2025 ILCOR Statement

2025 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations

Adult Basic Life Support

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ABSTRACT

The International Liaison Committee on Resuscitation conducts continuous review of new, peer-reviewed published cardiopulmonary resuscitation science, and publishes more comprehensive reviews every 5 years. The Basic Life Support Task Force chapter of the *2025 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations* addressed all published resuscitation evidence reviewed by the Basic Life Support Task Force science experts since 2020. Topics addressed by systematic reviews in the last year include chest compression–only cardiopulmonary resuscitation, starting cardiopulmonary resuscitation with compressions or airway and breathing, chest compression and ventilation ratios, durations of cardiopulmonary resuscitation cycles, hand positioning during compressions, head-up cardiopulmonary resuscitation, ventilation feedback devices, and pad and paddle size and placement. Members from the Basic Life Support Task Force have assessed, discussed, and debated the quality of the evidence, based on Grading of Recommendations Assessment, Development, and Evaluation criteria, and their statements include consensus treatment recommendations. Insights into the deliberations of the task force are provided in the Justification and Evidence to Decision Framework Highlights sections. In addition, the task force lists priority knowledge gaps for further research.

Key words: Heart arrest; resuscitation; basic life support; cardiopulmonary resuscitation; defibrillation; automatic external defibrillators; drowning; obesity

INTRODUCTION

This is the International Liaison Committee on Resuscitation (ILCOR) Basic Life Support (BLS) Task Force *2025 International Consensus on Cardiopulmonary Resuscitation* (CPR) *and Emergency Cardiovascular Care Science With Treatment Recommendations* (CoSTR). All reviews conducted by the BLS Task Force in the last 12 months are included; reviews conducted and published since the 2020 publication are also summarized to provide a single reference document for readers. The BLS Task Force work presented here encompasses 33 questions reviewed in some capacity, including 22 systematic reviews (SysRevs). Draft CoSTRs for all topics evaluated with SysRevs were posted on a rolling basis on the ILCOR website.[1] Each draft CoSTR includes the data reviewed and draft treatment recommendations, with public comments accepted for 2 weeks after posting. The task force considered public feedback and provided responses. All CoSTRs are now available online, adding to the existing CoSTR statements.

Although only SysRevs can generate a full CoSTR and new treatment recommendations, many other topics were evaluated with more streamlined processes, including scoping reviews (ScopRevs) and evidence updates (EvUps). Good practice statements, which represent the expert opinion of the task force in light of very limited or no direct evidence, can be generated after ScopRevs and occasionally after EvUps in cases where the task force thinks providing guidance is especially important. A separate article in this issue includes the full details of the evidence evaluation process.[2]

This summary statement contains the final wording of the treatment recommendations and good practice statements as approved by the ILCOR BLS Task Force as well as summaries of the key evidence identified. SysRevs include evidence-to-decision highlights and knowledge gaps, and ScopRevs summarize Task Force insights on specific topics and include evidence-to-decision highlights if good practice statements are generated. Links to the published reviews and full online CoSTRs are provided in the corresponding sections. Evidence-to-decision tables for SysRevs are provided in Appendix A, and the complete EvUp worksheets are provided in Appendix B. A summary of treatment recommendation changes and knowledge gaps is provided in Appendix C.

Most topics are presented using the population, intervention, comparator, outcomes, study design, and time frame (PICOST) format. To minimize redundancy, the study designs have been removed from the text except in cases where the designs differed from the BLS standard criteria. The standard study designs included are randomized clinical trials (RCTs) and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, and cohort studies) were eligible for inclusion. Case series, case reports, animal studies, and unpublished studies (conference abstracts, trial protocols) were excluded. All languages were included, provided there was an English abstract.

Two nodal reviews that included the BLS Task Force can be found in other CoSTR sections (Family Presence During Resuscitation[3] and Resuscitation of Durable Mechanical Circulatory Supported Patients[4]). The following topics are addressed in this BLS Task Force CoSTR:

- CPR by rescuers wearing personal protective equipment (BLS 2003: SysRev 2023, EvUp 2025)
- Bystander (without dispatcher-assisted instructions) chest compression–only CPR versus conventional CPR (BLS 2100: SysRev 2025)
- Optimization of dispatcher-assisted recognition (BLS 2102: ScopRev 2024, EvUp 2025)
- Optimization of dispatcher-assisted CPR (BLS 2113: ScopRev 2024, EvUp 2025)

- Dispatcher-assisted chest compression–only CPR versus conventional CPR (BLS 2112: SysRev 2025)
- Optimization of dispatcher-assisted automated external defibrillator (AED) retrieval and use (BLS 2120: ScopRev 2024)
- Drone AED delivery (BLS 2122: ScopRev, 2023 CoSTR summary; EvUp 2025)
- AED accessibility: locked cabinets (BLS 2123: ScopRev 2025)
- Starting CPR (compressions-airway-breathing [CAB] versus airway-breathing-compressions [ABC]) (BLS 2201: SysRev 2025)
- Compression-ventilation ratio (BLS 2202: SysRev 2025)
- Duration of CPR cycles (BLS 2212: SysRev 2025)
- Emergency medical services (EMS) chest compression–only CPR versus conventional CPR (BLS 2221: SysRev 2025)
- In-hospital chest compression–only CPR versus conventional CPR (BLS 2222: SysRev 2025)
- Hand position during compressions (BLS 2502: SysRev 2025)
- Head-up CPR (BLS 2503: SysRev 2025)
- Minimizing pauses in compressions (BLS 2504: SysRev 2022, EvUp 2025)
- Optimal surface for CPR (BLS 2510: SysRev 2024)
- Feedback for CPR quality (BLS 2511: ScopRev 2024)
- Passive ventilation techniques (BLS 2403: SysRev 2022, EvUp 2025)
- Real-time ventilation quality feedback devices (BLS 2402: ScopRev 2025)
- Paddle/pad size and placement in adults (BLS 2601: SysRev 2025)
- Removal of bra prior to defibrillation (BLS 2604: ScopRev 2025)

- Effectiveness of ultraportable/pocket AEDs (BLS 2603: ScopRev 2025)
- Immediate resuscitation in water or on boat in drowning (BLS 2702/2703: ScopRev 2021, SysRev 2023, EvUp 2025)
- Starting CPR (CAB versus ABC) in drowning (BLS 2704: ScopRev 2023, SysRev 2024, EvUp 2025)
- Chest-compression-only CPR in drowning (BLS 2705: ScopRev 2023, SysRev 2024, EvUp 2025)
- Ventilation equipment in cardiac arrest following drowning (BLS 2706: ScopRev 2023, SysRev 2024, EvUp 2025)
- Prehospital oxygen administration following drowning (BLS 2707: SysRev 2023, EvUp 2025)
- AED use versus CPR first in drowning (BLS 2708: ScopRev 2023, SysRev 2024, EvUp 2025)
- Public access defibrillation (PAD) programs for drowning (BLS 2709: SysRev 2023, EvUp 2025)
- CPR during transport (BLS 2715: SysRev 2022, EvUp 2025)
- CPR in obese patients (BLS 2720: ScopRev 2025)

Readers are encouraged to monitor the ILCOR website[1] to provide feedback on planned SysRevs and to provide comments when additional draft reviews are posted.

Safety and Prevention

CPR by Rescuers Wearing Personal Protective Equipment (BLS 2003: SysRev 2023, EvUp 2025)

A 2023 SysRev and 2025 EvUp examined the impact of rescuers wearing personal protective equipment on patient and CPR outcomes. The details of this review can be found in the SysRev,[5] the 2023 CoSTR summary[6,7] and on the ILCOR website.[8] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest (including simulated cardiac arrest)
- Intervention: CPR by rescuers wearing personal protective equipment
- Comparator: CPR by rescuers not wearing personal protective equipment
- Outcomes:
  - Critical: Survival to discharge, return of spontaneous circulation (ROSC)
  - Important: CPR quality, time to the procedure of interest, and rescuer's fatigue and neuropsychiatric performance such as concentration and dexterity
- Time frame: May 23, 2022, to August 9, 2024

Summary of Evidence

The EvUp identified 4 additional studies.[9-12] Because the new evidence does not alter the current treatment recommendations, an update to the existing SysRev is not warranted.

Treatment Recommendations (2023)

We recommend monitoring for fatigue in all rescuers performing CPR (good practice statement).

We suggest increased vigilance for fatigue in rescuers wearing personal protective equipment (weak recommendation, very low–certainty evidence).

Recognition and Early Access

Bystander Chest Compression-Only CPR (Without Dispatcher Assistance) (BLS 2100, SysRev 2025)

Rationale for Review

The previous SysRev[13] and existing ILCOR treatment recommendation were first published in 2017.[14,15] This topic was prioritized because it had not been reviewed since 2017. The SysRev[16] was registered on Prospective Register of Systematic Reviews (PROSPERO) (CRD42024559318), and the full CoSTR for adults can be found on the ILCOR website.[17] To inform the provision of immediate bystander CPR, it was decided to examine this question without cases where dispatcher-assisted CPR (DA-CPR) instructions were provided. Four studies that included cases with DA-CPR and were previously included in this CoSTR[18-21] have been moved to the DA-CPR CoSTR.

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: Chest compression–only CPR without dispatcher assistance
- Comparator: Conventional CPR with compressions and ventilations without dispatcher-assistance
- Outcomes:
    - Critical: Favorable neurological survival (as measured by Cerebral Performance Category [CPC] or modified Rankin Scale [mRS]) at discharge or 30 days and at any time interval after 30 days

    - Important: survival to discharge or 30 days, survival to hospital admission, survival to any time interval after discharge or 30 days survival, ROSC, quality of life as measured by any indicator or score
- Study design: In addition to standard criteria, observational studies that reported only unadjusted data were excluded.
- Time frame: Because the search terms were revised,[17] the search was all years to October 21, 2024.

Consensus on Science

No new studies that directly addressed this topic were found. The evidence remains 3 observational studies that compared bystander chest compression–only CPR with conventional CPR at a ratio of 15:2[22,23] and 30:2[24] in adults without DA-CPR instructions. Because 15:2 CPR is no longer recommended, all outcomes with these studies were downgraded for indirectness. No data was available from the included studies for the outcome of favorable neurological survival. Data for this outcome is drawn from a study of combined bystander-only and DA-CPR with a high prevalence of bystander-only CPR.[19] The evidence is summarized in Table 1.

Treatment Recommendations (2025, Unchanged From 2017)

We recommend that chest compressions be performed for all adults in cardiac arrest (good practice statement).

We suggest that bystanders who are trained, able, and willing, give chest compressions with rescue breaths for adults in cardiac arrest (weak recommendation, very low–certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is included in Appendix A.

In making these recommendations, the task force acknowledged the very low–certainty evidence in comparison with 15:2 CPR but placed greater emphasis on the need to give chest compressions in adult CPR and the potential to increase rates of bystander CPR with chest compression–only CPR or compression-focused CPR in adults.[20,25-27] The task force also considered the following:

- The existing evidence suggests chest compression–only CPR is comparable to 15:2 CPR in adults. Given the included studies were conducted without dispatcher assistance, it could be assumed that the CPR was performed by CPR-trained individuals or off-duty health care professionals.
- Three additional studies reported no difference in unadjusted patient outcomes between chest compression–only CPR and conventional CPR.[28-30] One of these studies, conducted in the 1980s, examined the impact of CPR quality. Using combined objective and subjective measures, this study reported higher unadjusted survival when 15:2 was performed correctly (good technique and effect), compared with incorrectly (31% versus 8%) or when compared with chest compression–only CPR (31% versus 20%).[30] Rates of correctly applied 15:2 were higher in bystanders who were health care professionals than in lay bystanders (58% versus 42%).[30]
- A pilot RCT, including high rates of DA-CPR, showed no difference in survival at 1-day between chest compression–only CPR and conventional CPR when delivered by trained laypersons.[31]
- Chest compression–only CPR is preferred by the public[32,33] and easier to learn and recall.
- A literature review reported that chest compression–only CPR results in a shorter time to initiate CPR and a higher total number of chest compressions.[34] However, as it continues,

rescuers may experience fatigue, which can reduce the depth of compressions compared with those delivered in conventional CPR with pauses for breaths.[34]

- Opening the airway and delivering ventilations are technical skills, and bystanders, especially if untrained or minimally trained, are typically unable to deliver effective ventilations during simulated CPR.[35]
- Both types of CPR are better than no CPR, and both should be taught in BLS/CPR training.

Knowledge Gaps

- The effect on outcomes of chest compression–only CPR compared with 30:2 CPR without dispatcher assistance
- Data in children are needed.

Table 1. The Evidence Comparing Chest Compression–Only CPR With Conventional CPR Without Dispatcher Assistance

Outcome (certainty of evidence)	Studies and patients	Results
Favorable neurological function (very low–certainty of evidence)	No studies without dispatcher assistance 1 cohort study of combined bystander (76% of cases) and DA-CPR (24% of cases) (4068 adult bystander-witnessed OHCAs)[19]	CCO-CPR, compared with 15:2 CPR, was associated with favorable neurological function (aOR, 2.22 [95% CI, 1.17–4.21])
Survival to hospital discharge or 30 days (very low–certainty of evidence)	3 observational studies: 1 in adults[24] and 2 in all ages[22,23]	Adult study: higher survival to hospital discharge with CCO-CPR compared with 30:2 CPR (aOR, 1.60 [95% CI, 1.08–2.35])[24] All-age studies: no difference in survival to 30 days (aOR, 1.18 [95% CI, 0.89–1.56])[23] or hospital discharge (aOR, 1.32 [95% CI, 0.35–4.94])[22] with CCO-CPR compared with 15:2 CPR
Survival to hospital admission (very low–certainty of evidence)	1 observational study in all ages[23]	No difference with CCO-CPR compared with 15:2 CPR (aOR, 1.03 [95% CI, 0.86–1.23])
ROSC (very low–certainty of evidence)	1 observational study in all ages[22]	No difference with CCO-CPR compared with 15:2 CPR (aOR, 1.02 [95% CI, 0.60–1.73])

aOR indicates adjusted odds ratio; C-CPR, conventional CPR; CCO-CPR indicates chest compression–only CPR; CPR, cardiopulmonary resuscitation; DA-CPR, dispatcher-assisted CPR; OHCA, out-of-hospital cardiac arrest; and ROSC, return of spontaneous circulation.

Optimization of Dispatcher-Assisted Recognition of OHCA (BLS 2102: ScopRev 2024, EvUp 2025)

This topic was first reviewed in an ILCOR nodal SysRev in 2020,[36] with treatment recommendations for dispatcher-assisted recognition of out-of-hospital cardiac arrest (OHCA) published in the 2020 CoSTR.[37,38] In 2024, the BLS Task Force decided to conduct a ScopRev to examine the evidence for interventions aiming to optimize dispatcher-assisted recognition of OHCA), with an EvUp conducted in 2025. The details of this review can be found in the ScopRev,[39] the 2024 CoSTR summary,[40,41] and on the ILCOR website.[42] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children who are in cardiac arrest outside of a hospital
- Intervention: Factors and interventions that improve dispatcher-assisted recognition of cardiac arrest
- Outcomes: Dispatcher-assisted recognition of cardiac arrest
- Time frame: June 2, 2023, to November 4, 2024

Summary of Evidence

The EvUp identified 2 additional studies.[43,44] The new evidence provided by these studies does not warrant a new SysRev.

Treatment Recommendations (2020)

We recommend that dispatch centers implement a standardized algorithm and/or standardized criteria to immediately determine if a patient is in cardiac arrest at the time of emergency call (strong recommendation, very low–certainty evidence).

We suggest that dispatch centers monitor and track diagnostic capability (good practice statement).

We suggest that dispatch centers look for ways to optimize sensitivity (minimize false negatives) (good practice statement).

Optimization of Dispatcher-Assisted CPR (BLS 2113: ScopRev 2024, EvUp 2025)

This topic was last reviewed in an ILCOR nodal SysRev in 2019, with treatment recommendations for dispatcher-assisted recognition of OHCA published in the 2019 CoSTR summary.[45,46] In 2024, the BLS task force decided to conduct a ScopRev to examine the evidence for interventions to optimize DA-CPR instructions, with an EvUp conducted in 2025. The details of this review can be found in the ScopRev,[47] the 2024 CoSTR summary,[40,41] and on the ILCOR website.[48] The 2025 EvUp is provided in Appendix B).

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children with OHCA when DA-CPR is implemented
- Intervention: Interventions used in addition to DA-CPR
- Comparators: Nonmodified DA-CPR
- Outcomes: Any outcomes
- Time frame: May 17, 2023, to November 1, 2024

Summary of Evidence

The EvUp identified 9 additional studies.[49-57] The new evidence does not warrant a new SysRev.

Treatment Recommendations (2019 and 2024)

We recommend that emergency medical dispatch centers have systems in place to enable call handlers to provide CPR instructions for adult patients in cardiac arrest (strong recommendation, very low–certainty evidence).

We recommend that emergency medical dispatchers provide CPR instructions (when deemed necessary) for adult patients in cardiac arrest (strong recommendation, very low–certainty evidence).

The existing evidence did not support a good practice statement for interventions to improve DA-CPR instructions.

Dispatcher-Assisted Chest Compression–Only CPR (BLS 2112, SysRev 2025)

Rationale for Review

The previous SysRev[13] and existing ILCOR treatment recommendation were first published in 2017.[14,15] This topic was prioritized for a detailed review because it had not been reviewed since 2017. The SysRev[16] was registered on PROSPERO (CRD42024559318), and the full CoSTR can be found on the ILCOR website.[58]

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: Dispatcher-assisted chest compression–only CPR
- Comparators: Dispatcher-assisted conventional CPR with compressions and ventilations
- Study design: In addition to standard criteria, observational studies that reported only unadjusted data were excluded.
- Outcomes:

    - Critical: favorable neurological survival (as measured by CPC or mRS) at discharge or 30 days and at any time interval after 30 days
    - Important: survival to discharge or 30 days, survival to hospital admission, survival to any time interval after discharge or 30-days survival, ROSC, quality of life as measured by any indicator or score
- Time frame: Because the search terms were revised,[17] search was inception to October 21, 2024.

Consensus on Science

Four RCTs[31,59-61] and 6 observational studies[18,19,62-65] were identified that compared dispatcher-assisted chest compression–only CPR with conventional CPR at a ratio of 15:2 or 30:2 in adults or all ages, with or without bystander CPR ongoing at the time of the call. As 15:2 CPR is no longer recommended, all outcomes were downgraded for indirectness. The overall certainty of evidence was rated as low to very low for all outcomes, primarily due to a very serious risk of bias. Because of this and a high degree of heterogeneity, meta-analyses were not performed. The evidence is summarized in Table 2.

Treatment Recommendations (2025, Unchanged From 2017)

We recommend that dispatchers provide chest compression-only CPR instructions to callers for adults with suspected OHCA (strong recommendation, low-certainty of evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

In making these recommendations, the task force acknowledged the low-certainty evidence but strongly endorsed the 2020 CoSTR that all rescuers should perform chest compressions for all patients in cardiac arrest. The task force also considered the following:

- Bystander CPR more than doubles OHCA survival.[66] We placed a higher emphasis on the importance of providing high-quality chest compressions and increasing the overall rate of bystander CPR over providing rescue breaths.
- Increases in rates of bystander CPR and patient outcomes have been reported following the introduction of dispatcher-assisted chest compression–only CPR or compression-focused CPR in adults.[20,25-27] Using a chest compression–only CPR strategy may increase the willingness of bystanders to respond during a cardiac arrest.
- Most bystander CPR for adults is given with DA-CPR instructions, even in the presence of CPR-trained lay bystanders.[67]
- In making these recommendations, the task force took into consideration heterogeneity in the body of evidence, particularly related to implementation of DA-CPR. Despite this, most included studies suggested either a slight improvement in favor of dispatcher-assisted chest compression–only CPR or no difference in patient outcomes, regardless of patient population or comparison ratio.

Knowledge Gaps

- Studies in children
- The number of chest compressions that should be given, and for how long before ventilation instructions are introduced
- Whether resuscitation instructions should be modified in the context of different causes of arrest (eg, choking, drowning)
- The impact of prior CPR training

Table 2. The Evidence Comparing Dispatcher-Assisted Chest Compression–Only CPR With Conventional CPR

Outcome (certainty of evidence)	Studies and patients	Results
	1 adult RCT[59]	No difference compared with 15:2

Outcome (certainty of evidence)	Studies and patients	Results
Favorable neurological function (very low–certainty of evidence)	4 observational studies: 1 study included adult bystander-witnessed DA-CPR cases[62] and 3 studies examined combined bystander CPR and DA-CPR in adults[19,63] and all-age bystander-witnessed[65] cases	3 cohort studies of combined bystander and DA-CPR cases, reported higher odds with CCO-CPR compared with 15:2 (aOR, 2.22 [95% CI, 1.17–4.21])[19] or compared with combined 15:2 and 30:2 CPR (aOR, 1.12 [95% CI, 1.06–1.19])[65] 2 studies reported no difference compared with either 15:2[63] or 30:2[62]
Survival to hospital discharge or 30 days (very low–certainty of evidence)	3 adult RCTs[59-61]	No difference in survival to hospital discharge compared with 15:2
	5 observational studies: 2 all-ages,[64,65] 2 adults,[18,62] and 1 adult-witnesed[68]	1 reported higher odds with CCO-CPR compared with C-CPR of either 15:2 or 30:2 (aOR, 1.05 [95% CI, 1.01–1.10])[65] 2 reported lower odds with CCO-CPR compared with either 15:2 (aOR, 0.69 [95% CI, 0.53–0.90])[64] or 30:2 CPR (aOR, 0.72 [95% CI, 0.59, 0.88])[62] 2 studies reported no difference with DA CCO-CPR compared with either 15:2[18] or 30:2[68]
Survival to hospital admission (low-certainty of evidence)	4 RCTs: 3 adults[31,59,60] 1 all-age[61]	No difference with DA CCO-CPR compared with either 15:2[60,61] or 30:2[31]
ROSC (very low–certainty of evidence)	1 all-age observational study[65]	No difference compared with either 15:2 or 30:2 CPR

aOR indicates adjusted odds ratio; C-CPR, conventional CPR; CCO-CPR, chest compression–only CPR; CPR, cardiopulmonary resuscitation; DA, dispatcher-assisted; DA-CPR, dispatcher-assisted cardiopulmonary resuscitation; RCT, randomized control trial; ROSC, return of spontaneous circulation.

Optimization of Dispatcher-Assisted AED Retrieval and Use (BLS 2120: ScopRev 2024)

A 2024 ScopRev examined the evidence for a new BLS question on interventions to optimize dispatcher-assisted AED retrieval and use for OHCA. The details of this review can be found in the ScopRev,[69] the 2024 CoSTR summary,[40,41] and on the ILCOR website.[70]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children with OHCA
- Intervention: Dispatcher-assisted AED retrieval and use
- Outcomes: Any outcomes
- Time frame: All years to April 13, 2023

Treatment Recommendations (2024)

EMS implementing dispatcher-assisted public access AED systems should monitor and evaluate the effectiveness of their system (good practice statement).

Once a cardiac arrest is recognized during the emergency call and CPR has been started, dispatchers should ask if there is an AED (or defibrillator) immediately available at the scene and ask the caller to update them when one arrives (good practice statement).

If an AED is not immediately available and if there is more than 1 rescuer present, dispatchers should offer instructions to locate and retrieve an AED. Retrieval instructions should be supported, where resources allow, by up-to-date registries about public access AED locations and accessibility (good practice statement).

Once an AED is available, dispatchers should offer instructions on its use (good practice statement).

Drone Delivery of AEDs (BLS 2122: ScopRev 2023; EvUp 2025)

A ScopRev for 2023 and a 2025 EvUp examined the evidence on drone delivery of AEDs. The details of this review can be found in the ScopRev,[71] the 2023 CoSTR summary,[6,7] and on the ILCOR website.[72] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in OHCA
- Intervention: Drone-delivered AEDs
- Comparators: Standard EMS response times (or time for EMS-delivered AED), AEDs delivered by bystanders (or activated volunteer responders)
- Outcomes: Real-world/estimated feasibility, time gain of drone-delivered AEDs (compared with standard EMS delivery), predicted survival, predicted quality-adjusted life years gained, cost-effectiveness, and calculated proportion of defibrillation and

survival compared with cases where AEDs are brought to the OHCA scene by standard means

- Time frame: December 1, 2022, to August 6, 2024

Summary of Evidence

The EvUp identified 11 additional studies.[73-83] The new evidence does not warrant a new SysRev. There is no existing treatment recommendation on this topic, and the current evidence does not support a new one.

AED Accessibility (Locked Cabinets) (BLS 2123: ScopRev 2025)

Rationale for Review

Rapid defibrillation is critical to improving patient outcomes because each minute of delay in attempting defibrillation reduces the chances of survival and good functional outcomes.[84-86] Concerns about theft, vandalism, and misuse of AEDs have led to the use of security measures, including using locked cabinets, to house these devices in public areas.[87-89] Given the lack of a comprehensive review of this approach, this topic was prioritized for review by the BLS Task Force. The full details of this review can be found in the ScopRev[90] and on the ILCOR website.[91]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in out-of-hospital settings
- Concept: The benefits and harms of placing AEDs in locked cabinets versus unlocked cabinets
- Context: Any locations where an AED is placed with the intention of the AED being publicly accessible for use

- Outcomes: Any outcome, including AED outcomes (eg, AED use, time to AED use, AED vandalism or theft)
- Time frame: All years to June 25, 2024

Summary of Evidence

Ten reports were included: 7 observational studies reporting rates of theft and vandalism,[92-100] 1 survey reporting on harm to rescuers,[101] and 2 AED retrieval simulation studies.[92,93] Four studies were reported as conference abstracts[97-100] and 2 were letters to the editor.[94,96]

No study reported on the impact of locked AED cabinets on patient outcomes. Most studies reported low rates (<2%) of theft, missing AEDs, or vandalism and this occurred in locked and unlocked cabinets.[92-100] The only study comparing unlocked and locked cabinets showed minimal difference in theft and vandalism rates (0.3% versus 0.1%).[99] Two simulation studies showed significantly slower AED retrieval when additional security measures, including locked cabinets, were used.[92,93] A survey of first responders reported half (n=25/50) were injured while accessing an AED that required breaking glass to access.[101]

Task Force Insights

An evidence-to-decision table is provided in Appendix A.

- While acknowledging that most of the data identified has not undergone peer review and there may be publication bias, reported rates of AED theft and vandalism were low across all studies, and thefts occurred in both locked and unlocked cabinets. AEDs reported as stolen may have been used in an emergency and not returned.
- To ensure EMS is activated for OHCAs, some systems use cabinets locked with a code obtained by calling EMS.[102] However, this may cause delays, particularly if a telephone is not readily available, and its impact requires further study.[103]

- The cost to replace stolen or vandalized AEDs may be a challenge in low-resource settings (eg, community groups with limited funding).
- We agree with the 2022 ILCOR scientific statement, which focuses on optimizing public access defibrillation and advises against using locked cabinets.[104,105] If locked cabinets are used, instructions for unlocking them need to be clear and ensure no delays in access.

Treatment Recommendations

We advise against using locked cabinets for public access defibrillator storage (good practice statement).

If locked cabinets are used for public access defibrillator storage, instructions for unlocking them must be clear and ensure minimal delays in access (good practice statement).

Emergency medical services should devise strategies to return public access defibrillators when used (good practice statement).

Knowledge Gaps

Peer-reviewed research and human studies on this topic, particularly studies focusing on real-life retrieval and the impact of security strategies on delivery times and patient outcomes

BLS SEQUENCE

Starting CPR (CAB Versus ABC) in Adults (BLS 2201, SysRev 2025)

Rationale for Review

This was a nodal review with BLS and the Pediatric Life Support (PLS) Task Forces. The existing ILCOR treatment recommendation was last updated in 2020.[37,38] This topic was prioritized for a detailed nodal review because only EvUps had been done since 2020. The pediatric CoSTR, treatment recommendations, and evidence-to-decision table are reported on the

ILCOR website[106] and in the PLS CoSTR section.[107] The SysRev[108] was registered on PROSPERO (CRD42024583890), and the full CoSTR can be found on the ILCOR website.[109]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: Commencing CPR with compressions first (30:2)
- Comparator: Commencing CPR with ventilations first (2:30)
- Outcomes:
    - Critical: Survival with favorable neurological outcome at hospital discharge or 30 days, survival at hospital discharge or 30 days, survival with favorable neurological outcome to 1 year, survival to 1 year, event survival, any ROSC
    - Important: Time to commencement of rescue breaths, time to commencement of first compression, time to completion of first CPR cycle, ventilation rate, compression rate, chest compression fraction, minute ventilation
- Time frame: Because the search terms were revised, the search included all years to June 18, 2024.

Consensus on Science

One new pediatric manikin simulation study[110] (published with corrections[111]), in addition to the 4 manikin simulation studies[112-115] found in the previous ILCOR reviews,[37,38,116,117] were identified. Of the 5 manikin studies, 3 were randomized studies (1 in adult[114] and 2 in pediatric resuscitation[110,113]), and 2 were observational studies in adult resuscitation.[112,115]

No human studies were identified. Evidence was very low certainty for all outcomes, downgraded for very serious risk of bias and indirectness. Because of this and a high degree of heterogeneity, no meta-analyses could be performed, and individual studies are difficult to interpret. This evidence from the manikin studies is summarized in Table 3.

Prior Treatment Recommendations (2020)

We suggest commencing CPR with compressions rather than ventilations (weak recommendation, very low–certainty evidence).

Treatment Recommendations (2025)

The 2025 treatment recommendation in adults is unchanged from 2020. The pediatric treatment recommendation is reported in the PLS CoSTR section.[107]

In adults in cardiac arrest, we suggest commencing CPR with compressions rather than ventilations (weak recommendation, very low–certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

Please see the PLS section for evidence-to-decision highlights for children. In making these recommendations for adults, the task forces considered the following:

Most of the existing evidence, all of very low certainty, suggests the following:

- Starting CPR with compressions first results in improvements in key elements of resuscitation, such as commencement of chest compressions, completion of the first cycle of compressions, and a higher chest compression fraction.
- Indirect evidence from before-and-after OHCA registry studies in adults suggests that switching from the ABC to CAB approach was associated with increased rates of bystander CPR[25] and improved patient outcomes.[25,118,119] Similar data on in-hospital cardiac arrest show conflicting evidence in patient outcomes.[120,121]
- While important uncertainties remain, in retaining this treatment recommendation in adults, the BLS task force also considered

- The benefits of a single training approach in adults
- Effective chest compressions generate cumulative coronary perfusion pressure, which falls to near zero when compressions stop. Therefore, early effective chest compressions are vital to establishing and maintaining coronary perfusion pressure.[122]
- Time to first compression is associated with better patient outcomes.[123]
- Bystanders are typically unable to deliver effective ventilations during simulated CPR.[35]
- Due to the public's concerns with mouth-to-mouth ventilation,[32] commencing CPR with airway and ventilations may result in no bystander CPR being provided.
- Evidence suggests that delivering the ABC approach leads to more errors in CPR,[113] that lay-bystanders prefer CAB, and that CAB is easier to learn and retain.[113]
- The delivery of non–mouth-to-mouth ventilation requires the retrieval and preparation of equipment (eg, bag-mask, pocket mask), which, when multiple rescuers are present, can occur during chest compressions.

Knowledge Gaps

No human studies directly evaluate this question in any setting. Because different councils worldwide have adopted CAB versus ABC, comparative studies of different registries may provide evidence to answer this question.

Table 3. Compressions First (CAB) Compared With Ventilations First (ABC): Summary of Findings of Manikin Studies

Outcome (certainty of evidence	Studies (participants)	Results for cardiac arrest scenarios
Time to commencement of chest compressions (very low)	1 cross-over pediatric manikin RCT (159 two-person teams)[113] 1 adult manikin RCT (108 two-person teams)[114]	CAB sequence resulted in faster mean time to chest compressions: 19.3±2.6 versus 43.4±5.0 seconds (p<0.05)[113]; 25±9 versus 43±16 seconds (p<0.001)[114]
	2 adult manikin observational studies (33 six-person teams[112]; 40 single rescuers[115])	CAB sequence was associated with shorter time to chest compressions: median=16.0 (IQR=14.0–26.0) versus 42.0 (IQR=41.5–59.0) seconds (p<0.001)[112]; and mean=15.4±3.0 versus 36.0±4.1 seconds (p<0.001)[115]
Time to commencement of rescue breaths/ventilations (very low)	1 cross-over pediatric manikin RCT (159 two-person teams)[113] 1 adult manikin RCT (108 two-person teams)[114]	CAB sequence resulted in later mean times to commencement of ventilations: 28.4±3.1 versus 22.7±3.1 seconds (p<0.05)[113]; 43±10 versus 37±15 seconds (p<0.001)[114] In the respiratory arrest scenario, CAB sequence resulted in faster mean time to commencement of ventilations: 19.1±1.5 versus 22.7±0.1 seconds (p<0.05)[113]
Time to completion of first CPR cycle (30 chest compressions and 2 rescue breaths) (very low)	1 adult manikin RCT (108 two-person teams)[114]	CAB sequence resulted in shorter mean times to completion of the first resuscitation cycle (30:2): 48±10 versus 63±17 seconds (p<0.001)
Ventilation rate (very low)	1 cross-over pediatric manikin RCT[110] (28 two-person teams)	In a sequence of delivering 5 rescue breaths before commencing chest compressions, ABC resulted in more ventilations delivered in the first minute of resuscitation: median 13 (IQR=12–15) versus 10 (IQR=8–10; p<0.05)
Compression rate (very low)	1 cross-over pediatric manikin RCT[110] (28 two-person teams)	No difference in compression rate
	1 adult manikin observational study teams (33 six-person teams)[112]	No difference in compression rate
Compression depth (very low)	1 cross-over pediatric manikin RCT[110] (28 two-person teams)	No difference in median compression depth
	1 adult manikin observational study teams (33 six-person teams)[112]	No difference in compression depth
CCF (very low)	1 cross-over pediatric manikin RCT[110] (28 two-person teams)	In a sequence of delivering 5 rescue breaths before commencing chest compressions, ABC resulted in lower median CCF 57% (IQR=54-64) versus 66% (IQR=59–68; p<0.001)
	1 adult manikin observational study teams (33 six-person teams)[112]	No difference in CCF
Minute alveolar ventilation in the first minute of	1 cross-over pediatric manikin RCT[110] (28 two-person teams)	In a sequence of delivering 5 rescue breaths before commencing chest compressions, minute alveolar ventilation in the first minute of resuscitation was

Outcome (certainty of evidence	Studies (participants)	Results for cardiac arrest scenarios
resuscitation (very low)		higher with ABC: median 370 mL (IQR=203–472) versus 276 mL (IQR=140–360; $p<0.001$)

ABC indicates airway-breathing-compressions; CAB, compressions-airway-breathing; CCF, chest compression fraction; IQR, interquartile range; RCT, randomized controlled trials.

Chest Compression–to–Ventilation Ratios (BLS 2202: SysRev 2025)

Rationale for Review

This was a nodal review with BLS and the PLS Task Forces. The previous SysRev[13] and existing ILCOR treatment recommendation was first published in 2017.[14,15] This topic was prioritized for a detailed review because it had not been reviewed since 2017. The SysRev[16] was registered on PROSPERO (CRD42024559318), and the full CoSTR can be found on the ILCOR website.[124]

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children in-hospital with cardiac arrest
- Intervention: Any CPR ratio delivered by EMS
- Comparators: Eligible comparator groups include a CPR ratio different from the one in the intervention arm delivered by EMS. Comparator groups that received no CPR or compared manual CPR with mechanical CPR were excluded from the review. Studies including automated CPR or any use of mechanical devices will only be included if administered to all treatment arms.
- Outcomes:
  - Critical: Favorable neurological survival (as measured by CPC or mRS) at discharge or 30 days and at any time interval after 30 days

    - Important: Survival to discharge or 30 days, survival to hospital admission, survival to any time interval after discharge or 30-day survival, ROSC, quality of life as measured by any indicator or score.
- Study design: In addition to standard criteria, observational studies that reported only unadjusted data were excluded.
- Time frame: Because the search terms were revised, the search included all years to October 21, 2024.

Consensus on Science

Eight studies examined the impact of the 2005 resuscitation guidelines, in which changes to compression-to-ventilation (CV) ratios were made in combination with other bundled interventions.[119,125-131] The studies consisted of 7 retrospective cohort studies[119,125-130], and one prospective study.[131] No study included children. Evidence was very low–certainty in all cases.

For the critical outcome of favorable neurological survival at discharge or 30 days, we identified 2 cohort studies.[126,131] In 1 cohort study of 3960 initially nonshockable OHCA,[126] implementation of the 2005 resuscitation guidelines (including a CV ratio of 30:2) was associated with an improvement in neurologically favorable survival at hospital discharge (CPC score 1–2) compared with a prior period using a CV ratio of 15:2 (odds ratio [OR], 1.56 [95% CI, 1.11, 2.18]). In another cohort study of 522 initially shockable OHCA,[131] being treated under the 2005 guidelines was associated with no change in neurologically favorable survival at 30 days (CPC score 1–2) compared with being treated with a CV ratio of 15:2 (OR, 0.50 [95% CI, 0.20, 1.25]).

For the critical outcome of survival to hospital discharge or 30-day survival, we identified 6 cohort studies.[119,125-128,130] Because of heterogeneity, no meta-analysis was performed.

- **CV ratio 30:2 versus 15:2:** In 3 studies of OHCA with all rhythms, a CV ratio of 30:2 compared with 15:2 was associated with higher odds of survival in 2 studies (adjusted OR[aOR], 1.8; [95% CI, 1.2, 2.7][128]; aOR, 2.5 [95% CI, 1.4, 4.6][127]) but not in the third study (aOR, 1.42 [95% CI, 0.79, 2.57]).[125] For OHCA with initially shockable rhythm, 1 study reported higher odds of survival to hospital discharge with a CV ratio of 30:2 compared with 15:2 (aOR, 1.62 [95% CI, 1.33–1.98]), which became nonsignificant after adjustment for the temporal trend (aOR, 1.07 [95% CI, 0.71, 1.62]).[130] In OHCA patients with initial nonshockable rhythm, a CV ratio of 30:2 compared with 15:2 was associated with higher odds of survival in one study (aOR 1.53 [95% CI, 1.14, 2.05]),[126] but not in the other (aOR 1.19 [95% CI, 0.82, 1.73]).[130]
- **CV ratio 50:2 versus 5:1:** A before-after study of 200 bystander witnessed OHCA with initial shockable rhythms reported an improvement in survival to hospital discharge following the implementation of a bundled change in resuscitation practice consisting of a CV ratio of 50:2 compared with 5:1 (aOR, 2.17 [95% CI, 1.26–3.73]).[119]

For the critical outcome of ROSC, one cohort study of 1243 OHCA patients found no change in the risk-adjusted odds of ROSC with a CV ratio of 30:2 compared with 15:2 (OR, 1.31 [95% CI, 0.99, 1.73]).[129]

Treatment Recommendations (2025, Unchanged From 2017)

We suggest a compression-ventilation ratio of 30:2 compared with any other compression-ventilation ratio in adult patients in cardiac arrest (weak recommendation, very low–certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

In making this recommendation, the task force placed a high priority on consistency with our prior treatment recommendations and the findings identified in this review, which suggest that the bundle of care, which included changing to a CV ratio of 30:2, resulted in more lives being saved. The task force also considered the following:

- All studies included in this review suffered from serious indirectness, where a change to CV ratio was delivered or introduced as part of a bundle of care that included other changes, such as increases in the duration of CPR cycles, removal of stacked shocks, removal of postshock rhythm checks and fewer interruptions to chest compressions. It is possible that the benefits observed in these studies are not related to a change in CV ratio.
- Future studies and reviews should focus on the benefit of higher CV ratios, compared with the current recommendation of 30:2.

Knowledge Gaps

- The impact of different ratios without any other concurrent changes in practice
- The benefit of higher CV ratios compared with 30:2
- The ability of CPR providers to deliver 2 effective ventilations during the short pause in chest compressions during CPR
- Examination of the ratio-dependent tidal volume required to maintain oxygenation

Duration of CPR Cycles (BLS 2212: SysRev 2025)

Rationale for Review

This topic was last reviewed in detail[132] for the 2020 CoSTR,[37,38] and was prioritized for a detailed review since only EvUps had been done since 2020. The full CoSTR can be found on the ILCOR website.[133] Because there was no intent to publish this review outside of the 2025 CoSTR, PROSPERO registration was not completed.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest.
- Intervention: Pausing chest compressions at another interval
- Comparators: Pausing chest compressions every 2 minutes to assess the cardiac rhythm
- Outcomes:
  - Critical: Survival with favorable neurological outcome at hospital discharge or 30 days; survival at hospital discharge or 30 days
  - Important: ROSC; coronary perfusion pressure, cardiac output
- Time frame: September 1, 2019, to September 22, 2024

Consensus on Science

No new clinical studies have been identified since the 2020 ILCOR SysRev.[37,38] The existing evidence consists of 2 RCTs (Table 4).[134,135]

Table 4. Evidence Comparing Duration of CPR Cycles

Study (design)	Participants, intervention	Outcomes: RR (95% CI)	Certainty of evidence
3 minutes versus 1 minute			
Wik 2003[134] (RCT)	200 adult OHCAs 3 minutes (intervention): immediate defibrillation (up to 3 stacked shocks) for VF/VT followed by 3 minutes of CPR regardless of postshock rhythm 1 minute (comparator): immediate defibrillation (up to 3 stacked shocks) for VF/VT followed by 1 minute of CPR for patients in refractory VF/VT, and 3 minutes of CPR for patients that were in nonshockable rhythms following initial 1–3 shocks	Compared with 1 minute, there was no difference for 3-minute duration: Survival to hospital discharge with favorable neurological outcome(absolute RR, 1.68, 95% CI, 0.85–3.32; p=0.13) Survival to hospital discharge(absolute RR, 1.52, 95% CI, 0.83–2.77; p=0.17) ROSC (absolute RR, 1.22 (95% CI, 0.92–1.50; p=0.16)	Very low (downgraded for risk of bias and imprecision)
1 minute versus 2 minutes			
Baker 2008[135]	202 adult OHCAs 1 minute (intervention): stacked shocks (up to 3 in refractory VF/VT), 15:2 CPR	Compared with 2 minutes, there was no difference for 1-minute duration:	Very low (downgraded for

Study (design)	Participants, intervention	Outcomes: RR (95% CI)	Certainty of evidence
	and 1 minute CPR cycles between defibrillation 2 minutes (comparator): single shock, 30:2 CPR and 2minuute CPR cycles between defibrillation	Survival to hospital discharge (RR, 0.49, 95% CI, 0.23–1.06; p=0.06) ROSC (RR, 0.95,95% CI: 0.73–1.24; p=0.71)	risk of bias and imprecision)

CPR indicates cardiopulmonary resuscitation; OHCA, out-of-hospital cardiac arrest; ROSC, return of spontaneous circulation; RR, relative risk, VF/VT, ventricular fibrillation/ventricular tachycardia.

Treatment Recommendations (2025, Unchanged From 2015)

We suggest pausing chest compressions every 2 minutes to assess the cardiac rhythm (weak recommendation, low-certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is included in Appendix A.

These included trials were designed to address the question of CPR or defibrillation first and provide only indirect evidence for different CPR cycle durations.

In making the suggestion to pause chest compressions every 2 minutes to assess cardiac rhythm, we placed a high value on being consistent with previous recommendations in the absence of any convincing evidence indicating potential benefit from changing to CPR cycles of a different duration. The BLS Task Force acknowledges that every guideline change comes with significant risk and costs.

Knowledge Gaps

- Whether the optimal CPR interval between rhythm analyses differs between initial cardiac rhythms
- The impact of no-flow and low-flow time
- The impact of stopping CPR on the overriding goal of minimizing interruptions in chest compressions

- The relationship between rescuer fatigue, chest compression quality, and the optimal interval for chest compression cycles

EMS Continuous–Chest Compression CPR (BLS 2221: SysRev 2025)

Rationale for Review

The previous SysRev[13] and existing ILCOR treatment recommendation were first published in 2017.[14,15] This topic was prioritized for a detailed review because it had not been reviewed since 2017. The SysRev[16] was registered on PROSPERO (CRD42024559318), and the full CoSTR can be found on the ILCOR website.[136]

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children with out-of-hospital with cardiac arrest
- Intervention: Continuous chest compressions (CCC) with or without ventilations delivered by EMS
  - Comparators: *Standard CPR*, defined as any CV ratio delivered by EMS. Comparator groups that receive no CPR or compared manual CPR with mechanical CPR were excluded from the review. Studies including automated CPR or any use of mechanical devices were only included if administered to all treatment arms.
  - Outcomes:
    - Critical: Favorable neurological survival (as measured by CPC or mRS) at discharge or 30 days and at any time interval after 30 days.
    - Important: Survival to discharge or 30 days, survival to hospital admission, survival to any time interval after discharge or 30 days survival, ROSC, quality of life as measured by any indicator or score.
  - Study design: In addition to standard criteria, observational studies that reported only unadjusted data were excluded.

- Time frame: Because the search terms were revised, the search included all years to October 2024.

Consensus on Science

We identified 1 cluster crossover RCT[137] and 3 cohort studies,[138-140] including 2 post hoc analyses of the earlier cluster RCT, providing low to moderate-certainty of evidence (downgraded for indirectness and risk of bias). The evidence is summarized in Table 5.

Table 5. The Evidence Comparing EMS Chest Compression–Only CPR With Conventional CPR

Outcome (certainty of evidence)	Studies and patients	Results
Favorable neurological function (moderate)	1 adult cluster RCT[137] randomized to either CCC with asynchronous PPV or standard CPR with a CV ratio of 30:2	No difference compared with 30:2
Survival to hospital discharge or 30 days (low to moderate)	1 adult cluster RCT[137]	No difference
	3 observational studies: 1 compared minimally interrupted cardiac resuscitation with C-CPR (including a CV ratio of 15:2, stacked shocks, and post-shock rhythm checks)[138]; 1 post hoc analysis of the Nichol cluster RCT[137] restricted to sites in British Colombia[139]; 1 secondary analysis of patients enrolled into the ROC registry or either the ROC CCC, ALPS, or PART clinical trials were classified CCC with asynchronous ventilations or C-CPR (30:2)[140]	Minimally interrupted cardiac resuscitation was associated with improved survival to hospital discharge (aOR, 3.0 [95% CI, 1.1–8.9]).[138] A post hoc analysis of the Nichol cluster RCT[137] reported no significant difference in survival to hospital discharge.[139] The secondary analysis showed that CCC was associated with improved survival to hospital discharge when compared with standard CPR (aOR, 1.20 [95% CI, 1.04, 1.38]). Further analysis showed when there was adherence to the intended strategy, CCC had significantly lower survival (aOR, 0.72 [95% CI, 0.64, 0.81), while in patients with the intended strategy, 30:2 had higher survival (aOR, 1.05 [95% CI, 0.90, 1.22]).[140]
ROSC (low to moderate)	1 adult cluster RCT[137]	No difference compared with 30:2
	1 cohort study compared minimally interrupted cardiac resuscitation C-CPR (including a CV ratio of 15:2, stacked shocks, and postshock rhythm checks).[138]	No difference compared with 15:2

ALPS indicates Amiodarone, Lidocaine, or Placebo in Out-of-Hospital Cardiac Arrest; aOR, adjust odds ratio; CCC, continuous chest compressions; C-CPR, conventional CPR; CCO-CPR, chest compression–only CPR; CPR, cardiopulmonary resuscitation; CV ratio, compression-to-ventilation ratio; PART, Pragmatic Airway Resuscitation Trial; PPV, positive-pressure ventilation; RCT, randomized control trial; ROC, Resuscitation Outcomes Consortium; ROSC, return of spontaneous circulation.

Prior Treatment Recommendations (2019)

We recommend that EMS providers perform CPR with 30 compressions to 2 breaths (30:2 ratio) or continuous chest compressions with positive-pressure ventilation delivered without pausing chest compressions until a tracheal tube or supraglottic device has been placed (strong recommendation, high-certainty evidence).

We suggest that, when EMS systems have adopted minimally interrupted cardiac resuscitation, this strategy is a reasonable alternative to conventional CPR for witnessed shockable OHCA (weak recommendation, very low–certainty evidence).

Treatment Recommendations (2025)

In adults in cardiac arrest, we recommend that EMS providers perform CPR with 30 compressions to 2 ventilations or continuous chest compressions with positive-pressure ventilations delivered without pausing chest compressions until a tracheal tube or supraglottic airway device has been placed (strong recommendation, moderate-certainty evidence)

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

The task force noted no high-certainty evidence to support the superiority of either CCC or standard CPR for patient outcomes in OHCA and placed a high value on the importance of providing high-quality chest compressions and simplifying resuscitation logistics for EMS providers. A substudy of the included cluster crossover RCT[137] suggests that a CV ratio of 30:2 may be harder to achieve in practice, but when performed correctly may be associated with improved outcomes compared to a CV ratio of 30:2 with asynchronous ventilations.[141]

The task force removed the 2017 recommendation supporting systems that have implemented minimally interrupted cardiac resuscitation (ie, 200 compressions without ventilations) for witnessed shockable OHCA. This decision was made because this former recommendation was supported by a single retrospective study reporting adjusted estimates for the intervention,[138] with a serious risk of bias from uncontrolled confounding because the study implemented a bundle including other resuscitation practices. The task force also considered the following:

- Interruptions in chest compressions have been associated with poorer clinical outcomes in observational studies.[142] Pauses for ventilations are a significant source of interruptions in chest compressions and may negatively impact coronary and aortic blood flow.[143] Asynchronous positive-pressure ventilation (PPV) (continuous chest compressions with PPV delivered without pausing chest compressions) may achieve similar oxygenation without compromising chest compression quality.
- Although there was relative homogeneity in the CCC strategies, there was heterogeneity in the use of ventilation strategies, including both asynchronous PPV and passive oxygenation (delivering oxygen during compressions without providing ventilation). The adequacy of ventilation was not assessed in any studies, although measures of chest compression quality (eg, chest compression fraction) were reported.

Knowledge Gaps

- The effect of delaying PPV during CPR
- The impact of different elements of minimally interrupted cardiac resuscitation (compressions, ventilation, delayed defibrillation) on patient outcomes
- The impact of adherence to CCC or a CV ratio of 30:2 on patient outcomes

In-Hospital CCC CPR (BLS 2222: SysRev 2025)

Rationale for Review

This was a nodal review with BLS and the PLS Task Forces. The previous SysRev[13] and existing ILCOR treatment recommendation was first published in 2017.[14,15] This topic was prioritized for a detailed review as it had not been reviewed since 2017. The SysRev was registered on PROSPERO (CRD42024559318), and the full CoSTR can be found on the ILCOR website.[144]

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children in-hospital with cardiac arrest
- Intervention: CCC with or without ventilations delivered by in-hospital providers
- Comparators: *Standard CPR*, defined as any CV ratio delivered by in-hospital providers. Comparator groups that received no CPR or compared manual CPR with mechanical CPR were excluded from the review. Studies including automated CPR or any use of mechanical devices were only included if administered to all treatment arms.
- Outcomes:
    - Critical: Favourable neurological survival (as measured by CPC or mRS) at discharge or 30 days and at any time interval after 30 days
    - Important: Survival to discharge or 30 days, survival to hospital admission, survival to any time interval after discharge or 30 days survival, ROSC, quality of life as measured by any indicator or score
- Study design: In addition to standard criteria, observational studies that reported only unadjusted data were also excluded.
- Time frame: Because the search terms were revised, the search included all years to October 21, 2024.

Consensus on Science

No new studies were identified. One single-center cohort study included in the previous review provided very low–certainty evidence (downgraded for risk of bias and very serious imprecision).[145] The study evaluated the effect of continuous mechanical chest compressions in patients admitted to an emergency department following OHCA. PPV without interruption of chest compressions after tracheal intubation was compared with interruption of chest compressions for one ventilation after every fifth chest compression (a CV ratio of 5:1) among patients admitted to a hospital emergency department after OHCA.

No adjusted data were reported for favorable neurological survival at discharge or 30 days. For the critical outcome of survival, patients who received tracheal intubation with PPV during continuous compressions had increased adjusted survival to hospital discharge (aOR, 2.43 [95% CI, 1.15–5.12]) and higher odds of ROSC (aOR, 1.62 [95% CI, 1.07–2.43]) when compared with those who received mechanical chest compressions interrupted for ventilations at a ratio of 5 compressions to 1 ventilation.

Prior Treatment Recommendation (2019)

Whenever tracheal intubation or a supraglottic airway is achieved during in-hospital CPR, we suggest that providers perform continuous compressions with PPV delivered without pausing chest compressions (weak recommendation, very low–quality evidence).

Treatment Recommendations (2025)

In-hospital providers should perform CPR with 30 compressions to 2 ventilations or continuous chest compressions with positive pressure ventilations delivered without pausing chest compressions in adults in cardiac arrest (good practice statement).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

In changing the recommendation to a good practice statement, the task force acknowledges the lack of evidence of this topic. The good practice statement for practice before an advanced airway is placed was added to fill the treatment gap and provide guidance for immediate CPR. The task force also considered the following:

- Interruptions in chest compressions have been associated with worse clinical outcomes in observational studies.[142] Pauses for ventilations are a significant source of interruptions in chest compressions and may negatively impact coronary and aortic blood flow.[143] PPV during chest compressions may achieve similar oxygenation without compromising chest compression quality.
- The only included study was conducted with a before-and-after design that, although adjusted for demographic and cardiac arrest characteristics, did not account for potential temporal differences in resuscitation efficiencies between study periods.
- Data on the same question in EMS found no high-quality evidence to support the superiority of either CCC or standard CPR for patient outcomes in OHCA. The task force also placed high value on providing consistent recommendations for EMS and in-hospital providers.
- The task force also placed a relatively high value on providing high-quality chest compressions and simplifying resuscitation logistics for providers.
- Evidence suggests that a CV ratio of 30:2 may be much harder to achieve in practice and could ultimately result in a higher degree of nonadherence compared with CCC.[140]

Knowledge Gaps

- Effectiveness of CCC with or without ventilations compared with standard CPR, when delivered by in-hospital professionals
- The effect of delaying PPV during CPR
- The effectiveness of passive oxygenation during resuscitation
- The impact of adherence to chest compression–only CPR or a CV ratio of 30:2 on patient outcomes

BLS Components—Compressions

Hand Position During Compressions (BLS 2502: SysRev 2025)

Rationale for Review

Hand positioning during compressions was last reviewed in detail for the 2020 CoSTR.[37,38] Since 2020, EvUps have identified evidence only from imaging studies. Because these studies contribute new indirect evidence, this topic was prioritized for review. The full CoSTR can be found on the ILCOR website.[146] Because there was no intent to publish this review outside of the 2025 CoSTR, PROSPERO registration was not completed.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: Any other location for chest compressions
- Comparators: Delivery of chest compressions on the lower half of the sternum
- Outcomes: Any clinical outcome
  - Critical: Survival to hospital discharge with good neurological outcome; survival to hospital discharge
  - Important: ROSC; blood pressure; coronary perfusion pressure; end-tidal carbon dioxide
- Time frame: October 1, 2019, to September 26, 2024

Consensus on Science

No studies reported the critical outcomes of favorable neurologic outcome, survival, or ROSC. No new clinical studies have been identified since the 2020 ILCOR SysRev.[37,38] The existing evidence consists of 3 very low–certainty studies reporting on physiologic endpoints.[147-

[149] One crossover study in 17 adults with prolonged resuscitation from nontraumatic cardiac arrest observed improved peak arterial pressure during compressions and higher end-tidal carbon dioxide when compressions were performed on the lower third of the sternum compared with the center of the chest, whereas arterial pressure during compression recoil, peak right atrial pressure, and coronary perfusion pressure did not differ.[149] A second crossover study in 30 adults observed no association between end-tidal carbon dioxide values and hand placement.[148] A further crossover study in 10 children observed higher peak systolic pressure and higher mean arterial blood pressure when compressions were performed over the lower third of the sternum compared with the middle of the sternum.[147]

Treatment Recommendations (2025, Unchanged From 2015)

We suggest performing chest compressions on the lower half of the sternum on adults in cardiac arrest (weak recommendation, very low–certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

No studies evaluated the effect of a specific hand position on short- or long-term survival after cardiac arrest, and only physiologic surrogate outcomes were evaluated.

Imaging studies were excluded from the current SysRev because they do not report clinical outcomes for cardiac arrest patients. However, they provide valuable indirect information. Recent studies indicate that, in most adults and children, the maximal ventricular cross-sectional area is located beneath the lower third of the sternum or the xiphisternal junction. Additionally, the ascending aorta and left ventricular outflow tract are positioned beneath the center of the chest.[150-156] The studies also highlight significant anatomical differences between individuals based on factors such as age, body mass index, congenital cardiac disease, and pregnancy. Consequently, no single hand-placement strategy may be universally optimal for chest compressions across all populations.[153,155,157,158]

In reaffirming the recommendation to perform chest compressions on the lower half of the sternum, we prioritized consistency with previous guidelines given the lack of compelling clinical evidence necessitating a change in approach.

Knowledge Gaps

- The effects of different hand positions during CPR on patient outcomes
- How to determine the optimal hand placement or compression point for individuals in cardiac arrest, particularly by leveraging physiologic feedback or incorporating insights from prior imaging.

Head-Up CPR (BLS 2503: SysRev 2025)

Rationale for Review

This was a nodal review with BLS and the Advanced Life Support (ALS) Task Forces. The first SysRev with treatment recommendations for head-up CPR was published in the 2021 CoSTR.[159,160] Since 2021, the topic has been reviewed in EvUps, which identified new observational studies, and the SysRev was therefore updated for 2025. The SysRev was registered on PROSPERO (CRD42024541714), the full details of this review can be found in the SysRev,[161] and the full CoSTR can be found on the ILCOR website.[162]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: Head-up CPR or head-up CPR bundle (eg, head-up position, active compression/decompression, and an impedance threshold device).

- Comparators: Standard or chest compression–only CPR in supine position
- Outcomes:
    - Critical outcomes: Survival to hospital discharge with good neurological outcome, survival to hospital discharge, event survival, survival to 30 days, survival to 30 days with good neurological outcome
    - Important outcome: ROSC
- Time frame: July 22, 2021, to July 19, 2024

Consensus on Science

Two new observational studies were identified, adding to the single study identified in 2021.[163-165] All studies were from the same research group. Details of study designs and key findings are presented in Table 6. Evidence was deemed very low–certainty for all outcomes because of serious risk of bias, inconsistency, and imprecision.

Table 6. Key Design Elements and Findings of Head-Up CPR Studies

Study	Design (time frame), participants, intervention, comparator	Outcomes	Certainty of evidence
Pepe 2019[165]	Before-after study, 2014–2017: 2322 adult OHCAs (1356 intervention) Intervention: Head-up CPR bundle that included mechanical CPR and ITD; oxygen but deferred PPV for several minutes; a pit-crew approach for rapid placement of the mechanical CPR device; and subsequent placement of patient in a reverse Trendelenburg position (≈ 20°) Comparator: Mechanical CPR and ITD (data from same EMS)	Survival to hospital discharge with favorable neurological outcome: Unadjusted 35% to 40% intact neurologic status in both groups (exact data and loss to follow-up not provided) Event survival: Unadjusted 17.9% (n=144/806) versus 34.2% (n=464/1356), p<0.001	All outcomes: very low–certainty evidence (downgraded for risk of bias, inconsistency, and imprecision)
Moore 2022[164]	Prospective observational: Automated Controlled Elevation CPR Registry, 2019–2020, 5423 adult OHCAs (227 intervention) Intervention: Automated controlled head and thorax patient positioning device. Immediate elevation of head and mid thorax to 12 cm and 8 cm, respectively, with conventional CPR for 2 minutes; followed by a gradual elevation of patient's head and torso during CPR over an additional 2-	After propensity matching: Survival to hospital discharge with favorable neurological outcome:5.9% (13/222) versus 4.1% (35/860); OR, 1.47 (95% CI, 0.76–2.82) 9.5% (21/222) versus 6.7% (58/860); OR, 1.44 (Survival to hospital discharge: 95% CI, 0.86–2.44) ROSC: 33% (74/222) versus 33% (282/860); OR, 1.02 (95% CI, 0.75–1.49)	

Study	Design (time frame), participants, intervention, comparator	Outcomes	Certainty of evidence
	minute period to a final head and thorax elevation of 22 cm and 9 cm, respectively. Comparator: Conventional CPR with supine position (data from 3 RCTs conducted between 2006–2015[166-168])		
Bashista 2024[163]	Prospective observational: Automated Head/Thorax-UP Positioning Registry (2019–2021); 2232 adult nonshockable OHCAs (380 intervention) Intervention: Automated controlled head and thorax patient positioning device, immediate elevation of head and mid thorax to 12 cm and 8 cm, respectively, with conventional CPR for 2 minutes; followed by a gradual elevation of patient's head and torso during CPR over an additional 2-minute period to a final head and thorax elevation of 22 cm and 9 cm, respectively. Comparator: Conventional CPR with supine position (data from 2 RCTs conducted between 2006–2009[166,168])	After propensity matching: Survival to hospital discharge with favorable neurological outcome: 4.2% (15/353) versus 1.1% (4/353); OR, 3.87 (95% CI, 1.27–11.78) Survival to hospital discharge: 7.6% (27/353) versus 2.8% (10/353); OR, 2.84 (95% CI, 1.35–5.96) ROSC: 33% (118/353) versus 29% (101/353); OR, 1.25 (95% CI, 0.91–1.72)	

CPR indicates cardiopulmonary resuscitation; EMS, emergency medical services; ITD, impedance threshold device; OHCA, out-of-hospital cardiac arrest; OR, odds ratio; PPV, positive-pressure ventilation; ROSC, return of spontaneous circulation; RCT, randomized controlled trial

Prior Treatment Recommendations (2021)

We suggest against the routine use of head-up CPR during CPR (weak recommendation, very low–certainty evidence).

We suggest that the usefulness of head-up CPR during CPR be assessed in clinical trials or research initiatives (weak recommendation, very low–certainty evidence).

Treatment Recommendations (2025)

We suggest against the use of head-up CPR or head-up CPR bundle during CPR except in the setting of clinical trials or research initiatives (weak recommendation, very low–certainty evidence).

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

In making this recommendation, the BLS Task Force recognized that the currently available evidence remains limited, highlighted by the absence of RCTs or observational studies with adequate comparisons. The comparator groups used in all 3 available studies are problematic (eg, earlier time frame), and some outcomes are reported without adjustment for known confounders or temporal trends. The implementation of the existing head-up CPR bundles requires the purchase of expensive equipment, which includes an automated head/thorax-up positioning device, a mechanical CPR device, and an impedance threshold device, as well as considerable training.

Although the intervention may sound simple, the included studies demonstrate the complexities. We did not find clinical evidence supporting a particular bundle approach or indicating that the sole use of head-up elevation is superior to other bundles without it. There is an indication that faster deployment of head-up CPR is associated with better neurological outcomes,[164] but this requires further study.

Knowledge Gaps

- High-quality evidence of the effect of head-up CPR or head-up CPR bundle is required.
- The optimal approach (eg, the angle and timing of head elevation) when head-up CPR is used

Minimizing Pauses in Compressions (BLS 2504: SysRev 2022, EvUp 2025)

A 2022 SysRev and 2025 EvUp examined the evidence on passive ventilation techniques. The details of the 2022 SysRev review can be found in the 2022 CoSTR summary[169,170] and on the ILCOR website.[171] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults in cardiac arrest in any setting

- Intervention: Minimizing pauses in chest compressions (higher CPR or chest compression fraction or shorter perishock pauses compared with control)
- Comparator: Standard CPR (lower CPR fraction or longer perishock pauses compared with intervention)
- Outcomes:
  - Critical: Survival to hospital discharge with good neurological outcome; survival to hospital discharge
  - Important: ROSC
- Time frame: June 1, 2021, to April 14, 2024

Summary of Evidence

The EvUp found 1 new study[172] directly relevant to the PICOST and several studies with meaningful data on interruptions in cardiac arrest care.[140,172-175] However, these later studies were excluded because they did not address the prespecified outcomes of interest. This suggests a SysRev might be warranted in the future after revising the PICOST question.

Treatment Recommendations (2022)

We suggest that CPR fraction and perishock pauses in clinical practice be monitored as part of a comprehensive quality improvement program for cardiac arrest designed to ensure high-quality CPR delivery and resuscitation care across resuscitation systems (weak recommendation, very low–certainty evidence).

We suggest that preshock and postshock pauses in chest compressions be as short as possible (weak recommendation, very low–certainty evidence).

We suggest that the CPR fraction during cardiac arrest (CPR time devoted to compressions) should be as high as possible and be at least 60% (weak recommendation, very low–certainty evidence).

Optimal Surface for Performing CPR (BLS 2510: SysRev 2024)

A 2024 SysRev updated the 2019 review[176] on the optimal surface for performing CPR. The full details of this review can be found in the SysRev,[177] the 2024 CoSTR summary,[40,41] and on the ILCOR website.[178]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults or children in cardiac arrest (OHCA and in-hospital cardiac arrest)
- Intervention: The performance of CPR using a hard surface (eg, backboard, floor, or deflatable or specialist mattress)
- Comparators: The performance of CPR on a regular mattress or other soft surface
- Outcomes:
  - Critical: Survival with a favorable neurological outcome at hospital discharge/30 days; survival at hospital discharge/30 days
  - Important: Event survival; ROSC; CPR quality (eg, compression depth, compression rate, compression fraction)
- Time frame: September 17, 2019, to February 5, 2024.

Treatment Recommendations (2024)

We suggest performing chest compressions on a firm surface when possible (weak recommendation, very low–certainty evidence).

During in-hospital cardiac arrest, we suggest, where a bed has a CPR mode, which increases mattress stiffness, it should be activated (weak recommendation, very low–certainty of evidence).

During in-hospital cardiac arrest, we suggest against moving a patient from a bed to floor to improve chest compression depth (weak recommendation, very low–certainty of evidence).

During in-hospital cardiac arrest, we suggest in favor of either a backboard or no-backboard strategy, to improve chest compression depth (conditional recommendation, very low–certainty of evidence).

Feedback for CPR Quality (BLS 2511: ScopRev 2024)

A 2024 ScopRev examined the wider literature on feedback for CPR quality during resuscitation. The details of this review can be found in the ScopRev,[179] the 2024 CoSTR summary,[40,41] and on the ILCOR website.[180]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children (excluding neonates) who are in cardiac arrest in any setting who are resuscitated by health professionals responding in a professional capacity
- Intervention: Real-time feedback and prompt devices regarding the mechanics of CPR quality (eg, rate and depth of compressions and/or ventilations)
- Comparators: No feedback or prompt devices or alternative devices
- Outcomes: Any outcomes or measure of CPR quality
- Time frame: All years to July 18, 2023. A grey literature search was performed in the Google search engine in addition to the standard databases.

Treatment Recommendations (2020)

We suggest the use of real-time audiovisual feedback and prompt devices during CPR in clinical practice as part of a comprehensive quality improvement program for cardiac arrest designed to ensure high-quality CPR delivery and resuscitation care across resuscitation systems (weak recommendation, very low–certainty evidence).

We suggest against the use of real-time audiovisual feedback and prompt devices in isolation (ie, not part of a comprehensive quality improvement program) (weak recommendation, very low–certainty evidence).

BLS COMPONENTS—VENTILATION

Passive Ventilation Techniques (BLS 2403: SysRev 2022, EvUp 2025)

A 2022 SysRev and 2025 EvUp examined the evidence on passive ventilation techniques. The details of this review can be found in the 2022 CoSTR summary[169,170] and on the ILCOR website.[181] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children with presumed cardiac arrest in any setting
- Intervention: Any passive ventilation technique (eg, positioning the body, opening the airway, passive oxygen administration, Boussignac tube, constant flow insufflation of oxygen) in addition to chest compressions
- Comparator: Standard CPR
- Outcomes:
  - Critical: Survival to hospital discharge with good neurological outcome; survival to hospital discharge
  - Important: ROSC
- Time frame: October 16, 2021, to July 5, 2024

Summary of Evidence

No new studies were identified, so a new SysRev is not warranted.

Treatment Recommendations (2022)

We suggest against the routine use of passive ventilation techniques during conventional CPR (weak recommendation, very low–certainty evidence).

Real-Time Ventilation Quality Feedback Devices (BLS 2402: ScopRev 2025)

Rationale for Review

A growing body of evidence suggests ventilation parameters during resuscitation often fall outside guideline recommendations.[182,183] This review was prioritized because new devices are now available to help BLS providers monitor and improve ventilation in real-time. Ventilation parameters were not addressed in detail in our recent review of real-time feedback.[179] The full details of this review can be found in the ScopRev[184] and on the ILCOR website.[185]

Population, Intervention, Comparator, Outcome, Study Design, and Time Frame

- Population: Adults and children in any setting (out-of-hospital or in-hospital) in cardiac arrest
- Intervention: Real-time ventilation quality feedback (eg, tidal volume, adequate ventilation, mask leak, ventilation rate)
- Comparators: No real-time ventilation feedback
- Outcomes: Any outcome
- Study designs: In addition to standard study designs, grey literature (Google Scholar, first 20 pages), letters to the editor, and conference abstracts were also eligible for inclusion.
- Time frame: Inception to September 11, 2024. The grey literature was searched on November 4, 2024.

Summary of Evidence

The ScopRev[184] identified 19 relevant studies (1 RCT,[186] 2 before-after prospective studies,[187,188] 2 observational studies,[189,190] 1 case series,[191] and 13 simulation studies[192-204]). Three of the simulation studies assessed pediatric scenarios.[196,202,204]

One RCT[186] and 2 prospective observational studies[187,188] examined clinical outcomes with and without real-time feedback (Table 7). The RCT reported improved immediate-term patient outcomes with real-time feedback but no change in short-term outcomes. The trial did not adjust for group differences or report ventilation quality.[186] The 2 observational studies found no change in patient outcomes but noted improved ventilation parameters with real-time feedback.[187,188] Most of the simulation studies showed improvements in ventilation quality.

Task Force Insights

The task force discussed the review findings and noted the following:

- Device registration with regulatory authorities alone does not provide evidence of device performance in real-world settings. As rescuer and patient factors influence high-quality ventilation, the current evidence is insufficient to demonstrate the clinical efficacy or effectiveness of real-time ventilation feedback devices.
- The lack of studies in humans, the significant heterogeneity between studies, and industry involvement in 7 included studies are all important limitations of the evidence.
- Many of the included studies inaccurately labeled inflation volume, the amount of airflow measured at the mask, or the advanced airway as *tidal volume*. We suggest using inspiratory volume rather than tidal volume for this measurement, because tidal volume represents the amount of air that moves in or out of the lungs with each respiratory cycle.

Based on this ScopRev, there is insufficient evidence to pursue a new SysRev on this topic.

Knowledge Gaps

- High-quality prospective evidence in humans, including changes to ventilation variables and conducted independent of industry, that assess the clinical efficacy (ie, whether the devices work in optimal settings) or clinical effectiveness (real-world settings) of these devices

- Data in children

Table 7. Clinical Studies Examining Real-Time Ventilation Feedback Devices With Control Groups

Author (year)	Study design (country)	Population	Participants	Intervention; control	Outcomes (device versus no feedback)
Lee (2023)[186]	RCT (South Korea)	OHCA	BLS and ALS hospital providers	Real-time visual ventilation feedback device using a flow sensor (n=63); no feedback (n=58)	Survival with neurological good outcome (11.1% versus 10.3%; p=0.77) Survival to discharge (4.9% versus 8.6%; p=0.54) 30-hour survival (49.2% versus 46.5%; p=0.001). ROSC (55.5% versus 36.2%; p=0.04)
Drennan (2024)[187]	Prospective before-after (Canada)	OHCA	BLS and ALS EMS providers	Real-time visual ventilation feedback device using a flow sensor (n=221); no feedback (n=191)	ROSC (27% versus 29%, p=NS) Ventilation rate (12/min [IQR 10, 17] versus 14/min [11, 19]; p=0.04) Rate in target range (53%±38 versus 29%±9; p<0.001) Insufflation volume (401 mL [353, 472] versus 374 mL [274, 453]; p=0.06) Volume in target range (28%±17 versus 21%±16; p<0.001) Rate and volume in target range (19%±17 versus 7%±10; p<0.001)
Abella (2007)[188]	Prospective cohort (United States)	IHCA	BLS and ALS hospital providers	Real-time audiovisual feedback system using thoracic impedance (n=101); no feedback (n=45)	ROSC (44.6% versus 40.0%; p=0.58) Survival to discharge (8.9% versus 9.1%; p=0.97) Ventilation rate (20±10/min versus 18±8/min; p=0.12 for difference in mean, p=0.04 for difference in variance)

ALS indicates advanced life support; BLS, basic life support; EMS, emergency medical services; IHCA, in-hospital cardiac arrest; IQR, interquartile range; OHCA, out-of-hospital cardiac arrest; RCT, randomized control trial; ROSC, return of spontaneous circulation.

BLS Components—Defibrillation

Pad/Paddle Size and Placement in Adults (BLS 2601: SysRev 2025)

Rationale for Review

This was a nodal review with BLS, PLS, and the ALS Task Forces. The existing ILCOR treatment recommendation was first published in 2010[205,206] and reviewed in a ScopRev for the

2020 CoSTR.[37,38] Publications found in EvUps and the publication of a cluster RCT[207] on pad placement prompted a nodal SysRev[208] with the BLS, PLS, and ALS Task Forces (PROSPERO registration CRD42024512443). The pediatric CoSTR, treatment recommendations, and evidence-to-decision table are reported on the ILCOR website[209] and in the PLS CoSTR section.[107] The CoSTR can be found on the ILCOR website.[210]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest and a shockable rhythm at any time during CPR
- Intervention: The use of any specific pad size/orientation and position
- Comparators: Reference standard pad size/orientation and position
- Outcomes:
    - Critical: Survival with favourable neurological outcome at hospital discharge or 30 days; survival at hospital discharge or 30 days.
    - Important: ROSC; termination of ventricular fibrillation (VF); rates of refibrillation.
- Time frame: All years to September 22, 2024

Consensus on Science

Two observational studies[211,212] and 1 RCT[207] were identified. Certainty of evidence was very low in all cases.

Pad Size

No studies compared the effects of different pad sizes with standard size for any critical outcomes or ROSC. One before-and-after study in OHCA reported no difference in defibrillation success with AEDs with large pad size (113 cm^2), compared with AEDs with small pad size (65 cm^2) (86% versus 88.8%; OR, 0.82 [95% CI, 0.42–1.60]).[211] No studies were identified in the in-hospital setting.

Pad Positions

No RCTs were found that compared different pad placements for the initial defibrillation.

One prospective EMS cohort study[212] adjusting for known predictors found no significant difference in favorable neurological outcome at hospital discharge with initial anterior-posterior (AP) pad placement compared with initial anterior-lateral (AL) placement (aOR, 1.86 [95% CI, 0.98–3.51]). There was also no difference in survival to hospital discharge (aOR, 1.55 [95% CI, 0.83–2.90]) or in defibrillation success (VF termination at 5-second postshock: OR, 1.08 [95% CI, 0.61–1.91]), although AP pad position was associated with higher ROSC rates after adjusting for known predictors (aOR, 2.64 [95% CI, 1.50–4.65]).

Pad Positions for Refractory VF

One cluster RCT, which was stopped early because of the COVID-19 pandemic, compared vector-change defibrillation (a change to the AP position) with continuation of the standard AL position in 280 adult OHCA patients with refractory VF (ie, persistence of VF or pulseless ventricular tachycardia after 3 consecutive AL defibrillations).[207] This RCT reported higher adjusted survival to hospital discharge with vector change to AP pad position (21.7% versus 13.3%; adjusted risk ratio [aRR], 1.71 [95% CI, 1.01–2.88]), but no difference in favorable neurological outcome at hospital discharge, (aOR, 1.86 [95% CI, 0.98–3.51]).

The same RCT reported higher rates of termination of VF with vector change to AP pad position (79.9% versus 67.6%; aRR, 1.18 [95% CI, 1.03–1.36]) but no difference in ROSC (35.4% versus 26.5%; aRR, 1.39 [95% CI, 0.97–1.99]).

No studies were identified in the in-hospital setting.

Prior Treatment Recommendations (2010)

It is reasonable to place pads on the exposed chest in an anterior-lateral position. An acceptable alternative position is anterior posterior. In large-breasted individuals, it is reasonable to place the left electrode pad lateral to or underneath the left breast, avoiding breast tissue. Consideration should be given to the rapid removal of excessive chest hair before the application of pads, but emphasis must be on minimizing delay in shock delivery.

There is insufficient evidence to recommend a specific electrode size for optimal external defibrillation in adults. However, it is reasonable to use a pad size greater than 8 cm.

Treatment Recommendations (2025)

For Defibrillator Manufacturers

There is insufficient evidence to recommend a specific pad or paddle size for optimal external defibrillation in adults (good practice statement).

Manufacturers should standardize adult pad or paddle placement in the anterior-lateral position (good practice statement). One pad or paddle should be placed below the right clavicle, just to the right of the upper sternal border, and the other with its center in the left midaxillary line, below the armpit.

Manufacturers should provide clear instructions to ensure proper contact between the pad or paddle and the skin, along with diagrams that accurately show the ILCOR-recommended pad and paddle positions (good practice statement).

For CPR Providers Using an AED

Follow the manufacturer's AED guidance and instructions for adult pad placement (good practice statement).

For CPR Providers Trained in Manual Defibrillation

In adults, place defibrillator pads or paddles in the AL position to optimize placement speed and minimize interruptions to chest compressions (good practice statement). One pad/paddle should be positioned below the patient's right clavicle, just to the right of the upper sternal border. The other pad/paddle should be placed on the patient's left midaxillary line, below the armpit.

In adults, if the initial AL position is not feasible, consider using the AP pad position if trained (good practice statement). Place the anterior pad on the left side of the chest, between the midline and the nipple. For female patients, place the anterior pad to the left of the lower sternum, ensuring it avoids breast tissue as much as possible. The posterior pad should be placed on the left side of the patient's spine, just below the scapula.

Pad or paddle placement should avoid breast tissue (good practice statement).

For Health Care Professionals Trained in Vector Change

For adults in refractory VF (persistent VF after 3 defibrillations), consider changing pads to the AP pad position (good practice statement). Place the anterior pad on the left side of the chest, between the midline of the chest and the nipple. For female patients, place the anterior pad to the left of the lower sternum, ensuring it avoids breast tissue as much as possible. The posterior pad should be placed on the left side of the patient's spine, just below the scapula. This treatment recommendation does not replace the existing treatment recommendation on vector change and double sequential defibrillation for advanced life support providers.[6,7]

Justification and Evidence-to-Decision Framework Highlights

The complete evidence-to-decision table is provided in Appendix A.

The pediatric treatment recommendations are reported in the PLS CoSTR section.[107] In making these recommendations for adults, the task forces considered the following:

- All included studies were at serious risk of bias. No study reported patient outcomes for pad size, and no study compared the effects of different pad placements on patient outcomes except when being used for refractory shockable rhythms. However, defibrillator manufacturers may have proprietary data, and we encourage manufacturers to make this data public.
- In the absence of in-hospital cardiac arrest studies, this evidence could be applied to in-hospital cardiac arrest, with additional downgrading for indirectness.
- Lower transthoracic impedance results in higher current flow, possibly enabling higher defibrillation success. Observational studies in adults showed that transthoracic impedance was significantly higher with small-sized pads/paddles compared with large-sized pads/paddles.[211,213,214]
- A secondary analysis of the Double Sequential External Defibrillation for Refractory Ventricular Fibrillation trial[215] explored the relationship between vector change to AP placement and the type of VF (shock-refractory or recurrent) on patient outcomes. The study reported that vector-change to AP placement, compared with continuation of AL positioning, was not superior for VF termination, ROSC, or survival for shock-refractory VF. For recurrent VF, vector-change defibrillation was superior for VF termination, but not for ROSC or survival.
- Paddles may still be in use in some low-resource ALS settings. However, the Task Force acknowledges that the AP position is not feasible with paddles and that paddle sizes are standard as provided by the manufacturer. The task force did not foresee future development in the use of paddles.

- AEDs have diagrams to guide users in correct pad positioning. However, there is wide variation in these diagrams, and evidence suggests that untrained bystanders fail to achieve accurate pad placement when guided by current defibrillation pad diagrams.[216]

Knowledge Gaps

- The impact of different pad positions in the first 3 shocks on patient outcomes
- The effect of different pad sizes on patient outcomes
- Optimal pad sizes and positions in children and in-hospital settings
- The interaction between pad size and orientation

Removal of Bra for Pad Placement and Defibrillation (BLS 2604, ScopRev 2025)

Rationale for Review

The BLS Task Force prioritized this review because the topic is controversial and, to date, no comprehensive review has been undertaken. The full details of this review can be found in the ScopRev[217] and on the ILCOR website.[218]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in cardiac arrest
- Concept: Adverse events and outcomes associated with pad placement and/or defibrillation without removing the patient’s bra/brassiere (including those with metal components)
- Context: In patients wearing a bra/brassiere in any setting (in-hospital or out-of-hospital)
- Time frame: All years to September 26, 2024. Grey literature searched (Good Scholar, first 200 references) October 1, 2024.

Summary of Evidence

No studies reporting patient outcomes were identified. One animal study[219] and 2 simulation mannikin studies[220,221] were included. The evidence is summarized in Table 8.

Table 8. Summary of the Evidence on Bra Removal for Defibrillation

Study details	Study design, publication type	Intervention	Key findings
Di Maio 2015	Porcine model (n=4) with induction of arrhythmia and defibrillation by an AED Conference abstract	AED pads in direct contact with the metal wires of a bra placed on the pig Induction of VF and defibrillation with 200 J shocks	No scorching or burning of the bra or skin Poor pad placement did not pose a risk to the operator (risk type not specified) No arcing No redirection of the current 100% first shock success (no instances of refibrillation)
Kramer 2015	69 randomly assigned undergraduate students: Simulation of OHCA with CPR and AED on male or female manikins (use of a wig, make-up, silicone breasts, front-opening brassiere, color-coordinated women's clothing). Peer-reviewed article	Voice prompt AED guidance on opening the case, activating AED, positioning of pads, shock delivery, administering CPR	Female manikins less likely to be completely disrobed than the male manikins (42.4% versus 91.7%, $p<0.001$) Male rescuers less likely to completely disrobe the female manikins than female rescuers (13.3% versus 66.7%, $p=0.002$) Opinions on removal of clothes: Thought they needed only to remove enough clothing to place the defibrillator pads according to instructions rather than ensuring the brassiere would not affect CPR Social norms Concerned for patient modesty Men did not want to remove more clothing than necessary
O'Hare 2014	78 randomly selected untrained AED users: Simulation of resuscitation with AED use on manikins as either "female" (clothed in a front-opening hooded sweater with a bra) or "male" (no bra) Conference abstract	Removal of clothes (including bra) from the manikin guided by the AED voice prompt	No difference in time to place electrodes: 52 versus 49 seconds for female versus male manikin No difference in time to first shock: 79.5 versus 77 seconds for female versus male manikin 88.5% of the participants correctly placed the electrodes and delivered a shock (sex of manikin not specified)

AED indicates automated external defibrillator; CPR, cardiopulmonary resuscitation; OHCA, out-of-hospital cardiac arrest; VF, ventricular fibrillation.

Task Force Insights

The evidence-to-decision table is included in Supplement Appendix A. The task force discussed the review findings and noted the following:

- Two included studies were published as conference abstracts by the same group of authors who were employed by a company that develops and manufactures AEDs.[5,6] A growing body of research has identified that women are less likely to receive CPR and defibrillation by the public.[222-224] Public opinion surveys show that some members of the public do not feel comfortable exposing women's breasts, and fear accusations of inappropriate touching and sexual assault.[225] These concerns may impact bystanders' willingness to perform CPR and defibrillation and explain why rates are lower in women. Whether it is necessary to remove such undergarments is unknown.
- This ScopRev demonstrated scant evidence on this topic. Peer review occurred for only 2 of the 3 included studies. We found no evidence reporting patient outcomes or any case studies reporting adverse events from defibrillation without removing a bra.
- Leaving the bra on could result in inaccurate pad placement, but routine removal could compromise timely defibrillation, particularly in bystander situations. Some AED's verbal and written instructions do not describe bra removal, so the public may not currently remove it to place pads.
- There are likely to be privacy and cultural issues associated with fully exposing a woman's chest. Some resuscitation groups are already actively training to keep the bra on to overcome hesitancy in bystanders. However, correct and timely pad placement must be a priority.
- Although insufficient studies were identified to support a more specific SysRev of defibrillation while wearing a bra at this time, the task force felt the need to highlight and address the inequality in AED application in women by making good practice statements to highlight this issue to the international community.

Treatment Recommendations (2025)

There is insufficient evidence to guide the routine removal of a bra, but it may not always be necessary to remove a bra for defibrillation. Pads must be placed on bare skin in the correct position, which may be possible by adjusting the bra's position rather than removing it (good practice statement).

Manufacturers should develop realistic manikins that reflect different body sizes that can impact pad placement (good practice statement).

Where possible, CPR training should cover defibrillation for patients wearing bras, focusing on correct pad placement and minimizing pauses in compressions (good practice statement).

Knowledge Gaps

- Whether removing a bra is necessary with modern bras, pads, and defibrillators
- Sex-specific barriers to high-quality CPR and defibrillation; listening to emergency calls may provide critical insights to address in public messaging and CPR training
- A better understanding of public opinions and sociocultural sensitivities related to exposing the chest

Effectiveness of Ultraportable AEDs (BLS 2603: ScopRev 2024)

A 2024 ScopRev examined the evidence on the effectiveness of ultraportable AEDs. The details of this review can be found in the ScopRev[226], the 2024 CoSTR summary,[40,41] and on the ILCOR website.[227]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in OHCA
- Intervention: the use of an ultra-portable or pocket AED
- Outcomes: all outcomes were accepted

- Time frame: 2012 to October 31, 2023. We did not search grey literature.

Treatment Recommendations (2024)

Urgent evaluation of the clinical effectiveness of ultra-portable or pocket AEDs is needed (good practice statement).

SPECIAL CIRCUMSTANCES

OHCA Following Drowning

A 2021 ScopRev, 2023 SysRev, and 2025 EvUps examined the evidence on 7 drowning questions. For these questions the population and outcomes are the same across all subtopics, and interventions and comparators are detailed for each subtopic. The details of this review can be found in the ScopRev,[228] SysRev,[229] the 2023 CoSTR summary,[6,7] and on the ILCOR website.[230-234] The 2025 EvUps are provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in cardiac arrest following drowning
- Outcomes:
  - Critical: Survival to discharge or 30 days with favorable neurological outcome; survival to discharge or 30 days
  - Important: ROSC
- Time frame: April 25, 2023, to April 14, 2024

Immediate Resuscitation in Water or on Boat in Drowning (BLS 2702/2703: 2023 SysRev, EvUp 2025)

Intervention and Comparator

- Intervention: Immediate resuscitation in water or on boat
- Comparator: Delaying resuscitation until on land

Summary of Evidence

The EvUp identified no new studies. A SysRev is not warranted.

Treatment Recommendations (2023)

We suggest in-water resuscitation (ventilations only) may be delivered if rescuers, trained in this technique, determine that it is feasible and safe with the equipment available and the distance to land warrants its use (weak recommendation, very low–certainty evidence).

We suggest on-boat CPR may be delivered if rescuers trained in this technique determine that it is feasible and safe to attempt resuscitation (good practice statement).

If the rescuers feel that the application of immediate CPR is or becomes too difficult or unsafe, then the rescuers may delay resuscitation until on land (good practice statement).

CAB Versus ABC in Drowning (BLS 2704: ScopRev, 2023 SysRev 2024, EvUp 2025)

A slight change to the 2023 treatment recommendation was made to align with the treatment recommendations for all cardiac arrest patients.

Intervention and Comparator

- Intervention: Resuscitation that incorporates a compression-first strategy (CAB)
- Comparator: Resuscitation that starts with ventilation (ABC)

Consensus on Science

No studies were identified that addressed the PICOST question in the SysRev or the EvUp.

Prior Treatment Recommendations (2023)

We recommend a compression-first strategy (CAB) for laypeople providing resuscitation for adults and children in cardiac arrest caused by drowning (good practice statement).

We recommend health care professionals and those with a duty to respond to drowning (eg, lifeguards) consider providing rescue breaths/ventilation first (ABC) before chest compressions if they have been trained to do so (good practice statement).

Treatment Recommendations (2025)

We recommend a compression-first strategy (CAB) for laypeople providing resuscitation for adults in cardiac arrest caused by drowning (good practice statement).

Health care professionals and those trained and with a duty to respond to drowning (eg, lifeguards) should consider providing rescue breaths/ventilation first (ABC) before chest compressions (good practice statement).

Justification and Evidence-to-Decision Framework Highlights

There is no evidence-to-decision table as no evidence was identified. In making the good practice statements, the task force considered the following:

- The compression-first strategy for adults prioritizes simplicity and cohesiveness in training recommendations for laypersons, with the goal of faster initiation of resuscitation. We also considered the indirect manikin studies[110,112-115] published in the review of this question for all cardiac arrests (BLS 2202).
- The ventilation-first strategy for health care professionals and those with a duty to respond considers that indirect evidence from a study examining in-water ventilations may improve outcomes[235] and the specialized training of lifeguards and health care professionals (including cardiac monitoring and ventilation-delivery equipment). It is unclear if earlier ventilations improve outcomes once cardiac arrest has occurred or if the benefit is in preventing respiratory arrest from deteriorating into cardiac arrest.

Of note, no direct or indirect evidence is available to support any certain number of initial ventilations if lifeguards or health care professionals adopt a ventilation-first strategy. Most importantly, resuscitation should not be delayed by either selected strategy.

Knowledge Gaps

There were no studies which directly evaluated this question. Further research, informed by the Utstein template for drowning may usefully address this ongoing uncertainty.

Chest Compression–Only CPR in Cardiac Arrest in Drowning (BLS 2705: SysRev 2023, EvUp 2025)

Intervention and Comparator

- Intervention: Chest compression–only CPR
- Comparator: Conventional CPR (compressions and ventilations)

Summary of Evidence

The EvUp identified no new studies. No SysRev is warranted.

Treatment Recommendations (2023)

For lay responders, the treatment recommendations for CPR in drowned OHCA patients who have been removed from the water remain consistent with CPR for all patients in cardiac arrest (good practice statement).

Adults: We recommend that bystanders perform chest compressions for all patients in cardiac arrest.

We suggest that bystanders who are trained, able, and willing to give rescue breaths and chest compressions do so for adults in cardiac arrest.

Children: We suggest that bystanders provide CPR with ventilation for infants and children younger than 18 years with OHCA.

We recommend that if bystanders cannot provide rescue breaths as part of CPR for infants and children younger than 18 years with OHCA, they should at least provide chest compressions.

For health care professionals and those with a duty to respond to drowning (eg, lifeguards), we recommend providing ventilation in addition to chest compressions if they have been trained and are able and willing to do so (good practice statement).

Ventilation Equipment in Cardiac Arrest Following Drowning (BLS 2706: SysRev 2023, EvUp 2025)

Intervention and Comparator

- Intervention: Ventilation with equipment before hospital arrival
- Comparator: Ventilation without equipment before hospital arrival

Summary of Evidence

The EvUp identified no new studies. No SysRev is warranted.

Treatment Recommendations (2023)

We recommend that health care professionals follow the ALS treatment recommendations for airway management for adults and children in cardiac arrest caused by drowning.[45,46]

Prehospital Oxygen Administration Following Drowning (BLS 2707: SysRev 2023, EvUp 2025)

Intervention and Comparator

- Intervention: Oxygen administration before hospital arrival
- Comparator: No oxygen administration before hospital arrival

Summary of Evidence

The EvUp identified no new studies. No SysRev is warranted.

Treatment Recommendations (2023)

When available, we recommend trained providers use the highest possible inspired oxygen concentration during resuscitation for adults and children in cardiac arrest following drowning (good practice statement).

AED Use First Versus CPR First in Cardiac Arrest in Drowning (BLS 2708: ScopRev, SysRev 2023, EvUp 2025)

Intervention and Comparator

- Intervention: AED administered before CPR
- Comparator: CPR administered before AED

Summary of Evidence

The EvUp identified no new studies. No SysRev is warranted.

Treatment Recommendations (2023)

We recommend that CPR should be started first and continued until an AED has been obtained and is ready for use for adults and children in cardiac arrest caused by drowning (good practice statement).

When available, we recommend an AED is used in cardiac arrest caused by drowning in adults and children (good practice statement).

PAD Programs for Drowning (BLS 2709: SysRev 2023, EvUp 2025)

Intervention and Comparator

- Intervention: PAD program
- Comparator: Absence of PAD program

Summary of Evidence

The EvUp identified no new studies. No SysRev is warranted.

Treatment Recommendations (2023)

This treatment recommendation is unchanged from the standing recommendation for all OHCAs.

We recommend implementing PAD programs for all patients with OHCA (strong recommendation, low-certainty evidence).[37,38]

CPR During Transport (BLS 2715: SysRev 2022, EvUp 2025)

A 2022 SysRev and 2025 EvUp examined the evidence on CPR during transport. The details of this SysRev can be found in the 2022 CoSTR summary[169,170] and on the ILCOR website.[236] The 2025 EvUp is provided in Appendix B.

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children receiving CPR following OHCA
- Intervention: Transport with ongoing CPR
- Comparator: Completing CPR on scene (until ROSC or termination of resuscitation)
- Outcomes:
  - Critical: Survival to hospital discharge with good neurological outcome; survival to hospital discharge
  - Important: Quality of CPR metrics on scene versus during transport (reported outcomes may include rate of chest compressions, depth of chest compressions, chest compression fraction, interruptions to chest compressions, leaning on chest/incomplete release, rate of ventilation, volume of ventilation, duration of ventilation, pressure of ventilation); ROSC.
- Time frame: November 2020 to April 22, 2024

Summary of Evidence

The EvUp identified several studies,[237-246] including a protocol[247] and early results in abstract form[248] for a recently completed but not yet fully published RCT. This SysRev will be updated following the publication of the RCT.

Treatment Recommendations (2022)

We suggest that providers deliver resuscitation at the scene rather than undertake ambulance transport with ongoing resuscitation unless there is an appropriate indication to justify transport (eg, extracorporeal membrane oxygenation) (weak recommendation, very low–certainty evidence).

The quality of manual CPR may be reduced during transport. We recommend that whenever transport is indicated, EMS providers should focus on the delivery of high-quality CPR throughout transport (strong recommendation, very low–certainty evidence).

Delivery of manual CPR during transport increases the risk of injury to providers. We recommend that EMS systems have a responsibility to assess this risk and, where practicable, to implement measures to mitigate the risk (good practice statement).

CPR in Obese Patients (BLS 2720, ScopRev 2025)

Rationale for Review

This topic was prioritized for review by the BLS, the ALS, the PLS, and the Education, Implementation, and Teams Task Forces because of the increasing prevalence of obesity worldwide and the specific challenges in providing CPR to this patient cohort. This topic has not previously been reviewed by ILCOR. The full details of this review can be found in the ScopRev[249] and on the ILCOR website.[250]

Population, Intervention, Comparator, Outcome, and Time Frame

- Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest
- Intervention: CPR (including mechanical and e-CPR) in obese patients (as defined in specific papers)
- Comparators: May have no comparator, comparator of nonobese patients, or compare modified CPR for obese patients with standard CPR
- Outcomes:
  - Critical: Survival to hospital discharge with good neurological outcome; survival to hospital discharge
  - Important: ROSC; CPR quality measures (chest compression rate, chest compression depth, ventilation rate, tidal volume, end-tidal carbon dioxide), CPR timing (time to commencement of rescue breaths, first compression, first defibrillation if shockable rhythm); CPR techniques (chest compressions, defibrillation, ventilation and airway management, vascular access and medications); health-related quality of life and provider outcomes (safety, manual handling)
- Time frame: All years to October 1, 2024

Summary of Evidence

Thirty-six studies were included.[251-286] Definitions of *obesity* varied. Full reporting of the results can be found in the ScopRev.[249]

In adults, the association between obesity and neurological outcomes, survival to hospital discharge, longer-term survival (months to years), and ROSC was variable. In children, worse neurological outcomes, lower survival, and lower ROSC than normal-weight children were reported in 2 studies. Few studies reported resuscitation quality indicators, and no studies reported on adjustments to CPR techniques or provider outcomes.

Task Force Insights

The task force discussed the review findings and noted the following:

- At the time of this review, there was no universal definition of *obesity* so for the purposes of this ScopRev, *obese* was defined according to each individual study. There was wide variability in the definitions of *obesity* across the studies.
- In adults, the evidence of the impact of obesity on patient outcomes was conflicting.
- In children, 2 studies suggested that obese children had worse neurological outcomes, lower survival, and lower ROSC than normal-weight children.
- The variability in results does not suggest an urgent need to deviate from standard CPR protocols. Some evidence suggests CPR duration may be longer in obese adults, which may have staffing and resource implications.

Treatment Recommendations

Standard CPR protocols should be used in obese patients (good practice statement).

Knowledge Gaps

- There are few studies of CPR in obese infants, children, and adolescents.
- A standardized definition of *obese*, or population-specific definition of *obese*, for the purpose of resuscitation research
- The true impact of obesity on CPR outcomes when other factors are accounted for
- The effect of obesity on CPR techniques (such as chest compressions, airway management and ventilation, and defibrillation), CPR quality, and time to and delivery of

resuscitation interventions (such as vascular access and medications, use of mechanical CPR devices, or extracorporeal membrane oxygenation) in both adults and children

- Whether the degree of obesity influences CPR performance, outcomes following CPR (including health-related quality of life), or inclusion in CPR research.
- The effect of patient obesity on provider outcomes (eg, physical exertion, manual handling, fatigue)

Topics Not Included in the 2025 Review

- Public access defibrillation programs (BLS 2121)
- CPR prior to defibrillation (BLS 2203)
- Check for circulation during BLS (BLS 2210)
- Timing of rhythm check (BLS 2211)
- Chest compression rate, depth, recoil (BLS 2501)

Topics Retired or Reposed

- Rescuer fatigue in chest compression–only CPR
- CPR before call for help
- Alternative compression techniques (cough, precordial thump, fist pacing)

Topics Moved to the First Aid Task Force

- Harm from CPR to victims not in arrest
- Foreign-body airway obstruction
- Resuscitation care for suspected opioid-associated emergencies
- Drowning factors related to survival

Collaborators

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