GUIDELINES 2025
EUROPEAN RESUSCITATION COUNCIL

[h1] European Resuscitation Council Guidelines 2025: Adult Basic Life Support

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[h1] Abstract

The European Resuscitation Council has produced these ERC Guidelines 2025 Basic Life Support for adults based on the ILCOR Consensus on Cardiopulmonary Resuscitation Science with Treatment Recommendations published since 2021.[1-3] The topics addressed include how to recognise cardiac arrest, alerting the emergency services, delivering chest compressions, performing rescue breaths, how to use an automated external defibrillator (AED) and safety considerations for rescuers. Quality of cardiopulmonary resuscitation (CPR) and the use of technology has been embedded into the relevant sections, rather than reported separately. The management of a cardiac arrest in children, infants and neonates are described in the ERC guidelines 2025 Neonatal Life Support and Paediatric Life Support.

[h2] **Keywords:** Out-of-hospital cardiac arrest, Recognition of cardiac arrest, Cardiopulmonary resuscitation, Automated External Defibrillator, Dispatcher-assisted CPR, Defibrillation

Key messages for BLS

- Everyone can learn how to perform CPR
- Recognition of cardiac arrest can be challenging. If a person is unconscious call the local emergency service before assessing breathing. The dispatcher will be able to assist you if you are uncertain.
- Train emergency medical services dispatchers in cardiac arrest recognition and telephone-CPR.
- Commence chest compressions as soon as possible
- Compress the chest at a rate to 100-120 min^{-1}
- Compress to a depth of at least 5 cm, but not more than 6 cm.
- If providing rescue breaths, deliver just enough air to make the chest start to rise; avoid excessive ventilation.
- Anyone can learn how to use an Automated External Defibrillator (AED)
- AEDs should be widely available
- Locations of AEDs should be prominently sign-posted with clear signage
- AED signage should include a statement that no training is needed to use an AED

- AEDs should be housed in unlocked cabinets
- AEDs should be available 24 hours a day, 7 days a week
- The risk of harm from CPR is low, rescuers should not be concerned that they will cause serious injury if the person is not in cardiac arrest

[h1] Introduction

These ERC Guidelines 2025 on Basic Life Support (BLS) for adults have been written with reference to the International Liaison Committee on Resuscitation (ILCOR) Consensus on Science and Treatment Recommendations (CoSTR) for Basic Life Support.[1-3] [2025 ILCOR COSTR] If no recent ILCOR recommendation was available, the ERC used findings from recently published studies to inform guideline recommendations, and when required, the guidelines were informed by the expert consensus.

BLS Writing Group members and the Guideline Steering Committee agreed to this version, which was posted for public comment between DATE and DATE. xy individuals from yz countries made zz comments. A total of [INSERT NUMBER] individuals from [INSERT COUNTRIES] submitted [INSERT NUMBER] comments, leading to [INSERT CHANGES] in the final version. The guidelines were presented to and approved by the ERC General Assembly on DATE. The methodology used for guideline development is presented in the Executive summary. [INSERT REF]

For the purpose of this guideline, the term CPR relates to the specific technical skills of cardiopulmonary resuscitation (i.e. performance metrics of chest compression and ventilation), whilst resuscitation is used as a generic term covering the broader range of skills and interventions. The term bystander is used to describe rescuers who happen to be at the scene to provide help, and the term first responder is used for those who have additional training and are alerted to attend the scene of a cardiac arrest. Healthcare Professionals (HCPs) are those who work in any healthcare sector (prehospital or in-hospital). Laypeople are persons not working in the healthcare sector. Basic Life Support (BLS) is defined as initiating the chain of survival, early high-quality chest compression, effective ventilation, and the early use of an automated external defibrillator (AED). Any form of resuscitation beyond BLS is described generically as advanced life support (neonatal, paediatric, and adult life support). Where the term 'ALS' is used, this refers specifically to the ERC adult Advanced Life Support course. The writing group of this ERC

Guideline 2025 Basic Life Support for adults considered the recently introduced ERC approach to diversity, equality, equity, and inclusion (DEI) while writing these guidelines, and applied it whenever possible, recognising and realising that this is a field for improvement in the production of evidence-informed guidelines.

- **[h1] Summary of key changes or new evidence**

Table 1. The major changes in the 2025 guidelines for Adult Basic Life Support (BLS).

ERC Guidelines 2021	ERC Guidelines 2025
Changes to guidance	
The 2021 ERC BLS guideline emphasised recognising cardiac arrest in a person who is unresponsive and not breathing normally, before calling the local emergency services.	The 2025 ERC BLS guideline emphasises calling the local emergency services for any person who is unresponsive. Rescuers no longer need to confirm abnormal breathing before calling. Initiate the call first then assess breathing. The dispatcher will assist you in identifying abnormal breathing.
The 2021 ERC BLS guideline emphasised descriptions of slow or laboured breathing as indicators of abnormal breathing.	Cardiac arrest often occurs during sporting events. Early after the onset of cardiac arrest, athletes may display a near normal or panting breathing pattern.
New topics added in the 2025 ERC BLS guidance	
The role of the dispatcher was previously addressed in the Systems Saves Lives chapter, which addresses the role of dispatchers with respect to system performance and the cardiac arrest population.	The 2025 ERC BLS guideline includes some detail of the role of dispatcher. The role of the dispatcher is critical to early recognition of cardiac arrest and initiation of CPR.
There are a few studies to indicate that head-up CPR might help improve patient outcomes.	Existing studies of head-up CPR include a bundle of interventions, and are not limited

There has been growing interest within the resuscitation community about the potential benefits of head-up CPR.	to just positioning the patient in a head-up position. Evidence addressing the impact of head-up CPR without the other elements of the CPR bundle is lacking.
Psychological wellbeing of rescuers was not previously addressed within BLS guidance	There is increasing evidence that finding a person in cardiac arrest and attempting resuscitation is a potentially traumatic experience for many lay rescuers. The 2025 ERC BLS guideline now recognises that lay rescuers and bystanders may benefit from psychological support.
CPR in obese patients was not previously addressed within BLS guidance	There is a growing body of evidence exploring cardiac arrest management and outcomes in obese patients. The 2025 ERC BLS guideline advises that obese patients receive standard 30:2 CPR without modifications.
Topics removed from the ERC 2025 BLS guideline	
The 2021 ERC BLS guideline included guidance for modification of BLS in response to COVID-19.	BLS modifications for COVID-19 been removed from the BLS guidelines. COVID-19 is now endemic in the community and this advice has been removed in line with national health policies.
The 2021 ERC BLS guideline included guidance for management of foreign body airway obstruction	Management of foreign body airway obstruction has been relocated from BLS to the First Aid guideline.

[h1] Concise Resuscitation Guideline for All Responders

[h2] Recognising cardiac arrest

- Suspect cardiac arrest in any person who is unresponsive.
- Call your local emergency number without delay.
- Slow, laboured breathing, as well as other abnormal patterns such as agonal gasping or panting, must be recognised as signs of cardiac arrest; in such cases, or when in doubt, always start CPR.
- A short period of seizure-like activity may occur at the onset of cardiac arrest. Once the seizure stops, if the person is unresponsive and not breathing normally, cardiac arrest should be assumed.

[h2] Alerting the emergency services

- If you have a mobile phone, activate speaker mode and dial the local emergency number without delay.
- If you are alone and do not have a mobile phone, or there is no mobile phone signal, you can shout for help and immediately commence CPR.
- However, if you think no-one will come to help then you will have to leave the person to alert the local emergency service. Do this as quickly as possible.
- If they remain unresponsive and not breathing normally when you return from summoning help, immediately commence CPR.

[h2] Role of the dispatcher

- Dispatchers should use standardised protocols to facilitate recognition of cardiac arrest.
- Once cardiac arrest is recognised, dispatchers should provide CPR instructions to all callers.
- Dispatchers should assume the caller does not know how to perform CPR, and provide chest-compression-only instructions. If the caller subsequently states they know how to perform CPR, then dispatchers should facilitate 30:2 CPR

- Once CPR is underway, dispatchers should ask if there is an ‘AED’ or ‘defibrillator’ at the scene.
- If no AED is available at the scene, and more than one bystander is present, dispatchers should guide bystanders to the nearest AED.
- As soon as an AED is available at the patient, dispatchers should instruct the bystander to activate the AED and to follow the AED instructions.
- Where first responder systems have been implemented, dispatchers should activate registered community volunteer responders to the incident and to retrieve a nearby AED.

[h2] High quality chest compressions

- Commence chest compressions as soon as possible.
- Place the heel of one hand on the lower half of the sternum (‘in the centre of the chest’).
- Place the heel of your other hand on top of the first hand.
- Interlock your fingers of the hands to ensure that pressure is not applied over the ribs.
- Keep your arms straight.
- Position your shoulders vertically above the persons chest.
- Compress to a depth of at least 5 cm, but not more than 6 cm.
- Compress the chest at a rate of 100–120 min^{-1} with as few interruptions as possible.
- Allow the chest to recoil completely after each compression; avoid leaning on the chest.
- CPR is most effective when performed on a firm surface. However, rescuers should not move a person from a ‘soft’ surface e.g. bed to the floor. Start CPR on the bed and, if needed, compress the chest deeper to compensate for the soft mattress.

[h2] Rescue breaths

- If not previously trained to provide rescue breaths, perform continuous chest compressions without interruptions.
- If trained to provide rescue breaths, alternate 30 chest compressions with 2 effective rescue breaths.

- When providing rescue breaths, deliver just enough air to make the chest start to rise; avoid excessive ventilation.

[h2] Using an Automated External Defibrillator (AED)

- Anyone can use an Automated External Defibrillator (AED).

[h3] How to find an AED

- Ensure that AED locations are indicated by clear signage (see figure xy).
- Signage should state that AEDs can be used by anyone and that no training is needed.
- AED locations may also be identified using electronic mapping systems available on some mobile phone and computer applications.
- The local emergency service should be able to direct callers to the nearest available AED.

[h3] When and how to use an AED

- Use an AED as soon as it is available
- Open the AED case (if present). Some AEDs automatically turn on when opened. If not, identify the power button and turn it on (see figure x)
- Follow the audio/visual prompts from the AED
- Attach the electrode pads to the person's bare chest according to the position shown on the AED and in figures 2 & 3 (these should be images for male/female chest)
- If more than one rescuer is present, continue CPR while the pads are being attached.
- Ensure that nobody touches the person whilst the AED is analysing the heart rhythm.
- If a shock is indicated, ensure that nobody is touching the person.
- Some AEDs (fully automatic AEDs) will deliver a shock automatically, while others (semi-automatic AEDs) will require the rescuer to press the shock button (see figure x) to deliver the shock
- After the shock has been delivered, immediately restart chest compressions.
- If no shock is indicated, immediately restart CPR chest compressions.
- Continue to follow the AED instructions.
- Usually, the AED will instruct the rescuer to perform CPR, then, after 2-minutes the AED will instruct the rescuer to pause CPR to undertake rhythm analysis.

[h3] Where to place AEDs

- AEDs should be placed in clear sight.
- AED cabinets should be unlocked and readily available 24 hours a day, 7 days a week, 365 days per year.
- Locations with a high population flow, such as airports, shopping centres and train stations should have on-site AEDs that are readily available for public use.
- Communities are encouraged to deploy AEDs in public spaces, particularly those with a higher incidence of cardiac arrest.
- AEDs should be registered with the local emergency service, especially if they are linked to AED registries and first responder programs.

[h2] Safety

- Ensure the safety of yourself, the person in cardiac arrest, and any bystanders
- Lay people should commence CPR for presumed cardiac arrest without concerns of harm to patients not in cardiac arrest.
- The risk of infection to rescuers performing CPR is low.
- The risk of harm to rescuers, from accidental shock during AED use, is low.
- The risk of physical injury to the rescuer, from performing CPR, is low.
- Consider the wellbeing of layperson and bystanders – offer them psychological support.

[h1] Evidence informing the guidelines

[h2] Recognising cardiac arrest

The practical, operational definition of cardiac arrest is when a person is unresponsive and not breathing normally.[4] Although unresponsiveness and abnormal breathing are present in other potentially life-threatening medical emergencies, they have very high sensitivity as diagnostic criteria for cardiac arrest.[5,6] Using these criteria will over triage for cardiac arrest,[7] however the small risk of commencing CPR in an unresponsive individual, who is not breathing normally but is not in cardiac arrest, is far outweighed by the increased mortality associated with delayed CPR for those in cardiac arrest.[8] The ERC acknowledges that confirming unconsciousness with abnormal breathing remains the primary barrier to recognition of cardiac arrest.[9]

[h3] Abnormal breathing

The ERC Guidelines 2025 BLS continue to highlight the importance of recognising agonal breathing as a sign of cardiac arrest.[9] Agonal breathing is an abnormal breathing pattern. It is observed in 30-60% of cardiac arrests,[10] most commonly at the onset of cardiac arrest.[11] It indicates the presence of residual brain stem function and is associated with improved outcomes.[12]

Agonal breathing is frequently misinterpreted as a sign of life.[5] This presents a challenge to lay people, first responders, emergency medical dispatchers and HCPs. Common terms used by lay people to describe agonal breathing include gasping, barely or occasionally breathing, moaning, sighing, gurgling, noisy, groaning, snorting, heavy or laboured breathing.[10,13]

Misinterpretation of abnormal breathing remains the biggest barrier to recognition of cardiac arrest.[6,10,14] Recognition of abnormal breathing as a sign of cardiac arrest will enable CPR to be started without delay. Failure to recognise cardiac arrest by dispatchers during emergency calls is also associated with decreased survival.[15,16]

In addition to agonal breathing patterns, other abnormal breathing patterns have been described, particularly when cardiac arrest is associated with collapse whilst playing sport.[17] Athletes who sustain a cardiac arrest may continue breathing more regularly[18-20] and/or have their eyes open following collapse. [21] This has prompted the ERC to include the descriptor of panting within the recognition of cardiac arrest section.

[h3] Seizures

Seizure-like movements of short duration among patients in cardiac arrest pose another important barrier to recognition of cardiac arrests. Seizures are common medical emergencies and are reported to constitute approximately 3-4% of all emergency medical calls.[22,23] However, only 0.6–2.1% of these calls will be cardiac arrests.[24-26] An observational study including 3502 OHCAs identified 149 (4.3%) victims with seizure-like activity[26]. Patients presenting with seizure-like activity were younger (54 vs. 66 years; $p < 0.05$), were more likely to have a witnessed arrest (88% vs 45%; $p < 0.05$), more likely to present with an initial shockable rhythm (52% vs. 24%; $p < 0.05$), and more likely to survive to hospital discharge (44% vs. 16%; $p < 0.05$). A more recent study identified seizure activity in 59/465 non-traumatic OHCA (12.7%) and also observed an association with improved outcomes.[27] Similar to agonal respiration, seizures complicate the recognition of cardiac arrest for lay people, first responders and HCPs (median time to dispatcher identification of the cardiac arrest; 130 s vs 62 s; $p < 0.05$).[26]

Recognising cardiac arrest after a seizure episode when the victim remains unresponsive with abnormal breathing is important to prevent delayed CPR. The risk of delaying CPR in cardiac arrest far outweighs any risk from performing CPR on a person who is not in cardiac arrest.

[h2] Alerting the emergency services

Whenever a person is unresponsive, bystanders who have a mobile phone should dial the local emergency number and activate speaker mode.[28] Once the call is underway, the caller can then assess for the presence abnormal breathing.

If the person is unresponsive and not breathing normally commence CPR (30:2) immediately.[9] If there is any doubt about breathing status, the dispatcher will assist the caller to identify abnormal breathing.[10] Callers should not delay contacting the emergency services to confirm the presence of abnormal breathing.

This recommendation is based on a recent ILCOR scoping review demonstrating that most cardiac arrests are initially recognised by the dispatcher during the call, rather than by bystanders at the scene.[10] Prioritising calling local emergency services for all unresponsive patients will increase the number calls made for patients not in cardiac arrest, however the majority of such unresponsive patients are likely to require assistance from the emergency services, even though they might not be in cardiac arrest. This approach is unlikely to adversely impact emergency service performance.[29] Despite widespread availability of mobile phones, there will inevitably be circumstances where no mobile phone is available, or there is no mobile phone signal. In these circumstances, a lone rescuer has 2 options – shout for help, or leave the person in cardiac arrest to alert local emergency services.

If a lone rescuer believes there are people nearby, who will come to their assistance, it is reasonable to shout for help and commence CPR. However, if no-one responds to the call for help, then the lone rescuer will have to stop CPR and leave the person in cardiac arrest, to summon the local emergency services. There is currently no evidence addressing how long to continue CPR before leaving the person to alert the local emergency services. If the lone rescuer does need to leave the person in cardiac arrest to summon help, the ERC advises that this is done as quickly as possible.

[h2] Role of the dispatcher

[h3] Dispatcher recognition of cardiac arrest

Prompt and accurate recognition of cardiac arrest is essential to initiating timely bystander CPR, including dispatch-assisted CPR and the appropriate emergency medical service (EMS) response.[30] Most cardiac arrests are not recognised by bystanders and are first recognised by the dispatcher during the call to the dispatch centre, emphasising dispatchers' critical role in facilitating recognition as quickly as possible.[10] A diagnostic systematic review by ILCOR published in 2021 included 47 studies and reported wide variability in dispatchers' ability to recognise OHCA (sensitivities and specificities for OHCA recognition varied from 0.46 to 0.98 and 0.32 to 1.00, respectively). It was not possible to identify any differences in diagnostic accuracy between criteria or algorithms.[7]

A more recent ILCOR scoping review reviewed 62 studies and found the most pertinent challenge to dispatcher-assisted recognition of OHCA is establishing whether or not the patient is breathing normally.[10] Several strategies were studied, but no strategy performed better than the commonly used 'two-questions' strategies (i.e., "Is the person conscious?" and "Are they breathing normally?"). Although several strategies were tested, there were no randomised controlled trials (RCT) comparing different strategies. One of the included RCTs tested the addition of an artificial intelligence (AI) model but did not find this intervention improved dispatcher-assisted recognition of OHCA.[10]

In accordance with ILCOR, the ERC continues to recommend dispatchers follow a standardised algorithm and/or standardised criteria to quickly identify if a patient is in cardiac arrest at the time of emergency call.[9] Further detail addressing how dispatch processes can improve outcomes from cardiac arrest can be found in the ERC Guidelines 2025 Systems Save Lives.[add ref]

[h3] Dispatcher CPR instructions

Dispatch-assisted CPR is recommended for-a person in cardiac arrest[30] and is widely implemented.[31-34] Compared with no CPR, there are improvements in survival to hospital discharge (OR 1.67, 95% CI 1.39 to 2.0) and survival to hospital discharge with favourable neurological outcome (OR 2.21, 95% 1.44 to 3.40).[35]

A 2024 ILCOR scoping review was unable to identify sufficient high-certainty evidence to recommend specific interventions to optimise dispatch-assisted CPR.[30] However, dispatch-assisted CPR studies addressing the impact of simple language to deliver CPR instructions suggest a reduction in time to first compression[36-38] and an increase in CPR quality.[39,40] Modifying the statement “Do you want to do CPR” to “We need to do CPR” increased the number of cases where CPR was actually peformed,[41] however instructions to “Put the phone down” found no difference in the quality of CPR.[42]

Although there is currently insufficient evidence to support any specific approach to dispatcher-assisted CPR instructions, the ERC continues to recommend that dispatchers provide CPR instructions for all patients in cardiac arrest.

[h3] The use of video for dispatcher CPR instructions

Traditionally, dispatchers provide audio-only CPR instructions. Newly developed technology enables dispatchers to provide video CPR instructions through the caller’s mobile phone. A recent systematic review and meta-analysis identified nine studies evaluating video instructions for simulated OHCA.[30] Compression fraction was greater with video instructions,[43-45] compression rates were higher with video-instructions,[44-47] and there was a trend towards better hand-placement.[44] No difference was observed in compression depth or time to first ventilation, and there was a slight increase in the time it took to start CPR with video instructions. In a more recent retrospective study of adult OHCA, 1720 eligible OHCA patients (1489 and 231 in the audio and video groups, respectively) were evaluated. The median instruction time interval was similar (136 s in the audio group and 122 s in the video group); however, survival to discharge rates were 8.9% in the audio group and 14.3% in the video groups ($p < 0.001$). Good neurological outcome occurred in 5.8% and 10.4% in the audio and video groups, respectively ($p < 0.001$).[48] RCTs testing the effect of live video streaming on outcomes are lacking.

There is currently insufficient evidence to support the widespread implementation of video for dispatcher CPR instructions. The ERC recommends that where such technology is implemented that it should be in a highly controlled manner, and preferably as part of formal research program.

[h3] Dispatcher AED instructions

High survival rates have been observed following on-site AED use by bystanders, such as in casinos, airports, sports facilities and train stations.[49-60] There is less evidence about dispatch instructions for AED retrieval and use, even though they are in widespread use[8,34] In a 2024 ILCOR scoping review there were no studies that addressed clinical outcomes attributable to dispatcher instructions for AED retrieval and use. This review did not include studies of AED use by dispatched responders[2025 ILCOR COSTR] In 2024, a before-and-after study reported that successful AED retrieval and pad placement following dispatcher instruction were associated with increased survival to hospital discharge and survival with favourable neurological outcome. AED shock delivery itself was not associated with any improvement in these clinical outcomes, either as a product of the few patients receiving a shock or because of unrecognised confounders.[61]

There is limited evidence that volunteer responders—whether laypeople, first responders, or HCPs—who are alerted via mobile app or text message to bring an AED to the scene, improve survival. One RCT randomised 5,989 lay volunteer responders dispatched through a text-message system and found bystander-initiated CPR was higher in the intervention group compared with the control group (62% vs 48%, $p<0.001$).[62] One cluster-randomised stepped-wedge trial dispatched 5,735 volunteer responders to OHCAs in private residences and found survival increased from 26% to 39% with improved neurologically favourable survival.[63] Several observational studies have found that activation of volunteer responders is associated with increased bystander CPR, bystander defibrillation, decreased time to defibrillation and improved survival.[64-66] However, substantial heterogeneity in systems' structure and reporting limits comparison between systems and transferability of results. Furthermore, there is increasing interest in the use of drones to deliver AEDs to cardiac arrests. As these systems develop, it is reasonable for dispatchers to inform bystanders that additional help and/or an AED may be arriving on scene. In accordance with ILCOR, the ERC recommends that, after recognising cardiac arrest and starting CPR, dispatchers should ask if there is an AED on-scene. If there is not, and if there is more than one bystander on scene, dispatchers should offer instructions to locate and retrieve an AED, if one is available nearby.[9] The location and availability of AEDs should be recorded in AED registries, and these registries integrated into dispatch systems to facilitate this.[67]

[h2] Use of technology to support dispatchers

The use of technology to support dispatchers is more completely addressed in the Systems Save Lives guideline.[add ref] The overview below is included in the BLS guideline to demonstrate how dispatchers might interact with technology during calls for cardiac arrest.

[h3] Closed-circuit television (CCTV)

A 2024 ILCOR scoping review identified two studies that explored how CCTV footage impacted dispatchers' understanding of the OHCA scene.[10] One study suggested that a lack of situational awareness was a barrier to recognition and that live-stream video from the scene would improve the situational awareness.[68] The second suggested that visual information from the scene would improve dispatcher understanding of the OHCA scene, which might, in turn, enhance communication, and improve dispatcher ability to coach bystanders and improve the quality of CPR.[69]

[h3] Machine learning

A 2024 ILCOR scoping review identified six studies that explored how machine learning might improve recognition of cardiac arrest.[10] Two of these studies assessed whether a machine-learning model could recognise OHCA using historical audio recordings of calls made to EMS. [70,71] The first assessed how the machine learning model performed compared with dispatchers.[70] The machine learning model had higher sensitivity (72.5% vs. 84.1%, $p < 0.001$) but lower specificity (98.8% versus 97.3%, $p < 0.001$) and lower positive predictive value than dispatchers (20.9% versus 33.0%, $p < 0.001$). Time-to-recognition was shorter for the machine learning model compared with the dispatchers (median 44s versus 54s, $p < 0.001$).

The second study assessed the ability of a deep neural network model to detect OHCA through speech recognition. [71] The machine learning model recognised 36% (*n* = 305) of the OHCAs within 60 s with median time to recognition of 72 s (IQR, 40–132 s), whereas the dispatchers recognised 25% (*n* = 213), median time to recognition was 94 s (IQR, 51–174 s). The machine learning model and dispatchers were equally effective at recognising OHCA at any time during the call. The machine learning model recognised 6% (*n* = 52) of OHCAs not identified by dispatchers, whereas dispatchers recognised 4% (*n* = 38) of OHCAs, not recognised by the machine learning model.

An RCT evaluated the impact of a machine learning cardiac arrest alert on dispatcher recognition of OHCA.[72] Dispatchers in one group were alerted when the machine learning model suspected an OHCA, while those in the other group followed normal protocols without a machine learning model alert. Dispatchers recognised 93.1% of confirmed cardiac arrests in the alert group and 90.5% of cardiac arrests in the no-alert group (P=0.15). Cases with a machine-learning alert had a significantly higher sensitivity than cases without alerts for confirmed cardiac arrest (85.0% vs. 77.5%; P<0.001) but lower specificity (97.4% vs 99.6%; P<0.001) and lower positive predictive value (17.8% vs. 55.8%; P<0.001). The study did not find a significant increase in dispatchers' ability to recognise cardiac arrest when using the machine learning algorithm. There is currently insufficient evidence that machine learning technologies improve patient outcomes. However, the ERC recognises that this is a rapidly evolving area of research, and it may play a significant role in the future, as technology improves. The ERC recommends that where machine learning is embedded into dispatcher algorithms that it should be implemented in a highly controlled manner, and preferably as part of formal research program.

[h3] Smart devices to detect agonal breathing

ILCOR found only one proof-of-concept study using existing technology to detect agonal breathing.[10] The study sought to determine if a smart speaker and mobile phone could be trained to recognise agonal breathing using calls recorded in the dispatch centre, compared with normal sleep sounds recorded in a sleep laboratory. The authors reported a sensitivity of 97.17% (95% CI: 96.79–97.55%) specificity of 99.38% (95% CI: 99.20–99.56%) and false positive rate of 0.22%.[73] To date, there is no evidence that these technologies improve patient outcomes.[10] There is currently insufficient evidence that using smart devices to detect agonal breathing improve patient outcomes. However, this technology may have a role to play if technology improves. The ERC recommends that use of smart devices to detect agonal breathing should only be implemented within a formal research program.

[h3] Wearable devices

Recently, wearable devices that can detect and assess a person's heart rhythm, such as smartwatches have been developed.[74] Some devices are able to detect abnormal and life-threatening heart rhythms such as ventricular tachycardia, ventricular fibrillation or asystole and automatically alert EMS.[75] Such devices can potentially reduce the interval from collapse to recognition of cardiac arrest and initiation of CPR and thus improve both care and outcomes in cardiac arrest, particularly among patients with unwitnessed cardiac arrest.[76] However, there are currently no clinical studies showing the benefit of wearing these devices on clinical outcomes. Thus, there is currently no evidence to support the use of wearable devices to improve outcomes after cardiac arrest. The ERC recommends that use of wearable devices to detect life-threatening arrythmias should only be implemented within a formal research program.

[h2] High quality chest compressions

Chest compressions are a critical component of effective CPR, serving as the most accessible means of maintaining cerebral and organ perfusion during cardiac arrest. Their effectiveness depends on correct hand position and chest compression depth, rate, and degree of chest wall recoil. Pauses in chest compressions interrupt perfusion and must be avoided to minimise ischemic the risk of injury.

Mechanical CPR falls outside the scope of BLS and is addressed in the advanced life support guideline.

[h3] Initiating CPR

The sequence for commencing CPR (compressions first versus breathing first) was updated by ILCOR in 2025.[2025 ILCOR COSTR] Five studies were included.[77-81] All of the studies were manikin studies, one of which used a paediatric manikin.[81]

Three adult manikin studies addressed time to first compression.[77,79,80] A compression first approach resulted in shorter time to first compression. One adult manikin study addressed time to first ventilation.[79] A compression first approach resulted in a longer time to first ventilation. One adult manikin study addressed time to completion of first CPR cycle (30 chest compressions and 2 rescue breaths).[79] A compression first approach resulted in a shorter time to completion of first CPR cycle. One adult manikin study addressed the impact of compression first versus ventilation first approach on compression rate, compression depth and chest compression fraction.[77] This study found that choice of approach had no impact on chest compression rate, depth or chest compression fraction.

Following the ILCOR treatment recommendation the ERC recommends a compression first approach.

[h3] Surface on which chest compression is performed

ILCOR updated the CoSTR for performing chest compression on a firm surface in 2024.[82] When chest compression is performed on a soft surface (e.g. a mattress), both the chest wall and the underlying mattress are compressed.[83] This has the potential to reduce chest compression depth. However, effective compression depths can be achieved on a soft surface, providing the CPR provider increases overall compression depth to compensate for mattress compression.[84-90] ILCOR identified 17 studies addressing the importance of a firm surface during CPR. The studies were analysed by categories - floor versus firm hospital mattress, backboard versus hospital mattress, floor versus home mattress and other surface types. No studies reporting clinical outcomes were identified.[82]

Two manikin RCTs[91,92] compared chest compressions delivered on a hospital bed versus on the floor. Seven manikin RCTs[93-99] compared chest compressions with and without a backboard on a hospital mattress. Two manikin RCTs compared chest compressions delivered on a normal bed versus on the floor.[100,101] There was no difference in chest compression depth on a hospital bed or normal bed versus on the floor.[82] There was a small improvement in chest compression depth when using a backboard.[82] Two further manikin RCTs compared chest compressions delivered on a sports mattress, with and without a backboard,[102] and in a dental chair.[103] Chest compressions were shallower on both sports matting and the in the dental chair.[102,103]

Consistent with the ILCOR, the ERC suggests performing chest compressions on a firm surface. For the in-hospital setting, if a mattress has a 'CPR mode' to increase mattress stiffness, it should be activated when performing CPR. Moving a patient from the bed to the floor is not recommended. The ERC does not advocate using a backboard.

[h3] Hand position during chest compressions

The evidence for optimal hand position was reviewed by ILCOR in 2025.[2025 ILCOR COSTR] Only three studies were identified, none of which included the critical outcomes of favourable neurological outcome, survival, or ROSC. All the identified studies reported physiological endpoints only.[104-106] Imaging studies were excluded from the ILCOR systematic review as they do not report clinical outcomes for patients in cardiac arrest.

However, such studies may provide supporting evidence addressing optimal hand position for chest compressions. This evidence indicates that, in most adults and children, the maximal ventricular cross-sectional area underlies the lower third of the sternum/xiphisternal junction, while the ascending aorta and left ventricular outflow tract underlie the centre of the chest.[105,107-112] However, there will be variation in anatomy between individuals dependent upon age, body mass index, congenital cardiac disease and pregnancy. Consequently, one specific hand placement strategy might not provide optimal compressions for all persons.[108,111,113]

The 2025 ILCOR systematic review identified one crossover study in 17 adults with prolonged resuscitation from non-traumatic 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 centre of the chest. Arterial pressure during compression recoil, peak right atrial pressure, and coronary perfusion pressure did not differ.[104] A second crossover study in 30 adults observed no association between end-tidal carbon dioxide values and hand placement.[106] The remaining 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.[114]

Consistent with the ILCOR recommendation [2025 ILCOR COSTR], the ERC continues to recommend performing and teaching that chest compressions be delivered ‘in the centre of the chest’, whilst at the same time demonstrating this position is on the lower half of the sternum.

[h3] Chest compression depth, rate and recoil

The ERC Guideline 2025 BLS maintains the previous recommendations from the 2021[9] and the previously published ILCOR scoping review.[115] This review included five observational studies that examined both chest compression rate and chest compression depth.[116-120] One RCT,[121] one crossover trial,[122] and six observational studies[118,123-127] examined chest compression rate only. One RCT[128] and six observational studies examined chest compression depth only, [129-134] while two observational studies examined chest wall recoil. [135,136] No studies were identified that examined different measures of leaning.

Consistent with ILCOR, the ERC continues to recommend a chest compression rate of 100 to 120 min^{-1} and a compression depth of 5-6 cm (avoiding excessive chest compression depths greater than 6 cm), while avoiding leaning on the chest between compressions to allow full chest wall recoil.[9]

[h3] Minimizing interruptions to chest compressions

Interruptions comprise pauses for rhythm analysis, charging the defibrillator, defibrillation, airway management, ventilation, pulse checks and any other unspecified interruption to chest compressions. The interval where chest compressions are not being performed is described as hands-off time. The chest compression fraction (CCF) is defined as the proportion of the CPR cycle devoted to compressions. Increasing hands-off time reduces the CCF. The evidence assessing the impact of interruptions to CPR was updated by ILCOR in 2025. One systematic review[137] and six non-randomized studies[138-143] were identified. [2025 ILCOR COSTR]

A systematic review included eight studies indicating that feedback, both real-time and post-event, may be associated with a marginal improvement in CCF but was not associated with improved clinical outcomes.[137] One RCT[144] and four observational studies[145-148] suggested that real-time feedback did not improve CCF. Three observational studies suggested post-event feedback did lead to improved CCF (MD 7.11; 95% CI, 5.85, 8.36) (I^2 = 0%).[137]

Six more recent observational studies suggested that interruptions had no impact on CCF,[138,140,141] ROSC[138,140,141] or survival to discharge[141]. Pre-charging the defibrillator while chest compressions were ongoing increased the CCF and may be associated with ROSC (adjusted OR 2.91; 95 %CI 1.09–7.8),[139] while placement of an advanced airway (tracheal tube or supraglottic airway) resulted in increased CCF (89.9% vs 84.5%) and ROSC (31.8% vs 12.2%).[103]

ILCOR continues to recommend that pre- and post-shock pauses should be as short as possible. Furthermore, the CCF should be as high as possible, and at least 60%.[2025 ILCOR COSTR] Consistent with the ILCOR recommendation, the ERC continues to recommend teaching that hands-off time should be minimised, and chest compression fraction should be maximised.

[h3] Compression-only CPR

The role of ventilation and oxygenation in the initial management of cardiac arrest remains debated. ILCOR last published a systematic review of continuous chest compressions (CCC) versus standard CPR in 2017.[149] ILCOR has since undertaken three different reviews addressing CCC by lay responders, EMS personnel and in-hospital clinicians. A 2024 systematic review[2025 ILCOR COSTR] failed to identify any new studies addressing CCC by lay responders. The previous systematic review[149] included three relevant observational studies[150-152] comparing CCC with CPR at a ratio of 15 compressions to two ventilations(15:2)[150,151] or 30 compressions to two ventilations (30:2).[152] None of the identified studies reported favourable neurological outcome. In one adult only study, survival to hospital discharge was higher for CCC than for 30:2.[152] However, in two all-age studies, one found there was no difference in ROSC or survival to discharge,[150] while the other reported no difference survival to hospital admission or survival to 30 days,[151] when comparing CCC and 15:2.[151]

A 2024 systematic review identified one RCT[153] and three cohort studies[142,154,155] addressing CCC by EMS personnel. [2025 ILCOR COSTR] Two of the cohort studies[142,155] were post-hoc/secondary analyses of previously published trials.[153,156,157] The RCT failed to identify any difference in favourable neurological outcome, survival to hospital discharge or ROSC when comparing CCC and 30:2.[153].

Secondary analysis of pooled trial data[153,156,157] initially suggested CCC by EMS personnel may be associated with improved survival to hospital discharge.[142] However, when analysed by adherence to the intended treatment strategy, CCC were associated with a lower survival rate than 30:2.[142] The remaining observational study[154] failed to report favourable neurological outcome but concluded that minimally interrupted cardiac resuscitation was associated with improved survival to hospital discharge but found no difference in ROSC.

Similarly, a 2024 systematic review [2025 ILCOR COSTR] failed to identify any new studies addressing CCC in hospital. The previous systematic review[149] included a single observational study comparing continuous mechanical chest compressions (with asynchronous ventilation via a secure airway) and interrupted mechanical chest compressions (5 compressions to 1 ventilation via a secure airway), among patients admitted to the emergency department following OHCA.[158] Patients who received continuous mechanical CPR with asynchronous ventilation were more likely to achieve ROSC and more likely to survive to hospital discharge than patients who received interrupted mechanical chest compressions.[158]

Finally, an ILCOR scoping review addressing continuous chest compressions and fatigue[3] identified four manikin studies.[159-162] One study[159] involved 84 laypersons comparing standard 30:2 CPR with CCC and reported no difference in the proportion of correct (rate and depth) compressions and no difference in the time to commencing chest compressions. They further reported a higher number of compressions with CCC and a longer periods off the chest with 30:2. They also found no difference in the time to exhaustion or the level of exhaustion.[159] A larger study randomised 517 laypersons to different CPR protocols - 30 compressions:2 second pause (30c:2s) , 50 compressions:5 second pause (50c:5s), 100 compressions:10 second pause(100c:10s) and CCC. They reported a significant difference in the percentage of compressions with correct depth among the groups (30c2s, 96%; 50c5s, 96%; 100c10s, 92%; CCC, 79%; p=0.006). They also reported a higher CCF in the CCC group and a greater frequency of pauses longer than 10 seconds in the 100c10s group.[161]

A different study involving 124 HCPs randomised participants to perform CCC in one of two CPR positions – from the conventional position at the manikin's side or straddling the manikin.[160] They found no difference in compression rate, compression depth or fatigue (measured using participant blood pressure, heart rate and respiratory rate). However, the intervention period was only 4-minutes long.[160]

Finaly, one study recruited three male participants to perform CPR at altitude (3776m) to assess the impact of performing CPR in a low oxygen environment.[162] Physical exertion was measured using percutaneous arterial oxygen saturation and reported using the Borg scale, a subjective score of fatigue. Percutaneous oxygen saturations were reduced when performing CCC but not when performing 30:2 CPR. Self-reported fatigue was noted to be 'somewhat hard' or 'hard'.[162]

The ERC supports the ILCOR recommendations that chest compressions are performed for all adults in cardiac arrest. Where bystanders are trained, able, and willing to provide rescue breaths they should perform CPR with a ratio of 30 compressions to 2 ventilations . If they are not trained, able or willing they should deliver CCC. HCPs may perform either CPR with a ratio of 30 compressions to 2 ventilations, or CCC with asynchronous positive-pressure ventilations, until such time as the airway has been secured with a tracheal tube or supraglottic airway device. Once the airway has been secured, they should provide CCC with asynchronous ventilations.

[h3] CPR in obese patients

The increasing prevalence of obesity worldwide and the challenges in providing CPR to this population prompted ILCOR to complete a scoping review in 2024[163].

Fifteen studies reported favourable neurological outcome data related to adults. Eight studies suggested obese patients had worse outcomes when compared with non-obese patients, [164-171] six studies suggested there was no difference in favourable neurological outcome [172-177] while one study suggested obese patients were more likely to have a favourable neurological outcome.[178]

Twenty-two studies reported survival to hospital discharge data related to adults. Nine studies suggested obese patients had worse survival to discharge outcomes than non-obese patients, [164-166,169,179-183] nine suggested there was no difference in survival to hospital discharge,[172-175,184-188] while four studies suggested obese patients were more likely to survive to hospital discharge.[189-192]

Six studies reported long-term survival data (months to years) related to adults. One study suggested obese patients had worse outcomes than non-obese patients,[173] four suggested there was no difference in long-term survival[164,176,177,193] while one study suggested obese patients were more likely to survive long-term.[189]

Six studies reported ROSC data related to adults. Two studies suggested obese patients had lower rates of ROSC than non-obese patients,[180,182] two suggested there was no difference in ROSC rates[184,185] while one study suggested obese patients were more likely to achieve ROSC.[192] One study further reported a difference in outcomes dependent upon the underlying aetiology of cardiac arrest.[194] In patients sustaining cardiac arrest of cardiac origin, ROSC was less likely in obese patients, whereas in cardiac arrest of non-cardiac aetiology, there was no difference in ROSC rates.[194]

The association between obesity and neurological outcomes, survival to hospital discharge, longer-term survival (months to years), and ROSC displayed considerable variation. Few studies reported resuscitation quality indicators, and no studies reported on adjustments to

CPR techniques or provider outcomes. ILCOR and the ERC advise that standard CPR protocols should be used in obese patients.

[h3] Head-up CPR

The updated ILCOR CoSTR for head-up CPR[1] found two new studies[195,196] to supplement the single study[197] identified in the former 2021 review. All three studies were undertaken by the same research group. The first study, a before-after study[197] comprising 2322 adult OHCAs, compared two CPR bundles. The first, an extended care bundle, comprising a pit-crew approach with rapid deployment of a mechanical CPR device, placing the patient in a head-up position (≈ 20°), use of an impedance threshold device and deferring positive pressure ventilation for several minutes. The second bundle comprised mechanical CPR with an impedance threshold device alone. Following introduction of the extended care bundle, poorly described resuscitation rates increased and survival with favourable neurology was higher (17.9% vs 34.2%), however there was no difference in survival with favourable neurological outcome (numbers not reported).[197] The second study[195] compared outcomes for 227 patients resuscitated using the head-up CPR bundle with a propensity matched cohort of 860 supine patients drawn from three previous trials. Survival propensity matched cohort of supine patients drawn from two previous trials. Survival with favourable neurological outcome was higher in the head-up CPR group 5.9% (13/222) versus 4.1% (35/860); OR, 1.47 (95%CI, 0.76–2.82).[195]

The third study[196] compared outcomes for 353 non-shockable cardiac arrests resuscitated using the head-up CPR bundle with a propensity matched cohort of supine patients drawn from two previous trials. Survival with favourable neurological outcome was higher in the head-up CPR group 4.2% (15/353) versus 1.1% (4/353); OR, 3.87 (95%CI, 1.27–11.78).[196]

Despite an apparent improvement in favourable neurological outcome associated with a head-up CPR bundle, there is currently insufficient evidence to indicate routine use of head-up CPR, without the other elements of the described CPR bundle (mechanical CPR, impedance threshold device), is associated with improved outcomes. The head-up CPR bundle includes use of an automated a head/thorax-up positioning device, a mechanical CPR device, an impedance threshold device and considerable investment in additional training. Consistent with ILCOR, the ERC suggest against routine use of head-up CPR in isolation, as we were unable to identify any evidence that head-up CPR, without a CPR bundle, leads to improved outcomes.

[h3] Use of CPR feedback devices

To improve CPR quality, key CPR metrics should be measured. CPR quality data can be presented to the rescuer in real-time and/or provided in a summary report at the end of a resuscitation. Three different types of feedback device were described, all for guiding chest compression: 1) digital audio-visual feedback including corrective audio prompts; 2) analogue audio and tactile 'clicker' feedback for chest compression depth and release; and 3) metronome guidance for chest compression rate.

The recent ILCOR CoSTR for feedback for CPR quality in real resuscitation[3] comprised 60 manuscripts, 24 of which were published since 2020. [198] Five themes were identified – system change/quality improvement, impact on patient outcomes, improved CPR quality without improved patient outcomes, CPR feedback as a generator of other CPR metrics and CPR feedback as a potential harm.[198] Use of CPR feedback to improve system performance is addressed in the ERC Guidelines 2025 Systems Save Lives,[add ref] here the impact of real-time feedback devices by CPR providers will be discussed.

Forty studies examined impact of real-time feedback on both chest compression quality and/or patient outcomes.[120,122,128,134,137,140,144,199-231] Real-time feedback did not lead to improved ROSC[128,137,144,199,201-203,205,208-211,213-215,219,223,224,226,228,230,231], improved survival[120,137,144,199,201-203,205,208,209,211,213,215,223,224,226,230,231] or survival with favourable neurological outcome.[137,202,208,213,215,224]

Real-time feedback did improve chest compression quality. Six studies reported improved compliance with life support guideline recommendations,[128,201,225,228,229,231]. Two studies reported improved cardiac output[209,223] Multiple studies reported improved chest compression rate,[120,134,137,140,199,202,206-208,210,211,214,218-222,226,231] chest compression depth,[120,134,137,140,144,199,202,207,208,210-212,214,218-220,222,226] chest compression fraction,[120,137,140,199,202,208,210,218-220] reduced hands-off time,[134,203,220,222] reduced leaning,[134,137,140,204,207,214,217,220] more appropriate ventilation rates,[137,199,218,231] and increased $EtCO_2$.[122,200,225,230,231] A single manuscript described cases where patients had died with visible damage to the chest wall caused by a feedback device.[232]

The ERC endorses the ILCOR recommendation against routine implementation of audiovisual feedback and prompt devices in isolation during chest compression, i.e. feedback devices are unlikely to improve clinical outcome for the patient directly in front of you. Rather, feedback devices are best implemented as part of a comprehensive quality improvement program after action, designed to elevated CPR quality across resuscitation systems (refer to the ERC Guideline 2025 Systems Saving Lives[add ref]).

[h2] Rescue breaths

Ventilation during cardiac arrest is a critical aspect of cardiopulmonary resuscitation that influences outcomes.[233,234] In the BLS context, ventilation may be provided by mouth-to-mouth, mouth -to-nose, mouth-to-stoma, mouth-to-mask or bag-valve-mask techniques. The ERC recommends that rescue breaths should have sufficient volume to cause the chest to rise visibly.[235] Rescuers should aim for an inflation duration of about 1 second, with sufficient volume to make the chest begin to rise, but avoid rapid or forceful breaths. The maximum interruption in chest compression to deliver two breaths should not exceed 10 seconds.[236] These recommendations apply to all forms of ventilation during CPR when the airway is unsecured, including mouth-to-mouth and bag-valve-mask ventilation, with and without supplementary oxygen.

Previous guidance addressing assisted ventilation and COVID-19 has been removed from resuscitation guidelines. Guidance for foreign body airway obstruction has been moved to the First Aid chapter.[add ref]

[h3] Ventilation feedback devices

There is a growing body of evidence to indicate that ventilation during resuscitation may not adhere to resuscitation guideline recommendations. [237,238] Several real-time feedback devices have been developed to improve quality of ventilation during cardiac arrest. ILCOR undertook a scoping review to determine if there was sufficient evidence to recommend their implementation.[239] Nineteen studies were identified, of which six were human studies[213,240-244] and 13 were simulation studies.[245-257]

Only three studies, [213,240,241] one RCT[213] and two prospective observational studies,[240,241] examined clinical outcomes with and without real-time feedback. The RCT reported improved higher rates of ROSC (55.5% versus 36.2%, p=0.004) with real-time feedback, but found no difference in survival with favourable neurological outcome (11.1% versus 10.3%, p=0.77).[213] The observational studies found no difference in either ROSC or survival to discharge; however, both reported improved ventilation parameters with real-time feedback.[240,241] Most simulation studies suggested improved ventilation quality when real-time feedback devices were used. ILCOR have not made a recommendation or good practice statement. Based upon the ILCOR scoping review, it is the view of ERC that there is currently insufficient evidence to recommend routine use of ventilation feedback devices during CPR.

[h3] Compression to ventilation ratios

ILCOR updated the CoSTR for chest compressions-to-ventilation ratios in 2025, [2025 ILCOR COSTR] and identified seven retrospective cohort studies,[258-264] and one prospective study,[265] examining the impact of the changes in 2005 , from 15 compressions to 2 ventilations (15:2) to 30 compressions to 2 ventilations (30:2).[266] Two cohort studies reported favourable neurological outcome following the switch from 15:2 to 30:2.[258,265] One study comprising 3960 non-shockable cases reported improved neurologically favourable survival at hospital discharge with 30:2 compared to 15:2.[258] However, a different cohort study comprising 522 shockable cases reported no difference in neurologically favourable survival (CPC score 1–2). [265] Six cohort studies reported on survival to hospital discharge or 30-day survival.[258-262,264] Three studies [258,261,262] reported that 30:2 improved survival, whereas two studies found no difference in the odds of survival.[260,264] An analysis of 200 bystander witnessed cardiac arrests with shockable rhythms reported an improvement in survival to hospital discharge with a compressions-to-ventilation ratio of 50:2 compared to 5:1.[259] Consistent with ILCOR, the ERC recommends a compression–ventilation ratio of 30:2 in adult patients in cardiac arrest.

[h3] Passive ventilation

Passive ventilation describes gas exchange secondary to recoil of the chest and lungs occurring during chest compressions. It has been suggested that passive ventilation may produce tidal volumes sufficient to provide adequate gas exchange during cardiac arrest.[267] ILCOR updated their 2022 systematic review in 2025 and did not identify any new studies.[2025 ILCOR COSTR]

Three RCTs, [268-270] one of which was a very small pilot study,[270] and one observational study[271] were identified. Meta-analysis of two of the RCT's[268,269] suggested passive ventilation did not improve ROSC or survival to ICU discharge.[2] Based on the ILCOR review, the ERC advises against the routine use of passive ventilation techniques during conventional CPR.

[h2] Using an Automated External Defibrillator (AED)

An automated external defibrillator (AED) is a portable, battery-powered device that includes adhesive defibrillation pads to attach to a patient's chest to detect the heart rhythm following suspected cardiac arrest. AEDs are accurate in their interpretation of the heart rhythm and are safe and effective when used by properly laypeople.[272] If the rhythm is a shockable rhythm (ventricular fibrillation or pulseless ventricular tachycardia), an audible (and sometimes visual) prompt is given to the operator to deliver a direct current electric shock (defibrillation) to re-establish a coordinated heart rhythm.[273]
Among patients in a shockable rhythm, each minute delay to defibrillation is associated with 6% higher probability of failure to terminate VF, and 3-6% lower probability of survival to discharge.[274-276] For other heart rhythms (including asystole and a normal rhythm), no shock is advised.
The probability of survival after OHCA can be markedly increased if victims receive immediate CPR and an AED is used.[277] AEDs make it possible for laypeople to attempt defibrillation following cardiac arrest many minutes before professional help arrives.[277] The highest survival rates following lay rescuer resuscitation have been reported after use of on-site AEDs such as at airports, casinos, sports facilities or train stations.[51,278-281] A recent update of the 2020 systematic review by ILCOR identified one ILCOR scientific statement,[282] one systematic review[283] and four observational studies.[284-286] The systematic review included 30 studies and reported that bystander CPR with use of an AED increased survival.[283] One observational study reported improvement in favourable neurological outcome[287] while another suggested no difference in favourable neurologic outcome.[284] Similarly, one observational study reported improvement in ROSC[285] while another suggested no difference in favourable neurological outcome.[284] The fourth study reported that annual rates of sudden cardiac death reduced following implementation of a public

access defibrillation (PAD) program for patients under 65 years of age, but not for patients aged 65 or over.[286] Based on the ILCOR CoSTR,[3] the ERC recommends the implementation of public access defibrillation programs, and recommends that public-access AEDs should be available for use 24/7, be stored in locations easily accessible to the general public and in unlocked cabinets.

This section addresses defibrillation in the BLS context. More advanced concepts including synchronised cardioversion, vector change and dual sequence defibrillation can be found in the ERC Guidelines 2025 Advanced Life Support for adults.[add ref] Wider systems considerations for the placement and deployment of Automated External Defibrillators are addressed in the ERC Guidelines 2025 Systems Save Lives.[add ref]

[h3] Ultra-portable AEDs

Several manufacturers have developed ultraportable or pocket AEDs for personal use or equipping community volunteer responders. This presents an opportunity to increase AED availability and consequently patient outcomes. However, these devices may be limited in the number and the energy of shocks they can deliver (e.g. restricted to up to 20 shocks and a maximum of 85J). Although these devices may have been approved as safe to use, this does not provide evidence of device performance in real-world settings. Consequently ILCOR has reviewed the evidence of efficacy to inform implementation decisions.[288] The review identified three studies.[289-291] One was an economic modelling suggesting ultraportable AEDs would reduce the annual risk of sudden cardiac death and improve quality of life measures.[289] One was a study protocol for a cluster RCT,[290] while the third was an abstract publication describing preliminary data from the cluster RCT.[291] There is currently insufficient clinical evidence to indicate ultraportable AEDs improve patient outcomes.[3] The ERC is currently unable to recommend their adoption until high-certainty clinical data demonstrate improved patient outcomes with their use.

[h3] How to find an AED

All public access AEDs should be registered with the local emergency service. Such registries enable the dispatcher to identify the nearest available AED at the time of the emergency call.[292-297] If more than one bystander is present at a cardiac arrest, the dispatcher is able to guide a bystander to locate and retrieve an AED. Prompting the bystander making the emergency call specifically about public-access AEDs on-site (i.e. immediately visible from the location at which the patient has collapsed is another way in which an available AED can be retrieved and used for a patient. If the public-access AED is immediately adjacent to the patient, and time away from the patient can be minimised, it may be appropriate even for a lone rescuer to retrieve the device. The ERC recommends that local emergency services should maintain an accurate registry of AED locations

[h3] Geolocation applications

Global positioning systems (GPS) in smartphones have enabled numerous apps to locate the user and display the location and availability of nearby AEDs. [296-299] They often allow the user to add details about new AEDs and to provide data about missing or malfunctioning AEDs. These apps can complement existing registries.[296,297] The apps may be capable of providing walking directions to the AED and can be integrated with dispatch systems so that dispatchers can send a push notification to a mobile phone (or other smart device e.g. smartwatch) during an emergency to help guide a bystander to the nearest AED.[296,299] The role of mobile phone technology as a tool to locate AEDs is described in detail in the ERC Guidelines 2025 Systems Saving Lives.[add ref]

[h3] AED signage

Although several different AED signs are available, understanding of these signs' meaning is often lacking.[300-302] Newer signs have been developed following public consultation,[302,303] but evidence addressing how signs increase AED deployment is lacking. Furthermore, many AEDs have no signage at their location, or signs in the vicinity that could guide bystanders to its location.[304] The ERC and ILCOR recommend that AED locations should be highly visible and easy to located. This includes clear signage at its location that is visible from a distance as well as signs in the vicinity of the AED that clearly direct bystanders to its location. Signs should indicate what the AED is for, and that anyone can use the AED, even if they have not had previous training.

[h3] AED cabinets

Concerns about theft or vandalism have led to security measures, such as using locked cabinets, to house AEDs in public locations. Since each minute of delay in attempting defibrillation critically decreases the chance of survival, the additional time needed to access an AED in a locked cabinet may negatively impact patient survival.[305] A 2025 ILCOR scoping review assessed the benefits and harms of placing AEDs in locked cabinets versus unlocked cabinets. There was limited evidence because only 10 studies were identified, some of which were simulation studies or conference abstracts.[306-314] Taken together, a low risk of theft, missing AEDs or vandalism was reported (<2%). Furthermore, two simulation studies identified significantly slower AED retrieval when additional security measures, such as locked cabinets, were used.[306] A survey of first responders further reported that half (n=25/50) were injured while accessing and AED that required breaking glass to access. Consistent with ILCOR, the ERC recommends that AED cabinets are not locked. If locks are necessary, unlocking instructions must be clear to prevent delays. Responsible systems should establish strategies for retrieving used public-access defibrillators.

[h3] Use of drones to deliver AEDs

Drones or unmanned aerial vehicles have the potential to speed up the delivery of an AED, especially for areas with longer response times. Evidence underpinning drone deployment of AEDs is currently lacking but real-world studies demonstrate feasibility of drone AED delivery, with a time advantage of 1-3 minutes over ambulances observed in approximately 60% of cases. Mathematical modelling can be used to optimise the location of drones to improve the emergency response in OHCA. ILCOR performed a scoping review in 2023[3] and an evidence update in 2024 [2025 ILCOR COSTR] to investigate the feasibility and impact of drone delivered AEDs for OHCA response. A total of 39 studies were included. Most of the studies were simulation studies or computer/prediction models. Only three studies reported drone AED delivery to real OHCAs.[315-317] There were no RCTs investigating drone AED delivery. The ERC recommends that where drone delivery of AEDs is possible, dispatchers should advise bystanders that a drone has been tasked to deliver an AED and provide basic instructions on retrieving the AED from the drone.

[h3] How and when to use an AED

An AED should be attached to any patient who is not conscious and not breathing normally. CPR should not be delayed whilst locating and retrieving an AED, but as soon as an AED has been brought to the patient's side, it should be attached to the patient.[3] If more than one bystander is present, one should continue CPR whilst the other attaches the pads. Some devices will power on automatically once their carrier/ case has been opened, whereas others may require the user to press a power on button. Most AEDs have voice ± visual prompts about where to locate the adhesive pads. Once the pads are connected, no-one should touch the patient whilst the AED performs rhythm analysis. If the AED advises a shock, it will either give that shock itself (fully automatic AEDs) or prompt the user to press a shock button (semi-automatic AEDs). Some AEDs also provide guidance and feedback on quality chest compressions.

[h3] Should chest compressions be performed before defibrillation?

ILCOR has updated the 2020 CoSTR[8] addressing when to perform defibrillation twice since the last guidelines however no new studies have been identified.[2,3] A 2020 systematic review by ILCOR[1] identified five RCTs[318-322] comparing a shorter with a longer interval of chest compressions before defibrillation.[1] No clear benefit from CPR before defibrillation was found. Four studies reported no significant difference in favourable neurological outcome in patients who received a shorter period of CPR before defibrillation compared with a longer period of CPR.[318,319,321,322] Five studies reported no significant difference in survival to hospital discharge in patients who received a shorter period of CPR before defibrillation compared with a longer period of CPR.[319-322] Consistent with ILCOR, the ERC recommends CPR be continued until an AED arrives on site, is switched on and attached to the victim, but defibrillation should not be delayed any longer for additional CPR.

[h3] Positioning of defibrillation pads

ILCOR undertook a systematic review addressing AED pad size and placement in 2024.[2025 ILCOR COSTR] Two observational studies [323,324] and one RCT[325] were identified. No studies addressed the impact of different pad sizes on ROSC, survival or favourable neurological outcome. One observational study reported no difference in defibrillation success when using a large size.[323]

One prospective study [324] found no significant difference in favourable neurological outcome, survival to hospital discharge or defibrillation success with initial anterior-posterior pad placement compared with initial anterior-lateral placement. However, anterior-posterior pad placement was associated with higher ROSC rates after adjusting for known predictors. The RCT[325] addressed pad placement for refractory ventricular fibrillation, which is beyond BLS, and further information can be found in the ERC Guidelines 2025 Advanced Life Support.[add ref]

There is currently insufficient evidence to recommend a specific pad size or position for optimal external defibrillation in adults. ILCOR has issued a good practice statement that recommends following the manufacturer's AED guidance and instructions for adult pad placement. The ERC endorses this recommendation.

For most manufacturers this will mean placing defibrillation pads on the front of the persons chest and their left side (the anterior-lateral position). One defibrillation pad should be positioned below the patient's right clavicle, just to the right of the upper sternal border. The other defibrillation pad/paddle should be placed on the patient's left mid-axillary line, below the armpit. Pad placement should avoid breast tissue if possible. This approach requires less manual handling so lowers the risk of manual handling injury to the rescuer, minimises the time needed to place defibrillation pads and therefore minimises interruptions to chest compressions.

The other possible position entails placing the pads on the persons chest and back (the anterior-posterior position). Place the anterior defibrillation 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 defibrillation pad should be placed on the left side of the patient's spine, just below the scapula. This approach requires more manual handling than the anterior-lateral position. If the anterior-lateral pad position is not feasible, then the rescuer can consider using the anterior-posterior pad position if trained.

[h3] Removing a bra prior to defibrillation

Evidence indicates females in cardiac arrest are less likely to receive cardiopulmonary resuscitation and defibrillation from bystanders.[326-328] This may stem from apprehension about exposing and touching a woman's chest and fears of being accused of sexual assault[329] To assess the impact of wearing a bra on defibrillation, ILCOR undertook a systematic review that identified two manikin studies[330,331] and one animal study.[332] The animal study suggested that a metal wire inside a bra did not adversely impact the defibrillation attempt nor cause any injury to the victim or rescuer.[332] The manikin studies suggested female manikins were less likely to be exposed or disrobed,[330] and time to defibrillation was longer with female manikins.[331] No studies addressing ROSC, survival or favourable neurologic outcome were identified.[333]

AED adhesive pads should be placed onto bare skin. In people wearing bras, there is little evidence addressing whether the bra needs to be removed completely, and no evidence that an underwire in a bra causes harm. ILCOR advises that 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. Defibrillation pads must be placed on bare skin in the correct position, which may be possible by adjusting the position of the bra, rather than removing it.

The ERC recommends that rescuers prioritise placing defibrillation pads in the correct location, and in contact with bare skin. If this can be quickly accomplished without removing the bra then, it is acceptable to leave the bra in place. However, if the bra interferes with correctly locating the defibrillation pads, then the bra should be removed immediately to facilitate correct defibrillation pad application. Rescuers should not be concerned about exposing the persons chest to apply defibrillation pads. They should prioritise life-saving interventions over concerns for modesty.

The ERC further recommends that manufacturers of manikins should develop realistic manikins that reflect different body sizes and shapes. CPR training should incorporate pad placement in people wearing bras.

[h3] Where to place an AED in public

Evidence pertaining to placement of AEDs can be found in the ERC Guidelines 2025 Systems Save Lives. The ERC recommends data informed AED placement considering historical OHCA rate, EMS response times and location of current AEDs.

[h2] Safety

[h3] Personal Protective Equipment (PPE)

The use of personal protective equipment during resuscitation plays an important role in protecting rescuers from potential exposure to infectious agents. A meta-analysis of six simulation-based randomised studies found no meaningful impact of personal protective equipment on the depth or rate of chest compressions in adult CPR. This was also the case in studies carried out during the COVID-19 pandemic, when personal protective equipment was widely used. However, rescuers wearing personal protective equipment reported feeling more fatigued. While personal protective equipment should be used when available—especially in settings with known or suspected infection risk—its use must not lead to unnecessary delay in starting chest compressions. The ERC recommends that regular training to facilitate timely donning and doffing of personal protective equipment is required, so that protection and prompt action can go hand in hand.[334]

[h3] Harm to people providing CPR

ILCOR performed a scoping review related to harm to people providing CPR and found very few reports of harm from performing CPR and defibrillation were identified. Five experimental studies and one case report published since 2008 were reviewed. The five experimental studies reported perceptions in experimental settings during shock administration for elective cardioversion. The authors measured current flow and the average leakage current in different experiments to assess rescuer safety. Despite limited evidence evaluating safety ILCOR and ERC support the interpretation that the use of an AED is generally safe.[8,266] The ERC consistent with ILCOR, recommend that rescuers perform chest compressions and use an AED as the risk of damage from accidental shock during AED use is low.

[h3] Unintentional injury from CPR to victims not in cardiac arrest

Lay people may be reluctant to perform CPR on an unresponsive person who is not breathing normally due to concern that performing chest compressions to a person who is not in cardiac arrest could cause serious harm. However, there is little evidence that CPR performed on a person not in cardiac arrest causes significant harm. There is however significant concern that delays to CPR results in worse patient outcomes.[305] The potential survival benefits of CPR initiated by laypersons for patients in cardiac arrest far outweigh the low risk of injury in patients not in cardiac arrest.

ILCOR recommends that laypersons, trained bystanders and first responders initiate CPR for presumed cardiac arrest without concerns of harm to patients not in cardiac arrest (good practice statement). The ERC guideline recommendations are consistent with the ILCOR treatment recommendations.

[h3] Safety of AEDs

Errors in AED use most commonly occur because of problems with how the operator interacts with the AED, rather than faults in or malfunction of the device itself, and include continuing CPR during rhythm analysis, not delivering a shock when instructed and premature removal of the AED.[335]

Simulation studies suggest that fully automatic AED increase safety, reduce error and shorten time to defibrillation compared to semi-automatic AED.[336,337] The ERC recommends the use of AEDs as they are safe to use and present a low risk of injury to rescuers

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[h1] Conflict of Interest statement

MAS, CMH, SM, VR, GR, CMS, AS and GDP are members of the ILCOR BLS Task Force. MAS is vice-chair of the ILCOR BLS Task Force, GDP is the out-going ILCOR co-chair. MAS and SvG are co-chairs of the ERC BLS Science and Education Committee (SEC). GDP is ERC Director of Science. NF, NKN, VR, GR CMS and TS are members of ERC SEC-BLS. JR is immediate past chair of young ERC. GDP is editor in chief of Resuscitation Plus. MAS, CMS and GDP have received research funding from the NIHR. SvG, CMH, NF, SM, NKN, VR, GR, JR, AS, TS and KW had no other potential conflicts to declare.

[h1] Abbreviations

ERC, European Resuscitation Council
CoSTR, Consensus of Science with Treatment Recommendations
ILCOR, International Liaison Committee on Resuscitation
HCPs, Healthcare professionals
AI, Artificial Intelligence
CPR, cardiopulmonary resuscitation
BLS, Basic Life Support
AED, Automated external defibrillator
ALS, Advanced Life Support
ILS, Immediate Life Support
PBLS, Paediatric Basic Life Support
NLS, Newborn Life Support
VR, virtual reality
AR, augmented reality
VLE, virtual learning environment
EMS, Emergency Medical Services
HBB, Helping Babies Breathe

PAD, Public Access Defibrillator

RCT, Randomised controlled trial

[h1] Figure legends

Figure 1: fdgdgfdg

Figure 2: ERC agfdgfdgsfdg

[h1] Table legends

Table 1. Key messages of dgfdgsdfsfg
Table 2. This table summarises sdgfgfdgsffbfdvxyf.

[h2] References

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