



European Resuscitation Council Guidelines for Resuscitation 2005

Section 2. Adult basic life support and use of automated external defibrillators

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Basic life support (BLS) refers to maintaining airway patency and supporting breathing and the circulation, without the use of equipment other than a protective device.¹ This section contains the guidelines for adult BLS by lay rescuers and for the use of an automated external defibrillator (AED). It also includes recognition of sudden cardiac arrest, the recovery position and management of choking (foreign-body airway obstruction). Guidelines for in-hospital BLS and the use of manual defibrillators may be found in Sections 3 and 4b.

Introduction

Sudden cardiac arrest (SCA) is a leading cause of death in Europe, affecting about 700,000 individuals a year.² At the time of the first heart rhythm analysis, about 40% of SCA victims have ventricular fibrillation (VF).^{3–6} It is likely that many more victims have VF or rapid ventricular tachycardia (VT) at the time of collapse but, by the time the first ECG is recorded, their rhythm has deteriorated to asystole.^{7,8} VF is characterized by chaotic, rapid depolarisation and repolarisation. The heart loses its coordinated function and stops pumping blood

effectively.⁹ Many victims of SCA can survive if bystanders act immediately while VF is still present, but successful resuscitation is unlikely once the rhythm has deteriorated to asystole.¹⁰ The optimum treatment for VF cardiac arrest is immediate bystander CPR (combined chest compression and rescue breathing) plus electrical defibrillation. The predominant mechanism of cardiac arrest in victims of trauma, drug overdose, drowning, and in many children is asphyxia; rescue breaths are critical for resuscitation of these victims.

The following concept of the Chain of Survival summarises the vital steps needed for successful resuscitation (Figure 1.1). Most of these links are relevant for victims of both VF and asphyxial arrest.¹¹

1. Early recognition of the emergency and calling for help: activate the emergency medical services (EMS) or local emergency response system, e.g. 'phone 112'.^{12,13} An early, effective response may prevent cardiac arrest.
2. Early bystander CPR: immediate CPR can double or triple survival from VF SCA.^{10,14–17}
3. Early defibrillation: CPR plus defibrillation within 3–5 min of collapse can produce survival rates as high as 49–75%.^{18–25} Each minute of

delay in defibrillation reduces the probability of survival to discharge by 10–15%.^{14,17}

4. Early advanced life support and post-resuscitation care: the quality of treatment during the post-resuscitation phase affects outcome.²⁶

In most communities, the time from EMS call to EMS arrival (response interval) is 8 min or longer.²⁷ During this time the victim's survival is dependent on early initiation by bystanders of the first three of the links of the Chain of Survival.

Victims of cardiac arrest need immediate CPR. This provides a small but critical blood flow to the heart and brain. It also increases the likelihood that a defibrillatory shock will terminate VF and enable the heart to resume an effective rhythm and effective systemic perfusion. Chest compression is especially important if a shock cannot be delivered sooner than 4 or 5 min after collapse.^{28,29} Defibrillation interrupts the uncoordinated depolarisation-repolarisation process that occurs during VF. If the heart is still viable, its normal pacemakers then resume their function and produce an effective rhythm and resumption of circulation. In the first few minutes after successful defibrillation, the rhythm may be slow and ineffective; chest compressions may be needed until adequate cardiac function returns.³⁰

Lay rescuers can be trained to use an automated external defibrillator (AED) to analyse the victim's cardiac rhythm and deliver a shock if VF is present. An AED uses voice prompts to guide the rescuer. It analyses the ECG rhythm and informs the rescuer if a shock is needed. AEDs are extremely accurate and will deliver a shock only when VF (or its precursor, rapid ventricular tachycardia) is present.³¹ AED function and operation are discussed in Section 3.

Several studies have shown the benefit on survival of immediate CPR, and the detrimental effect of delay before defibrillation. For every minute without CPR, survival from witnessed VF decreases by 7–10%.¹⁰ When bystander CPR is provided, the decline in survival is more gradual and averages 3–4% min⁻¹.^{10,14,17} Overall, bystander CPR doubles or triples survival from witnessed cardiac arrest.^{10,14,32}

Adult BLS sequence

BLS consists of the following sequence of actions (Figure 2.1).

- 1 Make sure you, the victim and any bystanders are safe.
- 2 Check the victim for a response (Figure 2.2).

Adult basic life support

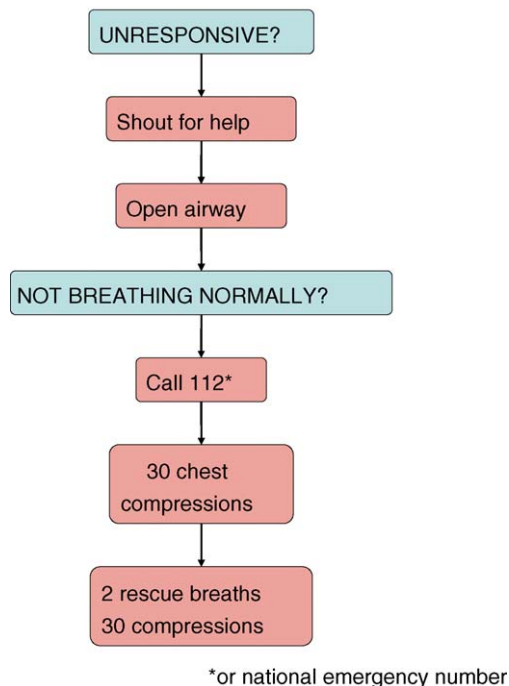


Figure 2.1 Adult basic life support algorithm.

- gently shake his shoulders and ask loudly: "Are you all right?"
- 3a If he responds
- leave him in the position in which you find him provided there is no further danger
 - try to find out what is wrong with him and get help if needed
 - reassess him regularly



Figure 2.2 Check the victim for a response. © 2005 European Resuscitation Council.



Figure 2.3 Shout for help. © 2005 European Resuscitation Council.

3b If he does not respond

- shout for help (Figure 2.3)
- turn the victim onto his back and then open the airway using head tilt and chin lift (Figure 2.4)
 - place your hand on his forehead and gently tilt his head back keeping your thumb and

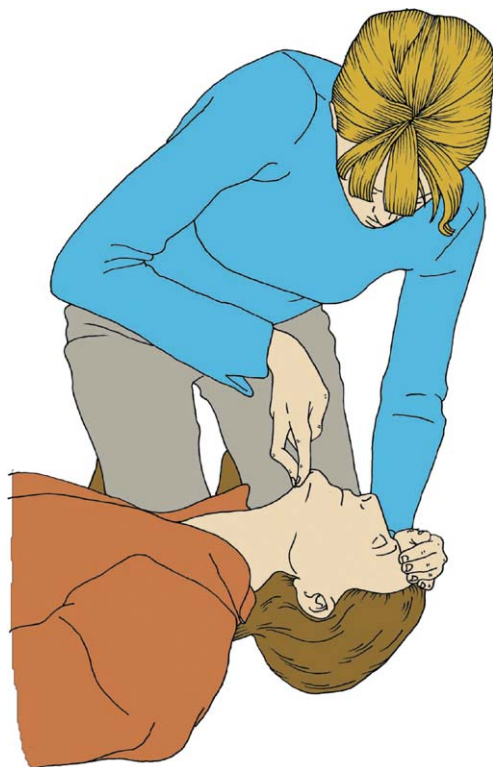


Figure 2.4 Head tilt and chin lift. © 2005 European Resuscitation Council.

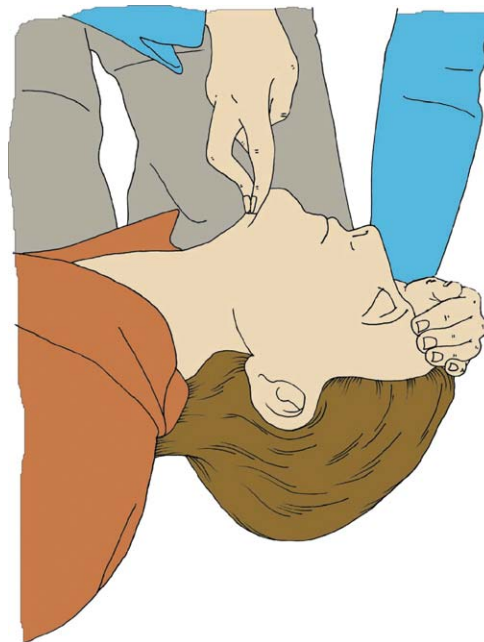


Figure 2.5 Head tilt and chin lift in detail. © 2005 European Resuscitation Council.

index finger free to close his nose if rescue breathing is required (Figure 2.5)

- with your fingertips under the point of the victim's chin, lift the chin to open the airway

4 Keeping the airway open, look, listen and feel for normal breathing (Figure 2.6).

- Look for chest movement.
- Listen at the victim's mouth for breath sounds.
- Feel for air on your cheek.

In the first few minutes after cardiac arrest, a victim may be barely breathing, or taking infrequent, noisy gasps. Do not confuse this with normal breathing. Look, listen, and feel for no



Figure 2.6 Look listen and feel for normal breathing. © 2005 European Resuscitation Council.

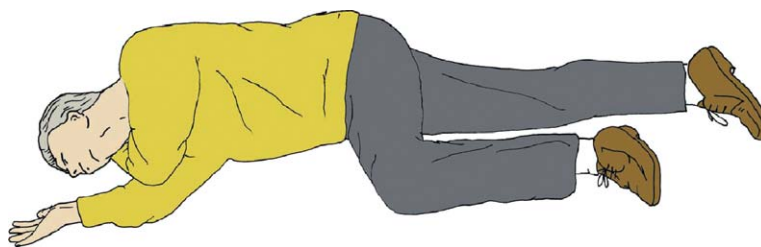


Figure 2.7 The recovery position. © 2005 European Resuscitation Council.

more than 10s to determine whether the victim is breathing normally. If you have any doubt whether breathing is normal, act as if it is not normal.

5a If he is breathing normally

- turn him into the recovery position (see below) (Figure 2.7)
- send or go for help/call for an ambulance
- check for continued breathing

5b If he is not breathing normally

- send someone for help or, if you are on your own, leave the victim and alert the ambulance service; return and start chest compression as follows:
 - kneel by the side of the victim
 - place the heel of one hand in the centre of the victim's chest (Figure 2.8)
 - place the heel of your other hand on top of the first hand (Figure 2.9)
 - interlock the fingers of your hands and ensure that pressure is not applied over the victim's ribs (Figure 2.10). Do not apply any pressure over the upper abdomen or the bottom end of the bony sternum (breast-bone)
 - position yourself vertically above the victim's chest and, with your arms straight,

press down on the sternum 4–5 cm (Figure 2.11)

- after each compression, release all the pressure on the chest without losing contact between your hands and the sternum; repeat at a rate of about 100 min^{-1} (a little less than $2 \text{ compressions s}^{-1}$)
- compression and release should take equal amounts of time

6a Combine chest compression with rescue breaths.

- After 30 compressions open the airway again using head tilt and chin lift (Figure 2.12).
- Pinch the soft part of the nose closed, using the index finger and thumb of your hand on the forehead.
- Allow the mouth to open, but maintain chin lift.
- Take a normal breath and place your lips around his the mouth, making sure that you have a good seal.
- Blow steadily into the mouth while watching for the chest to rise (Figure 2.13), taking about 1 s as in normal breathing; this is an effective rescue breath.
- Maintaining head tilt and chin lift, take your mouth away from the victim and watch for the chest to fall as air passes out (Figure 2.14).

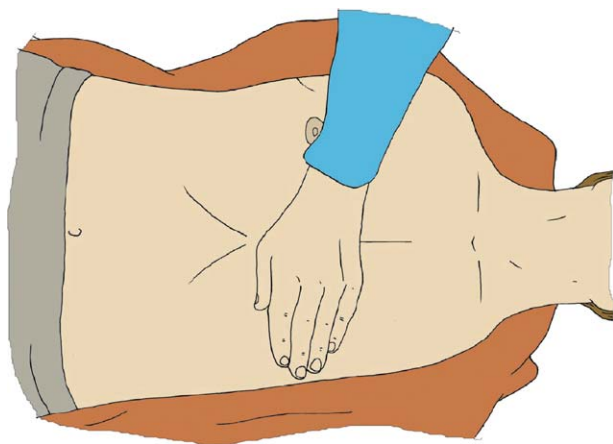


Figure 2.8 Place the heel of one hand in the centre of the victim's chest. © 2005 European Resuscitation Council.

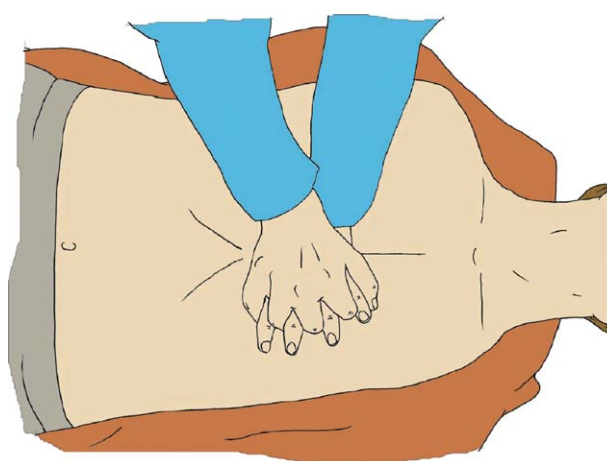


Figure 2.9 Place the heel of your other hand on top of the first hand. © 2005 European Resuscitation Council.

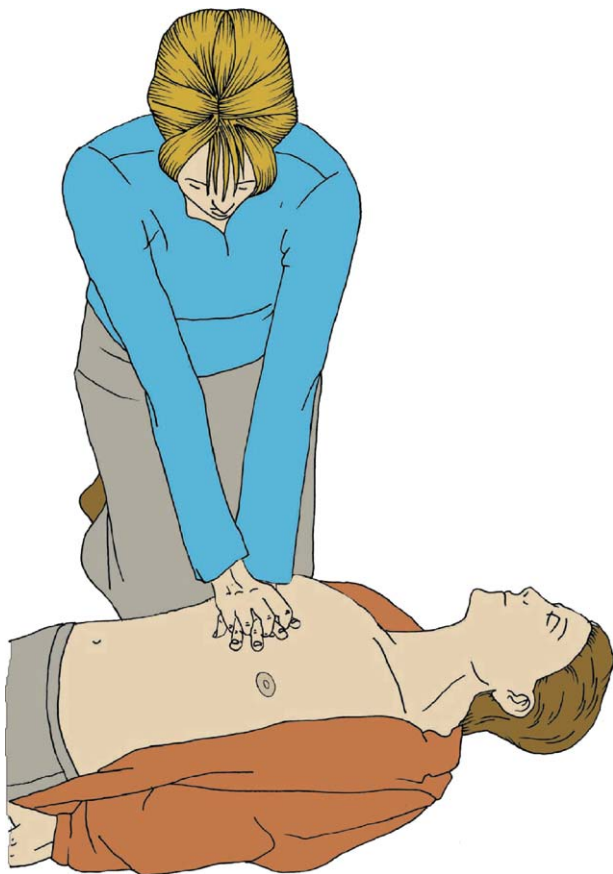


Figure 2.10 Interlock the fingers of your hands. © 2005 European Resuscitation Council.

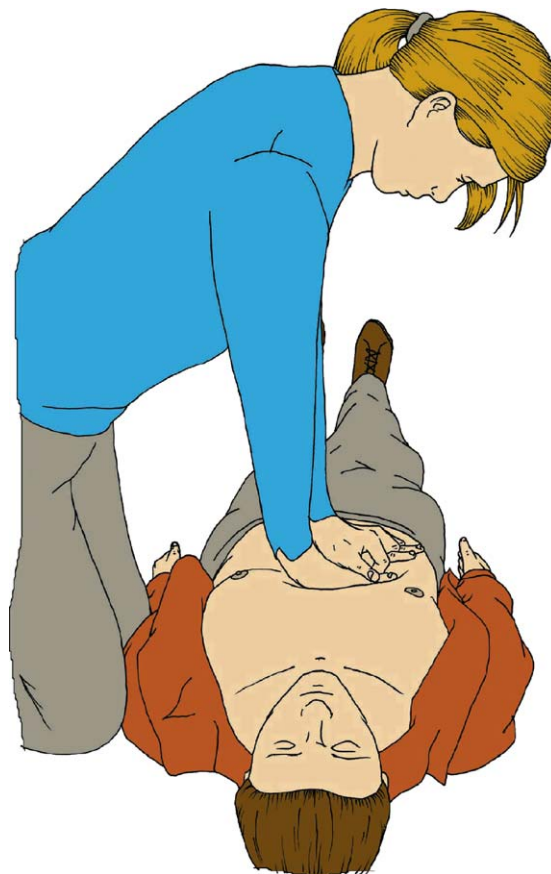


Figure 2.11 Press down on the sternum 4–5 cm. © 2005 European Resuscitation Council.

- Take another normal breath and blow into the victim's mouth once more, to achieve a total of two effective rescue breaths. Then return your hands without delay to the correct position on the sternum and give a further 30 chest compressions.
- Continue with chest compressions and rescue breaths in a ratio of 30:2.
- Stop to recheck the victim only if he starts breathing normally; otherwise do not interrupt resuscitation.

If your initial rescue breath does not make the chest rise as in normal breathing, then before your next attempt:

- check the victim's mouth and remove any obstruction
- recheck that there is adequate head tilt and chin lift
- do not attempt more than two breaths each time before returning to chest compressions

If there is more than one rescuer present, another should take over CPR every 1–2 min to prevent fatigue. Ensure the minimum of delay during the changeover of rescuers.

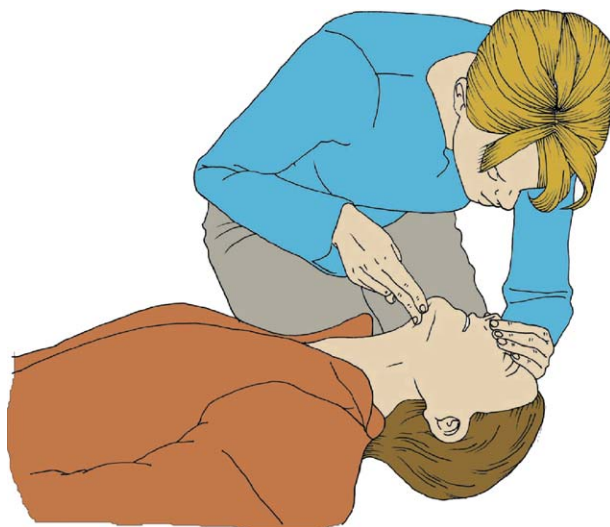


Figure 2.12 After 30 compressions open the airway again using head tilt and chin lift. © 2005 European Resuscitation Council.

6b Chest-compression-only CPR may be used as follows.

- If you are not able or are unwilling to give rescue breaths, give chest compressions only.



Figure 2.13 Blow steadily into his mouth whilst watching for his chest to rise. © 2005 European Resuscitation Council.

- If chest compressions only are given, these should be continuous, at a rate of 100 min^{-1} .
- Stop to recheck the victim only if he starts breathing normally; otherwise do not interrupt resuscitation.

7 Continue resuscitation until

- qualified help arrives and takes over
- the victim starts breathing normally
- you become exhausted

Risk to the rescuer

The safety of both rescuer and victim are paramount during a resuscitation attempt. There have been few incidents of rescuers suffering

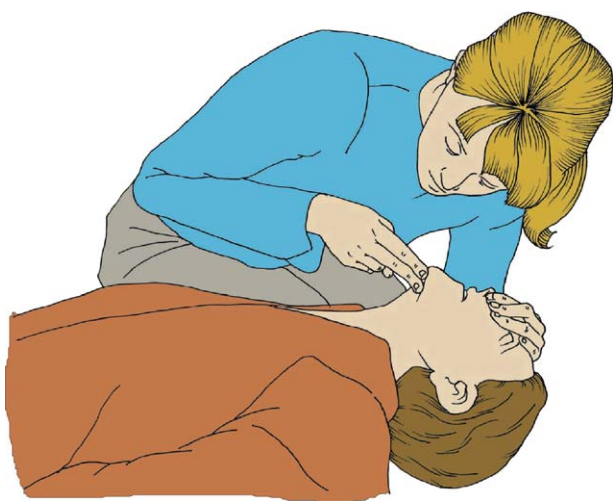


Figure 2.14 Take your mouth away from the victim and watch for his chest to fall as air comes out. © 2005 European Resuscitation Council.

adverse effects from undertaking CPR, with only isolated reports of infections such as tuberculosis (TB)³³ and severe acute respiratory distress syndrome (SARS).³⁴ Transmission of HIV during CPR has never been reported. There have been no human studies to address the effectiveness of barrier devices during CPR; however, laboratory studies have shown that certain filters, or barrier devices with one-way valves, prevent oral bacterial transmission from the victim to the rescuer during mouth-to-mouth ventilation.^{35,36} Rescuers should take appropriate safety precautions where feasible, especially if the victim is known to have a serious infection, such as TB or SARS. During an outbreak of a highly infectious condition such as SARS, full protective precautions for the rescuer are essential.

Opening the airway

The jaw thrust is not recommended for lay rescuers because it is difficult to learn and perform and may itself cause spinal movement.³⁷ Therefore, the lay rescuer should open the airway using a head tilt-chin lift manoeuvre for both injured and non-injured victims.

Recognition of cardiorespiratory arrest

Checking the carotid pulse is an inaccurate method of confirming the presence or absence of circulation.³⁸ However, there is no evidence that checking for movement, breathing or coughing ('signs of a circulation') is diagnostically superior. Healthcare professionals as well as lay rescuers have difficulty determining the presence or absence of adequate or normal breathing in unresponsive victims.^{39,40} This may be because the airway is not open⁴¹ or because the victim is making occasional (agonal) gasps. When bystanders are asked by ambulance dispatchers over the telephone if breathing is present, they often misinterpret agonal gasps as normal breathing. This erroneous information can result in the bystander withholding CPR from a cardiac arrest victim.⁴² Agonal gasps are present in up to 40% of cardiac arrest victims. Bystanders describe agonal gasps as barely breathing, heavy or laboured breathing, or noisy or gasping breathing.⁴³

Laypeople should, therefore, be taught to begin CPR if the victim is unconscious (unresponsive) and not breathing normally. It should be emphasised during training that agonal gasps occur commonly in the first few minutes after SCA. They are an indication for starting CPR immediately and should not be confused with normal breathing.

Initial rescue breaths

During the first few min after non-asphyxial cardiac arrest the blood oxygen content remains high, and myocardial and cerebral oxygen delivery is limited more by the diminished cardiac output than a lack of oxygen in the lungs. Ventilation is, therefore, initially less important than chest compression.⁴⁴

It is well recognised that skill acquisition and retention is aided by simplification of the BLS sequence of actions.⁴⁵ It is also recognized that rescuers are frequently unwilling to carry out mouth-to-mouth ventilation for a variety of reasons, including fear of infection and distaste for the procedure.^{46–48} For these reasons, and to emphasise the priority of chest compressions, it is recommended that in adults CPR should start with chest compression rather than initial ventilation.

Ventilation

During CPR the purpose of ventilation is to maintain adequate oxygenation. The optimal tidal volume, respiratory rate and inspired oxygen concentration to achieve this, however, are not fully known. The current recommendations are based on the following evidence:

1. During CPR, blood flow to the lungs is substantially reduced, so an adequate ventilation-perfusion ratio can be maintained with lower tidal volumes and respiratory rates than normal.⁴⁹
2. Not only is hyperventilation (too many breaths or too large a volume) unnecessary, but it is harmful because it increases intrathoracic pressure, thus decreasing venous return to the heart and diminishing cardiac output. Survival is consequently reduced.⁵⁰
3. When the airway is unprotected, a tidal volume of 1 l produces significantly more gastric distention than a tidal volume of 500 ml.⁵¹
4. Low minute-ventilation (lower than normal tidal volume and respiratory rate) can maintain effective oxygenation and ventilation during CPR.^{52–55} During adult CPR, tidal volumes of approximately 500–600 ml ($6–7 \text{ ml kg}^{-1}$) should be adequate.
5. Interruptions in chest compression (for example to give rescue breaths) have a detrimental effect on survival.⁵⁶ Giving rescue breaths over a shorter time will help to reduce the duration of essential interruptions.

The current recommendation is, therefore, for rescuers to give each rescue breath over about 1 s, with enough volume to make the victim's chest

rise, but to avoid rapid or forceful breaths. This recommendation applies to all forms of ventilation during CPR, including mouth-to-mouth and bag-valve-mask (BVM) with and without supplementary oxygen.

Mouth-to-nose ventilation is an effective alternative to mouth-to-mouth ventilation.⁵⁷ It may be considered if the victim's mouth is seriously injured or cannot be opened, the rescuer is assisting a victim in the water, or a mouth-to-mouth seal is difficult to achieve.

There is no published evidence on the safety, effectiveness or feasibility of mouth-to-tracheostomy ventilation, but it may be used for a victim with a tracheostomy tube or tracheal stoma who requires rescue breathing.

To use bag-mask ventilation requires considerable practice and skill.^{58,59} The lone rescuer has to be able to open the airway with a jaw thrust while simultaneously holding the mask to the victim's face. It is a technique that is appropriate only for lay rescuers who work in highly specialised areas, such as where there is a risk of cyanide poisoning or exposure to other toxic agents. There are other specific circumstances in which non-healthcare providers receive extended training in first aid which could include training, and retraining, in the use of bag-mask ventilation. The same strict training that applies to healthcare professionals should be followed.

Chest compression

Chest compressions produce blood flow by increasing the intrathoracic pressure and by directly compressing the heart. Although chest compressions performed properly can produce systolic arterial pressure peaks of 60–80 mmHg, diastolic pressure remains low and mean arterial pressure in the carotid artery seldom exceeds 40 mmHg.⁶⁰ Chest compressions generate a small but critical amount of blood flow to the brain and myocardium and increase the likelihood that defibrillation will be successful. They are especially important if the first shock is delivered more than 5 min after collapse.⁶¹

Much of the information about the physiology of chest compression and the effects of varying the compression rate, compression-to-ventilation ratio and duty cycle (ratio of time chest is compressed to total time from one compression to the next) is derived from animal models. However, the conclusions of the 2005 Consensus Conference⁶² included the following:

- (1) Each time compressions are resumed, the rescuer should place his hands without delay "in the centre of the chest".⁶³

- (2) Compress the chest at a rate of about 100 min^{-1} .^{64–66}
- (3) Pay attention to achieving the full compression depth of 4–5 cm (for an adult).^{67,68}
- (4) Allow the chest to recoil completely after each compression.^{69,70}
- (5) Take approximately the same amount of time for compression and relaxation.
- (6) Minimise interruptions in chest compression.
- (7) Do not rely on a palpable carotid or femoral pulse as a gauge of effective arterial flow.^{38,71}

There is insufficient evidence to support a specific hand position for chest compression during CPR in adults. Previous guidelines have recommended a method of finding the middle of the lower half of the sternum by placing one finger on the lower end of the sternum and sliding the other hand down to it.⁷² It has been shown that for healthcare professionals the same hand position can be found more quickly if rescuers are taught to ‘‘place the heel of your hand in the centre of the chest with the other hand on top’’, provided the teaching includes a demonstration of placing the hands in the middle of the lower half of the sternum.⁶³ It is reasonable to extend this to laypeople.

Compression rate refers to the speed at which compressions are given, not the total number delivered in each minute. The number delivered is determined by the rate, but also by the number of interruptions to open the airway, deliver rescue breaths and allow AED analysis. In one out-of-hospital study rescuers recorded compression rates of $100\text{--}120 \text{ min}^{-1}$ but, the mean number of compressions was reduced to 64 min^{-1} by frequent interruptions.⁶⁸

Compression–ventilation ratio

Insufficient evidence from human outcome studies exists to support any given compression:ventilation ratio. Animal data support an increase in the ratio above 15:2.^{73–75} A mathematical model suggests that a ratio of 30:2 would provide the best compromise between blood flow and oxygen delivery.^{76,77} A ratio of 30 compressions to two ventilations is recommended for the single rescuer attempting resuscitation on an adult or child out of hospital. This should decrease the number of interruptions in compression, reduce the likelihood of hyperventilation,^{50,78} simplify instruction for teaching and improve skill retention.

Compression-only CPR

Healthcare professionals as well as lay rescuers admit to being reluctant to perform mouth-to-

mouth ventilation in unknown victims of cardiac arrest.^{46,48} Animal studies have shown that chest compression-only CPR may be as effective as combined ventilation and compression in the first few minutes after non-asphyxial arrest.^{44,79} In adults, the outcome of chest compression without ventilation is significantly better than the outcome of giving no CPR.⁸⁰ If the airway is open, occasional gasps and passive chest recoil may provide some air exchange.^{81,82} A low minute-ventilation may be all that is necessary to maintain a normal ventilation-perfusion ratio during CPR.

Laypeople should, therefore, be encouraged to perform compression-only CPR if they are unable or unwilling to provide rescue breaths, although combined chest compression and ventilation is the better method of CPR.

CPR in confined spaces

Over-the-head CPR for single rescuers and straddle CPR for two rescuers may be considered for resuscitation in confined spaces.^{83,84}

Recovery position

There are several variations of the recovery position, each with its own advantages. No single position is perfect for all victims.^{85,86} The position should be stable, near a true lateral position with the head dependent, and with no pressure on the chest to impair breathing.⁸⁷

The ERC recommends the following sequence of actions to place a victim in the recovery position:

- Remove the victim’s spectacles.
- Kneel beside the victim and make sure that both legs are straight.
- Place the arm nearest to you out at right angles to the body, elbow bent with the hand palm uppermost (Figure 2.15).
- Bring the far arm across the chest, and hold the back of the hand against the victim’s cheek nearest to you (Figure 2.16).
- With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground (Figure 2.17).
- Keeping his hand pressed against his cheek, pull on the far leg to roll the victim towards you onto his side.
- Adjust the upper leg so that both hip and knee are bent at right angles.
- Tilt the head back to make sure the airway remains open.

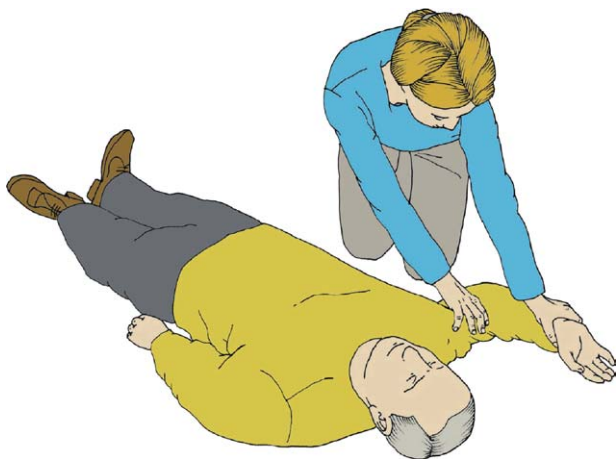


Figure 2.15 Place the arm nearest to you out at right angles to his body, elbow bent with the hand palm uppermost. © 2005 European Resuscitation Council.

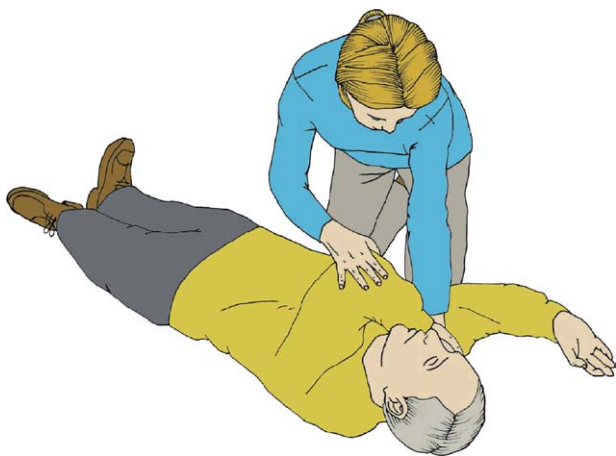


Figure 2.16 Bring the far arm across the chest, and hold the back of the hand against the victim's cheek nearest to you. © 2005 European Resuscitation Council.



Figure 2.17 With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground. © 2005 European Resuscitation Council.

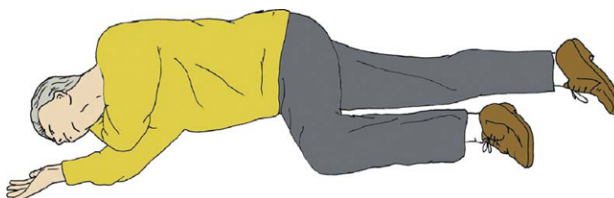


Figure 2.18 The recovery position. © 2005 European Resuscitation Council.

- Adjust the hand under the cheek, if necessary, to keep the head tilted ([Figure 2.18](#)).
- Check breathing regularly.

If the victim has to be kept in the recovery position for more than 30 min turn him to the opposite side to relieve the pressure on the lower arm.

Foreign-body airway obstruction (choking)

Foreign-body airway obstruction (FBAO) is an uncommon but potentially treatable cause of accidental death.⁸⁸ Each year approximately 16,000 adults and children in the UK receive treatment in an emergency department for FBAO. Fortunately, less than 1% of these incidents are fatal.⁸⁹ The commonest cause of choking in adults is airway obstruction caused by food such as fish, meat or poultry.⁸⁹ In infants and children, half the reported episodes of choking occur while eating (mostly confectionery), and the remaining choking episodes occur with non-food items such as coins or toys.⁹⁰ Deaths from choking are rare in infants and children; 24 deaths a year on average were reported in the UK between 1986 and 1995, and over half of these children were under 1 year.⁹⁰

Table 2.1 Differentiation between mild and severe foreign body airway obstruction (FBAO)^a

Sign	Mild obstruction	Severe obstruction
“Are you choking?”	“Yes”	Unable to speak, may nod
Other signs	Can speak, cough, breathe	Cannot breathe/wheezy breathing/silent attempts to cough/unconsciousness

^a General signs of FBAO: attack occurs while eating; victim may clutch at neck.

As most choking events are associated with eating, they are commonly witnessed. Thus, there is often the opportunity for early intervention while the victim is still responsive.

Recognition

Because recognition of airway obstruction is the key to successful outcome, it is important not to confuse this emergency with fainting, heart attack, seizure or other conditions that may cause sudden respiratory distress, cyanosis or loss of consciousness. Foreign bodies may cause either mild or severe airway obstruction. The signs and symptoms enabling differentiation between mild and severe airway obstruction are summarised in Table 2.1. It is important to ask the conscious victim ‘Are you choking?’

Adult FBAO (choking) sequence

(This sequence is also suitable for use in children over the age of 1 year) (Figure 2.19).

- 1 If the victim shows signs of mild airway obstruction
 - Encourage him to continue coughing but do nothing else
- 2 If the victim shows signs of severe airway obstruction and is conscious

- Apply up to five back blows as follows.
 - Stand to the side and slightly behind the victim.
 - Support the chest with one hand and lean the victim well forwards so that when the obstructing object is dislodged it comes out of the mouth rather than goes further down the airway.
 - Give up to five sharp blows between the shoulder blades with the heel of your other hand
 - Check to see if each back blow has relieved the airway obstruction. The aim is to relieve the obstruction with each slap rather than necessarily to give all five.
 - If five back blows fail to relieve the airway obstruction, give up to five abdominal thrusts as follows:
 - Stand behind the victim and put both arms round the upper part of his abdomen.
 - Lean the victim forwards.
 - Clench your fist and place it between the umbilicus and xiphisternum.
 - Grasp this hand with your other hand and pull sharply inwards and upwards.
 - Repeat up to five times.
 - If the obstruction is still not relieved, continue alternating five back blows with five abdominal thrusts.
- 3 If the victim at any time becomes unconscious.

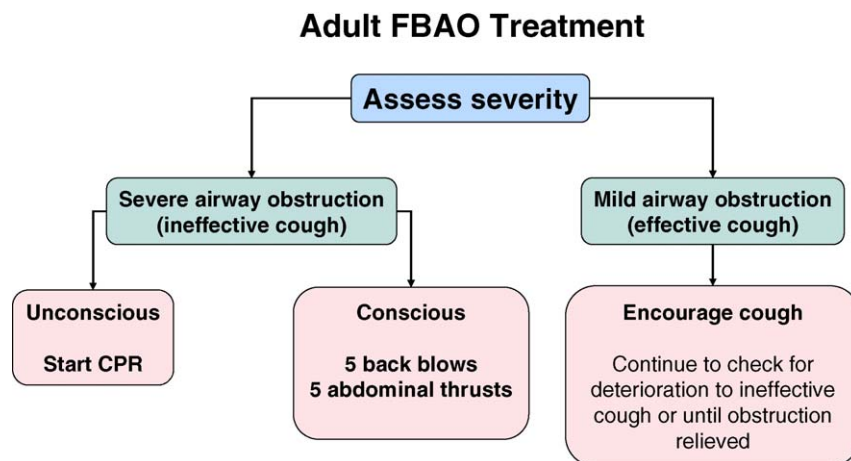


Figure 2.19 Adult foreign body airway obstruction treatment algorithm.

- Support the victim carefully to the ground.
- Immediately activate EMS.
- Begin CPR (from 5b of the adult BLS sequence). Healthcare providers, trained and experienced in feeling for a carotid pulse, should initiate chest compressions, even if a pulse is present in the unconscious choking victim.

FBAO causing mild airway obstruction

Coughing generates high and sustained airway pressures and may expel the foreign body. Aggressive treatment, with back blows, abdominal thrusts and chest compression, may cause potentially serious complications and could worsen the airway obstruction. It should be reserved for victims who have signs of severe airway obstruction. Victims with mild airway obstruction should remain under continuous observation until they improve, as severe airway obstruction may develop.

FBAO with severe airway obstruction

The clinical data on choking are largely retrospective and anecdotal. For conscious adults and children over 1 year with a complete FBAO, case reports demonstrate the effectiveness of back blows or 'slaps', abdominal thrusts and chest thrusts.⁹¹ Approximately 50% of episodes of airway obstruction are not relieved by a single technique.⁹² The likelihood of success is increased when combinations of back blows or slaps, and abdominal and chest thrusts are used.⁹¹

A randomised trial in cadavers⁹³ and two prospective studies in anaesthetised volunteers^{94,95} showed that higher airway pressures can be generated using chest thrusts compared with abdominal thrusts. Since chest thrusts are virtually identical to chest compressions, rescuers should be taught to start CPR if a victim of known or suspected FBAO becomes unconscious. During CPR, each time the airway is opened the victim's mouth should be quickly checked for any foreign body that has been partly expelled. The incidence of unsuspected choking as a cause of unconsciousness or cardiac arrest is low; therefore, during CPR routinely checking the mouth for foreign bodies is not necessary.

The finger sweep

No studies have evaluated the routine use of a finger sweep to clear the airway in the absence of visible airway obstruction,^{96–98} and four case reports have

documented harm to the victim^{96,99} or rescuer.⁹¹ Therefore, avoid use of a blind finger sweep and manually remove solid material in the airway only if it can be seen.

Aftercare and referral for medical review

Following successful treatment for FBAO, foreign material may nevertheless remain in the upper or lower respiratory tract and cause complications later. Victims with a persistent cough, difficulty swallowing or the sensation of an object being still stuck in the throat, should therefore be referred for a medical opinion.

Abdominal thrusts can cause serious internal injuries, and all victims treated with abdominal thrusts should be examined for injury by a doctor.⁹¹

Resuscitation of children (see also Section 6) and victims of drowning (see also Section 7c)

Both ventilation and compression are important for victims of cardiac arrest when the oxygen stores become depleted—about 4–6 min after collapse from VF and immediately after collapse from asphyxial arrest. Previous guidelines tried to take into account the difference in pathophysiology, and recommended that victims of identifiable asphyxia (drowning; trauma; intoxication) and children should receive 1 min of CPR before the lone rescuer left the victim to get help. The majority of cases of SCA out of hospital, however, occur in adults, and are of cardiac origin due to VF. These additional recommendations, therefore, added to the complexity of the guidelines while affecting only a minority of victims.

It is important to be aware that many children do not receive resuscitation because potential rescuers fear causing harm. This fear is unfounded; it is far better to use the adult BLS sequence for resuscitation of a child than to do nothing. For ease of teaching and retention, therefore, laypeople should be taught that the adult sequence may also be used for children who are not responsive and not breathing.

The following minor modifications to the adult sequence will, however, make it even more suitable for use in children.

- Give five initial rescue breaths before starting chest compressions (adult sequence of actions, 5b).

- A lone rescuer should perform CPR for approximately 1 min before going for help.
- Compress the chest by approximately one third of its depth; use two fingers for an infant under 1 year; use one or two hands for a child over 1 year as needed to achieve an adequate depth of compression.

The same modifications of five initial breaths, and 1 min of CPR by the lone rescuer before getting help, may improve outcome for victims of drowning. This modification should be taught only to those who have a specific duty of care to potential drowning victims (e.g. lifeguards). Drowning is easily identified. It can be difficult, on the other hand, for a layperson to determine whether cardiorespiratory arrest is a direct result of trauma or intoxication. These victims should, therefore, be managed according to the standard protocol.

Use of an automated external defibrillator

Section 3 discusses the guidelines for defibrillation using both automated external defibrillators (AEDs) and manual defibrillators. However, there are some special considerations when an AED is to be used by lay or non-healthcare rescuers.

Standard AEDs are suitable for use in children older than 8 years. For children between 1 and 8 years use paediatric pads or a paediatric mode if available; if these are not available, use the AED as it is. Use of AEDs is not recommended for children less than 1 year.

Sequence for use of an AED

See [Figure 2.20](#).

- (1) Make sure you, the victim, and any bystanders are safe.
 - (2) If the victim is unresponsive and not breathing normally, send someone for the AED and to call for an ambulance.
 - (3) Start CPR according to the guidelines for BLS.
 - (4) As soon as the defibrillator arrives
 - switch on the defibrillator and attach the electrode pads. If more than one rescuer is present, CPR should be continued while this is carried out
 - follow the spoken/visual directions
 - ensure that nobody touches the victim while the AED is analysing the rhythm
- 5a If a shock is indicated
- ensure that nobody touches the victim

- push shock button as directed (fully automatic AEDs will deliver the shock automatically)
- continue as directed by the voice/visual prompts

5b If no shock indicated

- immediately resume CPR, using a ratio of 30 compressions to 2 rescue breaths
- continue as directed by the voice/visual prompts

6 Continue to follow the AED prompts until

- qualified help arrives and takes over
- the victim starts to breathe normally
- you become exhausted

CPR before defibrillation

Immediate defibrillation, as soon as an AED becomes available, has always been a key element in guidelines and teaching, and considered of paramount importance for survival from ventricular fibrillation. This concept has been challenged because evidence suggests that a period of chest compression before defibrillation may improve survival when the time between calling for the ambulance and its arrival exceeds 5 min.^{28,61,100} One study¹⁰¹ did not confirm this benefit, but the weight of evidence supports a period of CPR for victims of prolonged cardiac arrest before defibrillation.

In all of these studies CPR was performed by paramedics, who protected the airway by intubation and delivered 100% oxygen. Such high-quality ventilation cannot be expected from lay rescuers giving mouth-to-mouth ventilation. Secondly, the benefit from CPR occurred only when the delay from call to the availability of a defibrillator was greater than 5 min; the delay from collapse to arrival of the rescuer with an AED will rarely be known with certainty. Thirdly, if good bystander CPR is already in progress when the AED arrives, it does not seem logical to continue it any further. For these reasons these guidelines recommend an immediate shock, as soon as the AED is available. The importance of early uninterrupted external chest compression is emphasised.

Voice prompts

In several places, the sequence of actions states 'follow the voice/visual prompts'. The prompts are usually programmable, and it is recommended that they be set in accordance with the sequence of shocks and timings for CPR given in Section 2. These should include at least:

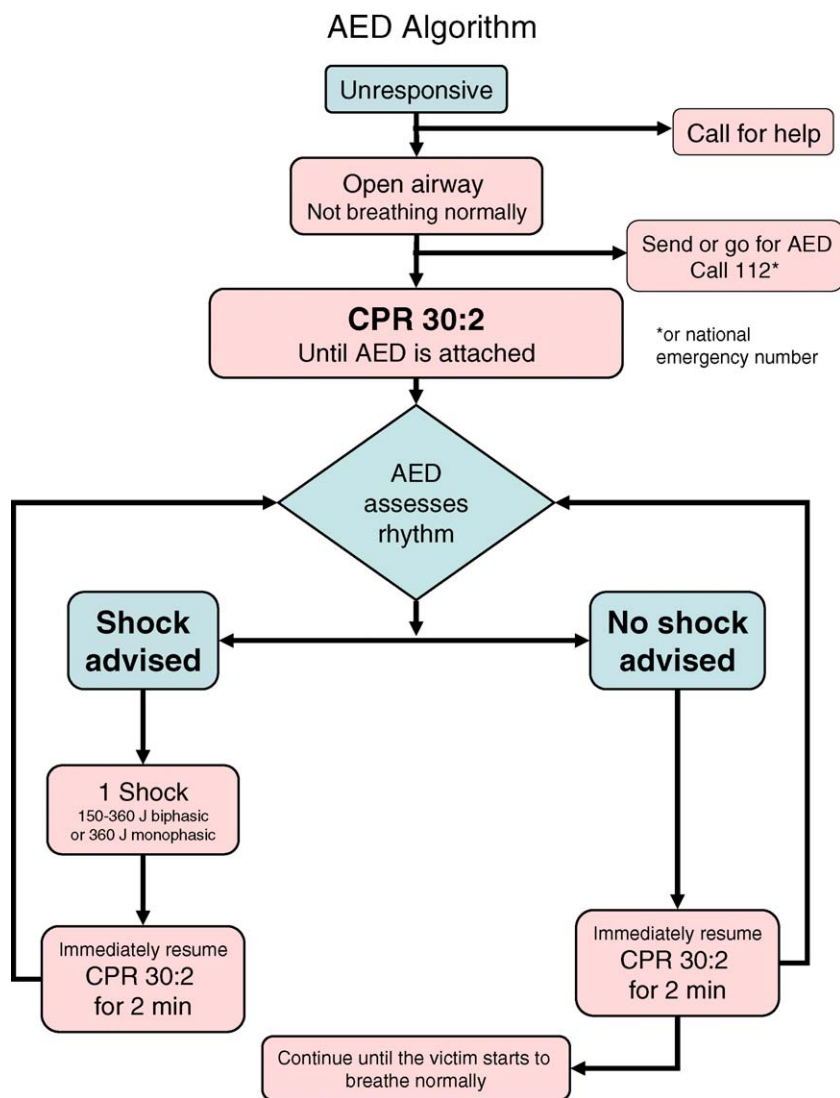


Figure 2.20 Algorithm for use of an automated external defibrillator.

- (1) a single shock only, when a shockable rhythm is detected
- (2) no rhythm check, or check for breathing or a pulse, after the shock
- (3) a voice prompt for immediate resumption of CPR after the shock (giving chest compressions in the presence of a spontaneous circulation is not harmful)
- (4) two minutes for CPR before a prompt to assess the rhythm, breathing or a pulse is given

The shock sequence and energy levels are discussed in Section 3.

Fully-automatic AEDs

Having detected a shockable rhythm, a fully-automatic AED will deliver a shock without further

input from the rescuer. One manikin study showed that untrained nursing students committed fewer safety errors using a fully-automatic AED rather than a semi-automatic AED.¹⁰² There are no human data to determine whether these findings can be applied to clinical use.

Public access defibrillation programmes

Public access defibrillation (PAD) and first responder AED programmes may increase the number of victims who receive bystander CPR and early defibrillation, thus improving survival from out-of-hospital SCA.¹⁰³ These programmes require an organised and practised response with rescuers trained and equipped to recognise emergencies, activate the EMS system, provide CPR and use the AED.^{104,105} Lay rescuer AED programmes with very rapid response

times in airports,²² on aircraft²³ or in casinos,²⁵ and uncontrolled studies using police officers as first responders,^{106,107} have achieved reported survival rates as high as 49–74%.

The logistic problem for first responder programmes is that the rescuer needs to arrive not just earlier than the traditional EMS, but within 5–6 min of the initial call, to enable attempted defibrillation in the electrical or circulatory phase of cardiac arrest.¹⁰⁸ With longer delays, the survival curve flattens;^{10,17} a few minutes' gain in time will have little impact when the first responder arrives more than 10 min after the call^{27,109} or when a first responder does not improve on an already short EMS response time.¹¹⁰ However, small reductions in response intervals achieved by first-responder programmes that have an impact on many residential victims may be more cost effective than the larger reductions in response interval achieved by PAD programmes that have an impact on fewer cardiac arrest victims.^{111,112}

Recommended elements for PAD programmes include:

- a planned and practised response
- training of anticipated rescuers in CPR and use of the AED
- link with the local EMS system
- programme of continuous audit (quality improvement)

Public access defibrillation programmes are most likely to improve survival from cardiac arrest if they are established in locations where witnessed cardiac arrest is likely to occur.¹¹³ Suitable sites might include those where the probability of cardiac arrest occurring is at least once in every 2 years (e.g., airports, casinos, sports facilities).¹⁰³ Approximately 80% of out-of-hospital cardiac arrests occur in private or residential settings;¹¹⁴ this fact inevitably limits the overall impact that PAD programmes can have on survival rates. There are no studies documenting effectiveness of home AED deployment.

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