

# Clinical Skills in Hospitals Project

## Advanced Life Support (ALS) adult

Module 1: Airway

Module 2: Defibrillation and ALS pharmacology

Module 3: ALS

Module 4: External cardiac pacing

Module 5: Complex ALS



# **Clinical Skills in Hospitals Project**

## Advanced Life Support (ALS) adult

Module 1: Airway

Module 2: Defibrillation and ALS pharmacology

Module 3: ALS

Module 4: External cardiac pacing

Module 5: Complex ALS

## Acknowledgments

The authors wish to acknowledge the following people for their important contributions to this project:

- Dr Stuart Dilley from St Vincent's Hospital, Melbourne, and Ms Debbie Paltridge from Health Education Innovative Solutions for their tireless efforts as the primary authors of the Advanced Life Support (adult) package.
- Mr Julian Van Dijk and Dr Robert O'Brien at St Vincent's Education Centre for their contributions to this package.

For further information please contact the project manager, Julian Van Dijk:

(03) 9288 2900

[julian.vandijk@svhm.org.au](mailto:julian.vandijk@svhm.org.au)

© State of Victoria 2008

This publication is copyright. No part may be reproduced by any process except in accordance with the provisions of the *Copyright Act 1968*.

The Clinical Skills Centres in Hospitals Training Materials ("Materials") were developed for the Department of Human Services ("DHS") for use by clinical educators ("Educators"). Any Educator wishing to use the Materials must review the Materials prior to use and ensure that they are suitable for the Educator's purpose, including the needs of the Educator's intended training recipients ("Training Recipients"). Some aspects of the Materials may not be relevant to some Educators or Training Recipients. Educators and Training Recipients must not represent themselves as employees or agents of DHS in their use of the Materials. Except at the time of publication, neither DHS nor the State of Victoria warrants the accuracy of the information contained in the Materials. Neither DHS nor the State of Victoria makes any warranty as to the appropriateness of the information to the circumstances of Educators or Training Recipients. The Materials may not include all of the information required by Educators or Training Recipients in providing or receiving clinical training. If in doubt, Educators and Training Recipients should seek their own advice about the interpretation of the Materials. Any Educator or Training Recipient using the Materials does so at their own risk and shall accept responsibility for any actions arising from their use. DHS may update the Materials at its own discretion, but is not responsible for the provision of updates to the Materials. No responsibility is taken for failure to update the Materials and it is the responsibility of the Educator to ensure that the information contained in the Materials is up to date and reflects current medical practice, law and guidelines.

## Preface

In 2007 the Department of Human Services commissioned St Vincent's Hospital Melbourne, to design and develop simulation-based training packages for clinical skills trainers in Victorian hospitals.

The project provides Victorian health professionals—specifically, hospital clinical educators—with a resource to deliver simulation-based clinical skills training.

The information in this manual complements current training programs and should be considered as a resource in the workplace, rather than the definitive resource on the topic.

Every effort has been made to provide the most current literature references. Authors have consulted other health professionals and current programs when possible in development to ensure that the modules produced in this package are consistent with current health practices.



# Course delivery in condensed form

## Sample timetable for one-day workshop

This is an example of how the modules in *ALS adult* could be combined into a one-day workshop. A sample timetable is provided for a course consisting of Modules 1, 2 and 3, and a course consisting of Modules 3, 4 and 5.

### Course 1 (Modules 1, 2 and 3)

Timing	Activity		Objective
8.30 to 8.45	Introduction faculty and participants		
8.45 to 9.30	Facilitated discussion: ABC		Module 1: all
9.30 to 10.30	Skills stations (three concurrent): <ul style="list-style-type: none"> <li>■ bag-mask ventilation</li> <li>■ ETT placement</li> <li>■ LMA placement</li> </ul>		Module 1: all
10.30 to 10.40	Summary of Module 1		Module 1: all
10.40 to 11.00	Morning tea		
11.00 to 11.40	Facilitated discussion: AED		Module 2: all
11.40 to 12.40	Skills stations 1 and 2		Module 2: all
12.40 to 12.50	Summary of Module 2		Module 2: all
<b>12–50 to 13.30</b>	<b>Lunch</b>		
13.30 to 13.50	Introduction and discussion		Module 3: 1
	Group 1	Group 2	
13.50 to 14.00	Simulation 1	Simulation 2	Module 3: all
14.00 to 14.30	Debrief	Debrief	Module 3: all
14.30 to 14.40	Simulation 2	Simulation 1	Module 3: all
14.40 to 15.10	Debrief	Debrief	Module 3: all
<b>15.10 to 15.30</b>	<b>Afternoon tea</b>		
15.30 to 16.00	Summary of Module 3 Evaluation of course		Module 3: all

## Course 2 (Modules 3, 4 and 5)

Timing	Activity		Objective
8.30 to 8.50	Introduction faculty, participants, simulator		
8.50 to 9.10	ALS introduction and discussion		Module 3: 1
	Group 1	Group 2	
9.10 to 9.20	Simulation 1	Simulation 2	Module 3: all
9.20 to 9.50	Debrief	Debrief	Module 3: all
9.50 to 10.00	Simulation 2	Simulation 1	Module 3: all
10.00 to 10.10	Debrief	Debrief	Module 3: all
10.10 to 10.20	Summary of Module 3		Module 3: all
<b>10.20 to 10.40</b>	<b>Morning tea</b>		
10.40 to 11.20	Facilitated discussion: external pacing		Module 4: all
11.20 to 12.05	Skills station: external pacing		Module 4: all
12.05 to 12.15	Summary of Module 4		Module 4: all
<b>12.15 to 13.00</b>	<b>Lunch</b>		
13.00 to 13.40	Facilitated discussion: CRM		Module 5: 1
	Group 1	Group 2	
13.40 to 13.55	Simulation 1	Simulation 2	Module 5: all
13.55 to 14.25	Debrief	Debrief	Module 5: all
14.25 to 14.40	Simulation 2	Simulation 1	Module 5: all
14.40 to 15.10	Debrief	Debrief	Module 5: all
<b>15.10 to 15.30</b>	<b>Afternoon tea</b>		
15.30 to 16.00	<ul style="list-style-type: none"> <li>■ Summary of Module 5</li> <li>■ Evaluation of course</li> </ul>		Module 5: all

# Advanced Life Support (ALS) adult

## Introduction

*ALS adult* (Advanced Life Support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the Clinical Skills in Hospitals Project (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of Advanced Life Support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD     Airway[Airway] --&gt; ALS[ALS]     Defibrillation[Defibrillation and ALS pharmacology] --&gt; ALS     Defibrillation --&gt; ExternalPacing[External cardiac pacing]     ALS &lt;--&gt; ExternalPacing     ExternalPacing --&gt; ComplexALS[Complex ALS] </pre>
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult* does not cover issues relating to post-resuscitation therapy, such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants should refer to the Australian Resuscitation Council's (ARC) Guideline 11.8: Post-resuscitation therapy in adult Advanced Life Support, February 2006, for this information.

*ALS adult* was designed to develop participants' knowledge, skills and behaviours in ALS, and expose them to increasingly complex scenarios to test their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 1: Airway

## Introduction

*ALS adult* (Advanced Life Support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of Advanced Life Support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult—Module 1: ALS airway* does not cover issues relating to post-resuscitation therapy such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants are referred to the Australian Resuscitation Council's Guideline 11.8 'Post-resuscitation therapy in adult Advanced Life Support, February 2006' for this information.

*ALS adult—Module 1: ALS airway* was designed to develop participants' knowledge, skills and behaviours in ALS and to expose them to increasingly complex scenarios aimed at testing their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 1: Airway

Authors: Dr Stuart Dilley, Ms Debbie Paltridge

## Aims

ALS adult—Module 1: Airway aims to teach participants how to perform safely, or assist others in safely performing, advanced airway skills, including endotracheal intubation, in the setting of adult Advanced Life Support (ALS). Educators or participants wishing to practise management of the difficult airway, or failed intubation, should refer to Respiratory Package 1.

## Presumed knowledge

This module is targeted to health professionals with minimal experience in advanced airway management. However, they are expected to have a basic knowledge of:

1. upper airway anatomy: mouth, tongue, mandible, pharynx, larynx
2. respiratory physiology: breath sounds, ventilation cycles
3. basic life support (BLS) airway skills (airway management, bag-mask ventilation).

Participants may have previously undertaken BLS adult—Module 1: ABC, which taught airway skills relevant to basic life support (BLS). If not, this module offers a chance to practise these skills.

## Objectives

By the end of this module, participants should have:

1. practised basic airway manoeuvre techniques on a manikin, including use of an oropharyngeal (OP) airway
2. practised bag-mask ventilation on a manikin
3. identified the indications for escalation to advanced airway management in cardiac arrest and adult ALS settings
4. practised endotracheal intubation on a manikin
5. practised laryngeal mask insertion on a manikin.

## Background information for educators

Basic airway manoeuvres and bag-mask ventilation may be sufficient for initial management of a patient in cardiac arrest, because rapid defibrillation could occur on return of spontaneous circulation and breathing. When ALS attempts are more prolonged, advanced airway management may be indicated, including endotracheal intubation or laryngeal mask insertion.

## Basic airway management

The airway should be inspected and cleared of foreign bodies which might cause obstruction and prevent adequate ventilation:

1. Manually remove solid foreign bodies with fingers.
2. Remove ill-fitting dentures.
3. Use suction to remove blood and secretions.

The patient's head and neck should be positioned appropriately to help maintain an airway in preparation for assisted ventilation. This involves flexion of the neck and extension of the head, with the responder standing at the top of the patient's head. If cervical spine injury is suspected or likely, minimise neck movement, maintain the airway via the jaw thrust manoeuvre and immobilise the cervical spine with a cervical collar.



*Figure 1: Head tilt/chin lift and jaw thrust*

Oropharyngeal (Guedel) airways may assist in obtaining and maintaining an airway. Oral airways should be sized and inserted as follows:

1. Measure from the corner of the patient's mouth to angle of jaw/tip of earlobe.
2. Initially insert upside-down.
3. Rotate 180 degrees as the device is introduced further into the mouth.

## Bag-mask ventilation

Most health professionals in the hospital setting favour a bag-mask device for rescue breathing. Responders should be familiar with the parts of such a device:

1. facemask
2. valve
3. pressure relief valve (not fitted to all devices, this prevents excessive pressure being delivered to the patient's lungs)
4. ventilation bag

5. oxygen inlet connection
6. oxygen reservoir bag.

For bag-mask ventilation, the responder should:

1. Position themselves at the patient's head.
2. Connect bag-mask device to maximal oxygen flow.
3. Obtain and maintain an open airway.
4. Hold the mask firmly in position with one hand.
5. Place the narrow end of the mask over the bridge of the nose.
6. Push down firmly on the mask with thumbs and fingers while simultaneously lifting the jaw into the mask to create a seal.
7. Blow oxygen into the patient's lungs by compressing the ventilation bag.
8. Look for a rise in the patient's chest.
9. Allow for expiration, observing for fall of the chest wall.
10. Two hands may be required to hold the mask in place, in which case, a second person may be employed to compress the ventilation bag.

As for BLS protocols, chest compressions and ventilations should be performed at a ratio of 30:2 while bag-mask ventilation continues<sup>1</sup>.



*Figure 2: Correct placement of mask*



*Single operator technique (nose to chin)*



*Double operator technique*

## Endotracheal intubation

The endotracheal tube (ETT) is generally considered the gold standard method of managing the airway and providing ventilation during cardiac arrest, but no evidence exists that insertion of an ETT leads to better outcomes.

If responders do not feel confident with endotracheal intubation, they may continue to provide effective bag-mask ventilation. While initial<sup>2</sup> deferral of intubation is acceptable, a trained operator should attempt intubation at the earliest opportunity once it becomes evident that resuscitation attempts will be ongoing. However, cardiopulmonary resuscitation (CPR) must continue, and interruptions to chest compressions should be less than 20 seconds duration<sup>1</sup>.

Bag-mask ventilation and chest compressions should continue while preparations are made to intubate. In the cardiac arrest situation, the patient is apnoeic, unresponsive and has no muscle tone—therefore, it is unlikely that drugs are required to assist the intubation process. Preparation for intubation should involve these steps:

- Confirm that the ventilation bag being used is appropriate for ventilation post-intubation.
- Confirm the roles of various assistants, including those responsible for cricoid pressure (see below) and airway equipment.
- Check that suction equipment is available and functioning.
- Check that an appropriate laryngoscope and blade (Macintosh) is available, assembled and that the light shines brightly.
- Select an appropriately sized ETT (7.5 for adult female, 8.0–8.5 for adult male), apply lubricant and confirm cuff inflation.
- Make requests for additional equipment items which may be required (for example, Magill's forceps for removing foreign bodies, introducers and or bougies to assist placement of the ETT).
- Prepare end tidal CO<sub>2</sub> (ETCO<sub>2</sub>) monitoring equipment.

Cricoid pressure is a common airway manoeuvre used in anaesthetic practice. Based on theory, it was introduced as a means of compressing the oesophagus and reducing the risk of pulmonary aspiration in patients undergoing urgent or semi-urgent endotracheal intubation when not properly fasted. The technique of cricoid pressure involves:

- Allocate the role to a dedicated assistant.
- Locate the cricoid cartilage on the anterior aspect of the neck immediately below the inferior border of the thyroid cartilage.
- Grasp the cricoid cartilage with thumb and index finger.

- Firmly push the cricoid cartilage directly backwards to occlude the oesophagus located immediately behind the upper airway.
- Maintain this pressure until instructed otherwise by the clinician performing endotracheal intubation.



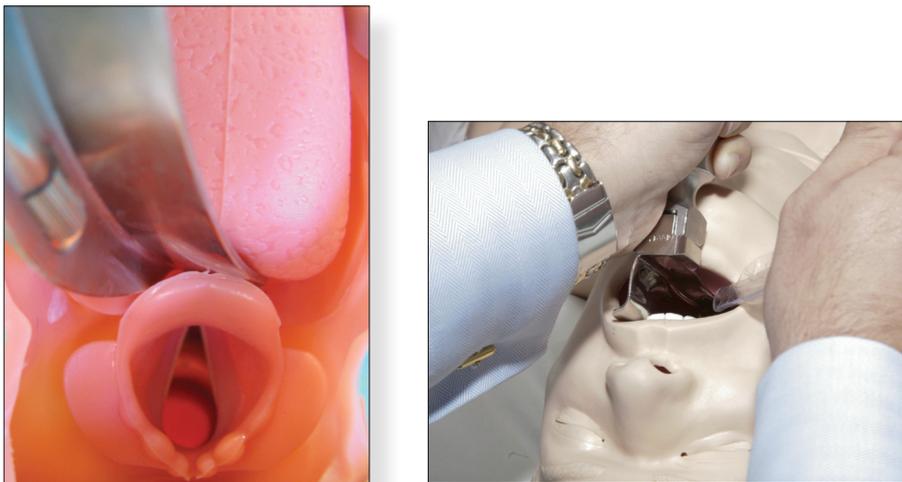
*Figure 3: Application of cricoid pressure*

Recently, the use of cricoid pressure has been challenged<sup>3</sup>. Incorrect application may make direct laryngoscopy more difficult, and the theoretical benefit of oesophageal occlusion and reduction in aspiration has not been proven. While debate persists, current best practice still recommends using this manoeuvre.

After the preparation procedure, ETT placement is then performed thus:

- Instruct an assistant to provide cricoid pressure.
- Open the mouth and remove any OP airway, dentures or foreign bodies if not already done.
- Position the head in the 'sniffing position' with the neck flexed and the head extended. This is more easily achieved with the patient's head on a pillow.
- Hold the laryngoscope in the left hand and introduce the tip of the blade into the right side of the patient's mouth—the patient's tongue is thus deflected to the left.
- Direct the tip of the laryngoscope blade to lie in the vallecula (space between base of tongue and front of epiglottis). The epiglottis should be visible posterior to the laryngoscope blade.
- Use suction to remove secretions or blood if view of anatomy is difficult.
- Lift the laryngoscope, tongue and jaw forwards in the line of the handle of the laryngoscope to allow direct view of the larynx and vocal cords. Do not rotate the laryngoscope backwards or use the teeth as a fulcrum. This does not improve the view of the larynx and may lead to dental trauma.
- Introduce the ETT into the right corner of the mouth and advance the tube through the vocal cords.
- Position and inflate the cuff of the ETT just beyond the vocal cords. Advancing the ETT too far may result in selective intubation of the right main stem bronchus and subsequent ventilation of the right lung only.

- Attach ETCO<sub>2</sub> monitor and ventilation bag.
- Ventilate with 15 litres oxygen per minute.
- Confirm correct placement of ETT.
- Firmly secure ETT.



*Figure 4: Identify the vocal cords and insertion of the ETT via the right side of the mouth*

Correct placement of the ETT should be confirmed. No method of confirmation is infallible, and it is recommended that operators use a variety of techniques. These include:

- direct visualisation of ETT passage through vocal cords
- observation of bilateral chest movement with ventilation
- bilateral chest auscultation for equal air entry
- auscultation of the epigastrium to exclude 'ventilation' of the stomach
- fogging of the tube due to expired humidified air from the lungs
- ETCO<sub>2</sub> detection: correct placement of the ETT in the trachea should lead to the detection of CO<sub>2</sub> with each expiration; however, the ETCO<sub>2</sub> level may be low or undetectable in patients suffering cardiac arrest due to low or absent pulmonary blood flow
- chest X-ray.

After placement of an advanced airway, it is acceptable to continue ventilations at a rate of 8–10 per minute without pausing chest compressions<sup>1, 2</sup>.

The procedure for intubation should be modified for patients who have, or are suspected of having a cervical spine injury.

- Minimise head and neck movement.
- Use the jaw thrust to maintain the airway, rather than the head tilt/chin lift method.

- Employ a dedicated assistant to provide in-line immobilisation of the cervical spine (see below).
- Once in-line stabilisation is in place, release the cervical collar to allow greater movement of the jaw during laryngoscopy.
- Perform intubation with minimal movement of the patient's head and neck.
- After successful intubation, re-fit the cervical collar.

In-line immobilisation of the cervical spine is performed by a dedicated assistant whose sole responsibility is to care for the patient's cervical spine:

- The assistant stabilises the patient's head and neck to prevent any movement during the intubation process.
- The assistant should only provide immobilisation, and not impart any traction to the cervical spine.
- The assistant may crouch at the head of the patient's bed with one hand placed on either side of the patient's head, and fingers pointing towards the patient's chest; however, in this position, the assistant may be a hindrance to the intubator. This position was initially described when the assistant was required to provide cervical spine traction in addition to stabilisation. Traction is no longer recommended in this situation.
- Alternatively, the assistant may lean over the patient's chest, placing one hand on either side of the patient's head with the fingers pointing towards the intubator. In this position, the person intubating has more room to move.
- The assistant should maintain their position until the patient is successfully intubated and the cervical collar is re-applied.

### **Laryngeal mask insertion**

The laryngeal mask airway (LMA) provides a more secure and reliable means of ventilation than the face mask<sup>2</sup>. The LMA may be considered in the ALS setting to assist in maintaining an airway and providing ventilation, but is regarded as inferior to the ETT<sup>1</sup>. The LMA does not protect the airway and lungs from aspiration. However, it may allow the responder to deliver adequate ventilations temporarily if bag-mask ventilation is difficult, if insertion of an ETT is not possible or fails, or the operator is not confident in attempting endotracheal intubation. The LMA should be replaced by an ETT when appropriately skilled personnel are available.

The following technique should be followed for inserting an LMA:

- Select the appropriate LMA size 4 (size 3–4 for female adults, size 4–5 for male adults).
- Apply adequate lubrication to the cuffed area of the device.

- Some operators prefer to inflate the cuff partially before insertion, although the device was initially designed to be inserted with the cuff deflated.
- The patient's head should be in the 'sniffing position' with the neck flexed and head extended.
- The LMA is initially inserted into the mouth in a horizontal position, staying close to the patient's hard palate and avoiding the tongue.
- Further pressure on the tube (when held like a pen) or mask (if introduced with index finger) results in the LMA advancing further until the tip of the mask lies in the hypopharynx posterior to the opening of the larynx.
- The cuff should then be inflated and the LMA seen to rise slightly and centre itself in the patient's mouth. Failure to sit centrally indicates misplacement of the LMA.
- A ventilation bag should then be applied and the patient ventilated with 15 litres per minute of oxygen.
- Adequate ventilation should be confirmed by observing equal and adequate chest movements and auscultating both lungs for air movement.



*Figure 5: Placement of the LMA showing correct seated position post-inflation over the hypopharynx*

## Learning activities

Suggested learning activities and timetable are outlined below.

Timing	Activity	Objective
40 minutes	Facilitated discussion	1, 2 and 3
60 minutes	Skills stations (three): <ul style="list-style-type: none"> <li>■ airway management</li> <li>■ bag-mask ventilation</li> <li>■ chest compressions</li> </ul>	4 5 6
10 minutes	Summary	All
10 minutes	Evaluation	

**Total time = 2 hours**

### Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information. They should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they may have encountered.

Major issues which the facilitator should cover include:

- techniques for obtaining an adequate airway
- bag-mask ventilation technique
- indications for advanced airway intervention
- technique for ETT placement
- technique for LMA placement.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion, or as triggers during the discussion.

### Skills stations

The skills stations allow participants to practise basic airway manoeuvres, bag-mask ventilation, ETT and LMA insertion on a training manikin while receiving feedback in a structured format from peers and/or facilitators. Participants should be guided through each of the three skills using Peyton's four-step model<sup>5</sup>. Feedback should be provided at the completion of the skill.

The activity and resources outlined assume three facilitators for every 12 participants, a ratio of 1:4. Each group of participants should rotate through three 20-minute skills stations. Each participant should have five minutes of hands-on experience at each station while observing three colleagues for 15 minutes.

Depending on the professional mix of the group (that is, medical and nursing), appropriate emphasis should be placed on those 'assisting' and 'doing', as appropriate for individual institutions.

## Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

- bag-mask ventilation technique
- indications for and timing of advanced airway techniques
- endotracheal intubation technique
- LMA insertion technique.

Participants should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence.

Participants may be encouraged to observe or assist experienced colleagues performing these skills in controlled settings (for example, anaesthetics departments) to put these skills into a clinical context.

## Resource list

The following resource list assumes three facilitators for every 12 participants, a ratio of 1:4. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
Facilitators	3	Allows a 1:4 ratio with 12 participants
PowerPoint presentation	1	Provided with module
Manikins	3	Should be suitable for bag-mask ventilation, endotracheal intubation and LMA insertion
Oxygen supply	3	Suggested: three wall outlets or oxygen cylinders
Oropharyngeal airways	3 sets	Include 2–3 different sizes
Bag-mask ventilation device	3	Including oxygen tubing
Ventilation mask	3	
Endotracheal tubes	3	Appropriate size for manikin
LMA	3	Appropriate size for manikin
10 mL syringe	3	For inflation of ETT/LMA cuffs
Feedback sheets	3	As a prompt for each facilitator
Evaluation forms	12	One for each participant

## Evaluation

A formal evaluation was specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Australian Resuscitation Council Guideline 11.7: Equipment and Techniques in Adult Advanced Life Support. February 2006
2. American Heart Association 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 7.1: Adjuncts for Airway Control and Ventilation. *Circulation* 2005 112: 51–57
3. Butler J. 2005 Cricoid Pressure in Emergency Rapid Sequence Induction. *Emerg Med J* 22: 815–816
4. Hein C. 2004 The Prehospital Practitioner and the Laryngeal Mask Airway: 'Are You Keeping Up?' *J Emerg Prim Health Care* 2: 1–11
5. Peyton J. 1998 *Teaching and Learning in Medical Practice*. Manticore Europe Ltd. Great Britain



## Module 1: Airway—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>ALS adult</i>	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
<i>Learning objectives of Module 1: Airway</i>					
Practised basic airway manoeuvre techniques on a manikin, including use of an oropharyngeal (OP) airway	<input type="checkbox"/>				
Practised bag-mask ventilation on a manikin	<input type="checkbox"/>				
Identified the indications for escalation to advanced airway management in the setting of cardiac arrest and adult ALS	<input type="checkbox"/>				
Practised endotracheal intubation on a manikin	<input type="checkbox"/>				
Practised laryngeal mask insertion on a manikin	<input type="checkbox"/>				

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

---



---



---



---



---



---

#### 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing ALS	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

#### 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

---



---



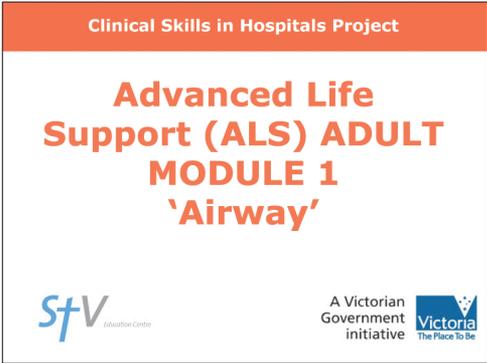
---



---

**Thank you**

## PowerPoint presentation

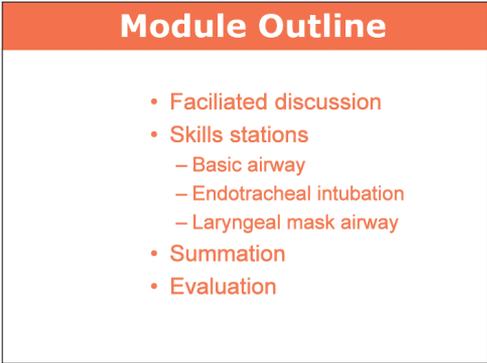
1. 

Clinical Skills in Hospitals Project

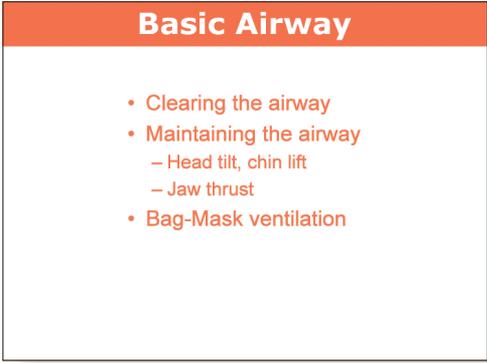
**Advanced Life Support (ALS) ADULT MODULE 1 'Airway'**

StV Education Centre

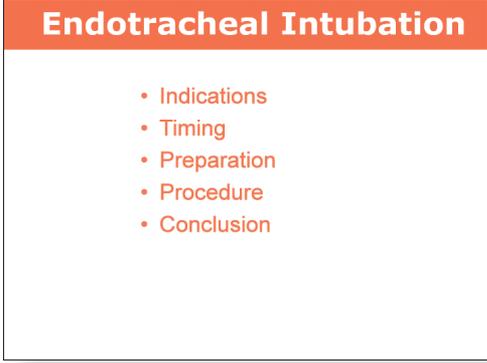
A Victorian Government initiative

Victoria The Place to Be
2. 

**Module Outline**

  - Facilitated discussion
  - Skills stations
    - Basic airway
    - Endotracheal intubation
    - Laryngeal mask airway
  - Summation
  - Evaluation
3. 

**Basic Airway**

  - Clearing the airway
  - Maintaining the airway
    - Head tilt, chin lift
    - Jaw thrust
  - Bag-Mask ventilation
4. 

**Endotracheal Intubation**

  - Indications
  - Timing
  - Preparation
  - Procedure
  - Conclusion
5. 

**Laryngeal Mask Airway**

  - Indications
  - Timing
  - Preparation
  - Procedure
  - Conclusion



# Module 2: Defibrillation and ALS pharmacology

## Introduction

*ALS adult* (Advanced Life Support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of Advanced Life Support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD     Airway[Airway] --&gt; ALS[ALS]     Defibrillation[Defibrillation and ALS pharmacology] --&gt; ALS     Defibrillation --&gt; ExternalPacing[External cardiac pacing]     ExternalPacing &lt;--&gt; ALS     ExternalPacing --&gt; ComplexALS[Complex ALS]   </pre>
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult—Module 2: Defibrillation and ALS pharmacology* does not cover issues relating to post-resuscitation therapy such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants are referred to the Australian Resuscitation Council's Guideline 11.8: Post-resuscitation therapy in adult Advanced Life Support, February 2006 for this information.

*ALS adult—Module 2: Defibrillation and ALS pharmacology* was designed to develop participants' knowledge, skills and behaviours in ALS and to expose them to increasingly complex scenarios aimed at testing their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 2: Defibrillation and ALS pharmacology

Authors: Dr Stuart Dilley, Ms Debbie Paltridge

## Aims

The purpose of *ALS adult—Module 2: Defibrillation and ALS pharmacology* is for participants to learn and become comfortable with recognising and managing the common arrhythmias encountered in adult Advanced Life Support (ALS), including the use of the manual defibrillator.

## Presumed knowledge

This module is targeted to health professionals with little or no experience in ALS management, manual defibrillation or cardiac pharmacology. However, they are expected to have a basic knowledge of:

1. cardiovascular anatomy: heart, peripheral pulses
2. cardiovascular physiology: blood pressure (BP), circulation, cardiac electrophysiology and conduction
3. basic life support (BLS) skills (airway management, bag-mask ventilation, chest compressions, use of automatic external defibrillator)
4. drugs commonly used in the ALS setting (adrenaline, amiodarone, lignocaine and atropine)
5. normal electrocardiograph (ECG) appearances.

## Objectives

By the end of this module, participants should have:

1. recognised ventricular fibrillation (VF), ventricular tachycardia (VT), asystole and pulseless electrical activity/electromechanical dissociation (PEA/EMD) using sample rhythm strips
2. discussed the roles of defibrillation and common pharmacological interventions in ALS
3. discussed the functionality and demonstrated the use of the manual defibrillator
4. recognised the indications for and the doses of pharmacological agents recommended in ALS, according to the Australian Resuscitation Council (ARC) ALS Guidelines<sup>1</sup>.

## Background information for educators

### ALS arrhythmias

A wide variety of arrhythmias exist (before, during or after a cardiac arrest), but the most important arrhythmias in the adult ALS setting are VF, VT, asystole and PEA/EMD. The current ARC Guidelines<sup>1</sup> conveniently divides these into 'shockable' (VF/pulseless VT) and 'non-shockable' (PEA/EMD, asystole).

### Ventricular fibrillation/ventricular tachycardia

VF is an asynchronous chaotic ventricular rhythm which follows no regular pattern and produces no cardiac output.

VT is a wide, complex regular tachycardia (rapid heart rate) which may or may not produce a detectable cardiac output (pulse, BP). Torsade de pointes, or polymorphic VT, is a variation of VT where the amplitude of the waveform varies quickly over time, resulting in a twisted ('torsade') appearance of the rhythm strip.

VF and pulseless VT should be managed by:

- confirmation of unresponsiveness/unconsciousness and correct lead placement (because electrical interference (artefact) may mimic VF on the monitor)
- institution of immediate cardiopulmonary resuscitation (CPR)
- rapid defibrillation
- adrenaline and an anti-arrhythmic drug (amiodarone or lignocaine) as per ALS guidelines
- repeat defibrillation and adrenaline as necessary.

### Asystole

Asystole is characterised by the absence of any cardiac electrical activity, and is associated with a very poor prognosis<sup>2</sup>. Defibrillation does not 'revert' asystole, and is not indicated. The patient may appear to be in asystole if the ECG monitoring leads are not applied correctly. Asystole should be managed by:

- confirmation of correct ECG lead placement
- confirmation of unresponsiveness/unconsciousness
- institution of immediate CPR
- adrenaline as per ALS guidelines
- consideration of atropine.

### **Pulseless electrical activity**

PEA or EMD is the presence of a coordinated electrical rhythm with no detectable cardiac output. Defibrillation is not indicated as fibrillation is not present. PEA or EMD should be managed by:

- institution of immediate CPR
- adrenaline as per ALS guidelines
- assessment for and management of ‘reversible causes’.

‘Reversible causes’ refers to several clinical conditions which could be responsible for persistent VF/VT, asystole or PEA and which, if treated expeditiously, may result in return of spontaneous circulation or successful defibrillation. Reversible causes include:

- hypoxia
- hypovolaemia
- hypo/hyperthermia
- hypo/hyperkalaemia
- cardiac tamponade
- tension pneumothorax
- toxins, poisons, drugs
- pulmonary embolism.

### **Manual defibrillation**

Defibrillation is the only intervention of proven benefit for patients in cardiac arrest. It is most effective if delivered within the first minute of a cardiac arrest. The probability of successful defibrillation diminishes rapidly over time. VF tends to deteriorate to asystole in a matter of minutes<sup>3</sup>.

Defibrillation is the delivery of an electrical charge to the heart. This charge stops all electrical activity in the heart, allowing the normal pacemaker of the heart (the sino-atrial (SA) node) or another part of the heart to ‘reset’ and initiate a more normal rhythm.

Defibrillation is indicated in cases of:

- ventricular fibrillation (VF)
- pulseless ventricular tachycardia (VT).

These patients will be unconscious, not breathing normally and have no detectable pulse or signs of life. Some patients in VT may still be conscious and have a pulse—these patients should not be defibrillated unless they become unconscious.

The defibrillator also serves as a monitor to enable assessment of cardiac rhythm if the patient is not already on a cardiac monitor. Cardiac rhythm may be observed by either:

1. applying the defibrillator pads/paddles directly to the patient's chest and selecting the 'paddles' option for the ECG display  
or
2. connecting the defibrillator ECG leads to the patient's chest and selecting a lead (I, II or III) for the ECG display.

Once the presence of VF or pulseless VT is confirmed, the defibrillator should be deployed. Methods of doing this vary slightly, depending on whether adhesive pads or manual paddles are used. For defibrillators with adhesive pads:

1. Turn on the defibrillator.
2. Apply the electrode pads to the patient's chest: one below the right clavicle near the right sternal border, the other over the left sixth intercostal space, mid-axillary line.
3. Confirm the presence of VF or pulseless VT on the monitor.
4. Dial up the appropriate charge (200 J for biphasic, 360 J for monophasic).
5. Press the 'charge' button to load the pads with the appropriate charge.
6. Do not touch the patient.
7. Advise everyone to stand clear and check for clearance visually.
8. Discharge the pads by pressing the 'shock' button.
9. Continue CPR while assessing for success of defibrillation.

For defibrillators with manual paddles:

1. Turn on the defibrillator.
2. Confirm the presence of VF or pulseless VT on the monitor.  
Place conductive gel pads on the patient's chest: one below the right clavicle near the right sternal border, the other over the left sixth intercostal space, mid-axillary line.
3. Dial up the appropriate charge (200 J for biphasic, 360 J for monophasic).
4. Firmly press the defibrillation paddles into the patient's chest over the conductive gel pads.
5. Press the 'charge' button (front of defibrillator console or on side of apex paddle) to load the paddles with the appropriate charge.
6. Do not touch the patient anywhere else.
7. Advise everyone to stand clear and check for clearance visually.

8. Discharge the paddles simultaneously by pressing the 'shock' buttons on the end of each paddle.
9. Continue CPR while assessing for success of defibrillation.

Debate surrounds the merits of using a single shock compared to the traditional 'stack of three'. The general consensus is that if there is a delay to defibrillation, then a single shock at maximum energy levels (200 J biphasic, 360 J monophasic) is advised. For patients where the onset of VF or pulseless VT is witnessed, and there is a defibrillator immediately available, then a 'stack of three' shocks is still appropriate (200 J, 200 J, 200 J biphasic or 200 J, 200 J, 360 J monophasic). Any subsequent shocks should be single<sup>1,4</sup>.

### ALS pharmacology

In contrast to defibrillation, very few drugs (if any) are of proven benefit in the cardiac arrest setting<sup>5</sup>. Nonetheless, the ARC<sup>1,6</sup> and other expert groups<sup>7</sup> recommend a small number of drugs for use in ALS, including:

- adrenaline
- amiodarone or lignocaine
- atropine
- magnesium (Mg), potassium (K) and sodium bicarbonate (NaHCO<sub>3</sub>).

### Adrenaline

Adrenaline is thought to be beneficial in cardiac arrest by causing peripheral vasoconstriction. The aim is to direct what cardiac output is present to the myocardium and brain. It may facilitate defibrillation by improving myocardial blood flow during CPR. Adrenaline is indicated in the ALS setting for:

- VF or pulseless VT after initial defibrillation attempts fail
- asystole
- PEA/EMD.

One milligram (1 mg) of adrenaline should be administered at regular intervals (every 3 minutes) during CPR until return of circulation or cessation of resuscitation efforts. Small doses of adrenaline or an adrenaline infusion may be needed after return of spontaneous circulation to augment blood pressure and cardiac output.

Adrenaline is available in both 1:1,000 and 1:10,000 solutions, and may be packaged as standard ampoules or ready-to-administer 'mini-jets', but all preparations of adrenaline contain 1 mg adrenaline. Responders should avoid using the phrases '1:1,000' or '1:10,000', and instead simply request or administer '1 mg adrenaline' to minimise confusion.

### **Amiodarone and lignocaine**

Amiodarone and lignocaine are the most commonly recommended anti-arrhythmic drugs in ALS protocols. Amiodarone has a complex mechanism of action acting on sodium, potassium and calcium channels in the myocardium, as well as alpha and beta receptors. Lignocaine is a sodium channel blocker. Both drugs stabilise the myocardial cell membrane to try to halt or prevent arrhythmias. Little evidence exists of the superiority of one agent over the other in ALS, and either drug is appropriate. Amiodarone or lignocaine is indicated in the ALS setting for:

- VF or pulseless VT after initial defibrillation attempts fail
- prevention of recurrent VF/VT after successful defibrillation.

In the ALS setting, amiodarone should be administered as:

- an initial 300 mg IV bolus
- a repeat dose of 150 mg IV considered for prolonged resuscitation attempts
- a subsequent infusion of 15 mg/kg over 24 hours after return of spontaneous circulation.

In the ALS setting, lignocaine should be administered as:

- an initial 1.5 mg/kg IV bolus (this equates to approximately 100 mg for an average 70 kg adult)
- a repeat bolus dose of 0.5 mg/kg considered for prolonged resuscitation attempts
- a subsequent infusion considered after successful return of spontaneous circulation.

### **Atropine**

Atropine is an anti-cholinergic agent which blocks the effect of the vagus nerve on the heart. The resultant effect is to increase heart rate. In the ALS setting, atropine should be considered for:

- asystole
- severe bradycardia.

In the ALS setting, atropine should be administered as:

- an initial bolus dose of at least 1 mg
- repeat bolus doses to a maximum of 3 mg total.

## Magnesium, sodium bicarbonate, potassium and calcium

Magnesium, sodium bicarbonate, potassium and calcium are electrolytes which have specific indications for use in the setting of ALS. These agents are not used routinely in most cardiac arrests because of their lack of proven efficacy—and in some instances, adverse effect—but should be considered in certain clinical situations.

Magnesium is a membrane stabiliser. An initial dose of 5 mmol IV (2.5 mL of 50% MgSO<sub>4</sub> or 5 mL of 20% MgCl<sub>2</sub>) and a subsequent infusion of 20 mmol over four hours should be considered in cases of:

- torsade de pointes (polymorphic VT)
- refractory VF/pulseless VT
- documented hypomagnesaemia
- documented hypokalaemia
- cardiac arrest associated with digoxin toxicity.

Sodium bicarbonate (8.4%) at a dose of 1 ml/kg should be considered in cases of:

- documented hyperkalaemia after initial treatment with calcium.
- cardiac arrest associated with tricyclic antidepressant toxicity.

Potassium chloride (5 mmol) should be considered in cases of:

- persistent VF/VT in documented or suspected hypokalaemia.

Calcium (5–10 mL of 10% CaCl<sub>2</sub> or 10 mL of 10% CaGluconate) should be considered in cases of:

- documented hyperkalaemia or hypocalcaemia
- cardiac arrest associated with calcium channel blocker toxicity.

The preferred route of administration for all of these drugs is intravenous (IV)<sup>6</sup>. However, adrenaline, lignocaine and atropine can be given via the endotracheal (ET) route if IV access is unavailable. Plasma concentration of the drug is considerably lower, and doses up to 10 times the IV dose may be required. Other cardiac arrest drugs should not be given via the ET route as they may damage the respiratory mucosa. Endotracheal drugs cannot be delivered via a laryngeal mask.

## Learning activities

Suggested learning activities and timetable are outlined below.

Timing	Activity	Objective
40 minutes	Facilitated discussion	All
60 minutes	Skill 1: Rhythm recognition	1, 2, 4
	Skill 2: Defibrillation	1, 2, 3
10 minutes	Summary	All
10 minutes	Evaluation	

**Total time = 2 hours**

### Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information, for example, arrhythmia recognition and indications for defibrillation and pharmacological intervention in ALS. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

Major issues which the facilitator should cover include:

- recognition of VF, VT, asystole and PEA/EMD
- indications for the use of the defibrillator
- indications for and doses of common ALS drugs (adrenaline, amiodarone, lignocaine and atropine)
- indications for the use of uncommon ALS drugs (calcium, sodium bicarbonate and magnesium)
- institution-specific policies regarding ALS drugs and defibrillator use.

PowerPoint slides are available for the facilitator to summarise these main points at the end of the discussion, or as triggers for discussion if the participants have not identified the major issues.

### Skills station 1: Rhythm recognition

This station allows participants to practise recognising common arrhythmias encountered in the ALS setting. The facilitator should use the case scenarios provided below. Participants should be asked to interpret the common ALS arrhythmias (VF, VT, asystole and PEA/EMD) as they are presented to them, either via cardiac rhythm generators/rhythm-capable manikins or hard copy rhythm strips. Participants should also be asked to recommend appropriate treatment for each case.

**Case 1: VF**

A 70-year-old man collapses in the waiting room of the hospital's outpatient department. The cardiac arrest team arrives and has attached a cardiac monitor. You are asked to interpret the cardiac rhythm and recommend treatment.

Teaching points:

- recognition of VF
- recommendation of appropriate treatment:
  - initiation of and ongoing CPR as necessary
  - defibrillation: 200 J biphasic, 360 J monophasic
  - adrenaline 1 mg every 3 minutes
  - anti-arrhythmic therapy (amiodarone 300 mg or lignocaine 100 mg).

Facilitator notes:

- initially show an obvious VF rhythm
- show variations of VF to demonstrate subtle differences, that is, fine VF compared to coarse VF
- include alternative therapies for variations in scenarios in the discussion, for example:
  - potassium if hypokalaemia suspected
  - magnesium if persistent VF
  - sodium bicarbonate in the setting of tricyclic antidepressant toxicity.

**Case 2: VT**

An 80-year-old woman presents to the emergency department with ischaemic sounding chest pain. She suddenly becomes unresponsive. She has cardiac monitoring attached. You are asked to interpret the current cardiac rhythm and recommend treatment.

Teaching points:

- recognition of VT
- confirmation of 'unresponsiveness/unconsciousness'
- recommendation of appropriate treatment:
  - initiation of and ongoing CPR as necessary
  - defibrillation: 200 J biphasic, 360 J monophasic
  - adrenaline 1 mg every 3 minutes
  - anti-arrhythmic therapy (amiodarone 300 mg or lignocaine 100 mg).

Facilitator notes:

- initially show an obvious VT rhythm
- show variations of VT to demonstrate different VT morphology, including torsade de pointes
- include alternative therapies for variations in scenarios in the discussion, for example:
  - potassium if hypokalaemia suspected
  - magnesium if consistent with torsade de pointes or persistent VT
  - sodium bicarbonate in the setting of tricyclic antidepressant toxicity.

### Case 3: Asystole

A 50-year-old man is brought to the emergency department via ambulance in full cardiac arrest. He collapsed at the football and was attended to by the volunteer ambulance service. He is taken to your resuscitation cubicle and attached to a cardiac monitor. You are asked to interpret the cardiac rhythm and recommend appropriate treatment.

Teaching points:

- recognition of asystole
- checking of lead placement
- confirmation of 'unresponsiveness/unconsciousness'
- recommendation of appropriate treatment
  - initiation of and ongoing CPR as necessary
  - adrenaline 1 mg every 3 minutes
  - consideration of atropine, 1 mg
  - ongoing management according to subsequent rhythms.

Facilitator notes:

- initially show an obvious asystole rhythm
- also cover differential diagnoses in the discussion:
  - ECG lead disconnection
  - very fine VF (check rhythm in other leads).

#### Case 4: PEA/EMD

A 40-year-old woman on the orthopaedic ward five days post-knee reconstruction collapses with chest pain. She is unresponsive, not breathing and has no palpable pulse. The cardiac arrest team arrives and connect an ECG monitor. You are asked to interpret the initial ECG rhythm and recommend management.

Teaching points:

- recognition of PEA/EMD
- confirmation of 'unresponsiveness/unconsciousness'
- confirmation of lack of cardiac output
- recommendation of appropriate treatment
  - initiation of and ongoing CPR as necessary
  - adrenaline 1 mg every 3 minutes
  - search for and management of 'reversible causes'
- ongoing management according to subsequent rhythms.

Facilitator notes:

- initially show an ECG showing a slow idioventricular rhythm (HR 30)
- cover possible reversible causes and appropriate management in the discussion
- suggest variations in the scenario (for example, asthmatic patient and the possibility of tension pneumothorax) to introduce some reversible causes.

#### Skills station 2: Defibrillation

This station allows participants to practise using the defibrillator on a training manikin while receiving feedback in a structured format from peers and/or facilitators. VF or VT should be simulated on the manikin to consolidate learning about rhythm interpretation gained in the previous skills station. Participants should be guided through the use of the defibrillator using Peyton's four-step model<sup>8</sup>. Feedback should be provided at the completion of the skill.

Key issues to cover include:

- placement of ECG leads/paddles
- confirmation of shockable rhythm
- selection of appropriate charge
- safe delivery of shock.

## Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

1. identification of 'shockable' heart rhythms, that is, VF and pulseless VT
2. defibrillator functionality and use
3. commonly used drugs in ALS (adrenaline, amiodarone and lignocaine)
4. institution-specific policies regarding ALS drugs and defibrillation.

Participants should be encouraged to review the appropriate ARC Guidelines in their own time to reinforce the skills acquired in this module. They should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence. Participants might also be encouraged to attend and observe a real-life cardiac arrest in order to put these skills into a clinical context.

## Resource list

The following resource list assumes two facilitators for every eight participants, a ratio of 1:4. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
Facilitators	2	Ratio of 1:4
ARC ALS flowchart	1	For display in tutorial area
PowerPoint presentation	1	Provided with module
Example rhythms	12	VF, VT, asystole handout for each participant
Case scenarios	4	Provided in module for facilitator to use
Manikin/rhythm generator	2	Capable of simulating VF/VT/asystole/ idioventricular rhythm and be receptive to defibrillation
Defibrillator	1	May require biphasic and monophasic models, depending on hospital's equipment
Drug ampoule props	3 sets	Adrenaline 1:1,000 and 1:10,000 amiodarone, lignocaine, magnesium (Mg), potassium (K) and sodium bicarbonate (NaHCO <sub>3</sub> )  Selection of ampoules and mini-jets
Feedback sheets	2	As prompt for each facilitator
Evaluation forms	12	One for each participant

## Evaluation

A formal evaluation was specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Australian Resuscitation Council Guideline 11.2: Protocols for Advanced Life Support. February 2006
2. Meyer A., Bernard S., Smith K., McNeil J. and Cameron P. 2001 Asystolic Cardiac Arrest in Melbourne, Australia. *Emerg Med Austral* 13: 186–189
3. American Heart Association, 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 5: Electrical Therapies: Automated External Defibrillators, Defibrillation, Cardioversion and Pacing. *Circulation* 2005 112: iiv35–iiv46
4. Australian Resuscitation Council Guideline 11.5: Electrical Therapy for Adult Advanced Life Support. February 2006
5. Walraven C., Stiell I., Wells G., Herbert P. and Vandernheen K. 1998 Do Advanced Cardiac Life Support Drugs Increase Resuscitation Rates from In-Hospital Cardiac Arrest? *Ann Emerg Med* 32: 544–553
6. Australian Resuscitation Council Guideline 11.6: Medications in Adult Advanced Life Support. February 2006
7. American Heart Association 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 7.2: Management of Cardiac Arrest. *Circulation* 2005 112: iv58–iv66
8. Peyton J. 1998 *Teaching and Learning in Medical Practice*. Manticore Europe Ltd. Great Britain



## Module 2: Defibrillation and ALS pharmacology—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>ALS adult</i> <i>Learning objectives of Module 3: ALS</i>	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Recognised ventricular fibrillation (VF), ventricular tachycardia (VT), asystole and pulseless electrical activity/electromechanical dissociation (PEA/EMD) using sample rhythm strips	<input type="checkbox"/>				
Discussed the roles of defibrillation and common pharmacological interventions in ALS	<input type="checkbox"/>				
Discussed the functionality and demonstrated the use of the manual defibrillator	<input type="checkbox"/>				
Recognised the indications for and the doses of pharmacological agents recommended in ALS according to the Australian Resuscitation Council (ARC) ALS Guidelines <sup>1</sup>	<input type="checkbox"/>				

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

---



---



---



---



---



---

#### 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing ALS	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

#### 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

---



---



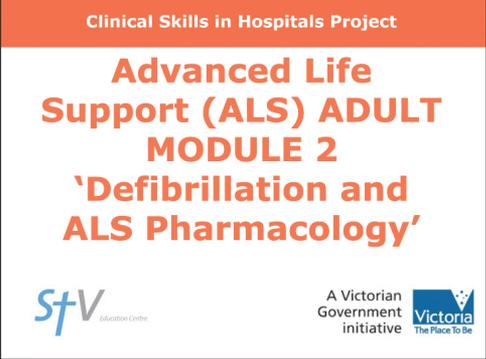
---



---

**Thank you**

## PowerPoint presentation

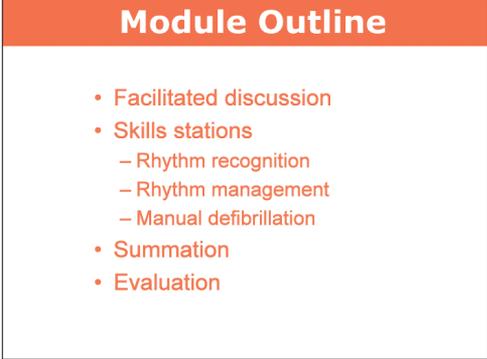
1. 

Clinical Skills in Hospitals Project

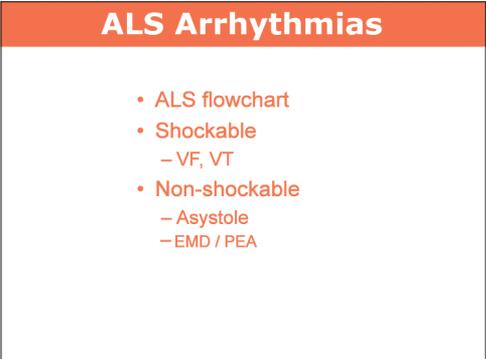
**Advanced Life Support (ALS) ADULT MODULE 2 'Defibrillation and ALS Pharmacology'**

StV Education Centre

A Victorian Government initiative

Victoria The Place To Be
2. 

**Module Outline**

  - Facilitated discussion
  - Skills stations
    - Rhythm recognition
    - Rhythm management
    - Manual defibrillation
  - Summation
  - Evaluation
3. 

**ALS Arrhythmias**

  - ALS flowchart
  - Shockable
    - VF, VT
  - Non-shockable
    - Asystole
    - EMD / PEA
4. 

**Manual Defibrillation**

  - Indications
  - Procedure
  - Safety
5. 

**ALS Pharmacology**

  - Adrenaline
  - Anti-arrhythmics
    - Lignocaine
    - Amiodarone
  - Atropine
  - Others



# Module 3: ALS

## Introduction

*ALS adult* (Advanced Life Support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate simulation into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of Advanced Life Support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult—Module 3: ALS adult* does not cover issues relating to post-resuscitation therapy, such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants should refer to the Australian Resuscitation Council’s (ARC) Guideline 11.8: Post-resuscitation therapy in adult Advanced Life Support, February 2006, for this information.

*ALS adult—Module 3: ALS adult* was designed to develop participants’ knowledge, skills and behaviours in ALS, and expose them to increasingly complex scenarios to test their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 3: ALS

Authors: Dr Stuart Dilley, Ms Debbie Paltridge

## Aims

The purpose of this module is for participants to apply their Advanced Life Support (ALS) skills learned in the basic modules to perform a coordinated ALS response in a controlled setting.

## Presumed knowledge

This module is targeted to health professionals who are competent in the component skills of ALS (advanced airway management, manual defibrillation and ALS drug therapy). However, they are expected to have an intermediate level of knowledge and skills relevant to:

1. adult ALS<sup>1</sup> and Basic Life Support<sup>2</sup> (BLS) protocols
2. endotracheal intubation
3. cardiac rhythm interpretation as it applies to ALS in: ventricular fibrillation (VF), ventricular tachycardia (VT), asystole, pulseless electrical activity/electromechanical dissociation (PEA/EMD)
4. use of the manual defibrillator
5. common drugs used in adult ALS (adrenaline, amiodarone, lignocaine and atropine).

Participants should have already practised these skills on manikins and in other skills stations, but may not have had an opportunity to apply them to a clinical scenario. If participants do not yet feel confident with the individual skills, they should be redirected to *Respiratory 1—Module 1: Pathophysiology* and *Module 2: Respiratory assessment*.

## Objectives

By the end of this module, participants should have:

1. reviewed the Australian Resuscitation Council (ARC) ALS Guidelines for cardiac arrest in adults<sup>1</sup>
2. performed team-based cardiopulmonary resuscitation (CPR) in a simulated environment
3. applied the appropriate airway management to a simulated patient (manikin) in an ALS setting
4. demonstrated the use of a manual defibrillator on a simulated patient (manikin)
5. analysed and applied appropriate drug therapy for life-threatening arrhythmias on a simulated patient (manikin).

## Background information for educators

Much of the background information pertaining to advanced airway techniques, defibrillation and ALS drug therapy is covered in *ALS adult—Module 1: Airway* and *Module 2: Defibrillation and ALS pharmacology*. Participants undertaking *ALS adult—Module 3: ALS* are presumed to have the knowledge and skills covered in these earlier modules. The purpose of this module is for participants to put these skills together as a coordinated ALS response in a team environment.

Standard treatment algorithms<sup>1,3</sup> should be followed once cardiorespiratory arrest is confirmed. Immediate BLS management should be initiated if:

- asystole or PEA/EMD is present
- VF or VT is present and the defibrillator is not immediately available.

During CPR, if not already done, responders should:

- check electrode/paddle position and contact
- secure IV access
- give adrenaline 1 mg every 3 minutes
- consider advanced airway management
- look for and manage any 'reversible causes':
  - hypoxaemia
  - hypovolaemia
  - hypo/hyperthermia
  - hypo/hyperkalaemia
  - cardiac tamponade
  - tension pneumothorax
  - toxins, poisons, drugs
  - pulmonary embolism.

If a 'shockable rhythm' is found (VF or VT):

- attempt defibrillation (200 J biphasic, 360 J monophasic)
- continue CPR for another 2 minutes
- re-assess rhythm
- repeat defibrillation if VF/VT persists
- administer adrenaline 1 mg every 3 minutes
- administer amiodarone 300 mg or lignocaine 100 mg
- consider other ALS drugs in appropriate circumstances.

If a 'non-shockable rhythm' is found (asystole or PEA/EMD):

- continue CPR
- administer adrenaline 1 mg every 3 minutes
- re-assess rhythm
- consider atropine 1 mg up to total dose of 3 mg.

## Learning activities

Suggested learning activities and timetables are outlined below. Timetable 1 is designed for 12 participants working in two groups of six. Timetable 2 is designed for six participants working together.

Timetable 1			
Timing	Activity		Objective
20 minutes	Introduction and simulation familiarisation		1
	Group 1	Group 2	
10 minutes	Simulation 1	Simulation 2	All
30 minutes	Debrief	Debrief	All
10 minutes	Simulation 2	Simulation 1	All
30 minutes	Debrief	Debrief	All
10 minutes	Summary		All
10 minutes	Evaluation		

**Total time = 2 hours**

Timetable 2		
Timing	Activity	Objective
20 minutes	Introduction and simulation familiarisation	All
10 minutes	Simulation 1	All
30 minutes	Debrief	All
10 minutes	Simulation 2	All
30 minutes	Debrief	All
10 minutes	Summary	All
10 minutes	Evaluation	

**Total time = 2 hours**

## Introduction

The facilitator should lead a brief discussion amongst participants to refresh and clarify any issues relating to ALS protocols and introduce the simulation training to follow. This should not be a comprehensive lecture on ALS. The ARC ALS protocol<sup>1</sup> should be displayed prominently and can also be given as a handout.

The discussion should highlight any departures from ARC Guidelines that might be peculiar to that institution. Institution-specific 'cardiac arrest call' nomenclature and phone numbers should be reinforced.

A brief DVD demonstrating an appropriate ALS response is provided as a stimulus for the discussion. Facilitators may use this DVD to set the scene for the scenario to follow.

## Simulation 1: VF arrest

### Scenario design

In this scenario, a 60-year-old male suffers a VF arrest in the emergency department (ED). Participants are required to recognise this, initiate CPR and demonstrate their ALS skills.

Case history	
Patient details	
Sex	Male
Age	60
Past history	Smoker Hypertension, prescribed irbesartan 150 mg daily
Social history	Married, lives at home
History of present illness	Patient was walking to TAB to collect winnings when onset of central chest pain occurred. Ambulance was called and transported to ED. Ambulance crew administered 150 mg aspirin orally and 5 mg morphine IV.
Presenting symptoms	As above. Chest pain persists. ECG performed on arrival indicates acute myocardial infarction (AMI).

Resources	
General	
Setting/environment	Hospital ED
Patient attire	Hospital gown
Monitoring	ECG, non-invasive blood pressure (BP) IV access already obtained
Supporting documentation required	Bedside observation and treatment chart

Equipment		
Equipment	Number	Sourced from
Manikin	1	Capable of simulating VF/VT, responsive to defibrillation and allows for ETT or LMA insertion and ventilation
Hospital bed/trolley	1	
Hospital gown	1	
Pillow, blanket	1 each	
Patient treatment chart	1	
Hudson mask and tubing	1	
Resuscitation trolley	1	
OP airway	1	
Bag-mask device	1	
Oxygen supply	1	
Laryngoscope	1	
Appropriate sized ETT	1	
Appropriate sized LMA	1	
Manual defibrillator	1	
Defibrillation/conductive gel pads	1 set	
IV cannulae	Various sizes	
IV fluid and giving set	2 sets	
ALS drug props (adrenaline, amiodarone, lignocaine, atropine and magnesium)	1 set	May include standard ampoules and/or mini-jets
12-lead ECG showing anterior AMI	1	

## Roles

### Participant 1

You are a health professional assessing a patient in the resuscitation cubicle of the ED. Another nurse (faculty member) performed a 12-lead ECG for you and has asked for assistance. You find that your patient is unwell and you need to initiate management. You have two colleagues who you may call on if you need assistance. The resuscitation cubicle is stocked with equipment and drugs as appropriate for a real ED.

### Participants 2 and 3

You are health professionals working in the hospital's ED. Your colleague (Participant 1) has gone to attend to a patient with chest pain in the resuscitation cubicle. Your colleague may call on you for assistance in managing the patient. A nurse is also present (faculty member) to assist with locating equipment and medications.

### Faculty role play: ED resuscitation nurse

You are a nurse working in the resuscitation area of the ED. You obtain an ECG which shows an anterior AMI and request assistance in managing this patient by calling in Participant 1. You assist all participants in finding equipment and appropriate drugs if needed. You may perform chest compressions if asked to do so, but you do not perform defibrillation or airway management. You may assist one of the participants in their management of the airway.

### Faculty role play: ED senior clinician (optional)

You are a senior clinician working in the ED. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient

Simulator programming considerations				
System	Baseline state	Change in State 1	Change in State 2	Resolution
Central Venous System*	Ventricular fibrillation	Ventricular fibrillation	Ventricular fibrillation	* Sinus tachycardia after defibrillation and intubation Return of spontaneous circulation (pulses) (assume return of pulses if low-fidelity manikin)
Respiratory	Apnoeic	Apnoeic	Ventilated by participant	Ventilated by participant if ETT/LMA inserted Return of spontaneous respirations, RR 18 if no ETT/LMA (assume return of spontaneous respiration if low-fidelity manikin)
Neurologic	Unresponsive	Unresponsive	Unresponsive	Unresponsive if ETT/LMA inserted Return of consciousness GCS is 14 if not (assume GCS 14 if low-fidelity manikin)
Response to participant intervention	No CPR then remain in baseline state CPR and use of defibrillator go to State 1	No CPR then remains in State 1 ETT or LMA insertion go to State 2 If no ETT or LMA, go to resolution after third defibrillation attempt*	No CPR then remain in State 2 CPR and use of defibrillator go to resolution	

\* For participants who perform well, the patient could be returned to VF or VT so that prolonged CPR and multiple attempts at defibrillation are needed.

Debriefing points:

- the ALS algorithm
- effective use of defibrillator
- appropriate ALS drug therapy
- timing of ETT/LMA insertion in ALS.

## Simulation 2: VT arrest

### Scenario design

In this scenario, a 65-year-old female suffers a cardiac arrest in the medical ward. She is initially profoundly bradycardic with no output. Participants are required to recognise this, and initiate CPR. Administration of adrenaline produces VT, which responds to defibrillation.

Case history	
Patient details	
Sex	Female
Age	65
Past history	Smoker, family history of heart disease
Social history	Married, lives at home
History of present illness	Admitted to CCU 48 hours previously with AMI and recently transferred to medical ward  Prescribed: aspirin 150 mg daily, enoxaparin 70 mg SC BD, metoprolol 50 mg BD
Presenting symptoms	She calls for assistance because she feels suddenly unwell and dizzy

Resources	
General	
Setting/environment	Hospital medical ward
Patient attire	Hospital gown
Monitoring	Non-invasive blood pressure (BP)  IV access present
Supporting documentation required	Bedside observation and treatment chart

Equipment		
Equipment	Number	Sourced from
Manikin	1	Capable of simulating cardiac arrhythmias, responsive to defibrillation and allows for ETT or LMA insertion and ventilation
Hospital bed/trolley	1	
Hospital gown	1	
Pillow, blanket	1 each	
Hudson mask and tubing	1	
Resuscitation trolley	1	
OP airway	1	
Bag-mask device	1	
Oxygen supply	1	
Laryngoscope	1	
Appropriate sized ETT	1	
Appropriate sized LMA	1	
Manual defibrillator	1	
Defibrillation/conductive gel pads	1 set	
IV cannulae	Various sizes	
IV fluid and giving set	2 sets	
ALS drug props (adrenaline, amiodarone, lignocaine, atropine and magnesium)	1 set	May include standard ampoules and/or mini-jets
12-lead ECG showing anterior AMI		

## Roles

### Participant 1

You are a health professional working in the medical ward of your hospital. Another nurse (faculty member) calls you to assist with a patient who has become unwell. This patient was admitted to the CCU 48 hours earlier with an AMI before transfer to the medical ward. You have two colleagues who you may call on if you need assistance. The resuscitation trolley is stocked with equipment and drugs as appropriate in a medical ward.

### Participants 2 and 3

You are health professionals working in the hospital's medical ward. Your colleague (Participant 1) has gone to attend to a patient who is unwell, having been admitted 48 hours previously with an AMI. Your colleague may call on you for assistance. A nurse is also present (faculty member) to assist with locating equipment and medications.

### Faculty role play: Ward nurse

You are a nurse working in the medical ward. You are looking after a patient who was admitted to the CCU 48 hours previously with an AMI and recently transferred to the medical ward. This patient now suddenly feels unwell and light-headed. You request assistance in managing this patient by calling in Participant 1. You assist all participants in finding equipment and appropriate drugs if needed. You may perform chest compressions if asked to do so, but you do not perform defibrillation or airway management. You may assist one of the participants in their management of the airway.

### Faculty role play: ED senior clinician (optional)

You are a senior clinician working in the hospital. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient.

Simulator programming considerations				
System	Baseline state	Change in State 1	Change in State 2	Resolution
CVS	Profound bradycardia, pulseless, no BP (PGA)	Ventricular tachycardia, pulseless, no BP	Ventricular tachycardia, pulseless, no BP	Sinus tachycardia after defibrillation with or without ETT/LMA  Return of spontaneous circulation (pulses) (assume return of pulses if low-fidelity manikin)
Respiratory	Apnoeic	Apnoeic	Ventilated by participant	Ventilated by participant if ETT/LMA inserted  Return of spontaneous respirations, RR 18 if no ETT/LMA (assume return of spontaneous respiration if low-fidelity manikin)
Neurologic	Unresponsive	Unresponsive	Unresponsive	Unresponsive if ETT/LMA inserted  Return of consciousness; GCS 14 if not (assume GCS 14 if low-fidelity manikin)
Response to participant intervention	No CPR then remain in baseline state  CPR and adrenaline go to State 1	No CPR then remain in State 1  ETT or LMA insertion go to State 2  If no ETT or LMA, go to resolution after third defibrillation attempt	No CPR then remain in State 2  CPR and use of defibrillator go to resolution	

Debriefing points:

- the ALS algorithm
- effective use of the defibrillator
- appropriate ALS drug therapy
- timing of ETT/LMA insertion in ALS.

## Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

- assessment of the collapsed person along ALS guidelines (shockable compared to non-shockable rhythms)
- early defibrillation
- effective CPR
- ALS algorithms
- knowledge of limited range of ALS drugs (adrenaline, amiodarone and lignocaine)
- timing and choice of advanced airway measures: ETT compared to LMA.

Participants should be encouraged to review the appropriate ARC Guidelines in their own time to reinforce the skills acquired in this module. They should be offered access to equipment and educators in the future if there is a need to practise or improve their skill level or confidence. Participants might also be encouraged to attend and observe a real-life cardiac arrest in order to put these skills into a clinical context.

## Resource list

The following resource list assumes two facilitators for every 12 participants. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
Facilitators	2	Allows one facilitator per simulation
ARC ALS flowchart	1	For display in tutorial area
ARC ALS flowchart handout	12	One for each participant
ALS DVD	1	
Equipment and resources listed for each simulation scenario	As per scenarios	See appropriate resource list for each simulation scenario
Evaluation forms	12	One for each participant

## Evaluation

A formal evaluation was specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Australian Resuscitation Council Guideline 11.2: Protocols for Advanced Life Support. February 2006
2. Australian Resuscitation Council Guideline 7: Cardiopulmonary Resuscitation. February 2006
3. American Heart Association 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 7.2: Management of Cardiac Arrest. *Circulation* 2005 112: iv58–iv66



## Module 3: ALS—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>ALS adult</i> <i>Learning objectives of Module 3: ALS</i>	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Reviewed the Australian Resuscitation Council (ARC) ALS Guidelines for cardiac arrest in adults <sup>1</sup>	<input type="checkbox"/>				
Performed team-based cardiopulmonary resuscitation (CPR) in a simulated environment	<input type="checkbox"/>				
Applied the appropriate airway management to a simulated patient (manikin) in an ALS setting	<input type="checkbox"/>				
Demonstrated the use of a manual defibrillator on a simulated patient (manikin)	<input type="checkbox"/>				
Analysed and applied appropriate drug therapy for life-threatening arrhythmias on a simulated patient (manikin)	<input type="checkbox"/>				

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

---



---



---



---



---



---

#### 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing ALS	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

#### 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

---



---



---



---

**Thank you**

## PowerPoint presentation

1.

Clinical Skills in Hospitals Project

**Advanced Life Support (ALS) ADULT  
MODULE 3  
'ALS'**

StV Education Centre

A Victorian Government initiative

Victoria The Place To Be

2.

**Module Outline**

- Introduction
- DVD ALS trigger
- Simulation 1
  - Debrief
- Simulation 2
  - Debrief
- Summation



# Module 4: External cardiac pacing

## Introduction

*ALS adult* (Advanced Life Support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of Advanced Life Support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD     Airway[Airway] --&gt; ALS[ALS]     Defibrillation[Defibrillation and ALS pharmacology] --&gt; ALS     Defibrillation --&gt; ECP[External cardiac pacing]     ALS &lt;--&gt; ECP     ECP --&gt; ComplexALS[Complex ALS]     style ECP stroke:#f00,stroke-width:2px   </pre>
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult—Module 4: External cardiac pacing* does not cover issues relating to post-resuscitation therapy, such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants should refer to the Australian Resuscitation Council’s (ARC) Guideline 11.8: Post-resuscitation therapy in adult Advanced Life Support, February 2006, for this information.

*ALS adult—Module 4: External cardiac pacing* was designed to develop participants’ knowledge, skills and behaviours in ALS, and expose them to increasingly complex scenarios to test their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 4: External cardiac pacing

Authors: Dr Stuart Dilley, Ms Debbie Paltridge

## Aims

The purpose of this module is for participants to learn how to safely perform or assist others in performing external cardiac pacing in the setting of adult Advanced Life Support (ALS).

## Presumed knowledge

This module is targeted to medical and nursing health professionals who are competent in the component skills of ALS (advanced airway management, manual defibrillation and ALS drug therapy). However, they are expected to have good knowledge and skills relevant to:

1. adult ALS<sup>1</sup> and basic life support<sup>2</sup> (BLS) protocols
2. cardiac rhythm interpretation as it applies to ALS, including recognition of complete heart block (CHB).

## Objectives

By the end of this module, participants should have:

1. analysed the clinical indications for external cardiac pacing
2. recognised CHB using sample rhythm strips
3. discussed the functionality of the external pacer
4. demonstrated the use of the external cardiac pacer in a simulated environment.

## Background information for educators

Complete heart block (CHB) occurs when there is interruption to normal cardiac conduction through the atrioventricular (AV) node. This disrupts the relationship between atrial and ventricular contractions which is reflected in a lack of relationship between P waves and QRS complexes on the electrocardiograph (ECG). The resultant QRS complexes are usually wide, due to the electrical activity responsible for ventricular contraction arising from the ventricular muscle, rather than being conducted through the atrioventricular node.

Some patients can produce an adequate cardiac output and blood pressure (BP) for a short period despite being in CHB. These patients do not need immediate external pacing, but will generally require a permanent pacemaker inserted acutely, unless their heart block is due to a reversible cause (for example, drug toxicity).

Patients in CHB whose cardiovascular state is compromised (low BP, cold, sweaty, poorly perfused, confused), or who have no detectable output, should be considered for external cardiac pacing<sup>1, 4, 5</sup>. Atropine (0.5 mg IV) or an adrenaline infusion (2–10 µg per minute) may be considered while awaiting cardiac pacing.

Attempts to pace should not interfere with good CPR. External cardiac pacing is rarely indicated in asystole<sup>3, 5</sup>.

The external cardiac pacer should be applied to the patient once it is determined that cardiac pacing is required.

1. Ensure adequate sedation/analgesia is provided to the patient.
2. Apply adhesive electrode pads to the patient's chest. Electrodes may be placed in the traditional positions for defibrillation, but placing electrodes in the anterior and posterior positions on the left side of the patient's chest may be more effective.
3. Connect the pads to the patient cable.
4. Apply cardiac monitoring electrodes.
5. Turn on the defibrillator/external cardiac pacer and select the 'pacing' option.
6. Select demand mode pacing. Verify that the dot markers appear near the middle of the QRS complexes of the ECG. Demand (synchronous) pacing will only fire when no QRS complex is sensed. Fixed (asynchronous) pacing may fire during a vulnerable period of the cardiac cycle and could precipitate arrhythmias.
7. Select the desired pacing rate, usually 80 BPM.
8. Select initial current to deliver, usually around 50 mA.
9. Press 'start' to initiate pulse delivery.
10. Gradually increase current output until electrical capture occurs (every pacemaker spike followed by QRS of ventricular depolarisation). Capture is usually achieved with a current of 65–100 mA.
11. Confirm that mechanical capture has also occurred by noting the correlation of the peripheral pulses/cardiac output with the electrical capture.

Patients with severe cardiac disease may still require inotropic support, despite being adequately paced.

## Learning activities

Suggested learning activities and timetable are outlined below.

Timing	Activity	Objective
40 minutes	Facilitated discussion	All
45 minutes	Skills station: practise external pacing	All
10 minutes	Summary	All
10 minutes	Evaluation	

**Total time = 1 hour 45 minutes**

### Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information, for example, the recognition of CHB and the clinical indications for external cardiac pacing. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

Major issues which the facilitator should cover include:

- recognition of CHB
- indications for the use of the external pacer
- external cardiac pacer functionality and use
- institution-specific policies regarding external cardiac pacing.

PowerPoint slides are available for the facilitator to summarise these main points at the end of the discussion, or as triggers for discussion if the participants have not identified the major issues.

### Skills station

This station allows participants to practise using the external cardiac pacer on a training manikin while receiving feedback in a structured format from peers and/or facilitators. CHB should be simulated on the manikin to consolidate learning about rhythm interpretation gained in the facilitated discussion. Participants should be guided through the use of the external cardiac pacer using Peyton's four-step model<sup>6</sup>. Feedback should be provided at the completion of the skill.

The activity and resources outlined assume three facilitators for every 12 participants, a ratio of 1:4. Each facilitator should have access to one manikin suitable for teaching external cardiac pacing (able to simulate CHB and be responsive to external pacing) and an external cardiac pacer. During the 45-minute skills station, each participant

should have approximately 11 minutes of hands-on experience while observing three colleagues for approximately 33 minutes.

Depending on the professional mix of the group (that is, medical and nursing), appropriate emphasis should be placed on those 'assisting' and 'doing', as deemed appropriate for individual institutions.

## Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

1. identification of CHB
2. external cardiac pacer functionality and use
3. problem solving if attempted pacing is unsuccessful
4. institution-specific policies regarding external cardiac pacing.

Participants should be encouraged to review the appropriate ARC<sup>3</sup> and AHA<sup>4</sup> guidelines in their own time to reinforce the skills acquired in this module. They should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence.

## Resource list

The following resource list assumes three facilitators for every 12 participants. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
Facilitators	3	Allows one facilitator per simulation
Hospital's external pacing protocol	1	
Manikin	3	Suitable for simulating CHB and responsive to external cardiac pacing
External cardiac pacer	3	
External cardiac pacing pads	3 sets	
Example CHB rhythm strips	12	One for each participant
Feedback sheets	3	As a prompt for each facilitator
Evaluation forms	12	One for each participant
PowerPoint presentation	1	Provided with module

## Evaluation

A formal evaluation was specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Australian Resuscitation Council Guideline 11.2: Protocols for Advanced Life Support. February 2006
2. Australian Resuscitation Council Guideline 7: Cardiopulmonary Resuscitation. February 2006
3. Australian Resuscitation Council Guideline 11.7: Equipment and Techniques in Adult Advanced Life Support. February 2006
4. American Heart Association 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 7.3: Management of Symptomatic Bradycardia and Tachycardia. *Circulation* 2005 112: iv67–iv77
5. American Heart Association 2005 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 5: Electrical Therapies: Automated External Defibrillators, Defibrillation, Cardioversion and Pacing. *Circulation* 2005 112: iiv35–iiv46
6. Peyton J. 1998 *Teaching and Learning in Medical Practice*. Manticore Europe Ltd. Great Britain



## Module 4: External cardiac pacing—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>ALS adult</i> <i>Learning objectives of Module 3: ALS</i>	Strongly disagree	Disagree	Slightly agree	agree	Strongly agree
Analysed the clinical indications for external cardiac pacing	<input type="checkbox"/>				
Recognised CHB using sample rhythm strips	<input type="checkbox"/>				
Discussed the functionality of the external pacer	<input type="checkbox"/>				
Demonstrated the use of the external cardiac pacer in a simulated environment	<input type="checkbox"/>				

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

---



---



---



---



---



---



---



---



---



---

#### 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing ALS	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

#### 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

---



---



---



---

**Thank you**

## PowerPoint presentation

1.

Clinical Skills in Hospitals Project

**Advanced Life Support (ALS) ADULT  
MODULE 4  
'External Cardiac Pacing'**

 A Victorian Government initiative 

2.

**Module Outline**

- Facilitated discussion
- Skills station
  - External Cardiac Pacing
- Summation
- Evaluation

3.

**External Cardiac Pacing**

- Indications
- Timing
- Preparation
- Procedure
- Safety



# Module 5: Complex ALS

## Introduction

*ALS adult* (advanced life support) was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *ALS adult* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course, as described in the Module Outline.

*ALS adult* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (train-the-trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*ALS adult* aims to make participants confident in their application of advanced life support (ALS) knowledge and skills on adults in different environments and settings. *ALS adult* is intended for use with medical and nursing participants.

## Package structure

*ALS adult* contains five modules which provide learning opportunities for health professionals at all levels of experience from medical and nursing disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate. Module 5 is more advanced and regarded as complex.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

ALS skills include advanced airway management (including endotracheal intubation), the recognition and management of common cardiac arrest arrhythmias, manual defibrillation and external cardiac pacing.

As a clinical skills course, *ALS adult—Module 5: Complex ALS* does not cover issues relating to post-resuscitation therapy, such as therapeutic hypothermia, glycaemic control, cerebral perfusion and respiratory support. Educators and participants should refer to the Australian Resuscitation Council’s (ARC) Guideline 11.8: Post-resuscitation therapy in adult Advanced Life Support, February 2006, for this information.

*ALS adult—Module 5: Complex ALS* was designed to develop participants’ knowledge, skills and behaviours in ALS, and expose them to increasingly complex scenarios to test their ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants’ level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of ALS and resuscitation for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant’s baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with of the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 5: Complex ALS

Authors: Dr Stuart Dilley, Ms Debbie Paltridge

## Aims

The purpose of this module is for participants to use their clinical, management and personal skills to deal with a complex Advanced Life Support (ALS) scenario.

## Presumed knowledge

This module is targeted to health professionals with significant experience in ALS. However, they are expected to have completed *ALS adult—Module 3: ALS* and *Module 4: External cardiac pacing*, and have a high level of knowledge and skills relevant to:

1. ALS<sup>1</sup> and Basic Life Support<sup>2</sup> (BLS) protocols
2. advanced airway management
3. use of the manual defibrillator
4. use of the external cardiac pacer
5. adult cardiac arrest management.

Participants should also have practised these skills on manikins, had an opportunity to apply them to the clinical scenarios in *ALS adult—Module 3: ALS* and completed the pacing skills station in *ALS adult—Module 4: External cardiac pacing*. If participants do not yet feel confident with the individual skills, they should be redirected to *ALS adult—Module 3: ALS* and *Module 4: External cardiac pacing*.

## Objectives

By the end of this module, participants should have:

1. reviewed the Australian Resuscitation Council (ARC) ALS Guidelines<sup>1</sup>
2. practised adult ALS on a simulated patient as a team member in a simulated difficult clinical setting
3. practised using the external cardiac pacer on a simulated patient (manikin)
4. reflected on their ability to problem solve and communicate effectively under stress
5. recognised factors that influence team performance.

## Background information for educators

Much of the background information pertaining to ALS airway management, manual defibrillation and external pacing is covered in *ALS adult—Module 1: Airway*, *Module 2: Defibrillation and ALS pharmacology* and *Module 4: External cardiac pacing*. Except for external pacing, participants should have practised these skills and worked as teams in *ALS adult—Module 3: ALS*.

The purpose of this module is for participants to use these skills in more complex scenarios where the issues are not necessarily clinical. Clinical knowledge is assumed. As evident in the learning activities, most of the discussion will revolve around opinions and experiences, rather than hard clinical facts.

Managing critical patients is a stressful challenge. Success relies on clinical knowledge and skills, but also on effective individual performance, teamwork and health care systems. Health professionals may need to deal with deficiencies in each of these aspects, while simultaneously confronting distressing emotional responses in staff and relatives.

Crisis resource management<sup>3</sup> (CRM) describes a set of strategies or skills developed to help individuals and teams to perform efficiently in these high risk/high stress situations. Common CRM principles include:

- know your environment (workplace, equipment, staff and policies)
- anticipate and plan (proactive contingency planning, expect the unexpected)
- call for help early
- exercise leadership
- communicate clearly
- use all available information
- allocate attention wisely (determine focus, avoid fixation, prioritise)
- distribute workload evenly.

Clinical educators are referred to Chapter 2 in the *Clinical Skills Facilitator's Advanced Course Manual* for more detailed information and references.

The performance of individuals—either on their own or as part of a team—has important implications for managing critical events. Individuals should be aware of factors that might influence personal performance in themselves or their colleagues, such as:

- experience and knowledge levels
- situational stress (some stress is good, too much may be harmful)
- fatigue and tiredness
- difficult environments (noise, distractions, unfamiliarity, workload, staff, resources)
- negative life events (illness, family crises)
- attitude and personality (anti-authority, impulsive, invulnerable, macho)
- drug and alcohol use.

Some of these issues might need to be directly addressed (adequate sleep, drug and alcohol counselling, education); in others, recognition and support may be

adequate (for example, family crises). Similarly, effective and efficient teamwork and leadership are crucial when dealing with critical clinical situations. Effective teams are characterised by<sup>3, 4</sup>:

- organisation
- leadership
- familiarity of members
- designated roles
- effective communication
- situational awareness (the 'big picture')
- avenues for conflict resolution.

Effective team leaders are characterised by:

- clear communication of plans and goals
- allocation of tasks
- remaining free to oversee management
- being receptive to input from team members
- situational awareness, maintaining team focus
- prioritisation and problem solving
- promoting a positive group culture.

Effective communication is characterised by:

- directed assertive communication in simple language (using eye contact and people's names)
- calm, polite, controlled tone and voice
- passage of information through leader as central relay
- verification of task completion and referral back to leader ('closing the loop')
- team awareness of situation.

Despite the best efforts of health professionals, many people will die because of their cardiac arrest, particularly if this occurs outside the hospital setting<sup>5,6</sup>. Apart from in exceptional circumstances (for example, hypothermia), prolonged resuscitation efforts beyond 30 minutes are usually futile. Similarly, if a patient is in asystole for more than 10 minutes, it is reasonable to stop resuscitation<sup>7</sup>. Conversations to this effect with a patient's relatives are difficult and emotionally charged. While not unanimous, the literature generally supports relatives being present during resuscitation<sup>8,9</sup>. This difficult task may be made a little easier by:

- choosing an appropriate private setting
- establishing trust

- asking the relatives what they understand
- responding to emotions
- offering support
- 'hope for the best, but prepare for the worst'.

## Learning activities

Suggested learning activities and timetables are outlined below. Timetable 1 is designed for 12 participants working in two groups of six. Timetable 2 is designed for six participants working together.

Timetable 1			
Timing	Activity		Objective
40 minutes*	Facilitated discussion		1
	Group 1	Group 2	
15 minutes	Simulation 1	Simulation 2	2, 3, 4, 5
30 minutes	Debrief	Debrief	2, 4, 5
15 minutes	Simulation 2	Simulation 1	2, 3, 4, 5
30 minutes	Debrief	Debrief	2, 4, 5
10 minutes	Summary		2, 4, 5
10 minutes	Evaluation		

**Total time = 2 hours 30 minutes**

\* Time allocated for the facilitated discussion may be reduced if participants have previously undertaken BLS adult—Module 5: Complex BLS.

Timetable 2		
Timing	Activity	Objective
40 minutes*	Facilitated discussion	1
15 minutes	Simulation 1	2, 3, 4, 5
30 minutes	Debrief	2, 3, 4, 5
15 minutes	Simulation 2	2, 4, 5
30 minutes	Debrief	2, 4, 5
10 minutes	Summary	2, 4, 5
10 minutes	Evaluation	

**Total time = 2 hours 30 minutes**

\* Time allocated for the facilitated discussion may be reduced if participants have previously undertaken BLS adult—Module 5: Complex BLS.

## Facilitated discussion

The facilitator should introduce the simulation training to follow and lead a discussion amongst participants around individual performance, teamwork and CRM principles. The time allowed for this discussion may be reduced if participants have previously completed *BLS adult—Module 5: Complex BLS*.

While the clinical conditions in the scenarios are straightforward, non-clinical issues make the scenarios more complex and difficult for the participants. Therefore, some time in the facilitated discussion should be spent on exploring participants' experience with resuscitations where human factors and communications issues have affected their ability to function clinically.

Major issues which the facilitator should cover include:

- teamwork principles
- barriers to individual performance
- effective leadership
- effective teams
- effective team communication
- effective communication with relatives.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion, or as triggers if participants have not identified the major issues. However, facilitators should avoid delivering a didactic lecture.

## Simulation session

The purpose of this exercise is to allow participants to practise their ALS skills in a team environment complicated by human factor issues. Participants are exposed to a mock cardiac arrest situation and are expected to manage the clinical aspects within the confines of their ALS skills.

The program assumes two facilitators for every 12 participants. Participants should be divided into two groups of six (Table 1). Three participants each participate in one scenario and observe a second. The debriefing period should include all six participants of that group—that is, the active participants and their observers.

As a more complex scenario, it may be difficult to enrol 12 participants. However it might be possible to run these scenarios with smaller groups. If only six participants are present, Simulations 1 and 2 can be run sequentially (Table 2).

These scenarios can be run on low-fidelity simulators (for example, Resus Anne), but are also quite suitable for more sophisticated simulators (for example, Sim Man, HPS METI).

## Simulation 1: VF/CHB

### Scenario design

In this scenario, a 50-year-old man on the cardiac ward collapses with a VF arrest. He responds to immediate defibrillation, but develops complete heart block (CHB) and is compromised by this. Participants initially must defibrillate and then manage his heart block via external cardiac pacing. The patient's wife witnesses some of this and is visibly upset by it.

Case history	
Patient details	
Sex	Male
Age	50
Past history	Smoker, no previous medications
Social history	Lives at home with wife, Edith
History of present illness	Admitted to cardiac ward with AMI 24 hours ago Currently taking aspirin 150 mg daily, atenolol 50 mg daily and atorvastatin 20 mg daily
Presenting symptoms	Has had recurrence of chest pain for 30 minutes

Resources	
General	
Setting/environment	Cardiac ward
Patient attire	Hospital gown
Monitoring	ECG, non-invasive BP, pulse oximetry IV access already obtained
Supporting documentation required	Bedside medication/observation chart

Equipment		
Equipment	Number	Sourced from
Manikin	1	Capable of simulating VF/VT, CHB, receptive to defibrillation and able to be intubated
Hospital gown	1	
Bedside chart	1	
Hudson mask and tubing	1	
OP airway	1	
Bag-mask vent device	1	
Oxygen supply	1	
Manual defibrillator with external cardiac pacing capability	1	
Defibrillation pads/gel pads	1 set	
ALS drug props (adrenaline, amiodarone, lignocaine and atropine)	1 set	Include standard ampoules and/or mini-jets
Laryngoscope	1	
Appropriate sized ETT	1	
Appropriate anaesthetic drugs (midazolam, fentanyl, morphine and so on)	Various, depending on local hospital practices	

Roles
<b>Participants 1, 2 and 3</b>
You are health professionals working in the cardiac ward of your hospital. You are looking after a patient who was admitted with an anterior AMI 24 hours earlier. He received thrombolysis for this because you do not have cardiac catheter lab facilities. You are called to see him by his treating nurse because she is concerned about ongoing chest pain. You have access to all the usual drugs and equipment available on the cardiac ward.
<b>Faculty role play: Cardiac ward nurse</b>
You are a nurse working in the cardiac ward, and are looking after a patient who was admitted to your ward 24 hours previously with an anterior AMI. He received thrombolysis because you do not have access to a cardiac catheter lab. You request assistance from the participants because he complains of new chest pains. You assist the participants in finding equipment and appropriate drugs if needed. You may perform chest compressions if asked to do so, but you do not perform defibrillation, external pacing or airway management.

**Faculty role play: Patient's wife**

You are the wife of the patient. You are by his bedside when he complains of chest pain and witness him have a VF arrest. You are upset and worried about whether your husband will survive, but you can see that the hospital staff are doing all they can. If asked to leave, you do so, otherwise you remain in the room.

**Faculty role play: Senior clinician (optional)**

You are a senior clinician working in the cardiac ward. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient.

**Simulator programming considerations**

System	Baseline state	Change in State 1	Change in State 2	Resolution
CVS	Sinus tachycardia, 110 BPM BP 120/70	Ventricular fibrillation, pulseless	Complete heart block, weak pulse, BP 65 mmHg systolic	Paced rhythm, rate as per pacer (80 BPM), BP 110 mmHg systolic
Respiratory	Spontaneous respiration 16 per minute	Apnoeic	Spontaneous respiration 20 per minute	Spontaneous respiration 20 per minute
Neurologic	GCS 15	Unresponsive	GCS 13	GCS 15, depending on sedation/analgesic used for pacing
Response to participant intervention	Go to State 1 after initial enquiry about 'chest pain'	No CPR or defibrillation then stay in State 1 Defibrillation go to State 2	No pacing then remain in State 2 Successful pacing go to resolution	

Debriefing points:

- effective ALS management
- recognition of need for pacing
- effective use of external cardiac pacer
- communication with relatives
- relative's presence at resuscitation
- effective teamwork and leadership
- supporting colleagues.

## Simulation 2: VT

### Scenario design

In this scenario, an 85-year-old woman presents to the ED with chest pain. She rapidly deteriorates with pulseless VT. Participants need to manage the VT appropriately. This woman is an oxygen dependent, steroid dependent COAD sufferer. Her son is unsure about her wishes with regards to resuscitation, while he favours intubation.

Case history	
Patient details	
Sex	Female
Age	85
Past history	Heavy smoker, COAD for 50 years, IHD/AMI, AF Confined to home, limited mobility Prescribe: salbutamol nebuliser 5 mg every 4 hours, ipratropium nebuliser every 6 hours, prednisolone 25 mg daily, oxygen 2 litres per minute, aspirin 150 mg daily, GTN patch 25 mg topically daily, frusemide 80 mg mane, slow K (potassium) 2 tablets daily, digoxin 125 ug daily
Social history	Widowed, lives with son
History of present illness	Chest pain for 4 hours, called ambulance and transported to ED
Presenting symptoms	Chest pain and increasing shortness of breath

Resources	
General	
Setting/environment	Hospital ED
Patient attire and appearance	Hospital gown
Monitoring	ECG, non-invasive BP, pulse oximetry On supplemental oxygen IV access already obtained
Supporting documentation required	Emergency department observation chart

Equipment		
Equipment	Number	Sourced from
Manikin	1	Capable of simulating VF/VT, receptive to defibrillation and able to be intubated
Hospital gown	1	
Emergency department observation chart	1	
Hudson mask and tubing	1	
OP airway	1	
Bag-mask vent device	1	
Oxygen supply	1	
Manual defibrillator	1	
Defibrillation pads/gel pads	1 set	
ALS drug props (adrenaline, amiodarone, lignocaine and atropine)	1 set	Include standard ampoules and/or mini-jets
Laryngoscope	1	
Appropriate sized ETT	1	

## Roles

### Participants 1, 2 and 3

You are health professionals working in the emergency department of your hospital. You are looking after a patient who was transported to your hospital with chest pain. She is an elderly lady who has multiple medical problems, including oxygen/steroid dependent COAD. You are called to see her by the resuscitation nurse because she is concerned about ongoing chest pain. You have access to all the usual drugs and equipment available in the emergency department.

### Faculty role play: Resuscitation nurse

You are a nurse working in the emergency department, and are looking after a patient who was brought to the ED by ambulance with chest pain. She has a past history of heart disease, including an AMI. She is also suffers from oxygen/steroid-dependant COAD. You request assistance from the participants because she has ongoing chest pains. You assist the participants in finding equipment and appropriate drugs if needed. You may perform chest compressions if asked to do so, but you do not perform defibrillation or airway management.

### Faculty role play: Patient's son

You are the patient's son. You are by her bedside when she complains of chest pain and witness her become unresponsive. You are not sure whether your mother would want to be resuscitated or not. You anguish over what to do. You request some time to confer with other relatives. You realise that she has been very unwell for some time, and that her exercise tolerance is very poor. However, you have not been able to raise the subject of resuscitation with her to know what her wishes might be. You look for guidance from the clinicians. Ultimately you favour intubation and continued attempts at resuscitation for your mother.

### Faculty role play: Senior clinician (optional)

You are a senior clinician working in the emergency department. If participants experience difficulties, it is appropriate to enter the scenario and offer assistance. Otherwise, at the conclusion of the scenario, you arrive to take a handover of the patient.

Simulator programming considerations				
System	Baseline state	Change in State 1	Change in State 2	Resolution
CVS	Atrial fibrillation 120 BPM BP 110/85	Ventricular tachycardia, pulseless	Ventricular tachycardia, pulseless	AF 140 BPM BP 90/75 Return of spontaneous circulation (assume return if low-fidelity manikin)
Respiratory	Spontaneous respiration 25 per minute Oxygen saturation 88% on O <sub>2</sub>	Apnoeic	Ventilated by participant Oxygen saturation 98%	Ventilated by participant if intubated Return of spontaneous respirations (RR 18) (assume return of spontaneous respiration if low-fidelity manikin)
Neurologic	GCS 14, a little confused	Unresponsive	Unresponsive	Unresponsive if intubated GCS 14 if not intubated (assume GCS 14 if low-fidelity manikin)
Response to participant intervention	Go to State 1 after initial enquiry re 'chest pain'	No CPR or defibrillation then stay in State 1 ETT intubation go to State 2 If not intubated, go to resolution after third defibrillation attempt	No CPR or defibrillation then stay in State 2 CPR and use of defibrillation go to resolution	

Debriefing points:

- effective ALS management
- communication with relatives/colleagues
- end-of-life decisions and 'do not resuscitate' orders
- relative's presence at resuscitation.

## Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have covered. No new material should be introduced.

- Points to cover in the summary include:
  - external cardiac pacing
  - teamwork principles
  - individual and team performance issues
  - leadership
  - effective communication
  - communication with relatives.

Participants should be encouraged to explore the literature relevant to CRM, teamwork and performance issues. They may be interested in attending further training in CRM through other complex modules or packages included in this project, or through courses run by providers outside their parent institution.

## Resource list

The following resource list assumes two facilitators for every 12 participants. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
Facilitators	2	Based on 12 participants
ARC ALS flowchart	1	For reference in introduction
PowerPoint presentation	1	For use in discussion
Equipment as listed for each individual scenario		
Feedback forms	2	As a prompt for each facilitator
Evaluation forms	12	One for each participant

## Evaluation

A formal evaluation was specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Australian Resuscitation Council Guideline 11.2: Protocols for Adult Advanced Life Support. February 2006
2. Australian Resuscitation Council Guideline 7: Cardiopulmonary Resuscitation. February 2006
3. Murray W. and Foster P. 2000 Crisis Resource Management Among Strangers: Principles of Organising a Multidisciplinary Group for Crisis Resource Management. *J Clin Anesth* 12: 633–638
4. Sundar E., Sundar S. and Pawlowski J. 2007 Crew Resource Management and Team Training. *Anesthesiology Clin* 25: 283–300
5. Meyer A., Bernard S., Smith K., McNeil J. and Cameron P. 2001 Asystolic Cardiac Arrest in Melbourne, Australia. *Emerg Med Austral* 13: 186–189
6. Jennings P. and Pasco J. 2001 Survival from Out-of-Hospital Cardiac Arrest in the Geelong Region of Victoria, Australia. *Emerg Med Austral* 13: 319–325
7. Eisenberg M. and Mengert T. 2001 Primary Care: Cardiac Resuscitation. *N Eng J Med* 344: 1304–13
8. Holzhauser K., Finucane J. and De Vries S. 2006 Family Presence During Resuscitation: a Randomised Controlled Trial of the Impact of Family Presence. *Aust Emerg Nurs J* 8: 139–147
9. Halm M. 2005 Family Presence During Resuscitation: a Critical Review of the Literature. *Am J Crit Care* 14: 494–512



## Module 5: Complex ALS—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>ALS adult</i> <i>Learning objectives of Module 3: ALS</i>	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Reviewed the Australian Resuscitation Council (ARC) ALS Guidelines <sup>1</sup>	<input type="checkbox"/>				
Practised adult ALS on a simulated patient as a team member in a simulated difficult clinical setting	<input type="checkbox"/>				
Practised using the external cardiac pacer on a simulated patient (manikin)	<input type="checkbox"/>				
Reflected on their ability to problem solve and communicate effectively under stress	<input type="checkbox"/>				
Recognised factors that influence team performance					

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

---



---



---



---



---



---



---

## 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing ALS	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

## 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

---



---



---



---

**Thank you**

## PowerPoint presentation

- Clinical Skills in Hospitals Project**

**Advanced Life Support (ALS) ADULT MODULE 5 'Complex ALS'**

  
- Module Outline**

  - Discussion
  - Simulation
    - Debrief
  - Simulation
    - Debrief
  - Summation
  - Evaluation
- Crisis Resource Management**

  - Know your environment
  - Anticipate and plan
  - Call for help early
  - Exercise leadership
  - Communicate clearly
  - Use all available information
  - Allocate attention wisely
  - Distribute workload evenly
- Individual Performance**

  - Experience and knowledge
  - Situational stress
  - Fatigue, tiredness
  - Environment
  - Negative life events
  - Attitude and personality
  - Drug, alcohol use
- Effective Teams**

  - Organisation
  - Leadership
  - Familiarity
  - Designated roles
  - Effective communication
  - Situational awareness
  - Conflict resolution
- Effective Leaders**

  - Clear communication
  - Allocation of tasks
  - Overseeing management
  - Receptive to team input
  - Situational awareness
  - Prioritisation
  - Positive group culture
- Effective Communication**

  - Directed and assertive
  - Calm, polite, controlled
  - Central relay via leader
  - Verification of completed task
  - Team awareness

# Acronyms, abbreviations and measurements

## Acronyms

A/C	assist control
AAFB	acid and alcohol fast bacilli
ABG	arterial blood gas
ACS	acute coronary syndromes
AEDs	automated external defibrillator(s)
AF	atrial fibrillation
AHA	American Heart Association
ALS	advanced life support
AMI	acute myocardial infarction
APO	acute pulmonary oedema
APTT	activated partial thromboplastin time
ARC	Australian Resuscitation Council
ASB	assisted spontaneous breathing
AV node	atrioventricular node
BBB	bundle branch block
BiPAP	bilevel positive airway pressure
BLS	basic life support
BUN	blood urea nitrogen
CABG	coronary artery bypass graft
cath lab	catheterisation laboratory
CE	cardiac enzymes
CHB	complete heart block
CK	creatine kinase
CKMB	creatine kinase Mb
CMV	controlled mandatory ventilation
CNS	central nervous system
COAD	chronic obstructive airways disease
COPD	chronic obstructive pulmonary disease
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
CRM	crisis resource management
CVA	cerebrovascular accident
CVC	central venous catheter
CVS	cardiovascular system
CXR	chest X-ray
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DKS	Damus-Kaye-Stansel [procedure]

DRABC	D: danger R: response A: airway B: breathing C: circulation
DVT	deep vein thrombosis
ECF	extracellular fluid
ECG	electrocardiogram
ED	emergency department
EMD	electromechanical dissociation
ENT	ear, nose and throat
EPAP	expiratory positive airways pressure
ET	endotracheal
FBE	full blood examination
FFP	fresh frozen plasma
FRC	functional residual capacity
g	gram
GCS	Glasgow Coma Scale
GI	gastro-intestinal
GIT	gastro-intestinal tract
GTN	glyceryl trinitrate
Hb	haemoglobin
HIV	human immunodeficiency virus
HME	heat moisture exchanger
HPS METI	a brand (Human Patient Simulator) of fully automatic, high-fidelity patient simulator
HR	heart rate
I:E ratio	inspiration-to-expiration ratio
ICF	intracellular fluid
ICP	intracranial pressure
INR	international normalised ratio
IO	intraosseous
IPAP	inspiratory positive airways pressure
IPPV	intermittent positive pressure ventilation
IV	intravenous
LBBB	left bundle branch block
LDH	lactate dehydrogenase
LMA	laryngeal mask airway
mA	milliampere
MET	medical emergency team
NBM	nil by mouth

NGT	nasogastric tube
NIMC	national inpatient medication chart
NIPPV	non-invasive positive pressure ventilation
NIV	non-invasive ventilation
NP airways	nasal prong airways
NSEACS	non-ST elevation acute coronary syndrome
NSR	normal sinus rhythm
OP	oropharyngeal airway
OTC	over-the-counter medications
PCA	patient-controlled analgesia
PCI	percutaneous coronary intervention
PEA	pulseless electrical activity
PEEP	positive end expiratory pressure
pH	the measure of the acidity or alkalinity of a solution
PICC	peripherally inserted central catheter
PIP	peak inspiratory pressure
PRVC	pressure regulated volume control
PS	pressure support
PTX	pneumothorax
QRS	wave form seen on electrocardiogram
RA	room air
RBBB	right bundle branch block
RIC line	rapid infusion catheter exchange set
RMO	registered medical officer
rPA	retaplastase
RR	respiration rate
RSI	rapid sequence induction
rt-PA	alteplase
RV	right ventricular
SIMV	synchronised intermittent mandatory ventilation
SK	streptokinase
SR	Sinus rhythm
STEMI	ST elevation myocardial infarction
SVC	superior vena cava
TPN	total parenteral nutrition
UWSD	underwater seal drainage
V/Q mismatch	ventilation/perfusion mismatch
VF	ventricular fibrillation
VT	ventricular tachycardia
WCC	white cell count
WOB	work of breathing
WPW	Wolf-Parkinson-White syndrome

## Chemical formulae

CaCl <sub>2</sub>	calcium chloride
CO <sub>2</sub>	carbon dioxide
ETCO <sub>2</sub>	end-tidal carbon dioxide
FiO <sub>2</sub>	fraction of inspired oxygen
H <sub>2</sub> CO <sub>3</sub>	bicarbonate
MgCl <sub>2</sub>	magnesium chloride
MgSO <sub>4</sub>	magnesium sulphate
PaCO <sub>2</sub>	partial pressure of carbon dioxide in arterial blood
PaO <sub>2</sub>	partial pressure of oxygen in arterial blood
SpO <sub>2</sub>	percentage of oxygen saturation in blood
SaO <sub>2</sub>	saturation of oxygen in arterial blood flow

## Units of Measurement

abbreviation	unit
mmHg	millimetres of mercury
L	litre
mL	millilitre
µg	microgram — one-millionth (10 <sup>-6</sup> ) of a gram
mmol	millimole
J	joule
mg	milligram
cm	centimetre
m	metre

