Australian Resuscitation Council

NEW ZEALAND Resuscitation Council WHAKAHAUORA AOTEAROA

Guideline 10.2 – Advanced Life Support (ALS) Training

Summary

ANZCOR Guideline 10.2 outlines the design and delivery of advanced life support (ALS) education for healthcare providers in all settings**.** This guideline should be read alongside the age-specific life support recommendations (Refer to ANZCOR Guidelines 11 to 13).

ALS training builds on the continuum of care initiated by bystander and basic life support (BLS) (Refer to ANZCOR Guideline 10.1) by integrating advanced skills and resources to optimise resuscitation outcomes. A robust foundation in BLS is a prerequisite for ALS. Accordingly, this guideline focuses on the acquisition and ongoing maintenance of the enhanced knowledge, technical proficiency and non-technical behaviours required for effective performance as part of a resuscitation team.[1]

To whom does this guideline apply?

This guideline applies to healthcare professionals who may either have a role as an initial responder or as part of a responding team involved in the resuscitation of newborns, children, or adults.

Who is the audience for this guideline?

This guideline is intended for ALS education curriculum developers and providers of ALS training.

Conflict of interest statement

The New Zealand Resuscitation Council and the Australian Resuscitation Council credential resuscitation training curricula. Some member organisations are providers of life support training and generate income from these activities.

Recommendations

Who should training be available to?

- ANZCOR recommends the provision of accredited ALS training for health care providers who provide ALS for adults [CoSTR 2022, strong recommendation, very low certainty of evidence].
- ANZCOR recommends the provision of accredited courses in Paediatric ALS (PALS) Training for health care providers who provide ALS for infants and children [CoSTR 2022, strong recommendation, very low certainty of evidence].
- ANZCOR recommends the provision of accredited courses in Neonatal Resuscitation Training (NRT) and Helping Babies Breathe (HBB) for health care providers who provide ALS care for newborns and babies [CoSTR 2022, strong recommendation, very low certainty of evidence].

What should training include?

- ANZCOR recommends that pre-course preparation is provided [CoSTR 2022, strong recommendation, very low to low certainty of evidence].
- ANZCOR suggests that delivery of the required knowledge that underpins ALS should be flexible and consider prior knowledge of experienced practitioners [Good Practice Statement].
- ANZCOR suggests that team and leadership training should be included as part of ALS training [CoSTR 2022, weak recommendation, very low-certainty evidence].

How should training be delivered?

- ANZCOR recommends the option of blended learning (combination of online and face-to-face) where resources and accessibility permit its implementation [CoSTR 2022, strong recommendation, very low-to-low certainty evidence].
- ANZCOR suggests the use of cognitive aids in ALS training [CoSTR 2023, weak recommendation, very low certainty of evidence]. It is preferable that these cognitive aids should be the same or similar, where practical, to those available to participants in clinical practice [Good Practice Statement].
- ANZCOR suggests the use of feedback devices that provide directive feedback on the quality of cardiopulmonary resuscitation (CPR) during training [CoSTR 2024, weak recommendation, low-certainty evidence]. If feedback devices are not available, we suggest the use of tonal guidance (examples include music or a metronome) during training to improve compression rate only [CoSTR 2024, weak recommendation, low-certainty evidence]. ANZCOR suggests data-driven, performance-focused feedback and debriefing of rescuers during training [Good Practice Statement].
- ANZCOR suggests the use of high-fidelity manikins when training centres/organisations have the infrastructure, trained personnel, and resources to maintain the program [CoSTR 2024, weak recommendation, very-low-certainty evidence].
- ANZCOR suggests the use of low-fidelity manikins if high-fidelity manikins are not available [CoSTR 2024, weak recommendation, low-certainty evidence].
- ANZCOR suggests that technology needs to be appropriate in order to generate skills; therefore, at a minimum, there should be learner access to a basic manikin with an airway and the ability to simulate the display of cardiac rhythm [Good Practice Statement].
- ANZCOR suggests that high fidelity scenarios (those that integrate psychomotor skills, non-technical skills, and clinical decision making) are more important than the fidelity of the manikin [Good Practice Statement].

- ANZCOR suggests that either the use of augmented reality or traditional methods be used for basic life support (BLS) training of lay people and healthcare providers [CoSTR 2023, weak recommendation, very-low certainty of evidence].
- ANZCOR suggests that resuscitation education be configured to account for local resource availability in terms of both appropriateness of learning objectives and selection of equipment and adjuncts with which to conduct ALS training [Good Practice Statement].

How often should training take place?

- ANZCOR suggests frequent manikin-based ALS refresher training to maintain competence compared with standard retraining intervals of 12 to 24 months [CoSTR 2020, weak recommendation, very-low-certainty evidence].
- ANZCOR suggests that all ALS courses should have a robust process for continuous evaluation and quality improvement [Good Practice Statement].

Who should deliver ALS training?

- ANZCOR suggests trainers/facilitators (for courses for laypersons or healthcare professionals) must have received appropriate instruction qualifications in facilitation of learning and must receive facilitation updates on a regular basis [Good Practice Statement].
- ANZCOR suggests that educators who use high-fidelity manikins and simulators must have adequate knowledge and familiarity with the capabilities of their training devices [Good Practice Statement].

How long should training be?

- ANZCOR suggests that ALS training programs include 6 to 8 hours of instructor-led training time [Good Practice Statement].
- ANZCOR suggests ALS training can be delivered by either a spaced learning approach (training/retraining distributed over time) or a 1 to 2 day block ALS course [CoSTR 2020, weak recommendation, very low certainty of evidence].

1.0 | Definitions

- For the purposes of this guideline, the terms Basic Life Support (BLS), Advanced Life Support (ALS) and Health Care Professional are defined in the Australian and New Zealand Resuscitation Councils glossary (https://resus.org.au/glossary/)
- **Blended learning**: is an educational approach that combines face-to-face and online approaches.[1]
- **Deliberate practice**: Activities that have been specifically designed to improve the current level of performance, in which weaknesses are systematically identified and addressed to move on to the next level.[2]
- **Fidelity:** Fidelity in simulation training refers to the degree to which a simulation replicates real-life clinical scenarios. This includes both the technical or “hardware” fidelity (e.g., high-fidelity manikins that provide realistic physiological responses) and the scenario fidelity, that is, how well the simulated environment incorporates realistic clinical cues, patient responses, and the integration of psychomotor skills, non-technical skills, and

clinical decision-making.[3]

- **Insitu training**: in situ training, workplace-based simulation-based resuscitation training.[4]
- **Instructor-led training**: as education or training (e.g., lecture, simulation, skills demonstration, skills feedback) that occurs in the presence of a BLS instructor.[5]
- **Mastery**: The term mastery implies that the learner can consistently demonstrate a predefined level of competence for a specific skill or task.[2]
- **Self-directed, digitally based BLS training** is defined as any form of digital (e.g, video, phone application [app] based, internet based, game based, virtual reality, augmented reality) education or training for BLS that can be completed without an instructor, except for mass media campaigns (e.g., television, social media education).[5]

2.0 | ALS courses

Advanced Life Support (ALS) training enhances the ability of **health professionals** to manage life-threatening emergencies effectively. ALS training equips healthcare providers with **structured, evidence-based protocols** for **cardiac arrest, acute coronary syndromes, stroke, and other critical conditions**, improving patient survival and outcomes.[6]

Acquisition of ALS knowledge, skills, attitudes and behaviours have a positive impact on quality of resuscitation and patient outcomes (return of spontaneous circulation and survival).[6-10]

ANZCOR recommends the following [CoSTR 2022, strong recommendation, very low certainty of evidence]:

- Provision of accredited ALS training for health care providers who provide ALS care for adults.
- Provision of accredited courses in paediatric resuscitation training for health care providers who provide ALS for infants and children.
- Provision of accredited courses in newborn resuscitation training and Helping Babies Breathe or equivalent for health care providers who provide ALS care for newborns and babies.

Section 1 covers the content for initial ALS training and Section 2 covers refresher training.

The Australian Resuscitation Council and New Zealand Resuscitation Council (ANZCOR) believe that organisations and individuals experienced in resuscitation training are best positioned to contextualise the above principles into their training programs.

2.1 | Pre-course preparation

A demonstrated ability to perform basic life support (BLS) skills is a prerequisite to enrolment and attendance at an ALS training course.

Pre-course preparation should ideally:

- be provided with sufficient time for participants to assimilate knowledge
- be tailored to participants' learning needs
- be aligned with intended learning outcomes
- be designed to optimise participant engagement and active learning.

Pre-course preparation is recommended as part of resuscitation courses. Pre-course learning may be facilitated by a variety of tools (e.g., computer-assisted learning tutorials, written self-instruction materials, video-based learning, textbook reading, and pretests). Blended learning models (e.g., independent electronic learning coupled with a reduced-duration face-to-face course time) have been reported to achieve similar learning outcomes and substantial cost savings.[10]

Any method of pre-course preparation that aims to reduce instructor-to-learner face-to-face time should be formally assessed to ensure equivalent or improved learning outcomes compared with traditional fully instructor-led courses.[11,3,12]

There are various strategies for pre-course learning. Large, published studies have investigated diverse methods of pre-course learning (e.g., manuals, online simulators) as well as how pre-course learning interconnects with the course (e.g., whether it provides additional material or replacement of material within the course). Blended learning models (e.g., independent electronic learning coupled with a reduced-duration face-to-face course time) have been reported to achieve similar learning outcomes and substantial cost savings.[12]

At a minimum, the pre-course preparation should include the course objectives, pre-requisite knowledge, and links for candidates to achieve such knowledge, course outline, method of delivery (online, face-to-face), and assessment criteria. This information should be provided with sufficient time for participants to assimilate the knowledge. There is insufficient evidence to make clear recommendation for a specific method or timeframe.

ANZCOR recommends that pre-course preparation is provided [CoSTR 2022, strong recommendation, very-low to low certainty of evidence].

ANZCOR recommends providing the option of eLearning as part of a blended learning approach to reduce face-to-face training time for ALS courses [CoSTR 2022, strong recommendation, very low- to low-certainty of evidence].

2.2 | Course content

ALS courses involve the acquisition of specific knowledge, skills (psychomotor, teamwork, communication), and attitudes with the goal of maximising resuscitation performance, and therefore patient outcomes.[2] ALS courses should be designed with the target patient population in mind. ALS courses should have core components that may be supplemented by context-specific components. ANZCOR suggests ALS training programs should include the following core elements or recognition of prior learning:

Figure 1: Suggested core elements of Advanced Life Support (ALS) training course for adults, children and newborns compared to community BLS training courses

Setting		**Adults**	**Infants & Children**	**Newborns**
Community Setting		**BLS programs**	**BLS programs**	
Untrained Rescuer		Community Awareness (Call-Push-Shock)	Community Awareness (Call-Push-Shock)	
Trained Rescuer		BLS training: CPR + AED use	BLS training: CPR + AED use	
Healthcare Setting		**ALS programs**	**PALS programs**	**NLS programs**
First Responder (Inpatient & Outpatient areas)		BLS training PLUS: · Recognition of deterioration. · Airway adjuncts. · Bag-Mask ventilation (BVM). · Vascular Access (intravenous (IV)/ intraosseous (IO)). · Fluid resuscitation. · Resuscitation drugs. · Reversible causes and rhythms associated with cardiac arrest.	PBLS training PLUS: · Recognition of deterioration. · Airway adjuncts. · Bag-Mask ventilation. · Vascular Access (IV/IO). · Fluid resuscitation. · Resuscitation drugs. · Reversible causes and rhythms associated with cardiac arrest.	· Recognition of antenatal and intrapartum risk for needing resuscitation. · Vascular Access (IV/ umbilical venous catheter (UVC)). · Assessment of need for resuscitation at birth. · Initial steps in resuscitation of the neonate.

Advanced Responder (RRS or Critical Care Areas - ED, ICU, OT)		Above PLUS: · Advanced airway management (endotracheal tube (ETT), supraglottic airway (SGA) insertion). · Manual Defibrillation. · Management of shockable or non-shockable arrest rhythms. · Advanced drug therapy – inotropes, rapid sequence induction (RSI). · Teamwork & communication. · Post-resuscitation care.	Above PLUS: · Advanced airway management (ETT, SGA insertion). · Manual Defibrillation. · Management of shockable or non-shockable arrest rhythms. · Advanced drug therapy – inotropes, RSI. · Teamwork & communication. · Post-resuscitation care.	Above PLUS: · Advanced airway management. · Special circumstances, e.g., very or extremely preterm neonates, neonates with congenital anomalies. · Advanced drug therapy. · Teamwork & communication. · Post-resuscitation care.
Other		· Legal and ethical issues related to resuscitation. · Communication with and care of families, significant others, and bystanders.	· Legal and ethical issues related to resuscitation. · Communication with and care of families, significant others, and bystanders.	· Legal and ethical issues related to resuscitation. · Communication with and care of parents.

Teamwork, communication and leadership

Team competency training targeting nontechnical skills like communication, task allocation, leadership, followership, situational awareness, and appropriate resource use[2,13] aims to enhance resuscitation outcomes.

An ILCOR 2020 systematic review found no randomised control trials (RCTs) testing the effect of specific leadership or team training on the critical outcome of patient survival.[14] The 2024 systematic review aimed to assess the effect of specific training on a broader range of team competencies as part of resuscitation training. This review of 17 studies on team competencies in resuscitation training assessed non-technical skills such as communication, leadership, and task allocation. While some studies showed benefits in CPR skills, team communication, and leadership behaviour at course completion, there was no evidence of sustained improvements beyond one year. Additional research highlighted improved CPR time performance in a few studies, but most found no significant impact on CPR quality or patient outcomes. Confidence and team competencies beyond course completion varied, and no studies provided strong evidence linking team competency training to long-term patient survival.[6]

ANZCOR suggests that teaching team and leadership training should be included as part of ALS training for healthcare providers [CoSTR 2022, weak recommendation, very low-certainty evidence].

2.3 | Course delivery / educational approaches

Establishing a Safe Learning Environment

Establishing a psychologically safe training environment includes: clarifying expectations; engaging in an explicit and collaborative agreement in which both instructors and learners commit to what can reasonably occur to make the situation as real as possible whilst acknowledging the limitations of a simulation environment; and enacting a commitment to respecting learners and their psychological safety. The instructor-participant relationship should be collaborative and there should be consistency between what instructors say and do.[15] Instructors should be aware of the intended learning outcomes so that training can be tailored to specific learners or learner groups.[2] Intended learning outcomes should be learner-focused and not solely meet the requirements of content delivery.[2] Instructors should have a sound and clear understanding of the key instructional design features that enhance learning in an ALS course and should have specific training in feedback and debriefing.[2]

Knowledge

Methods used to teach the knowledge component of ALS training should align with and achieve the intended learning outcomes. It is acknowledged that participants will have varying levels of prior knowledge and this needs to be considered in decisions regarding the most appropriate teaching method. For example, new learners may require more detailed initial explanations. Options for delivery of knowledge should be flexible and may include: self-directed learning, use of written or online materials, lectures or small group sessions.

Skills

Mastery “implies that a learner can consistently demonstrate a predefined level of competence for a specific skill or task”.[2p e4] Therefore, resuscitation education experiences should enable learners to practice fundamental resuscitation skills, receive directed feedback, and improve their performance until mastery is achieved.[2]

Participants should demonstrate satisfactory performance in:

- both component (e.g., ‘skill station’) and scenario-based skills
- capacity to operate within a team.

Participants should demonstrate an understanding of the:

- indications for resuscitation
- indications for equipment and potential complications of procedures
- sequencing and prioritisation of resuscitation interventions.

The 2023 ILCOR CoSTR suggests that stepwise training, an instructional approach for resuscitation skill training that utilises several steps; should be the method of choice for skills training in resuscitation [CoSTR 2022, weak recommendation, very-low certainty of evidence}.[16] The optimal stepwise training approach (including the number and types of steps) is likely to be dependent on the type of skills taught, and therefore should be adapted appropriate to that skill.[17]

Consider learning styles

Educators should be cognisant that different people will have preferred sensory inputs when they are learning or communicating, and these preferences may change over time. These sensory inputs include what they can see, what they can read and what they can touch and feel. When teaching ALS knowledge and skills, educators should try to include elements of all sensory learning styles to cater to all learners.[18]

Model / exemplar demonstration

Whenever possible, educators should provide a model or exemplar performance for learners. This may be a practical demonstration by the educator/education team or an exemplar video.[2]

Blended learning approach

The 2022 ILCOR CoSTR recommended blended learning (as opposed to a non-blended learning approach) for life support training when resources and accessibility permit its implementation.[19,20] For ALS, this recommendation is based on 8 studies in which blended learning, compared to face-to-face learning, was associated with increased or similar knowledge, ALS skills and participant preferences.[19,20] A blended learning approach utilises some online content that supports face to face learning. A blended learning approach is grounded in a strong framework from educational theory and the blended learning approach has resulted in similar or better educational outcomes for learners. Blended learning also enables consistent messaging regarding content which can be particularly useful for pre-course preparation.[1] A non-blended learning approach (i.e. face to face only or online only) is an acceptable alternative where resources or accessibility do not permit the implementation of a blended learning approach.[1]

ANZCOR recommends the option of blended learning (i.e. eLearning and face-to-face) where resources and accessibility permit its implementation [CoSTR 2022, strong recommendation, very low- to -low certainty evidence].

Use of Pre-Brief as an educational strategy

Pre-briefing is an important strategy to create a safe learning environment, acknowledge to learners that mistakes are expected and are seen as valuable learning opportunities, and to build rapport between learners and educators.[2] Further, pre-briefing should make explicit performance targets and outline the key elements of performance feedback (timing, sources, intent) so learners have clear expectations.[2]

Scripted Debriefing in resuscitation training

Debriefing during simulation-based training enhances provider knowledge, clinical performance, and nontechnical skills, with some studies showing improved survival outcomes when informed by clinical data. Various debriefing frameworks exist, leading to variability in implementation, and efforts to standardize using debriefing scripts have gained traction. A review of six studies (five RCTs and one quasi-experimental) found mixed results on the benefits of scripted debriefing in resuscitation education, with some showing improvements in CPR quality and team leadership skills, while others reported no significant differences. No studies assessed patient outcomes, and only one integrated CPR performance metrics into debriefing scripts.[6]

ANZCOR suggests that ALS trainers should consider using debriefing scripts to support instructors during debriefing in resuscitation programs because they may improve learning and performance. Instructors need to ensure they have a complete understanding of how the debriefing script should be used [Good Practice Statement].

Spaced or distributed practice

The traditional approach to ALS provider courses has been 1 to 2 day courses culminating in an assessment of skill acquisition and renewal after a variable period of time, typically 1 to 4 years.[2] [2,3,21] Spaced learning (training or retraining distributed over time) may be used instead of massed learning (training provided at one single time point) to improved skill retention and reduce training costs. Evidence shows that after resuscitation courses, skills and knowledge deteriorate after 1 to 6 months without ongoing practice.[2] There is growing evidence to suggest that spaced learning can improve skill retention (performance 1 year after course conclusion), skill performance (performance between course completion and 1 year), and knowledge at course completion.[5] Increasing the frequency of training may improve training outcomes and mitigate skill deterioration.[2]

ANZCOR suggests ALS training can be delivered by either a spaced learning approach (training/retraining distributed over time) or a 1 to 2 day block ALS course [CoSTR 2020, weak recommendation, very low certainty of evidence].

Use of cognitive aids

Managing cardiac arrest and other emergencies is inherently complex. Cognitive aids—such as algorithms, flow charts, checklists, posters, and digital apps—are used globally to support guideline adherence and reduce errors by offering a structured clinical framework. However, their effect on performance and patient outcomes remains uncertain. ILCOR reviewed the evidence in 2020 and did not recommend cognitive aids for laypersons during training and real CPR; however, they were suggested for the training of health care professionals. Since then, new evidence has been published, triggering an update of the systematic review in 2024.[6,19,20]

A review of 29 simulation studies on cognitive aids in resuscitation found that, despite very low certainty of evidence and significant study heterogeneity, many tools ranging from augmented reality decision support and interactive apps to noninteractive checklists can improve protocol adherence and task performance across neonatal, paediatric, adult ALS, and other emergency scenarios. However, improvements in CPR quality were inconsistent, and a few studies reported undesirable effects such as delays in initiating compressions or calling for help. Notably, none of the studies examined cognitive aids as educational tools, and no meta-analysis was possible due to the diversity of methods and outcomes.[6]

The 2020 treatment recommendation was based on trauma resuscitation studies, which report teams using aids report better adherence to guidelines, fewer errors, and perform key tasks more frequently.[3] The 2024 systematic review did not examine the use of cognitive aids in health professional or lay rescuer training in resuscitation, so no recommendation for or against was issued.[6]

ANZCOR believes it is reasonable to use cognitive aids (e.g., checklists, flow charts) during resuscitation training, provided that they do not delay the start of resuscitative efforts. It is preferable that these cognitive aids should be the same or similar, where practical, to those available to participants in clinical practice. ALS trainers should be aware that cognitive aids may result in adverse events, such as the promotion of fixation errors and groupthink[22], impair communication among team members[23], and be distracting if not well-developed.[3]

ANZCOR suggests that the use of cognitive aids may be considered for use in ALS training [CoSTR 2020, weak recommendation, very low certainty of evidence]. It is preferable that these cognitive aids should be the same or similar, where practical, to those available to participants in clinical practice [Good Practice Statement].

CPR prompt or feedback devices

CPR prompt or feedback devices may be considered during CPR training for healthcare professionals. The use of CPR feedback or prompt devices during CPR in clinical practice or CPR training is intended to improve CPR quality as a means to improving return of spontaneous circulation (ROSC) and survival.[11,24] The forms of CPR feedback or prompt devices include audio and visual components such as voice prompts, metronomes, visual dials, numerical displays, wave-forms, verbal prompts, and visual alarms. Visual displays enable rescuers to see compression-to-compression quality parameters, including compression depth and rate.[24] Audio prompts may guide CPR rate (e.g., metronome) and may offer verbal prompts to rescuers (e.g., “push harder,” “good compressions”).[24]

The 2015 and 2020 ILCOR CoSTRs[3,25] did not identify any studies related to the use of real-time audiovisual feedback and prompt devices during CPR training and the critical outcomes of improvement of patient outcomes and skill performance in actual resuscitations. The 2020 review identified 14 simulation-based studies (13 RCTs). A review of 5 studies (four studies of 1029 participants in adult CPR training[26-29] and one study of 36 participants in neonatal CPR training)[30] showed substantial skill decay 6 weeks to 12 months after training with and without the use of a feedback device. For the important outcome of skill performance at course conclusion, a review of 28 studies[26-53] showed limited improvements in CPR quality (i.e., compression depth, compression rate, chest recoil, hand placement, hands-off time, and ventilation) with a feedback device. An evidence update in 2024 found that feedback devices improve CPR quality, including long-term retention. Augmented reality-assisted feedback enhances all CPR metrics. Real-time feedback devices in simulated infant CPR showed similar performance to non-feedback CPR. In observational studies, defibrillators with CPR feedback features led to better adherence to American Heart Association (AHA) guidelines for chest compression rate and fraction.[6]

ANZCOR suggests the use of feedback devices that provide directive feedback on compression rate, depth, release, and hand position during training [CoSTR 2024, weak recommendation, low-certainty evidence]. If feedback devices are not available, we suggest the use of tonal guidance (examples include music or metronome) during training to improve compression rate only [CoSTR 2020, weak recommendation, low-certainty evidence].

Gamified Learning as an educational approach:

Younger generations' comfort with technology suggests that active, peer-engaging teaching strategies may be more effective. Gamification using game elements like competition, points, levels, and leaderboards has shown mixed results in enhancing CPR knowledge and skills, whether used alone or as pretraining. A 2024 systematic review of 13 studies (6 RCTs and 7 observational) on gamified resuscitation training, mostly involving healthcare professionals and a few high school students, found mixed but generally positive effects. Digital platforms (online interfaces, leaderboards, and smartphone apps) were most commonly used, with a couple of studies using board and card games. Some RCTs and observational studies showed improved CPR performance (e.g., chest compression quality and faster intervention times), enhanced knowledge in neonatal resuscitation, and increased self-reported confidence in ALS scenarios. However, due to high study heterogeneity and low certainty of evidence, no meta-analysis was performed, and none reported on process outcomes, costs, or critical clinical outcomes.[6]

ANZCOR suggests the use of gamified learning be considered as a component of resuscitation training for all types of BLS and ALS courses [CoSTR 2023, weak recommendation, very low–certainty evidence].

Using a stepwise approach for training

The most appropriate training method for resuscitation skills has been long debated, particularly on a stepwise approach and the number of steps to be used. It is known from practice that many instructors do not adhere to a particular stepwise approach in their teaching. The optimal stepwise training approach (including the number and type of steps) may be dependent on the learner and the type of skills taught. A variation of the number and kinds of steps should be tailored to the learner and adapted to the nature of the skill taught.[3,4] This may include the opportunity for learners to be given more time or for a different educational approach to be used if the standard approach is not working for them to attain the knowledge and skills needed.[2]

ANZCOR suggests that stepwise training should be the method of choice for skills training in Advanced Life Support [CoSTR 2022, weak recommendation, very low-certainty evidence].

Rapid cycle deliberate practice as an educational approach

Rapid cycle deliberate practice (RCDP) is a training method that uses stop-and-go practice with immediate feedback, allowing ample repetition in a safe, non-judgmental environment to improve clinical outcomes. It is distinct from simple repetitive practice, and in 2024 a systematic review was initiated since ILCOR had not previously evaluated its evidence in resuscitation training.[6]

Across seven RCTs and one observational study of RCDP in simulated resuscitation training (involving medical students, interns, residents, physicians, and mixed clinical staff across adult, paediatric, and neonatal scenarios), no clinical outcomes were reported. Meta-analysis of time to chest compressions in paediatric/neonatal settings showed very low-certainty evidence of no benefit compared with after-event debriefing, although one observational study noted a shorter time to compression initiation. Other findings were mixed: one RCT showed improved time to positive-pressure ventilation, some studies reported shorter defibrillation times and pauses, and improvements in compression fraction were noted. However, skill retention at four months was similar between groups, protocol adherence results were inconsistent, and while team leader performance improved in one study, participants rated RCDP as less effective for teaching.[6]

ANZCOR suggests it may be reasonable to include RCDP as an instructional design feature of BLS and ALS training [CoSTR 2023, weak recommendation, very low–certainty evidence].

2.4 | Course duration

The optimum duration and structure of ALS training programmes are unknown,[10] however course duration should provide sufficient opportunity for participants to achieve the intended learning outcomes (knowledge, skills, attitudes, and behaviours).

ANZCOR suggests that ALS training programs include at least 6 hours of instructor-facilitated training time [Good Practice Statement].

ANZCOR suggests ALS training can be delivered by either a spaced learning approach (training/retraining distributed over time) or a 1 to 2 day block ALS course [CoSTR 2020, weak recommendation, very low certainty of evidence].

2.5 | Performance Feedback and Assessment

Minimum Passing Standard

The minimum passing standard should be made clear to learners from the very beginning. Educators should develop key metrics and clear assessment tools. This allows learners and educators to establish performance goals for both mastery learning and deliberate practice [2]. Standard performance should be an observable behaviour and set based on improving patient outcomes and process measures (time, accuracy, best practice, local protocols, or a checklist of standard performance).[2]

Performance Feedback

Feedback is defined as information regarding performance compared with a specific standard; whereas, debriefing is defined as a reflective analysis of prior performance between 2 or more individuals with the aim of improving future performance.[3] Performance feedback is vital to maintaining and improving clinical skills, even for experienced clinicians.[2,54] Effective feedback should be specific, timely, actionable, and learner-specific. Feedback should also enable the learner to identify positive aspects of performance and those requiring improvement.[2,15] Instructors should be cognisant that learners have difficulty using feedback that threatens their self-esteem or conflicts with their perceptions of self.[55,56] Careful consideration must be given to feedback, as the effect of feedback can be positive or negative on learning.[55,56]

A systematic review and meta-analysis of the effectiveness of feedback during procedural skills training using simulation-based medical education showed that feedback was associated with significantly improved skill outcomes.[57] There was no significant difference between formative and summative feedback for skill outcomes assessed immediately at the end of the intervention or when skills were assessed at least 5 days post-training.[57] When compared to a single source of feedback, multiple sources (e.g., instructor and visual) of feedback enhanced learning outcomes.[57]

ANZCOR suggests data-driven, performance-focused feedback and debriefing of rescuers during training [Good Practice Statement].

Assessment

Assessment is defined as “any systematic method of obtaining information from tests and other sources, used to draw inferences about characteristics of people, objects or programmes”.[58] In the context of ALS courses, the domains that should be assessed include resuscitation knowledge, technical skills (e.g., chest compressions), and nontechnical skills (e.g., leadership or communication). These domains are complex, so the construct being assessed must be clearly identified.[2] Assessment methods may include written assessments (e.g., multiple-choice questions) and assessments of performance (e.g., a simulated resuscitation scenario or demonstration of a specific technical skill).[2] Assessments should measure elements of resuscitation that are important for patient outcomes rather than what is easy to assess,[2] and should be performed for both the individual (e.g., delivery of guideline compliant chest compressions) and team performance.[2]

Assessment data may be derived from direct observation, retrospective video review, or CPR feedback devices.[2] Assessment *for* learning (formative assessment) should occur throughout the course to inform instructor feedback and coaching. Assessment *of* learning (summative assessment) typically occurs at the end of an ALS course as a measure of the effectiveness of the educational intervention and for certification.[2] Assessment tools should be valid, reliable, and reflect the course learning outcomes. Assessment results should be reproducible.[2]

Assessment of ALS knowledge and skills may include written and practical testing components. The use of written assessment alone is insufficient.[419,20] A 2020 ILCOR systematic review of end-of-course testing versus continuous assessment found no studies that addressed the PICOST question, and no treatment recommendation was made.[3]

ANZCOR suggests that assessment of ALS skills during and/or after training should be considered as a strategy to improve learning outcomes [Good Practice Statement].

2.6 | Equipment / resources

Manikin Fidelity

High fidelity manikins are computerised, full-body manikins that can be programmed to provide realistic physiological response to learner's actions. There is insufficient evidence to support or refute the use of techniques such as high-fidelity manikins and workplace-based simulation-based resuscitation training compared with training on low-fidelity manikins and education centre-based training.[11]

High-fidelity training compared with low-fidelity training has been shown to have a moderate effect on improved skills performance at course completion (very-low-certainty evidence from 12 RCTs with 726 participants),[59-70] but no benefit on skills performance at 1 year (one RCT with 86 participants[59] and one RCT with 47 participants).[60] High-fidelity training compared with low-fidelity training had no benefit in knowledge at course conclusion (low-certainty evidence from 8 RCTs with 773 participants[60-63,68,69,71,72] and 1 non-RCT with 34 participants).[73]

Perhaps more important is designing resuscitation training that is contextual to each learner's real-world scope of practice incorporating learner and environmental factors.[2] Learner factors include age, background, clinical experience, cognitive load, expectations, emotions, and stress levels. Environmental factors include training setting, devices and media used, manikin/simulator features, local institutional and societal considerations.[2]

ANZCOR suggests the use of high-fidelity manikins when training centres/organisations have the infrastructure, trained personnel, and resources to maintain the programme [CoSTR 2024, weak recommendation, very-low-certainty evidence].

ANZCOR suggests that the use of low-fidelity manikins is equally acceptable for standard ALS training in an educational setting if high-fidelity manikins are not available [CoSTR 2024, weak recommendation, low-certainty evidence].

ANZCOR suggests that the fidelity of the scenario is more important than the fidelity of the manikin [Good Practice Statement].

In making these recommendations, ANZCOR considered the well-documented, but self-reported participant preference for high-fidelity manikins (versus low-fidelity manikins) and the likely impact of this preference on willingness to train.[74] ANZCOR considered the positive impact of skill acquisition at course completion, as well as the lack of evidence of sustained impact on the learner, and the relative costs of high-versus low-fidelity manikins. High-fidelity manikins can provide physical findings, display vital signs, physiologically respond to interventions (via computer interface), and enable performance of procedures.[75] When considering physical realism, high-fidelity manikins are more expensive but are increasingly more popular with candidates and faculty, however, there may be marginal benefits for the intervention. In reviewing the science, it was clear that there was a benefit to high-fidelity manikins but it was less clear whether the incremental costs justified the added expenses.[10]

As part of the 2020 evidence review, ILCOR scoped the literature but did not make a treatment recommendation for the use of virtual reality, augmented reality, and gamified learning in ALS training.[3]

ANZCOR recommends that technology needs to be appropriate in order to generate skills, therefore at a minimum, there should be learner access to basic manikin with an airway and the ability to simulate the display of cardiac rhythm [Good Practice Statement].

Immersive Technologies as an educational approach

Current training methods for both laypeople and health care professionals are often inadequate, leading to poor skill acquisition and rapid decay. Alternative strategies, such as immersive technologies, virtual reality (VR), and augmented reality (AR) offer interactive, real-time simulation experiences that may enhance learning and improve cardiac arrest outcomes. These technologies can complement traditional methods like video, manikin-based, and online training; however are often costly. Despite their use in various educational settings, the overall impact of VR and AR on learning and performance remains unclear, which prompted a systematic review in 2024.

Due to high heterogeneity across studies in terms of design, intervention type, and outcome measures, no meta-analysis was possible. Out of 18 studies, 3 focused on AR for BLS training, two with mixed results on CPR depth. VR was explored in 12 studies: 9 for BLS and 3 for ALS. VR showed mixed results compared to traditional methods, with some studies favouring VR for knowledge acquisition and others noting no difference in CPR performance. Notably, those in instructor-led BLS training typically performed better in CPR depth, rate, and other skills than those trained with VR. Additionally, some studies found no lasting improvements in knowledge retention or CPR performance after VR training, though one study showed greater willingness to perform CPR with instructor-led training.[6]

ANZCOR suggests against the use of VR <u>only</u> for BLS and ALS training of laypeople and health care professionals [CoSTR 2023, weak recommendation, very low–certainty evidence]. If used, VR should be combined with instructor-led training.

3.0 | Advanced Life Support re-training and refresher training

The evidence related to optimal retraining intervals for resuscitation education is limited in both quantity and quality. The optimal interval for retraining, meaning re-completion of a full ALS course, has not been established. However, repeated refresher training is needed for individuals who are not performing resuscitation on a regular basis.[2]

What is well established is that the frequency of ALS re-training or refresher activities will be influenced by how quickly skills and knowledge gained in training decay over time. CPR skills are known to deteriorate within weeks to months after traditional single-encounter courses and well before traditional retraining intervals of 1 to 2 years.[2,77]

Health professionals exposure to cardiac arrest is relatively low. Victorian data shows that paramedics are exposed to an average 1.4 (IQR=0.0- 3.0) out-of-hospital cardiac arrests per year, and it takes, on average, 163 days for paramedics to be exposed to out-of-hospital cardiac arrest.[76] Annually, there are approximately 10.2 million hospital admissions in Australia[77] and 1.1 million in New Zealand.[78] A systematic review of the frequency, characteristics and outcomes of adult in-hospital cardiac arrests in Australia and New Zealand showed that the frequency of in-hospital cardiac arrests ranged from 1.31-6.11 per 1000 admissions in four population studies and 0.58-4.59 per 1000 in 16 cohort studies.[79] In contrast, newborn resuscitation is more frequent. While one in five newborn infants is reported to receive some form of resuscitation intervention, one in twenty received assisted ventilation (which is often the most important neonatal resuscitation intervention). Nevertheless, only about 3 per 1000 receive chest compressions, suggesting a low frequency of exposure of newborn care providers to the need to provide extensive resuscitation.[80]

Retraining cycles of 12 to 24 months are not adequate to maintain high-quality in resuscitation skills.[10] While the optimal retraining intervals remain uncertain, more frequent refresher training (brief, focused practice sessions aimed at reinforcing key skills) has been shown to benefit healthcare providers in maintaining ALS proficiency.[10,81-86] Refresher training, in the form of low-dose, high-frequency sessions using manikins, may be a practical, cost-effective solution. Sessions should be brief, typically 5 to 15 minutes in duration, and scheduled frequently, for example, on a weekly, monthly, or quarterly basis, depending on learner needs and operational feasibility. **Note:** Throughout this guideline, the term "*brief refresher training*" refers to short, low-dose practice sessions (5 to 15 minutes in duration), aligned with the principles of low-dose, high-frequency training to support ongoing ALS skill retention. Such sessions can be integrated into daily workflow, reducing the need for full course attendance and allowing for ongoing reinforcement.[82] Learning from “frequent, low-dose” compared with “comprehensive, all-at-once” instruction is effective and preferred by learners.[83] Instructional methods such as RCDP,[4,84] which involve repeated short simulations with immediate feedback, warrant further consideration. The role of experiential clinical exposure and feedback in retraining requires further study.

Where possible, more frequent refresher sessions (e.g., monthly) are preferred, but any increase in refresher frequency compared to traditional annual or biennial retraining is likely to improve skill retention and patient outcomes.

In line with the principles outlined for initial ALS education, refresher and retraining programs should incorporate a Minimum Passing Standard where practical. The minimum standard should be made clear to learners at the outset. Educators should define key metrics and assessment tools appropriate to the refresher context, focused on observable performance behaviours. These should aim to reinforce actions that improve patient outcomes and key process measures such as time, accuracy, adherence to best practice, or local protocols.

Figure 2: Examples of refresher training options for ALS skill retention

Training Method	Session Length	Suggested Frequency	Focus Area	Notes
Advanced airway skills station (e.g., intubation, supraglottic airway insertion).	10 to 15 minutes	Weekly or fortnightly	Airway management techniques.	Can be self-directed or peer-assisted using airway mannequins.
Short instructor-led scenario practice (e.g., ward or prehospital simulation).	10 to 20 minutes	Monthly	Cardiac arrest algorithms, team leadership, defibrillation protocols.	Rapid feedback recommended; focus on critical decision-making.
Medication preparation and delivery drills.	5 to 10 minutes	Monthly	Safe preparation and administration of ALS drugs.	Can include mock-code drug box checks, dose calculation exercises.
Team communication drills (e.g., closed-loop communication in resus team)	10 to 15 minutes	Monthly or quarterly	Teamwork, leadership, and handovers during resuscitation	Useful in both in-hospital and prehospital ALS settings
Low-dose high-fidelity in situ simulation	15 to 30 minutes	Quarterly	Full ALS resuscitation response in a realistic clinical environment.	Focus on the integration of technical and non-technical ALS skills.

These examples are flexible and should be adapted to the learner's clinical role, scope of practice, available resources, and operational setting. Emphasis should be placed on critical interventions that are low frequency but high-risk, and on maintaining familiarity with evolving ALS protocols and local guidelines.

ANZCOR suggests that more frequent manikin-based refresher training for students of ALS courses may be better to maintain competence compared with standard retraining intervals of 12 to 24 months [CoSTR 2020, weak recommendation, very-low-certainty evidence].

ANZCOR considers the rapid decay in skills after standard ALS training to be of concern for patient care.

4.0 | Governance and administration

Governance structures

Governance structures and processes are the essential systems and procedures of oversight for consistent delivery, maintenance of standards, and review of outcomes. They should guide all courses making statements to the rules, procedures, and other informational guidelines. In addition, governance frameworks define, guide, and provide for the enforcement of these processes.

Models for the governance will vary but should incorporate aspects of:

- Defined rules and regulations
- Organisational and individual accountability
- Administration requirements before/during and following the course
- Review processes.
- Information storage
- Health and safety requirements
- Fiscal probity
- Equity
- Participant requirements
- Instructor proficiency and conduct
- Candidate selection /eligibility
- Assessment systems
- Appeal process

Governance should comply with statutory legislative requirements and be available to all participants for review. Ongoing review of the material, structures, and participant feedback of the course should occur to ensure the substance of the course is current in the clinical and governance scope.

ANZCOR suggests that all ALS courses should have a robust process for continuous evaluation and quality improvement [Good Practice Statement].

Faculty Development

Faculty development for resuscitation course instructors remains an important element contributing to improved teaching and the learners' outcomes in accredited life support courses. Faculty development should have an intentional focus on optimising the delivery of resuscitation curriculum in a contextualised manner for different learner groups.[2]

However, no clear picture of the most appropriate and most effective faculty development programs has been identified from the studies reviewed. It is recommended that any organisation offering resuscitation education should also provide faculty development programs for the teaching staff of their resuscitation programs. Different approaches need to consider the local training environment and resource availability, as well as instructors' needs to maximize learning outcomes of such programs. The best ways to maintain and assess instructor competency whilst concurrently maximizing cost-effectiveness needs to be established by organisations individually.[1,2]

Instructor training should include content on, practice with, and evaluation of key instructor competencies, including:

- Knowledge and skills associated with the science of resuscitation and the science of education.
- Use of feedback devices and approaches to dealing with the most common challenges.
- Ability to effectively debrief others and facilitate peer coaching.
- Contextualisation of content to various audiences and practice settings.
- Facilitation of the development of teamwork training skills.
- Giving and receiving feedback (e.g., peer coaching).
- Reflective practice.
- Helping instructors to recognise themselves as change agents.[2]

ANZCOR suggests trainers/facilitators (for courses for laypersons or healthcare professionals) must have received appropriate instruction qualifications in facilitation of learning and must receive facilitation updates on a regular basis [Good Practice Statement].

ANZCOR suggests that educators who use high-fidelity manikins and simulators must have adequate knowledge and familiarity with the capabilities of their training devices [Good Practice Statement].

Abbreviations

Abbreviation	Meaning/Phrase
AED	Automated external defibrillator
AHA	American Heart Association

ALS	Advanced Life Support
ANZCOR	Australian and New Zealand Committee on Resuscitation
AR	Augmented reality
BLS	Basic life support
BVM	Bag-valve mask
CPR	Cardiopulmonary resuscitation
CoSTR	Consensus on Science with Treatment Recommendations
CPR	Cardiopulmonary resuscitation
ETT	Endotracheal tube
HBB	Helping babies breathe
ILCOR	International liaison committee on resuscitation
IO	Intraosseous
IV	Intravenous
NLS	Neonatal Life Support
NRT	Neonatal resuscitation training
PALS	Paediatric Advanced Life Support
RCT	Randomised control trials
RCDP	Rapid cycle deliberate practice
ROSC	Return of spontaneous circulation
RSI	Rapid sequence induction
SGA	Supraglottic airway
UVC	Umbilical venous catheter
VR	Virtual reality

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Search date/s	ILCOR literature search details and dates are available on the CoSTR page of the ILCOR website (https://costr.ilcor.org) and the relevant CoSTR documents.
Question/PICO:	Are described in the CoSTR documents (https://costr.ilcor.org)
Method:	This Guideline was developed under the processes outlined in Guideline 1.4. Evidence review included: reviews of existing evidence (worksheets), and review of the ILCOR systematic reviews and published CoSTRs (including peer-review and draft version on website).
Main changes:	This guideline replaces the 2020 version of ANZCOR Guideline 10.2 and reflects the most current international evidence and educational best practices for Advanced Life Support (ALS) training. · Integrates multiple recent ILCOR CoSTR reviews (2020–2025), including gamification, Rapid Cycle Deliberate Practice, spaced learning, contemporary approaches to clinical education, blended learning, team training, cognitive aids, and simulation fidelity. · Cognitive Aids & feedback devices: Detailed discussion of types, risks (e.g. fixation), and preference for real-world alignment · Mastery learning & deliberate practice: Emphasised as foundational educational principles · High vs. Low Fidelity manikins: Contextualised recommendations based on evidence and cost-benefit analysis · Governance Administration: Newly added comprehensive section detailing standards, quality assurance, and responsibilities · Assessment & Feedback: Detailed discussion on formative/summative feedback, safe learning environment, instructor prep
Primary reviewers:	Tracy Kidd, Julie Considine, Janet Bray, Jason Acworth, Joshua Sherwood, Nichola Goodger, George Lukas, Andy Mathison,
Other consultation:	N/A

Worksheet:	Worksheet ANZCOR Guideline 10.2 ALS Training
Approved:	May 2025
Guidelines superseded:	March 2020

Resources for Guideline 10.2 - Worksheets

Pre Course Learning

Simulation

Feedback

Referencing this guideline

When citing the ANZCOR Guidelines we recommend:

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