused update on pediatric basic life support: an update to the American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 2019;140:e915–e921. doi: 10.1161/CIR.0000000000000736.

This article has been reprinted in *Pediatrics*.

Disclosures

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
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(*Continued*)

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Tia T. Raymond	Medical City Children's Hospital	NIH R01 (OPTI-VENT [Optimized and Personalized Ventilation to Improve Pediatric Cardiac Arrest Outcomes], Studies in Neonatal and Pediatric Resuscitation)*; NIH R03 (The Impact on Outcomes of Emergency Medications at the Bedside in Pediatric Cardiac Intensive Care Unit Patients)*	None	None	None	None	None	None
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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 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

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*Significant.

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