



# Hart First Response

## Treatment Procedure Use of Defibrillators

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### 1. Introduction

- 1.1. The British Heart Foundation estimates that over 270,000 people suffer a heart attack every year in the UK and 46% are fatal. 30% of those will die before reaching hospital. Training in basic life support and use of community based defibrillators, has improved the pre-hospital survival rate by between 25% - 30%.
- 1.2. Automated External Defibrillators (AEDs) have become increasingly available in the pre-hospital environment for the treatment of sudden cardiac arrest. Early defibrillation has been shown to be effective in improving survival from out of hospital cardiac arrest. AEDs have been demonstrated to be reliable and intuitive to use, and advancements in technology have resulted in reductions in size, weight, cost and maintenance<sup>i</sup>. AEDs have been successfully used by police officers<sup>ii</sup>, flight attendants in airplanes and airports<sup>iii iv</sup> and by security guards in casinos<sup>v</sup>, to name a few.
- 1.3. This protocol is structured around the instructions for the use of the Laerdal FR2 and FRX AED and the CU-HD1 Defibrillator all following Resuscitation Council UK (RCUK) guidelines 2010<sup>vi</sup>.

### 2. Responsibilities

- 2.1. The Lead Trainer is the Executive Lead for HFR and is responsible for implementation of this procedure, and is the person to whom enquiries should be referred.
- 2.2. HFR volunteers should ensure that they follow this policy at all times.
- 2.3. The Officer In Charge (OIC) at events is responsible for monitoring/observing HFR volunteers to ensure best practice is adhered to.

### 3. Cardiac arrest

Cardiac arrest can be defined as the abrupt cessation of cardiac function, which is potentially reversible. Respiratory and cardiac arrest may produce similar signs but there is one important difference: cardiac arrest – no arterial pulse; respiratory arrest – arterial pulse is present. Four arrhythmias that cause cardiac arrest are:

- 3.1. Asystole
- 3.2. Ventricular fibrillation
- 3.3. Ventricular Tachycardia
- 3.4. Electromechanical dissociation (EMD) also known as pulseless electrical activity (PEA)

### 4. Agonal gasps

Agonal gasps are present in up to 40% of cardiac arrest victims. 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 sudden cardiac arrest. They are an indication for starting CPR immediately and should not be confused with normal breathing.

### 5. Defibrillation



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Defibrillation causes a simultaneous depolarization of the myocardium. This will stop the heart, allowing it the opportunity to regain useful electrical activity with the ultimate aim of gaining normal sinus rhythm.

### 6. CPR before defibrillation

From RCUK: Immediate defibrillation, as soon as an AED becomes available, has always been a key element in guidelines and teaching. This concept has recently been challenged. There are studies showing that when the time between calling for an ambulance and its arrival exceeds 5 minutes, a period of chest compression before defibrillation may improve survival. However, in these studies CPR was performed by paramedics, who also protected the airway by intubation and delivered 100% oxygen. Similar results may not be achievable by lay responders. For this reason the RCUK Guidelines 2010 continue to recommend an immediate shock as soon as the AED is available.

### 7. Training Governance

- 7.1. Training will be undertaken by those with AED training qualifications, or those under their supervision.
- 7.2. Training programmes will be validated as suitable by HFR's Medical Advisor.
- 7.3. Training will be in accordance with the current RCUK guidelines.

### 8. Training and Qualifications

- 8.1. For the use of a defibrillator in AED mode: Current standard First Aid or First Aid at Work certificate and documented training in this protocol, which is valid for 12 months.
- 8.2. For the use of a defibrillator in manual mode: State Registered Paramedic or suitably qualified and experienced Doctor holding an Advanced Life Support qualification.
- 8.3. For the use of a defibrillator in pacing mode: A suitably qualified and experienced Doctor.
- 8.4. For the use of a defibrillator to conduct 12 lead electrocardiograms (ECG): State Registered Paramedic or suitably qualified and experienced Doctor holding an Advanced Life Support qualification.
- 8.5. For the use of a defibrillator to conduct 3 lead ECGs: State Registered Paramedic or suitably qualified and experienced Doctor holding an Advanced Life Support qualification, or Ambulance Aiders who have attended a suitable training course as approved by the Paramedic Advisor and Medical Advisor.

### 9. Equipment

- 9.1. HFR has FR2 (figure 1a) and FRX (figure 1b) AEDs:



Figure 1a: FR2 Defibrillator



Figure 1b: FRX Defibrillator



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9.2. HFR also has a LifeGain CU-HD1 (figure 2) 12 lead ECG with AED , manual defibrillation and pacing functionality:



Figure 2: CU-HD1 Defibrillator

### 10. Pre-use Equipment Checklist

10.1. The defibrillator and associated supplies must be checked prior to event attendance using the relevant checklist in Appendix 1.

### 11. Use

- 11.1. The AED is only to be used on unconscious patients with no signs of normal breathing.
- 11.2. Resuscitation must be performed in accordance with the current guidelines of the Resuscitation Council (UK).
- 11.3. The usual procedure for approaching a patient must be followed: DRSAB before the AED is used.

### 12. Procedure: Adult (8 years and over, or over 55lbs/25 Kg)



Figure3: Positioning of adults pads

- 12.1. **Danger** Make sure the patient, any bystanders, and you are safe.
  - 12.1.1. If two rescuers are present, assign tasks.
- 12.2. **Response, Airway, Breathing** If the patient is unresponsive and not breathing normally:
  - 12.2.1. Send someone for the AED and to call for an ambulance. If you are on your own do this yourself; you may need to leave the patient.
- 12.3. **CPR** Start CPR according to the guidelines for BLS (30 Compressions:2 Breaths). Remember that one rescuer should only perform CPR for a maximum of two minutes, before swapping with another rescuer.
- 12.4. As soon as the **AED** arrives:
  - 12.4.1. Switch on the AED and follow voice prompts.
  - 12.4.2. Continue CPR whilst this is done.
  - 12.4.3. Remove clothing from the patient's upper body (if necessary using scissors)
  - 12.4.4. Ensure chest is dry and hairless where pads are to be applied
    - 12.4.4.1. Check the Ps: **p**atch, **p**acemaker, **p**elt, **p**erspiration, **p**endant, **p**laytex, **p**iercings, **p**uddle, **p**recipitation (rain), **p**ets, **p**ure oxygen, **p**roximity, **p**etrol.



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- 12.4.5. Open the pads, check expiry date and that they are intact and undamaged, remove protective backing and check gel is not dry
- 12.4.6. Place each pad on patient, in the position indicated on the pad (see figure 3) with the sticky side onto the skin. If pads are placed incorrectly, or reversed they should not be removed and replaced as this wastes time and the AED will still work. Handle pads by the wire end only, carefully smooth the pads in place so that there are no air bubbles underneath (these could cause burning during shocking).
- 12.4.6.1. Place one AED pad to the right of the breast bone (sternum), below the collar bone (clavicle). Place the other pad in the mid-axillary line (in line with armpit), approximately level with the female breast. This position should be clear of any breast tissue. It is important that this electrode is placed sufficiently laterally (to the side). In order to improve efficiency, place the mid-axillary pad with its long axis vertical.
- 12.4.7. Connect the pads to the AED, by plugging in the connector unless using the FRX model, where the pads are already connected.
- 12.4.8. Follow the voice / visual prompts.
- 12.4.9. Ensure that nobody touches the patient whilst the AED is analysing the rhythm.
- 12.5. **If a shock is indicated:**
  - 12.5.1. Ensure that nobody touches the patient.
  - 12.5.2. If you want to stop the charging just press the OFF button.
  - 12.5.3. **REMEMBER:** Only one person uses machine and one finger presses the button, for safety sit on your other hand.
  - 12.5.4. **Shock Delivery** - There will be voice, sound, and light prompts telling you to press the orange Shock button. No shock will be delivered unless you press the button.
  - 12.5.5. **State loudly, Stand clear – Shocking.**
  - 12.5.6. Press the Orange shock button as directed.
  - 12.5.7. Continue as directed by the voice / visual prompts.
- 12.6. **If no shock is indicated:**
  - 12.6.1. Immediately resume CPR using a ratio of 30 compressions to 2 rescue breaths.
  - 12.6.2. Continue as directed by the voice / visual prompts.
- 12.7. Continue to follow the AED prompts until:
  - 12.7.1. qualified help arrives and takes over (remember to swap CPR every 2 minutes) ,
  - 12.7.2. the patient starts to breathe normally, or
  - 12.7.3. you become exhausted.
- 12.8. **Afterwards**
  - 12.8.1. Complete the patient report form as soon as reasonably possible.
  - 12.8.2. Once the ambulance has departed with the patient, update any details missing from the patient report form.
  - 12.8.3. Report use of the AED to the HFR Executive Committee as soon as possible. Remember you can always discuss any issues with them.
  - 12.8.4. Complete the RCUK AED database form and pass to the HFR Executive Committee.



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### 13. Procedure: Child (1-8 years, or under 55lbs/25Kg)

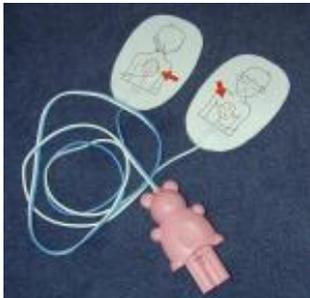


Figure 4: FR2 Child pads with teddy adaptor



Figure 5: FRX Child adaptor key (for use with adult pads)

- 13.1. **From RCUK guidelines:** Smaller, paediatric, self-adhesive pads, that attenuate the delivered current during defibrillation, are available for use with AEDs. Standard AEDs are suitable for use in children older than 8 years. In children between 1 and 8 years paediatric pads or a paediatric mode should be used if available; if not, the AED should be used as it is. There is insufficient evidence to support a recommendation for or against the use of AEDs in children less than 1 year.
- 13.2. Do not delay treatment to determine child's exact weight or age
- 13.3. Follow the adult procedure except:
- 13.4. Use child BLS sequence: 5 breaths, check C, then 15 compressions to 2 breaths).
- 13.5. For the FR2 use child pads (figure 4), for the FRX use the child adaptor key (figure 5) with adult pads.
- 13.6. Place the pads as indicated, one centred on the chest between the nipples, and the other on the back between the shoulder blades.
- 13.7. The special disposable infant/child pads contain electronics that attenuate, or reduce, the energy of the defibrillator's shock. A recent study showed that 50J is the appropriate dosage of SMART Biphasic therapy for infants and small children<sup>vii</sup> and the FR2 defibrillators are able to evaluate children's heart rhythms with outstanding accuracy for appropriate shock/no-shock decisions<sup>viii</sup>.

### 14. CU-HD1 3/12 lead ECG Manual and Automatic External Defibrillator

- 14.1. AED Mode
  - 14.1.1. Attach pads to patient's bare chest, plug in pads to lead set.
  - 14.1.2. Connect lead set to front panel, note the lock and unlock arrow directions, the green collar has to be turned anti-clockwise to fit the leads



- 14.1.3. Switch on by selecting AED mode on rotary dial, by turning it anti-clockwise



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- 14.1.4. Follow instructions, there are standard RCUK 2010 guidance prompts, set for 30:2 CPR and an inbuilt metronome.
- 14.2. Paediatric defibrillation guidance:
  - The LIFE GAIN HD-1 may be used on children from 1 to 8 years old or under 25kg (55 lb) in weight.
  - If the patient appears to be from 1 to 8 years old or less than 25kg (55 lb), use the reduced-energy defibrillator pads.
  - For children older than 8 years old, the European Resuscitation Council recommends using the adult Chain of Survival and resuscitation sequence
- 14.3. Self check for calibration
  - 14.3.1. Plug in cable set as per 14.2 above
  - 14.3.2. Attach 50ohm test load to end of cable
  - 14.3.3. Press rotary knob
  - 14.3.4. Dial through the options to get to 'Device Management' and press the knob
  - 14.3.5. Dial through the options to get to 'etc' and press the knob
  - 14.3.6. Select 'self test' and press the knob
  - 14.3.7. Follow instructions
  - 14.3.8. Store the test result in the vehicle folder.
- 14.4. Manual Operation
  - 14.4.1. Manual defibrillation shall only be undertaken by suitably qualified Paramedics or Doctors following current published RCUK Advanced Life Support Guidelines. <https://www.resus.org.uk/pages/guide.htm>
- 14.5. Electrocardiograms (ECG)
  - 14.5.1. 12 lead ECGs shall only be undertaken by suitably qualified Paramedics or Doctors.
  - 14.5.2. 3 lead ECGs may be undertaken by Ambulance Aiders who have undertaken approved training.
- 14.6. Pacing Operation
  - 14.6.1. External Cardiac Pacing shall only be conducted by a suitably qualified and experienced Doctor who has been approved to do so by the Medical Advisor.

## 15. Contraindications

- 15.1. Conscious/responsive patient
- 15.2. Presence of normal breathing

## 16. Dangers, Warnings and Cautions

### Dangers (immediate hazards that will result in injury or death)

- 16.1. There is a possibility of explosion if the AED is used in the presence of concentrated oxygen



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- 16.2. The AED has not been evaluated or approved for use in hazardous locations, i.e. it must not be used in the presence of flammable substances/air mixtures e.g. petrol stations
- 16.3. Do not recharge the battery

### Warnings (conditions that can result in injury or death)

- 16.4. Use the AED only as described.
- 16.5. Do not press the shock button if the pads are touching each other or are damaged (i.e. open and exposed)
- 16.6. Prolonged aggressive CPR on a patient with defib pads attached can damage the pads. Replace defib pads if they become damaged
- 16.7. Using damaged or expired equipment or accessories may cause the AED to perform improperly and injure someone
- 16.8. CPR rates significantly above 120 compressions per minute can cause incorrect or delayed analysis by the AED
- 16.9. Poor electrode pad to patient contact may result in a voice prompt from the AED. Check all connections
- 16.10. Do not touch the patient during shocking. Disconnect pads from AED before using any other defibrillator
- 16.11. Handling or transporting the patient can cause incorrect or delayed diagnosis. Keep the patient as still as possible, and allow at least 15 secs of non-movement/contact when the AED can analyse.

### Cautions (conditions that can result in minor injury to persons or damage to AED)

- 16.12. Hazardous electrical equipment
- 16.13. Do not immerse any part of the AED in water or other fluids. Do not spill fluids on it or sterilise it or its accessories
- 16.14. The AED is designed to be used only with manufacturer supplied accessories; otherwise it may perform improperly.
- 16.15. Follow all instructions supplied with the defib pads. Use the defib pads before the expiry date shown. DO not reuse defib pads discard the after use.
- 16.16. Aggressive handling of defib pads in storage or prior to use can damage them. Discard if damaged
- 16.17. Follow all instructions supplied with battery, install battery before expiry date.
- 16.18. Do not use on aircraft
- 16.19. The AED is sturdy, but rough handling can cause damage. Inspect regularly
- 16.20. Alteration of factory default for AED should only be performed under the authorisation of a medical director.
- 16.21. Do not open the AED's covers or attempt repair, there will be an electrical shock hazard



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### Appendix 1

#### AED FR2 Pre-use Checklist

**Model:** Heartstart FR2



Date						
Inspected by (initials)						
AED ID						
AED						
• Clean						
• No contamination						
• No signs of damage						
• Switch on check status						
• Shows hourglass						
Supplies: Pads (undamaged, in date)						
• Adult set 1, date.....						
• Adult set 2, date .....						
• Paed set 1, date .....						
Ancillary						
• Spare battery, in date .....						
• Tissues						
• Scissors						
• Razor						
• Pen						
• Gloves						
Ancillary not with AED						
• BVM						
• Patient report form						
Other comments						



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### AED FRX Pre-use Checklist

**Model:** Heartstart FRX



Date							
Inspected by (initials)							
AED ID							
AED							
• Clean							
• No contamination							
• No signs of damage							
• Switch on check status							
Supplies: Pads (undamaged, in date)							
• Adult set 1, date.....							
• Adult set 2, date .....							
• Paed Key							
Ancillary							
• Spare battery, in date .....							
• Tissues							
• Scissors							
• Razor							
• Pen							
• Gloves							
Ancillary not with AED							
• Patient report form							
• BVM							
Other comments							



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### Defibrillator CU-HD1 Pre-use Checklist

**Model:** LifeGain CU-HD1



Date							
Inspected by (initials)							
Defibrillator ID							
AED							
• Clean							
• No contamination							
• No signs of damage							
• Switch on check status with 50ohm load							
Supplies: Pads (undamaged, in date)							
• Adult set 1, date.....							
• Adult set 2, date .....							
Ancillary							
• Tissues							
• Scissors							
• Razor							
• Pen							
• Gloves							
• 50ohm test load							
• 3 lead ECG lead set							
• 12 lead ECG lead set							
• Packs of dots							
• Paper rolls							
• Mains charging lead							
Ancillary not with AED							
• Patient report form							
• BVM							
Other comments							



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### Appendix 2

#### Resuscitation – AED

<b>Candidate's Name</b> (must have current FAW certificate)			
<b>Assessor's Name</b> (must have current EMT certificate)			
<b>Date of performance evidence</b>			
<b>Date of knowledge evidence</b>			
<b>Decision and assessor's signature</b>			
<b>Date of competency expiry (1 year)</b>			

Demonstrate safe and appropriate practice when using an AED in line with current protocols.

#### Knowledge evidence

*To be assessed by separate written paper*

#### **Performance evidence**

The candidate is required to demonstrate, as a lone rescuer, the assessment of an unconscious, non-breathing patient who has no signs of a circulation. This is to be followed by a demonstration of how to use an AED and perform CPR. An appropriate resuscitation manikin and training AED should be used. The following situations should be simulated:

- Patient in ventricular fibrillation - "Shock advised"
- "No shock advised"

Each simulation should last about two minutes

	<b>Performance criteria</b>	<b>Observed (tick)</b>		
	• Ensures AED is fit for purpose prior to event (by completing checklist)			
D	• Rescuer looks for dangers to themselves (puts on gloves), the patient and any bystanders			
R	• Patient is found to be unresponsive			
S	• Rescuer shouts for help and turns patient onto back			
A	• Patient's head is positioned (head tilt, chin lift) to ensure a clear airway			
B	• Absence of <b>normal</b> breathing is established (for no more than 10 sec)			
	• Additional help is summoned (dial 999 and get AED)			
C	• CPR is commenced at 30 compressions to 2 breaths			
	• Compressions at 100 to 120 per minute and a depth of 5cm to 6cm			
	• Rescuer switches on the AED and attaches the AED pads			
	• Prompts given by the AED are followed			
	• Ensures no one touches the patient whilst the rhythm is being analysed			
D	• Defibrillation by delivering a shock to the patient safely			
	• If appropriate CPR is recommenced immediately following the shock			
	• Continue as directed by voice/visual prompts			
	• Interruptions to chest compressions are minimised			
	• Demonstrate safe and appropriate practice when using an AED in line with current protocols			

Range: non-breathing patient	Feedback
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Reference:



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- Resuscitation Council (UK) Competencies 2002
- Resuscitation Council (UK) Guidelines 2010



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### Medical Device Competency - Use of Monitoring Defibrillator

<b>Candidate's Name</b> (must have current EMT certificate)	
<b>Assessor's Name</b> (must have current EMT certificate)	
<b>Date of performance evidence</b>	
<b>Date of knowledge evidence</b>	
<b>Decision and assessor's signature</b>	
<b>Date of competency expiry (3 years)</b>	

ECG monitoring can alert responders to changes in a patient's condition and aid diagnostic decisions. Indications include: Any acute critical illness; Peri and post cardiac arrest; Acute coronary syndromes; History of life-threatening cardiac arrhythmias; Any procedure involving sedation or anaesthesia; Cardiovascular or conduction abnormalities, such as electrolyte or metabolic imbalance or drug overdose; decreased level of consciousness; heat stroke; thoracic trauma; anaphylaxis; and asthma.

The interpretation of the rhythm strip must be undertaken by a suitably qualified and experienced person. In most cases with HFR this will be a paramedic, or doctor.

#### Knowledge evidence

- Flatline - A flatline ECG trace is often caused by a lead or electrode becoming disconnected, but check ABCDE first
- A standard three bipolar lead configuration is most commonly used for continual ECG monitoring.
- Electrode placement - Electrode pads are placed below the right clavicle, the left clavicle and the left lower rib cage. The red cable is connected to the right clavicle electrode, the yellow cable is connected to the left clavicle electrode, and the green cable is connected to the lower ribcage electrode.
- PEA - A patient may also display an ECG rhythm on a monitor but have no pulse. This is known as pulseless electrical activity and should be treated as an emergency as the patient is in cardiac arrest.
- Rhythm strip interpretation – 6 step RCUK approach – Is there any electrical activity present? What is the ventricular (QRS) rate? Is the QRS rhythm regular or irregular? Is the QRS width normal or broad/prolonged? Is atrial activity (P waves) present? How is atrial activity related to ventricular activity?
- Signs or symptoms of cardiac arrhythmias include: Shock; Syncope or fainting; Myocardial ischaemia; Heart failure and can indicate acute or chronic illness
- Causes of asystole and cardiac arrest (4Hs, 4Ts): Hypoxia, Hypovolemia, Hypothermia, Hypo/hyperkalemia or other electrolyte or metabolic imbalance, Tension pneumothorax, Cardiac tamponade, Toxicity (poisoning), a thromboembolic event. These conditions can be reversible!

#### Performance evidence

The candidate shall demonstrate appropriate set-up by:

- Explain the procedure to the patient and gain consent to carry out procedure
- Ensure the patient is relaxed and limbs are still
- Place the electrodes in the correct position (Good contact between the electrode and the skin is essential so the skin should be clean and dry and excess hair shaved)
- Plug the electrode leads into the Defib
- Press the button to start the recording on to the rhythm strip



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- If the rhythm is irregular an additional rhythm strip should be recorded
- The following should be documented once ECG monitoring has been commenced: Indication for ECG monitoring; The date and time monitoring started; The lead configuration used; Skin preparation; Any rhythm rate abnormality; Any action taken as a result of the analysis; Any significant patient events that occur during the monitoring process, such as shortness of breath
- A paper strip that allows for the calculation of the PR interval and QRS width should be printed and correctly labelled.
- Interpretation of the rhythm strip must be undertaken by a suitably qualified and experienced person.

Performance criteria	Observed (tick)
• Check that equipment has been serviced and is ready for use	
• Demonstrate correct set-up of equipment	
• Demonstrate awareness of health and safety risks and how to minimise these	
• Demonstrate correct documentation process	
• Clean equipment appropriately after use	
• Explain how to obtain supplies of biohaz wipes, or report a fault	

Range: Any patient with indication for ECG monitoring	Feedback
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### References:

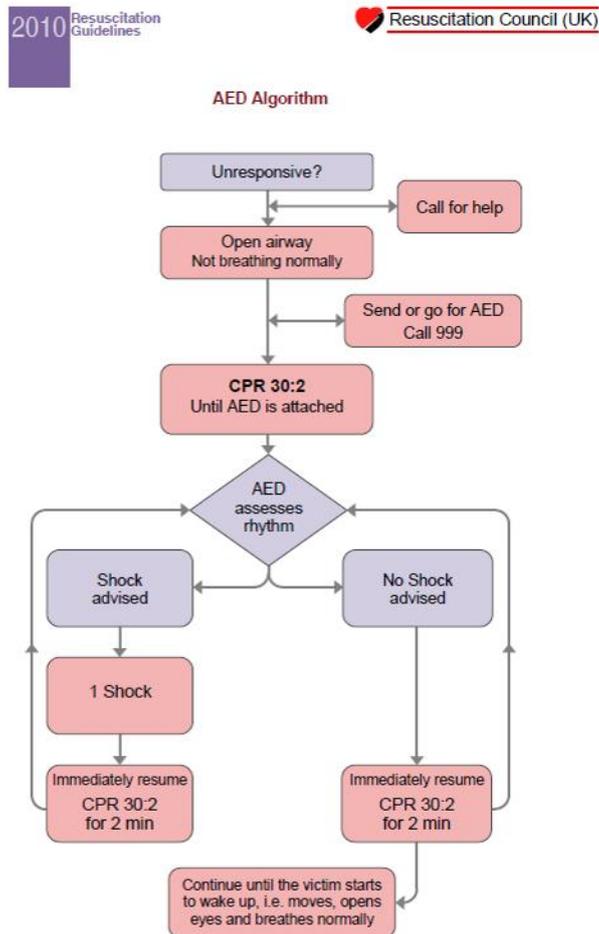
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### Appendix 3 RCUK 2010 Algorithm



### References

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- <sup>iv</sup> Caffrey SL, Willoughby PJ, Pepe PE, Becker LB. Public use of automated external defibrillators. *New Engl J Med* 2002;347:1242\_/7.
- <sup>v</sup> Valenzuela TD, Roe DJ, Nichol G, Clark LL, Spaite DW, Hardman RG. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. *New Engl J Med* 2000;343:1206\_/9.
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- <sup>vii</sup> Tang, et al. Pediatric Fixed Energy Biphasic Waveform Defibrillation Using Standard AED and Special Pediatric Electrodes. Supplement to *Circulation*, Abstracts from the 72nd Scientific Sessions, Atlanta, Georgia, November 7-10 1999.
- <sup>viii</sup> Cecchin, et al. Is Arrhythmia Detection by Automated External Defibrillator Accurate for Children?, *Circulation*, May 22, 2001