2017 American Heart Association Focused Update on Adult Basic Life Support and Cardiopulmonary Resuscitation Quality

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

ABSTRACT: Cardiopulmonary resuscitation is a lifesaving technique for victims of sudden cardiac arrest. Despite advances in resuscitation science, basic life support remains a critical factor in determining outcomes. The American Heart Association recommendations for adult basic life support incorporate the most recently published evidence and serve as the basis for education and training for laypeople and healthcare providers who perform cardiopulmonary resuscitation.

Monica E. Kleinman, MD, Chair
Zachary D. Goldberger, MD, MSc, FAHA
Thomas Rea, MD, MPH
Robert A. Swor, DO
Bentley J. Bobrow, MD, FAHA
Erin E. Brennan, MD, MMEd
Mark Terry, MPA, NRP
Robin Hemphill, MD, MPH
Raúl J. Gazmuri, MD, PhD
Mary Fran Hazinski, MSN, RN, FAHA
Andrew H. Travers, MD, MSc

In 2015, the American Heart Association (AHA) published the "2015 AHA Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" including recommendations for adult basic life support (BLS) and cardiopulmonary resuscitation (CPR) quality.[1] That guidelines update was based on the "2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations" (CoSTR) developed by the International Liaison Committee on Resuscitation (ILCOR).[2] As planned, ILCOR is now transitioning to a process of continuous evidence evaluation, with the intent to issue updated systematic reviews and CoSTR statements when prompted by the publication of new evidence. A description of the evidence review process and a glossary of terms are available in the 2017 BLS CoSTR summary.[3] When indicated, the AHA will publish focused updates for guidelines related to the areas reviewed by ILCOR.

The first topics selected by ILCOR as part of the continuous evidence evaluation process are related to BLS, including dispatch-assisted CPR, the use of continuous versus interrupted chest compressions by emergency medical services (EMS) providers, and the use of chest compression–only (hands-only) CPR versus CPR using chest compressions with ventilation in both the in-hospital and out-of-hospital settings. The evidence evaluated included studies used to support the 2015 CoSTR[2] and new literature published since 2015.

It is important to note that this focused update covers only those topics addressed by ILCOR's new continuous evidence evaluation process as of 2017. The ILCOR systematic reviews use the Grading of Recommendations Assessment, Development, and Evaluation methodology and its associated nomenclature for strength of recommendation and level of evidence. The expert writing group for this adult BLS–focused update reviewed the studies cited in the 2017 BLS CoSTR summary[3] and carefully considered the ILCOR consensus recommendations in light of the structure and resources of the out-of-hospital and in-hospital resuscitation systems that use AHA guidelines. In addition, the writing group determined classes of recommendation and levels of evidence according to the most recent report by the American College of Cardiology/AHA on clinical practice guidelines (Table)[4] by using the process detailed in part 2 of the 2015 guidelines update.[5] All other recommendations and algorithms published in the 2015 guidelines update[1] and the "2010

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Table. ACC/AHA Recommendation System: 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

CLASS I (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

CLASS IIa (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

CLASS IIb (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

CLASS III: No Benefit (MODERATE) — **Benefit = Risk**
(Generally, LOE A or B use only)

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

CLASS III: 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 (QUALITY) OF EVIDENCE‡

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

LEVEL B-R (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

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

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

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 I and IIa; 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.

American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care"[6] remain the official recommendations of the AHA Emergency Cardiovascular Care Science Subcommittee and writing groups.

Recommendations for each topic addressed in this adult BLS–focused update are classified as follows:

1. Unchanged recommendations
2. Updated recommendations (may be updated in wording, class, level of evidence, or any combination of these)

At the request of the AHA Training Network, we have also clarified the descriptions of lay rescuers as follows:

1. Untrained
2. Trained in chest compression–only CPR

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3. Trained in CPR using chest compressions and ventilation (rescue breaths)

DISPATCH-ASSISTED CPR

The 2017 BLS CoSTR summary[3] and systematic review considered instructions for dispatch-assisted chest compression–only CPR for out-of-hospital cardiac arrest (OHCA).

2017 Summary of Evidence

No new studies were reviewed for this topic.

2017 Recommendation—Updated

1. **We recommend that when dispatchers' instructions are needed, dispatchers should provide chest compression–only CPR instructions to callers for adults with suspected OHCA (*Class I; Level of Evidence C-LD*).**

BYSTANDER CPR

The 2017 BLS CoSTR summary[3] and systematic review compared bystander use of chest compression–only CPR with CPR using chest compressions and ventilation (rescue breaths).

2017 Summary of Evidence

Iwami et al[7] examined the influence of Japan's nationwide dissemination of recommendations for continuous chest compression CPR for lay rescuers, including dispatcher-assisted CPR, at a time when CPR guidelines recommended compressions plus ventilation (rescue breaths) at a ratio of 30 compressions to 2 breaths. The unadjusted analysis showed that nationwide the intervention was associated with improved bystander CPR rates and increased survival. However, in an unadjusted analysis of crude data, patients receiving continuous chest compressions had a lower rate of return of spontaneous circulation (odds ratio, 0.80; 95% confidence interval [CI], 0.78–0.82), worse 1-month survival (odds ratio, 0.75; 95% CI, 0.73–0.78), and worse 1-month survival with good neurological outcome (odds ratio, 0.72; 95% CI, 0.69–0.76) compared with those receiving CPR using a ratio of 30 compressions to 2 breaths.

2017 Recommendations—Updated

1. **For adults in OHCA, untrained lay rescuers should provide chest compression–only CPR with or without dispatcher assistance (*Class I; Level of Evidence C-LD*).**
2. **For lay rescuers trained in chest compression–only CPR, we recommend they provide chest compression–only CPR for adults in OHCA (*Class I; Level of Evidence C-LD*).**
3. **For lay rescuers trained in CPR using chest compressions and ventilation (rescue breaths), it is reasonable to provide ventilation (rescue breaths) in addition to chest compressions for the adult in OHCA (*Class IIa; Level of Evidence C-LD*).**

EMS-DELIVERED CPR

The 2017 BLS CoSTR summary[3] and systematic review considered the use of interrupted versus continuous chest compressions when EMS providers performed CPR using chest compressions and ventilation before placement of an advanced airway.

2017 Summary of Evidence

The Resuscitation Outcomes Consortium conducted a cluster-randomized crossover trial of adults with EMS-treated nontraumatic, nonasphyxial cardiac arrest.[8] All patients received positive-pressure ventilation during CPR before placement of an advanced airway (supraglottic airway or tracheal tube). In the intervention group, chest compressions were provided continuously and ventilation was delivered asynchronously at a rate of 10 breaths per minute without pausing chest compressions. In the control group, chest compressions were interrupted for ventilation at a ratio of 30 compressions to 2 breaths. The study analyzed 23711 adults with cardiac arrest using a primary outcome of survival to hospital discharge. Overall, there was no significant difference in outcome between patients in the intervention group and those in the control group, with survival to discharge of 9.0% and 9.7%, respectively (adjusted difference, –0.7; 95% CI, –1.5 to 0.1; *P*=0.07). Likewise, there was no difference in survival with good neurological outcome (7.0% versus 7.7%; adjusted difference, –0.6; 95% CI, –1.4 to 0.1; *P*=0.09).

2017 Recommendations—Updated

1. **We recommend that before placement of an advanced airway (supraglottic airway or tracheal tube), EMS providers perform CPR with cycles of 30 compressions and 2 breaths (*Class IIa; Level of Evidence B-R*). As an alternative, it is reasonable for EMS providers to perform CPR in cycles of 30 compressions with 2 breaths without interrupting chest compressions to give breaths (*Class IIa; Level of Evidence B-R*). It may be reasonable for EMS providers to use a rate of 10 breaths per minute (1 breath every 6**

seconds) to provide asynchronous ventilation during continuous chest compressions before placement of an advanced airway (*Class IIb; Level of Evidence C-LD*).

2. **These updated recommendations do not preclude the 2015 recommendation that a reasonable alternative for EMS systems that have adopted bundles of care is the initial use of minimally interrupted chest compressions (ie, delayed ventilation) for witnessed shockable OHCA (*Class IIb; Level of Evidence C-LD*).**

CPR FOR CARDIAC ARREST

The 2017 BLS CoSTR summary[3] and systematic review considered the use of continuous versus interrupted chest compressions after placement of an advanced airway in the hospital setting.

2017 Summary of Evidence

No new studies were reviewed for this topic.

2017 Recommendations—Updated

1. **Whenever an advanced airway (tracheal tube or supraglottic device) is inserted during CPR, it may be reasonable for providers to perform continuous compressions with positive-pressure ventilation delivered without pausing chest compressions (*Class IIb; Level of Evidence C-LD*). It may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths per minute) while continuous chest compressions are being performed (*Class IIb; Level of Evidence C-LD*).**

CHEST COMPRESSION–TO–VENTILATION RATIO

The 2017 BLS CoSTR summary[3] and systematic review considered the compression-to-ventilation ratio for adult BLS.

2017 Summary of Evidence

No new studies were reviewed for this topic.

2017 Recommendation—Updated

1. **It is reasonable for rescuers trained in CPR using chest compressions and ventilation (rescue breaths) to provide a compression-to-ventilation ratio of 30:2 for adults in cardiac arrest (*Class IIa; Level of Evidence C-LD*).**

2017 Focused Update: Adult BLS Recommendations

Year Last Reviewed	Topic	Recommendation	Comments
2017	Dispatch-assisted CPR	We recommend that when dispatchers' instructions are needed, dispatchers should provide chest compression–only CPR instructions to callers for adults with suspected OHCA (*Class I; Level of Evidence C-LD*).	Updated for 2017
2017	Bystander CPR: untrained lay rescuer	For adults in OHCA, untrained lay rescuers should provide chest compression–only CPR with or without dispatcher assistance (*Class I; Level of Evidence C-LD*).	Updated for 2017
2017	Bystander CPR: lay rescuer trained in chest compression–only CPR	For lay rescuers trained in chest compression–only CPR, we recommend they provide chest compression–only CPR for adults in OHCA (*Class I; Level of Evidence C-LD*).	Updated for 2017
2017	Bystander CPR: lay rescuers trained in CPR using chest compressions and ventilation (rescue breaths)	For lay rescuers trained in CPR using chest compressions and ventilation (rescue breaths), it is reasonable to provide ventilation (rescue breaths) in addition to chest compressions for the adult in OHCA (*Class IIa; Level of Evidence C-LD*).	Updated for 2017
2017	EMS-delivered CPR focus on chest compression–to–ventilation ratios	We recommend that before placement of an advanced airway (supraglottic airway or tracheal tube), EMS providers perform CPR with cycles of 30 compressions and 2 breaths (*Class IIa; Level of Evidence B-R*).	Updated for 2017
2017	EMS-delivered CPR focus on chest compression–to–ventilation ratios	As an alternative, it is reasonable for EMS providers to perform CPR in cycles of 30 compressions with 2 breaths without interrupting chest compressions to give breaths (*Class IIa; Level of Evidence B-R*).	Updated for 2017
2017	EMS-delivered CPR focus on chest compression–to–ventilation ratios	It may be reasonable for EMS providers to use a rate of 10 breaths per min (1 breath every 6 s) to provide asynchronous ventilation during continuous chest compressions before placement of an advanced airway (*Class IIb; Level of Evidence C-LD*).	Updated for 2017
2017	EMS-delivered CPR focus on chest compression–to–ventilation ratios	These updated recommendations do not preclude the 2015 recommendation that a reasonable alternative for EMS systems that have adopted bundles of care is the initial use of minimally interrupted chest compressions (ie, delayed ventilation) for witnessed shockable OHCA (*Class IIb; Level of Evidence C-LD*).	Updated for 2017

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2017 Focused Update: Adult BLS Recommendations (Continued)

Year Last Reviewed	Topic	Recommendation	Comments
2017	CPR for cardiac arrest with an advanced airway	Whenever an advanced airway (tracheal tube or supraglottic device) is inserted during CPR, it may be reasonable for providers to perform continuous compressions with positive-pressure ventilation delivered without pausing chest compressions (*Class IIb; Level of Evidence C-LD*).	Updated for 2017
2017	CPR for cardiac arrest with an advanced airway	After placement of an advanced airway, it may be reasonable for the provider to deliver 1 breath every 6 s (10 breaths per min) while continuous chest compressions are being performed (*Class IIb; Level of Evidence C-LD*).	Unchanged for 2017
2017	Chest compression–to–ventilation ratio	It is reasonable for rescuers trained in CPR using chest compressions and ventilation (rescue breaths) to provide a compression-to-ventilation ratio of 30:2 for adults in cardiac arrest (*Class IIa; Level of Evidence C-LD*).	Updated for 2017

BLS indicates basic life support; CPR, cardiopulmonary resuscitation; EMS, emergency medical services; and OHCA, out-of-hospital cardiac arrest.

FOOTNOTES

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 focused update was approved by the American Heart Association Science Advisory and Coordinating Committee on September 15, 2017, and the American Heart Association Executive Committee on October 9, 2017. A copy of the document is available at http://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.

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DISCLOSURES

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Monica E. Kleinman	Children's Hospital Boston	None	None	None	None	None	None	None
Erin E. Brennan	Kingston Resuscitation Institute (research grant in CPR education)*	None	None	None	None	None	None	None
Bentley J. Bobrow	Arizona Department of Health Services	None	None	None	None	None	None	None

(*Continued*)

Writing Group Disclosures Continued

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Raúl J. Gazmuri	Rosalind Franklin University of Medicine and Science	DePaul-Rosalind Franklin University Collaborative Pilot Research Grant Program (basic science research; study mechanisms by which cyclophilin-D modulates transcription of mitochondrial genes)†; James R. & Helen D. Russell Institute for Research & Innovation: Small Research Grants Program (basic science research; prevention of oxidative injury to the neonatal heart)*; Department of Defense US Army Medical Research and Material Command (translational research: sustained V1A receptor activation for prolonged hemodynamic support and neurological protection after noncompressible hemorrhage and traumatic brain injury)†; Zoll Medical Corp (translational research: AMSA to guide shock delivery in a swine model of ventricular fibrillation and closed chest resuscitation)†	None	None	None	None	None	None
Zachary D. Goldberger	University of Washington	None	None	None	None	None	None	None
Mary Fran Hazinski	Vanderbilt University	None	None	None	None	None	American Heart Association ECC†	None
Robin Hemphill	Veterans Health Administration	None	None	None	None	None	None	None
Thomas Rea	University of Washington	None	None	None	None	None	None	None
Robert A. Swor	William Beaumont Hospital	None	None	None	None	None	None	None
Mark Terry	Johnson County MED-ACT	None	None	None	None	None	None	None
Andrew H. Travers	Emergency Health Services, Nova Scotia (Canada)	None	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, 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

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Lorrel E. Brown	University of Louisville	None	None	None	None	None	None	None
Tomas Drabek	University of Pittsburgh	None	None	None	None	None	None	None
Judith Finn	Curtin University (Australia)	NHMRC (director of the Australian Resuscitation Outcomes Consortium [Aus-ROC], an NHMRC Centre of Research Excellence)*	None	None	None	None	None	None

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Fredrik Folke	Gentofte University Hospital, Hellerup (Denmark)	None	None	None	None	None	None	None
Guillaume Geri	Ambroise Paré Hospital (France)	None	None	None	None	None	None	None
James T. Niemann	Harbor–UCLA Medical Center	None	None	None	None	None	None	None

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.

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