

ILCOR Advisory Statement

Education in Resuscitation

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Writing Group

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The Need for Change

The value of bystander cardiopulmonary resuscitation (CPR) has been well defined by studies in many countries and communities. Randomized clinical trials are inappropriate in this setting and cannot accurately determine the degree of benefit conferred, but observational data from 17 papers published before 1991¹ and 2 nationwide studies since that time^{2,3} suggest that the odds ratio for improved survival of victims of collapse is ≈ 2.5 . This benefit is achieved principally by extending the period for which defibrillation can be successful in cases of ventricular fibrillation or pulseless ventricular tachycardia. These are not grounds for complacency, however. Even in countries or areas where emergency services are well developed, most victims of cardiac arrest do not receive bystander CPR, and when it is given, the quality is generally far from ideal. The need, therefore, is not only for more CPR but also for better-quality CPR.

Both skills acquisition and skills retention have been shown to be poor after conventional training in CPR for laypersons. The reasons are manifold. The necessary psychomotor skills for current courses are complex and demanding, an issue of particular importance because in many

countries the average student is usually older than 50 years of age. Course curricula and instructor training are generally poorly adapted to the needs of course participants, and few instructors have been trained to teach. In addition, instructors frequently digress from the planned script (telling anecdotes and providing other irrelevant material), do not allow sufficient time for practice, and provide poor supervision and feedback. This is not a criticism of individual instructors but rather of the methods that have developed as a response to a perceived need but without consideration or knowledge of educational principles, clear objectives, appropriate formats, or agreed-on methods of evaluation and audit.

Unexpected cardiac arrest is a major cause of premature death in industrialized countries.⁴ The potential value of bystander CPR, which can reduce mortality by one half in appropriate settings,¹ is therefore of considerable importance. Yet in most countries, little effort has been given to making CPR a universal skill. The major efforts that have been made have largely come through voluntary organizations rather than government or healthcare agencies.

Survival rates for unexpected cardiac arrest depend not only on the quality of the education given to potential caregivers but also on the validity of treatment guidelines and

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Theoretical Model of Factors in Patient Outcome

	Guideline Quality	Efficient Education of Patient Caregivers	Well-Functioning Chain of Survival at a Local Level	Patient Survival Relative to Theoretical Potential (Factors Multiplied)
Utopia	1	1	1	≈1.00
Ideal?	0.9	0.9	0.9	≈0.72
Actual?	0.8	0.5	0.5	≈0.20
Attainable?	0.8	0.9	0.5	≈0.32

a well-functioning Chain of Survival. These factors interact in such a way that they can be regarded as multiplicands. For example, poor guidelines can affect even good education, whereas a potential rescuer who is poorly trained may not be able to effectively access even a well-functioning emergency medical services system. This is illustrated in the Table, which suggests that even slight imperfections in the quality of guidelines, together with realistic decrements in education and performance of the Chain of Survival, may well cost the lives of 4 of 5 potential survivors. A realistic target for improving the standard of education could have an important impact, irrespective of better techniques, guidelines, and rescue processes.

Universally, there is an urgent need to promote more and better CPR that is complementary to—and does not replace—policies aimed at providing earlier defibrillation. The impediments are formidable. Instruction must be provided on a large scale and must be readily accessible. Fears of infection and litigation must be countered with better information. Skills acquisition and retention, which are poor,^{5–9} must be improved by simplified procedures and better training methods, and ideally by both. Successful strategies to achieve these aims must therefore be a matter for international debate and concerted action. The potential exists for extending the window of opportunity for successful resuscitation with better survival rates.

The need for improvement in the way CPR is taught has received scant attention but should no longer be ignored.

Utstein Symposium on Education in Resuscitation

An international debate began at an educational symposium held June 22 to 24, 2001, at Utstein Abbey, on the island of Mosteroy, off the coast of Stavanger, Norway. The name Utstein is already associated with resuscitation because of previous conferences held at the abbey to discuss uniform reporting of out-of-hospital cardiac arrest,^{10,11} in-hospital cardiac arrest,^{12,13} and pediatric emergencies.^{14,15} Other meetings related to trauma¹⁶ and laboratory resuscitation research^{17,18} have also carried the name Utstein to signify international coordinated effort and agreement in these areas. Participants at 4 of these meetings have been active members of the national and international resuscitation organizations that make up the International Liaison Committee on Resuscitation (ILCOR). The Utstein symposium was held under the direct auspices of ILCOR but included independent invited experts in resuscitation education. Participating organizations were the American Heart Association, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, the Australia and New Zealand Resuscitation Council, the Resuscitation Council of Southern Africa, and the Consejo

Latino-Americano de Resuscitación. The Japanese Resuscitation Council was also represented by an observer.

Symposium Procedure

After an introductory session and discussion of planned expert presentations, participants divided into 4 panels during each of 2 sessions, making a total of 8 panels. After 1 hour of brief presentations and discussion with 2 moderators, the other panel members moved to other groups so that as many as possible could contribute to each topic. The moderators subsequently presented key points of the panel discussions to the whole group so that issues could be more widely debated, allowing refinement of conclusions and recommendations. All panel discussions were recorded after amendment during plenary sessions and were distributed for final comments to panel members and then the whole group. These 8 panel proceedings are available on request but have been condensed into this report as the definitive record of the Utstein education symposium. The discussions are presented under 7 major headings, each followed by recommendations that represent a consensus of participants.

Subsequent Action

Participants in the Utstein symposium regarded the meeting as the start of an ongoing process that must continue if its potential benefit is to be realized. If education in basic life support (BLS) is to become even near ideal, evidence-based change is required. Current methods and future developments must be tested by accepted methods. Teaching strategies should be evaluated and compared on the basis of how well learners achieve predefined teaching outcomes (see section 7, "Measurement of Teaching Outcomes"). No single method will be suitable for all circumstances. Thus, evaluation of training methods for purposes of research must be at a higher level than simple assessment of skills acquisition during routine community training. Sophisticated methods of outcome evaluation are warranted. One prototype for assessment discussed at the symposium is presented in Appendix 1 of this report. Scoring is as objective as possible; advanced recording capabilities were used on a manikin with a commercially available PC Skill Reporting System (Laerdal Medical, Norway). Although this has merit and has been validated as reproducible between observers, definitive tools are needed to ensure continuing improvement in the success of education in cardiopulmonary resuscitation.

Discussions and Recommendations

1. General Objectives in CPR Training

The ideal situation—someone attempts to provide BLS in every case of witnessed cardiac arrest in a community—is

neither attainable nor even readily measurable. Other more practical objectives are required but have rarely been defined or debated. At present, the number of persons receiving training in any one area has been regarded as the principal measure of success, without measure of quality or benefit. This limited view has now come under scrutiny and is recognized as unsatisfactory.

In advanced life support (ALS), limited success has been achieved in measuring the most relevant indicators of the value of CPR training: an increase in the proportion of victims who achieve return of spontaneous circulation, more hospital admissions after out-of-hospital cardiorespiratory arrest, more hospital discharges, and improved 1-year survival.¹⁹ Such measures require a highly organized system that is only rarely available, and similar data for BLS are more difficult to obtain. Therefore, more specific and detailed measurements of the quality of training in BLS are required.

Symposium participants agreed that objectives in CPR training should be defined, and the best methods of achieving these objectives should be agreed on. Although such ambitious goals could not be achieved during a 2-day symposium, participants believed a start should be made and a mechanism found to continue debate and progress toward global influence. Established adult educational principles that encourage simplification should be adopted in resuscitation training.⁷ The result should achieve a measurable change in a potential rescuer's behavior. Although this requires a cognitive element, demonstration of satisfactory performance must be the principal indication of success.^{8,20–30} Moreover, only improved training outcomes should justify changes in training techniques.^{22,31} An effective strategy is not necessarily the best strategy, but it can be used as an interim standard for testing new developments to provide continuing beneficial evolution in methodology.^{32–35}

The objectives of a training program form a hierarchy of steps toward the ultimate goal of improved outcome:

- The learner, preferably from a targeted group, will enroll in and complete the training experience in basic or ALS for adults or children.
- The learner will recognize an emergency and be able to summon help, including the use of an emergency response number.
- The learner will be able to demonstrate lifesaving CPR (including ALS/advanced cardiovascular life support [ACLS] or pediatric advanced life support [PALS]) on a manikin in a simulated scenario at the end of the training course.
- The learner will be able to perform the same lifesaving skill adequately 6 months after the training course.
- The learner will express confidence in his or her ability to act in an emergency.
- The learner will later be able to perform satisfactory CPR (or ALS/ACLS or PALS) in a *real cardiac arrest*.
- Survival rates after cardiac arrest and attempted resuscitation within the community will increase.

Summary of Specific Recommendations

- A template should be introduced for research on or evaluation of any educational intervention designed to improve resuscitation performance.
- The template should specify the target population and in particular whether it comprises laypersons, those with a duty to respond, or healthcare professionals.
- The template should specify which outcome is being tested, preferably with reference to the end points listed above.
- The template should specify the intervention in sufficient detail to permit replication and assessment of generalizability.

2. Training Laypersons in Basic Life Support

CPR training of laypersons should follow an organized plan of implementation that targets 2 ends of the age spectrum. First are persons most likely to encounter someone in cardiac arrest, typically persons 40 years of age and older. Second, as a valuable long-term investment, instruction of schoolchildren is important because they are at an age when knowledge and skills are well retained; they are also relatively immune to social pressures and the fear of involvement that can be a negative influence in later years.^{36–41} Thus, the symposium participants strongly recommended that instruction in CPR be incorporated as a standard part of the school curriculum.

More efficient use of resources is possible if attempts are made to attract volunteers who wish to participate and if programs focus on the learner's personal objectives rather than on the more standardized objectives of training organizations.⁴²

Easy accessibility of training is a fundamental requirement that is often overlooked. Training should take place in a comfortable environment to make CPR appropriate in the familiar settings of everyday life. This implies some differences in the presentation of courses designed for the classroom, the work site, or the home.

Most people who complete CPR training will not perform effective basic CPR even immediately after training.* This is because of (1) inadequate training of instructors who devote too much time to presenting information and too little time to hands-on practice and (2) lack of teaching methods appropriate for laypersons, which has a negative effect both on learning and psychosocial willingness to respond. Benefit to the community is also reduced by failure to target persons most likely to encounter someone in prehospital cardiac arrest.

Instructors frequently fail to achieve satisfactory results from conventional courses, partly because they lack the necessary skills, but also because they allow insufficient time for practice. This has led to development of strategies that minimize the role of the instructor, who might be more appropriately called the facilitator.^{49–51} These strategies include video-based techniques: watch-then-practice or watch-while-you-practice (so-called synchronous self-instructional learning).^{27,41,52–61} Television instruction should also be considered.⁶¹ From the outset, immediate hands-on practice meets students' expectations for training, helps prevent anxiety about skills performance that can be a barrier to learning,

*References 9, 19, 24, 25, 28–30, 43–48.

and increases the relevance of any necessary verbal information so that answers do not preempt questions. Television and video instruction can be adapted to any setting and both are particularly suitable for the lay student. Video-based *self-training* at home has been recommended for the general public but is less suitable for families or caregivers of persons at high risk.^{27,41,52,53,56,62} Whatever the method of instruction, the emphasis must be on a simple explanation of “pump and blow” techniques, but 2 additional skills may be added: control of bleeding and knowledge of when (and how) to move victims. These skills are easy to teach, readily understood, and of value in immediate management of life-threatening emergencies. Initial training must always include specific plans for refresher sessions because even the best instructional techniques are unlikely to impart permanent optimum skills and knowledge.^{63,64} The first session should therefore be presented as the first phase of a continuing process of learning and not as a once-only event.^{65,66}

A training session of 1 to 4 hours is limited as a means of providing sustained motivation for laypersons to act in a cardiac arrest emergency.⁶⁷ The media can and should be encouraged to help through available contacts and by offering newsworthy stories of successful resuscitations.^{68,69} Accounts or images of lay people recognizing cardiac emergencies and providing effective interventions can be a powerful motivation to others. Celebrities from all walks of life can act as role models and contribute to the acceptability of CPR in the community. Increased confidence and willingness to respond to an emergency are best achieved by repeated practice in realistic role-playing scenarios with situations and environments students are most likely to encounter, although such a strategy is not always feasible.^{57,70,71}

Although there has been sporadic research since the 1960s on how effectively students acquire and retain CPR skills, only recently has attention turned to instructor competence and quality and relevance of courses.* Much more attention should be given to program development, quality of instruction, and evaluation of results.

It is appropriate to assess how a lay rescuer responds to an emergency, shouts or phones for help, compresses the chest, and ventilates the lungs adequately. (For children, the order of priority for phoning, ventilation, and compression is different.) More specifically, these skills can be measured by rate of chest compressions, number of compressions given per minute, degree of chest depression or deformation, and ability to make the chest rise with ventilation. More detailed definitions for assessing actions associated with an educational intervention are shown in the draft template (Figure 1). Course development should be evidence based, and educational efficacy should be demonstrated before the course is conducted.⁷³

Summary of Specific Recommendations

- Learning objectives for training of lay rescuers must include the following: recognition of an emergency, ability to call an emergency response number, competence in

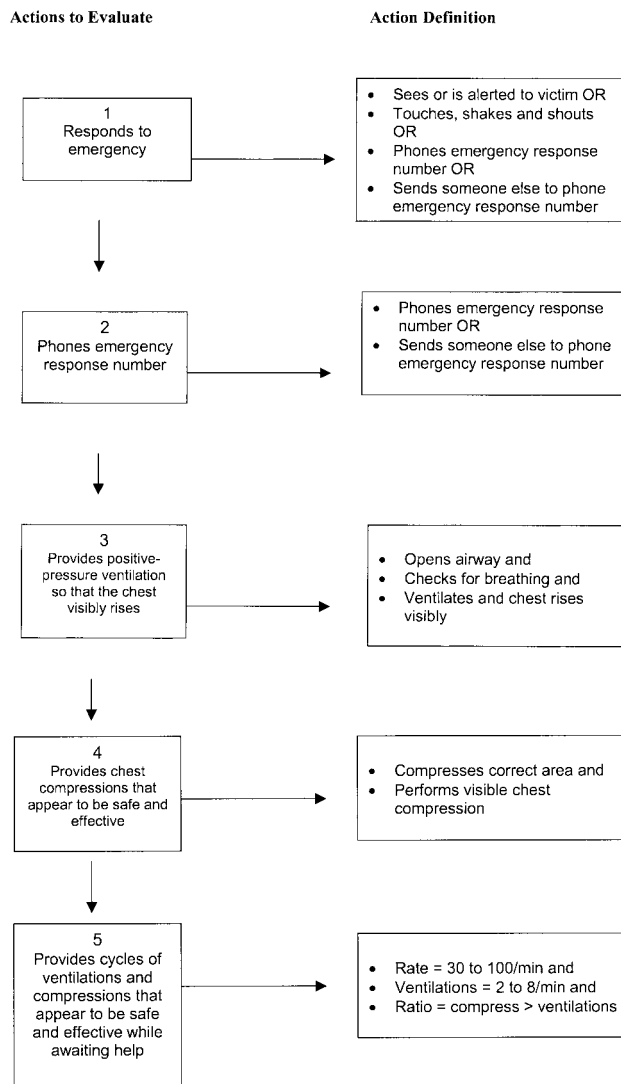


Figure 1. Utstein Education Template. Uniform definitions for reporting initial and remote outcomes from adult BLS training.

compression and ventilation skills, and emotional preparation for the capability to act in an emergency.

- CPR training of laypersons should follow an organized plan of implementation that targets those most likely to encounter victims of cardiac arrest as well as young persons such as schoolchildren. Access to training courses or self-instruction must be readily available in the community.
- The definition of specific characteristics and needs of each training group should be an initial step in all curriculum development.
- Because conventional CPR instruction has not been sufficiently effective in developing skills performance, other instructional methods must be considered, including video-assisted instruction when more effective or appropriate.
- Certification should be restricted to a statement of course participation.
- Trainers/facilitators (for courses for laypersons or health-care professionals) must have received appropriate instruction in facilitation learning and must attend training updates on a regular basis.

*References 9, 22, 33, 34, 44, 45–47, 57, 67, 72.

- Training should take place in an environment that is comfortable for learners and should use instructional methods that learners understand and use daily.
- The media should promote accounts and images of laypersons recognizing cardiac emergencies and intervening positively.
- Initial training must always include specific plans for refresher training.
- Research in CPR training must be encouraged and developed. The educational efficacy of new course content or methods should be demonstrated before the course is widely conducted.

3. BLS Training of Laypersons With a Duty to Respond

Until recently, 2 broad classes of rescuers were recognized: healthcare professionals and lay bystanders. The increased use of automated external defibrillators (AEDs) in the community has brought to the fore another important class: persons who are not healthcare professionals but whose occupation includes a duty of care that has been expanded to include BLS and defibrillation.

Symposium participants agreed on 3 important principles:

- (1) This group does require a different type of training course.
- (2) This course should be tailored to a specific occupational role.
- (3) The evaluation must be competence-based and tailored to the participant's occupational role.

The following are characteristics of laypersons with a "duty to respond":

- They have an increased probability of encountering someone in cardiac arrest.
- They are likely to be well motivated.
- They are likely to have only limited equipment available to them, ideally a pocket mask and an AED.
- They require training specific to their needs with particular attention to correct use of equipment.
- Their resuscitation training must be integrated into their occupational duties.

It was agreed that any training program should be developed on the basis of an understanding of the primary occupational role and integrated with it. Resuscitation should not conflict with nor deflect from other occupational duties. Students must understand the integration of training and its implications with their primary occupation, particularly when the 2 aspects of duty have very different connotations, for example, the police officer who may need to use a gun or a pocket mask. The training course should take into account the time constraints of the primary role. A conventional BLS course for laypersons, appropriately modified, would probably provide an adequate basis for training but require additional time for training in the use of pocket masks and AEDs. Any move toward providing a more complex course or teaching ALS/ACLS skills should be strongly resisted: simplicity must be the keynote.

Training could start in the classroom but should move quickly to scenario-based training through role playing within

the appropriate work-related context. For learners to achieve the required performance, the course must train to a high standard and learners must take refresher courses at regular intervals. All training must be integrated with the learner's primary occupational role. Training should be conducted by specially trained facilitators with training and resuscitation skills and experience in the learners' primary occupation. These qualities are essential to motivate the learner, achieve credibility, and understand the learner's specific occupational role. The learner's occupation may influence the manner in which conventional CPR must be used, for example, in commercial aircraft. Although employers should cover the time and cost of training, employees should do their part in showing that these expenses will be used well on the job.

Well-intentioned but ill-informed advice from bystanders who are healthcare professionals, especially those without experience in emergencies, is a frequent problem that can limit the effectiveness of first-responder interventions and must be addressed during training. Rivalry between professional peer groups is another concern that must be identified and diffused at an early stage if optimum benefit is to be attained. Healthcare professionals need to be aware of local first-responder groups, the type of training they receive, and their effectiveness and availability. Encouragement from healthcare professionals will help motivate lay rescuers who are first responders.

Summary of Specific Recommendations

- Resuscitation training programs for those with a duty to respond must be developed and integrated with an understanding of the learners' primary occupational roles.
- The training course should take into account the time constraints of the learners' primary role and can be based on a conventional BLS course for laypersons with additional time for special requirements related to automated external defibrillation and role-related issues.
- Training must be conducted to a high standard; regular refresher courses are required.
- Certification of participation is likely to be appropriate, but any statement on competence will depend on the circumstances and must be decided locally.
- Training should be conducted by facilitators with skills in training and resuscitation and experience in the learners' primary occupational roles.
- Trainers/facilitators must receive training in facilitating learning and must also be competent in assessment. This principle is applicable regardless of the level of the learners.
- The content and format of training needs frequent reevaluation.
- Quality control should be defined and scrupulously applied.
- The possibility of inappropriate advice from other healthcare professionals must be addressed during training, and rivalry between professional groups must be identified and countered.
- Good performance in real situations must be recognized and rewarded with positive feedback.
- Healthcare professionals must be aware of local first-responder groups.

4. Training Healthcare Professionals in Basic Life Support

Healthcare professionals are reluctant to attend BLS courses, although numerous studies have shown that they are not uniformly proficient in BLS skills.⁷⁴ Their level of skills retention is variable and generally poor.^{56,75–79} Requirements for BLS training for healthcare professionals vary significantly between countries. Some require certification or appropriate credentials, whereas others do not require certification or formal training.

Training of healthcare professionals should be tailored to learners' settings (prehospital versus in-hospital), individual roles (lone rescuer, team member, team leader), and educational background (doctor, nurse, paramedic). Specific work roles must also receive appropriate consideration. For example, the role, experience, expectations, and motivation of an emergency department nurse are likely to be different from those of a ward nurse; similar considerations should be given to an emergency department physician, whose responsibilities differ from those of a physician with an office-based practice. The elements of a course for healthcare professionals will therefore vary in format, content, and style, but the course objectives and cognitive and psychomotor evaluation should remain the same.

All healthcare professionals should be able to demonstrate competency in the skills of BLS.^{77,78} Healthcare professionals should receive their initial training in BLS as students. In some environments the use of peer instruction (for example, doctor to doctor or nurse to nurse) may increase acceptance of BLS training.⁷⁹ Self-instruction is acceptable, provided competence is achieved. Uniform evaluation of BLS competencies is required to assess the knowledge and skills of healthcare professionals.⁸⁰

Course design and training should adopt validated educational principles.⁷ Course content and educational messages should be tailored to each group, with simplicity as an acceptable goal,⁷ but training should include skills that the healthcare professional would generally need, including the use of adjunctive equipment. Examples of these special requirements are 2-person CPR; special resuscitation situations, such as trauma, drowning, and pregnancy; and adjuncts such as bag masks and AEDs. Use of realistic scenarios is important for contextual learning and relevance. Additional evaluation of different educational methods for use with healthcare professionals is needed.

Summary of Specific Recommendations

- All healthcare professionals should be able to demonstrate competency in the skills of BLS.
- All healthcare professionals should also demonstrate their skills on a regular basis. Evidence is needed about the frequency of such demonstrations for a particular situation; currently a detailed general statement on frequency cannot be made.
- Courses and educational format should be based on validated educational principles.
- Content and messages should be tailored to each group, with simplicity as an acceptable goal.

- Certification of participation is likely to be appropriate, but a statement on competence will depend on circumstances and must be a matter for local decision.
- Healthcare professionals must receive their initial training in BLS while students.
- Use of peer instruction (eg, doctor to doctor or nurse to nurse) may improve acceptance of BLS training in some settings. Self-instruction is also acceptable. Competence should be demonstrated, regardless of the method of training used.

5. Training Healthcare Professionals in Advanced Skills

Courses in advanced resuscitation skills are now well established in many countries.⁸¹ When these courses were first introduced, much instruction was didactic and lecture based. Although the emphasis has changed to action-oriented learning, even more responsibility should be placed on learners themselves. To promote this change, the term *instructor* should be changed to *facilitator* or another term compatible with peer-directed education.

Evidence is still needed to demonstrate conclusively the benefits of advanced training in terms of educational and patient outcomes. Although there is evidence that skills retention after courses is unsatisfactory, most studies are 15 to 20 years old. Resuscitation outcome is improving, however, and this change is concurrent with implementation of courses in ALS/ACLS. The BRESUS report⁸² drew data from selected hospitals in the United Kingdom from 1985 to 1987, before organized ALS training had begun. An overall survival-to-discharge rate of 17% was reported. Simultaneously, 21% of those who required defibrillation survived. By the time of the 1997 United Kingdom national audit,⁸³ when more than 50 000 persons had received training in ALS skills, overall survival to discharge had increased slightly to 17.6% but was 43% for the more reliable comparator of those treated for ventricular fibrillation. It seems reasonable to ascribe at least some of this improvement to better resuscitation training. Evidence also exists in other areas that ACLS training can improve clinical outcomes. For example, a study of anesthetists' management of ventricular fibrillation in the operating room⁸⁴ showed that ACLS training led to significantly better adherence to protocols.

The relevance of some components of ALS/ACLS courses is questionable, including assessment of individual skills, performance of lone rescuers, classroom performance, and written examination scores. Performance in the clinical environment and within a team is more relevant. Many courses provide combined training in BLS and ALS/ACLS skills; in these courses, CPR is integrated with defibrillation skills, use of AEDs, management of airway and ventilation, transcutaneous pacing, and intravenous techniques. Some skills, such as tracheal intubation, cannot be taught in a 2- or 3-day course. If required, it is more appropriate for these skills to be attained in a clinical setting under supervision (and documented) elsewhere. Attention should be given to the suitability of course participants and the level of prior skill required.

There are significant international differences in the use of multidisciplinary teaching for advanced skills, a practice that has both advantages and disadvantages. It is relevant to know

who is taking courses and why they are doing so. In the European Resuscitation Council (ERC) ALS course, all participants are taught all relevant skills. Thus, even relatively inexperienced nurses are taught to be team leaders on the assumption that role-play offers different useful perspectives. Conversely, in the AHA ACLS course, participants are taught only those skills needed for their own clinical practice. Facilitators with multidisciplinary expertise can provide more realism and a wider knowledge of skills that might be required, but this approach also requires more knowledge on the part of students. Having participants play multidisciplinary roles can aid teamwork, enhance communication, and encourage mutual learning. But participants' level of knowledge might not be clear to the facilitator, authority gradients can be troublesome, and some participants will learn skills they will not be permitted to use.⁸⁵ Although there is evidence in aviation medicine and military training of the relative advantages of these approaches, no specific evidence of this exists in resuscitation. A mix of single-profession skills stations followed by multidisciplinary teamwork training in a mock arrest may be an optimal compromise in some circumstances.

Training in small groups is probably advantageous. Such training is more interactive but also more demanding of the facilitator's time. The optimum size of a skills station may depend on the skill being taught but should generally range from 4 to 8 participants. At present there is no direct evidence to support this belief in resuscitation education, but meta-analyses in the continuing medical education literature show that large-group lecture-based teaching is relatively ineffective in changing practice.

Scenario-based teaching allows useful repetition of sequences and variations on themes and forces the facilitator to prepare for the course. It requires careful scripting and skilled supervision and is time consuming. For healthcare professionals, however, it should be a central part of the program.

When compared with instructor-directed training, high-fidelity simulation-directed instruction provides the advantage of more interaction with the "victim" and less personal interaction with the facilitator.^{86–89} Real-time physiological measurements create realism. High-fidelity simulation should also provide accurate and relevant presentations, reliable tests, more interest to students, and adaptability to individual skills needs. The facilitator can focus on aspects such as team leadership and communication; future courses may require fewer support staff. These benefits must be weighed against increased cost, more intensive facilitator training, and increased time. A cost-benefit analysis should be undertaken to assess variations in quality related to technology. Most evidence in favor of simulation is derived from experience in the fields of aviation, the armed services, and robot surgery. Little direct evidence is derived from health care.

Crew resource management is another commonplace strategy in aviation that has implications for resuscitation medicine. It aims to improve the quality of communication, leadership, coordination, delegation, use of information, and prioritization,⁹⁰ which is believed to reduce errors, improve handling of critical incidents, and promote teamwork. The importance of "crisis" resource management may be suffi-

cient for it to be adopted as a training module now with consideration toward expanding it into a separate course in the future.

The introduction of medical emergency teams has highlighted more opportunities for progress.^{91,92} An initial malignant arrhythmia that is nonshockable is observed in >60% of in-hospital cardiac arrests. The prognosis for these patients is very poor when they experience a cardiac arrest; up to 80% demonstrate deteriorating physiology with hypoxia, hypotension, or reduced consciousness in the few hours before cardiac arrest.^{93,94} Outcome is more likely to be improved by prevention of cardiac arrest than by attempted resuscitation afterward. Currently the AHA ACLS course focuses on patient management after cardiac arrest (particularly ventricular fibrillation arrest). The ERC ALS course includes content on recognition of critically ill patients and prevention of cardiac arrest. Although additional emphasis on this aspect of resuscitation adds to a crowded course curriculum, it is justifiable for in-hospital healthcare providers, even if additional time is required for implementation.

Summary of Specific Recommendations

- Training should move away from large-group, lecture-based courses to small-group, scenario-based, facilitated, interactive teaching.
- High-fidelity simulation-directed training should increasingly supplement instructor-directed training in ALS/ACLS.
- Crisis resource management and communication should be a component of ALS/ACLS training, either as an add-on module or a separate course.
- Course content may be extended to take into account specific emergencies that participants are likely to encounter, and priorities may be adjusted accordingly.
- Training of medical emergency teams in prevention of cardiac arrest and treatment of prearrest conditions is recommended, especially for those working in hospitals.
- Certification of course participation is probably appropriate, but any statement on competence will depend on circumstances and must be a matter for local decision.

6. New Technologies in Training

The general disappointment in skills acquisition and retention after conventional resuscitation training programs has shown the need for a change in teaching methods and reduced reliance on instructors.* Ideally instructors should be replaced by facilitators who complement the new educational technology. Simple audio prompting of chest compressions and rescue breathing has been a remarkably effective tool for improving CPR training and performance.^{62,95–97} In addition, increased use of video instruction has proved valuable,^{41,53–56,58–60} but new technologies are becoming available. Some are relevant to large-scale training of lay rescuers, whereas others are suited to the more complex requirements of healthcare professionals and others in occupations with a duty to respond to medical emergencies.

In the first of these categories, automated feedback during training warrants careful consideration.^{95,96} The voice-assisted manikin is an example of a technological innovation

*References 9, 19, 24, 25, 28–30, 44–48.

designed to improve skills acquisition and retention.^{51,98–103} In the second category, major developments in simulation, ranging from CDs for use in personal computers to highly developed artificial reality, offer the prospects of far more effective learning experiences than have been available until now.^{88–90,104,105}

Technological educational support can also provide a tool for research to improve CPR performance, particularly because of the quality of objective and recorded information available on variables such as compressions, ventilation rates, and ratios.^{98–103}

Dangers are common to all technological advances, however. All too often technology drives the goals, whereas clinical and educational objectives must drive the technology. Moreover, technology must not be seen as a panacea for the problem of poor skills retention. The deterioration in skills that is common after conventional training will remain a challenge,⁵¹ although one that might be met more readily if self-instruction devices are available and used.¹⁰⁶ Some concern exists about the inevitable evolution of relevant clinical data and treatment variables included in both simple and sophisticated educational devices. These can be readily updated in computerized equipment, and manufacturers must recognize this need. But economic realities in many areas of the developing world will dictate the use of old manikins for many years.

Telephone prearrival instruction (telephone-directed CPR) is not a new technology,¹⁰⁷ but it is one that has not been universally used. It is especially valuable in areas where training of laypersons in resuscitation is limited or unavailable. To a degree, poor use of telephone-directed CPR may be attributable to inadequate methodology and poor empathy between controllers and anxious bystanders who are seeking help. The potential for improving this service must be recognized.

Novel technological aids are likely to be deployed in the future, possibly in association with AEDs. But some risk is associated with use of these devices if they are encountered for the first time during a real cardiorespiratory arrest: the anxiety and panic that characterize a cardiac arrest situation may be a barrier to understanding the unfamiliar. On the other hand, useful instructional aids that improve performance during training should be available to support performance during cardiopulmonary resuscitation for a real cardiac arrest as well. An ideal solution to these concerns, especially in some situations, would be to have available similar aids (identically configured) available during both training and resuscitation attempts. For example, the audio guidance used in training^{49,62,95–97,106} could be incorporated into clinical bedside monitors, AEDs, or even cellular telephones.

Summary of Specific Recommendations

- New technologies will have an increasing and important role in resuscitation training, and use of these technologies in all levels of instruction must be encouraged.
- Technology must be appropriate to training needs. For the lay public, technology should be simple and inexpensive. For those with a duty to respond, technology should—where possible—be available for both training and real

emergencies. For healthcare professionals, more sophisticated aids such as virtual reality should be explored and more widely used.

- As with all new developments, technology must not be accepted uncritically. It must be subject to the same sorts of scrutiny and evaluation now recommended for any change in course content or delivery.
- Telephone-directed CPR is a technology already available in many areas of the world. Providers of this service should be encouraged to act as BLS facilitators to give greater insight into the problems faced by lay rescuers.

7. Measurement of Teaching Outcomes

Teaching strategies should be evaluated and compared on the basis of how well learners achieve predefined teaching outcomes.^{19,21–30,42} Strategies that do not achieve the intended outcomes must be discarded, and those that succeed should dominate training.^{22,31} Evaluation of resuscitation training serves many purposes: to identify for both student and instructor any areas in which the student needs help, to assess overall effectiveness of a course, to identify and troubleshoot any problems within a course, and for research into the most effective teaching methods. The overall intention of evaluation must be to improve educational outcome, thus providing every student with the opportunity to acquire the skills needed to respond appropriately in a real arrest.

Reliable assessment methods are required to record students' knowledge and skills in CPR. The higher the level of performance, the greater the prospects for survival of future victims.^{19,22,24,26,28–30} At present most assessments are conducted by the instructors responsible for the course and tend to be subjective, prone to observer error, and overoptimistic, whether based on written test or practical skills demonstration alone.⁷⁵

No single method of assessment is suitable for every circumstance, but all should be based on core skills such as those outlined above and should make use of standardized operational definitions.⁷⁵ Assessment must be related to learning objectives and reflect performance objectives that might influence real interventions. Details have not yet been agreed on, but consensus and widespread adoption must be a priority for future work. Assessment can be considered at the following 3 levels:

- *For individual laypersons.* Instructor assessment of skills acquisition may be an acceptable compromise, particularly because an attendance certificate is generally issued rather than a pass or fail mark. But instructors or facilitators should be trained for the task and aided when possible by manikins that measure basic performance by sound, lights, printouts, or other devices. Training in assessment skills should be mandatory for all who seek to instruct or conduct training classes. An outline of key markers of performance is discussed beginning on page 2576 and shown in Figure 1.
- *For healthcare professionals.* Although skills performance tests will be necessary, validated written tests also may be appropriate for those with a duty to respond and who require a formal certificate of competence. Written tests may also be used for self-assessment, research, and quality

control and to ensure completion of precourse reading. Research may show how these tests can serve as cost-effective substitutes for practical skills testing in these settings. Ideally there should also be measures of motivation that will lead to appropriate action in an emergency, which is clearly more difficult to obtain.

- *For research.* A more sophisticated and detailed assessment tool is needed to determine the effectiveness of an educational intervention in providing the best skills acquisition and retention attainable. For research purposes, such an assessment will involve analysis of CPR performance to a degree that would be impractical for routine use. The various skills used in lifesaving procedures must be scored with weighting that reflects the relative importance of each and by the most objective method possible. Objective mechanical measurement supplemented by video assessment is strongly recommended for both research and quality control purposes to help achieve the objectives outlined above, with the potential additional advantages of independent scoring and later review.

Templates should be introduced for research or evaluation of educational interventions designed to improve resuscitation performance for both BLS and ALS. Possible interventions include new courses or course components, educational strategies, and new technology. The target population should be specified, for example, schoolchildren, families of high-risk patients, the general public, laypersons with a duty to respond, or healthcare professionals. Sufficient details on the educational intervention are needed for replication and assessment of generalizability. The template should specify which educational outcomes are being tested (see section 1 beginning on page 2576) and, when relevant, should indicate whether the intervention has an effect on willingness to train and the quality likely to be achieved in any response. When research involves assessment of core objectives, testing should take place immediately after instruction and, ideally, 6 months later. Symposium participants made no attempt to agree on a suitable template, and although it may not be practical to have one model for all purposes, one group did discuss the merits of templates used in recent studies.^{19,22,23,26,28–30} Composites that take into account these discussions are shown as examples in Appendices 1 and 2.

Appendix 1 is an update of a previously published evaluation method with acceptable levels of reliability and validity.²³ This method requires a very brief evaluation of each subject and requires only 1 person to set up and conduct evaluations. An instrumented manikin is used to assess compression and ventilation skills. Use of the checklist without an instrumented manikin could produce misleading results.

The main purpose of this report was to make the checklist consistent with the *ECC Guidelines 2000*.^{108,109} More specifically, the updated checklist reflects the guidelines for lay rescuers implemented in AHA or other programs. Instructions for the evaluator, the script to be read to subjects, and definitions have also been updated to improve subject compliance and increase method reliability.

Procedures for implementation of the checklist differ from other evaluation methods that have been established over the years in that subjects receive no prompting from the evaluators. Instead, once the scenario is read, the evaluators do not provide any information about the “victim’s” condition. Subjects are told to rely on their own assessments of the manikin. This choice has evolved from 2 observations. First, subjects in conventional training courses display conditioned behavior. Specifically, cues from the instructor or the evaluator signal each step. In the absence of prompts, conventionally trained subjects frequently confuse steps and make other errors. The second observation is that when the evaluators are CPR instructors, the opportunity to give a prompt can very easily lead to coaching (something as simple as repeating “no pulse” if the subject does not start compressions). Of course, training in conducting evaluations should discourage such interactions, but complete elimination of coaching is difficult to achieve.

The checklist method can be modified and enhanced by use of videotaped performances. If videotape is available, the evaluators need not be CPR instructors and require only brief instruction. Videotaped performances can be observed and rated by expert evaluators. Videotape can also be used to assess the extent of agreement between raters without bringing more observers into the evaluation and having to shield observers from one another.

Appendix 2 was developed in Cardiff, Wales, and is related to both BLS and use of an AED. The principle illustrated is that of breaking complex psychomotor skills into discrete components that can be evaluated. The performance of each component was “scored” against well-defined criteria. The scoring system was validated by research workers and a paramedic trainer who watched videotapes of volunteers performing CPR on a manikin (Resusci Anne, Laerdal Medical, Norway). They combined their assessment of performance with the results of printouts from a recording Resusci Anne. A high level of agreement was achieved.¹¹⁰ Further development of the method might involve weighting of the scores by the importance of each skill component in achieving a successful outcome from a resuscitation attempt. At present, however, such information does not exist but may be an area for additional research.

Summary of Specific Recommendations

- Video should be recognized and more widely adopted as a useful assessment tool for research and quality control purposes to be used with objective mechanical measurements.
- Outcome measurements must reflect core objectives identified for specific learner groups.
- Core objectives tested for research purposes should involve performing the same lifesaving skills at the end of training and 6 months later.
- In general, written tests should not be used for CPR courses for laypersons but should be considered especially for healthcare professionals and laypersons with a duty to respond.

- All instructors should acquire skills in assessment of learner performance.

Appendix 1

Room letter: _____ Video number: _____ Time code at start of test: _____

Subject ID: _____ Subject name: _____

____ Checks unresponsiveness by tapping or shaking manikin and shouting

____ Calls for help or indicates help should be called

____ Opens airway using head tilt–chin lift

____ Checks breathing for no more than 10 seconds

____ Attempts to give at least 2 breaths so that chest rises at least once and no more than twice

____ Checks for signs of circulation for no more than 10 seconds

____ [*Attempts a pulse check*]

____ Places long axis of palm on lower half of sternum [*see definitions to note method used* _____]

____ Gives at least 13 and no more than 17 compressions

____ Opens airway using head tilt–chin lift

____ Attempts at least 2 breaths so that chest rises at least once and no more than twice

____ Repeats cycles at least 2 more times

____ Opens airway between *every* set of compressions using head tilt–chin lift

____ Attempts breaths with at least 1 chest rise between *every* set of compressions

____ Locates compression position between *every* set of compressions

____ Checks for signs of circulation for no more than 10 seconds

____ Resumes CPR

Overall subjective rating of CPR performance (check only one)

____ Outstanding

____ Very good

____ Competent

____ Questionably competent

____ Not competent

Figure 2. Checklist.

Checklist Definitions

Subject checks unresponsiveness. Subject is close to manikin. Subject shouts “Are you all right?” (or a similar phrase). Subject taps or gently shakes manikin during this step.

Sequence: The unresponsiveness check must precede any intervention, including opening the airway.

Subject calls or phones for help or sends someone to call or phone for help: Subject either simulates a phone call or tells “bystander” to phone 911 (or other emergency response number), phone for an ambulance, or another clear instruction (getting an AED is not required nor is it acceptable to get an AED *without* calling or phoning for help).

Sequence: This must occur after a check of unresponsiveness and before starting ventilations. If there is no check for unresponsiveness, the call for help must precede all other steps.

Subject opens airway using head tilt–chin lift: Subject kneels beside the manikin near shoulders and uses the palm of one hand to apply firm backward pressure on forehead and uses the other hand to lift the bony part of the lower jaw near the chin. There is obvious movement of the head from the neutral position. The nose may or may not be pinched.

Sequence: This must precede checking for breathing.

Subject checks breathing. Subject places his or her ear near mouth and nose of the manikin and looks at manikin chest. The breathing check should take no more than 10 seconds. Do not count breathing check if the subject has not opened the airway.

Sequence: This must occur before any breaths are given.

Subject attempts 2 breaths so that the chest rises at least once and no more than twice: Subject maintains an open airway (as above), pinches the nose shut, places his/her mouth over mouth of manikin, and exhales into manikin. The manikin chest rises visibly at least once and no more than twice. Do not count breaths if subject has not opened airway.

Sequence: Must precede any chest compressions.

Subject checks for signs of circulation. Subject pauses after first 2 breaths and looks, listens, and feels for breathing AND scans the manikin for signs of movement. The check for signs of circulation should take no more than 10 seconds (verify this with a clock or watch). To get a check, the subject must perform the look, listen, and feel component *and* the scan the manikin component.

Sequence: Must follow initial 2 breaths and precede any chest compressions.

(*Subject checks pulse: Pulse check is not part of the BLS standards for lay subjects; we are recording it to see if subjects carry the skill over from previous CPR training or other experience. Give a check for any effort to check pulse.*)

Subject locates compression position on lower half of the sternum: Subject aligns the long axis of the palm of one hand directly on the lower half of the sternum. If palm is located primarily in the upper half of the sternum or a significant part of the palm is below the end of the sternum, do not give a check for this skill. If the palm is rotated incorrectly, do not count it. (No single method need be used for this step, but use the separate line on the right to record a “1” if the subject traces the outline of the ribs and finds a place 1 finger above where the ribs come together; record a “2” if the subject finds a place 2 fingers above the xiphoid; record a “3” if the subject bares the chest and visually finds a point on the sternum between the nipples.)

Sequence: Must precede any compressions.

Subject gives at least 13 and no more than 17 compressions. Compressions must result in visible depression and release of the sternum.

Subject attempts to give 2 breaths. Chest must rise at least once and no more than twice (as above).

Subject repeats cycles at least 2 more times. Performs at least 2 more cycles of a minimum of 13 and a maximum of 17 compressions interspersed with breathing attempts after each cycle.

Subject opens airway between every set of compressions using head tilt–chin lift: As above, but check only if done for *all* additional sets of compressions and ventilations.

Subject attempts at least 2 breaths so that chest rises at least once and no more than twice between every set of compressions: As above, but check only if done for *all* additional sets of compressions and ventilations.

Subject locates compression position between every set of compressions. As above, but check only if done for *all* additional sets of compressions and ventilations. *It is not necessary to record the method used beyond the first cycle.*

Subject checks for signs of circulation. As above but after the third, fourth, or fifth cycle of compressions and ventilations (including looking, listening, and feeling for breathing *and* scanning the manikin for signs of movement). Must have both the look, listen, and feel component and the scan the manikin component to get a check. Subject should stop and reassess the victim for no more than 10 seconds.

Sequence: Must follow at least 3 and no more than 5 cycles of compressions and ventilations

Subject resumes CPR: After reassessment, subject resumes CPR, including both compression and ventilations.

Overall Subjective Rating Definitions

Outstanding. All skills were performed very well with no errors and almost exactly as described in the standards. CPR performed in this way is likely to be effective and the victim would not be endangered.

Very good. All skills were performed competently, although improvement is possible. Errors may be minor; most were corrected.

No serious errors in technique or sequence were made. CPR performed in this way is likely to be effective and the victim would not be endangered.

Competent. Skills were crude and sometimes failed to meet standards; several steps may have been out of sequence or were skipped, and/or some errors went uncorrected, although any serious errors were corrected. CPR performed in this way would probably be effective and the victim would not be endangered.

Questionably competent. Skills were crude and often failed to meet the standard and/or serious errors were left uncorrected. There may have been serious errors in sequence or delays. The chest was compressed and some ventilations resulted in chest rise. CPR performed this way might be effective. Errors might endanger the victim.

Not competent. Skills were performed poorly or not at all; errors might seriously endanger a victim. CPR may not have been performed. Efforts, if any, did not result in BOTH chest rise and compression of chest. CPR performed in this way would probably not be effective and/or the safety of the victim would be endangered.

Appendix 2

The Cardiff Test of BLS and AED Version 3.1: Assessment Guidelines

Each action should be performed within its numbered STEP but need not necessarily be in order within that STEP, except for opening the airway, which must be performed before checking for breathing. Also, Phone EMS (eg, 911, 999, or 112) must be performed before commencement of CPR.

Psychomotor Skills

Part 1: Initial Assessment

STEP 1—Safety of rescuer and victim

DESCRIPTION

Before starting a resuscitation attempt, the rescuer must rapidly assess the scene for dangers. The scene must be made safe before the rescuer continues with a resuscitation attempt.

GUIDE FOR MARKING

Video assessment

Scenario: Electrical danger using a “dummy” electric cable that is in contact with the manikin’s hand.

2. Performed—Rescuer must identify this hazard and attempt to eliminate the danger (for example, isolating the electrical source at a mains or use of a nonconducting object, such as a wooden broom handle, to remove the electrical contact from the victim).
1. Not performed—Rescuer does not identify the danger and actually puts himself or herself at risk by touching the patient before removing the danger.

STEP 2—Check responsiveness

DESCRIPTION

This check is carried out to assess whether the victim is conscious. It involves gently shaking the victim’s shoulders while asking loudly, “Are you all right?”

GUIDE FOR MARKING

Video assessment

Talk. Rescuer attempts some form of verbal communication with victim, for example, asking “Are you all right?”

2. Performed—Marker can actually hear the rescuer attempting verbal communication.
1. Not performed—Rescuer makes no effort at verbal communication.

Shake. Rescuer places hands on the victim’s shoulders and shakes gently.

3. Performed adequately—Rescuer places hands on the victim’s shoulders and shakes gently.
2. Not performed—Rescuer makes no attempt to gently shake the shoulders of the victim.

1. Potentially dangerous (this is awarded the lowest score in this particular assessment because of the potential harm that could be caused by the rescuer)—Rescuer violently shakes the victim’s shoulders. Violent shaking involves the victim’s head moving upwards and downwards, colliding with the ground, or moving from side to side. These movements could cause head or cervical spine injuries.

Shout for help. If the victim does not respond during the above checks, the rescuer must then shout for help.

2. Performed—Marker can actually hear the rescuer loudly call for help.

1. Not performed—Rescuer does not call for help.

STEP 3—Airway and breathing

DESCRIPTION

Method to open the airway

Rescuer places one hand on the victim’s forehead and gently tilts the head back (the thumb and index finger are kept free to be able to close the victim’s nose if rescue breathing will be required).

Rescuer removes any visible obstructions from the victim’s mouth (for example, dislodged dentures).

Rescuer lifts the victim’s chin. This is done by placing 2 fingertips under the point of the victim’s chin (on the bone, not the soft tissue) and gently lifting the chin.

Method to assess breathing

Rescuer keeps the victim’s airway open and checks for breathing (more than an occasional gasp or weak attempts at breathing). This is performed by looking for chest movement, listening at the mouth for breath sounds, and feeling for breath with his or her cheek. The “look, listen, and feel” method should be done for no more than 10 seconds.

GUIDE FOR MARKING

Video assessment and use of a stopwatch

Open airway

5. Performed as instructed—Rescuer performs the procedures as instructed by a trained emergency medical dispatcher.
4. Performed as per ERC guidelines—Rescuer performs the procedures described above.
3. Performed other—Rescuer performs airway maneuver but achieves head tilt and chin lift using methods different from the ones described above.
2. Visibly attempted—Rescuer attempts to open the airway but fails to achieve any head tilt and chin lift.
1. Not performed—No attempt is made to open the airway.

Check/clear airway

2. Performed—Removes any visible obstruction from the victim’s mouth, for example, dislodged dentures.
1. Not performed—No attempt is made to check/clear the victim’s airway.

Check breathing (look, listen, and feel)

4. Correct—Rescuer performs the procedures described above. Two out of 3 actions can be marked as correct.
3. Incorrect—Rescuer attempts to check breathing but does not use the look, listen, and feel method.
2. Ineffective—Rescuer performs check without having opened airway.
1. Not performed—Rescuer makes no attempt to check for breathing.

STEP 4—Phone EMS (eg, 911, 999, 112)

DESCRIPTION

On identifying that the victim is not breathing, the rescuer should either send someone for help or, if alone, leave the victim and go for help. Help must be in the form of a telephone call to 999 requesting an ambulance to attend.

ID No.	Marker
Test No.	Test Type
Tape No.	Counter No.

Scenario: Collapsed adult victim, AED present

Psychomotor skills

Part 1: Initial Assessment

STEP 1 Safe approach <i>(video)</i>	2. Performed	1. Not performed			
STEP 2 Check responsiveness					
Check responsiveness: shout <i>(video)</i>	2. Performed	1. Not performed			
Check responsiveness: shake <i>(video)</i>	3. Performed adequately	2. Not performed	1. Potentially dangerous		
Shout for help <i>(video)</i>	2. Performed	1. Not performed			
STEP 3 Airway & breathing					
Initial airway opening <i>(video)</i>	5. Performed as instructed	4. Performed as per ERC guide	3. Performed other	2. Visibly attempted	1. Not attempted
Initial check/ clear airway <i>(video)</i>	2. Performed	1. Not performed			
Initial breathing check <i>(video)</i>	4. Correct	3. Incorrect	2. Ineffective Airway not opened	1. Not attempted	
STEP 4 Phone EMS <i>(video)</i>	3. Phone ambulance	2. Get help: unspecified	1. Not performed		
STEP 5 First rescue breaths <i>(video)</i>					
First breaths: open airway <i>(video+PDF)</i>	4. Opened as ERC guide or maintained	3. Opened: other or maintained	2. Visibly attempted	1. Not performed	
Two initial rescue breaths delivered <i>(video+PDF files)</i>	4. Successful: 2 inflations given in 5 or fewer attempts	3. Incorrect: more than 5 attempts or more than 2 successful inflations	2. Ineffective: attempted but unsuccessful or fewer than 2 attempts	1. Not performed	
Two initial rescue breaths: average inflation volume (in liters) <i>(PDF file+VAM)</i>	7. 0.7–1.0	6. 1.0–1.3	5. 0.4–0.7	4. >1.3	
	3. <0.4	2. 0	1. Not attempted	Insert exact mean score: _____	
STEP 6 Initial check for signs of circulation					
Initial check for signs of circulation: open airway <i>(video)</i>	4. Performed as ERC guide or maintained	3. Performed: other or maintained	2. Visibly attempted	1. Not attempted	
Initial check for signs of circulation (other) <i>(video)</i>	4. Correct	3. Incorrect	2. Ineffective: airway not opened	1. Not attempted	
Initial pulse check <i>(video)</i>	3. Not Performed	2. Checked carotid	1. Checked other		

(If rescuer does not use AED move to Part 3)

Part 2: AED Sequence Shock 1 to 3

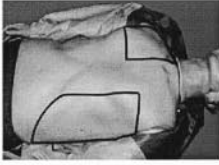
STEP 7 Switch on AED <i>(video)</i>	2. Performed	1. Not performed			
STEP 8 Defibrillation electrode location/connection <i>(video)</i>					
	7. Both electrodes completely in areas	6. One electrode completely in area, one crossing the border of area	5. Both electrodes crossing the border of area	4. One electrode completely in the area, one electrode completely outside area	
	3. One electrode crossing the border of area, one completely outside the area	2. Both electrodes outside the areas	1. Electrodes not attached or not plugged into AED		
STEP 9 Visual & verbal 'hands off' checks during AED analysis (shock 1) <i>(video & VAM)</i>	3. Verbal AND visual checks performed	2. Verbal OR visual check performed	1. Not performed		
(Contact with manikin provoked by researcher in a standardized manner)					
STEP 10 Checks safety of researcher <i>(video & VAM)</i>	2. Rescuer asks researcher to stand clear of the victim	1. Rescuer fails to ask researcher to stand clear of the victim			
(1 st shock advised)					
STEP 11 Hands off safety check before pushing 'shock' button (shock 1) <i>(video)</i>	4. Verbal AND visual checks, shock button pushed	3. Verbal OR visual check, shock button pushed	2. No safety checks and shock button pushed	1. Shock button not pushed	
STEP 12 Time to first shock (in seconds) <i>(video)</i>	Insert time: _____				
STEP 13 Visual & verbal 'hands off' checks during AED analysis (shock 2) <i>(video & VAM)</i>	3. Verbal AND visual checks performed	2. Verbal OR visual check performed	1. Not performed		
(2 nd shock advised)					
STEP 14 Hands off safety check before pushing 'shock' button (shock 2) <i>(video)</i>	4. Verbal AND visual checks, shock button pushed	3. Verbal OR visual check, shock button pushed	2. No safety checks and shock button pushed	1. Shock button not pushed	
STEP 15 Visual & verbal 'hands off' checks during AED analysis (shock 3) <i>(video & VAM)</i>	3. Verbal AND visual checks performed	2. Verbal OR visual check performed	1. Not performed		
(3 rd shock advised)					
STEP 16 Hands off safety check before pushing 'shock' button (shock 3) <i>(video)</i>	4. Verbal AND visual check, shock button pushed	3. Verbal OR visual check, shock button pushed	2. No safety checks and shock button pushed	1. Shock button not pushed	
(After 3 shocks)					
STEP 17 Check signs of circulation					
Post-shock check for signs of circulation: open airway <i>(video)</i>	4. Performed as ERC guide or maintained	3. Performed: other or maintained	2. Visibly attempted	1. Not attempted	
Check signs of circulation <i>(video)</i>	4. Correct	3. Incorrect	2. Ineffective Airway not opened	1. Not attempted	
Pulse Check <i>(video)</i>	3. Not Performed	2. Checked carotid	1. Checked other		
(Researcher indicates there are NO signs of circulation)					

Figure 3.

Part 3: CPR Sequence

Part 4: AED Sequence Shock 4

STEP 18 Perform CPR (video & VAM)				
	3. Performed as advised by AED	2. Performed CPR only	1. Not performed	
STEP 19 Ventilation				
Average inflation volume (in liters) (VAM)	7. 0.7–1.0	6. 1.0–1.3	5. 0.4–0.7	4. >1.3
	3. <0.4	2. 0	1. Not attempted	Insert exact mean score: _____
STEP 20 Ventilation				
Average number of inflations delivered (VAM)	Insert number: _____			
STEP 21 Hand positioning for chest compressions)				
Total number of compressions delivered (VAM)	Insert number: _____			
Hand position too low (dangerous) (VAM)	Insert number: _____			
Incorrect hand position (VAM)	Insert number: _____			
STEP 22 Compression				
Average compression rate (VAM)	6. 90–110	5. 110–120	4. 80–90	
	3. >120	2. <80	1. Not attempted	Insert exact mean score: _____
STEP 23 Compression				
Average number of compressions delivered (VAM)	Insert number: _____			
STEP 24 Compression				
Average compression depth (in mm) (VAM)	Insert number: _____			
STEP 25 Compression				
Compression to Rescue breath Ratio 15:2 (video & PDF file)	4. Correct	3. Incorrect Specify:	2. Compression only	1. Rescue breaths only

(AED indicates "check for pulse")

STEP 26 Check signs of circulation				
Open airway (video)	4. Performed as ERC guide or maintained	3. Performed—other or maintained	2. Visibly attempted	1. Not attempted
Check signs of circulation (video)	4. Correct	3. Incorrect	2. Ineffective: airway not opened	1. Not attempted
Pulse check (video)	3. Not performed	2. Checked carotid	1. Checked other	

STEP 27 Visual & verbal "hands off" checks during AED analysis (shock 4) (video & VAM)		
3. Verbal AND visual checks performed	2. Verbal OR visual check performed	1. Not performed

(4th Shock advised)

STEP 28 Hands off safety check before pushing 'shock' button (shock 4) (video)				
4. Verbal & visual check, shock button pushed as directed	3. Verbal or visual check, shock button pushed as directed	2. No safety checks and shock button pushed as directed	1. Shock button not pushed as directed	

STEP 29 Check signs of circulation				
Open airway (video)	4. Performed as ERC guide or maintained	3. Performed—other or maintained	2. Visibly attempted	1. Not attempted
Check signs of circulation (video)	4. Correct	3. Incorrect	2. Ineffective: airway not opened	1. Not attempted
Pulse check (video)	3. Not performed	2. Checked carotid	1. Checked other	

(Researcher indicates that there ARE signs of circulation)

STEP 30 Sequence performed in order? (video)		
2. Performed in correct order	1. Performed in incorrect order	

COMMENTS

Figure 3. The Cardiff Test of BLS and AED, Version 3.1.

Scenario: A "dummy" telephone will be available for the rescuer to use. The rescuer will be informed that he or she is a lone rescuer.

GUIDE FOR MARKING

Video assessment

3. Phone 999 for ambulance—Rescuer uses "dummy" telephone to dial 999 and calls for an ambulance.
2. Get help (unspecified)—Rescuer calls for help but does so either by using a different method than the "dummy" telephone (ie, leaves the patient to go and get help from elsewhere) or uses the "dummy" telephone and calls for someone other than the ambulance service.
1. Not performed—Rescuer does not attempt to get help at this stage.

STEP 5—First rescue breaths

DESCRIPTION

Two effective rescue breaths should be delivered in no more than 5 attempts. Effective rescue breaths entail:
 An open airway (ensure head tilt and chin lift as described in STEP 3).
 Rescuer must pinch the victim's nostrils together with the index finger and thumb of the hand that is on the victim's forehead.
 Rescuer must keep the head tilted and allow the victim's mouth to open. After taking a breath himself or herself, the rescuer should place his or her mouth completely over the mouth of the victim (ensuring a good seal) and breathe steadily into the victim.

Each rescue breath should be sufficient to cause the victim's chest to rise and fall, as in normal breathing (each breath delivered should take an approximate time of 2 seconds).

Maintaining an open airway. The rescuer should maintain this head tilt and repeat the sequence to give a total of 2 effective rescue breaths.

Importantly, no more than 5 attempts should be made to achieve 2 effective breaths.

GUIDE FOR MARKING

Video assessment PDF file and voice-assisted manikin (VAM) open airway

Airway open

4. Opened as ERC guide or maintained—Rescuer performs the procedures described above.
3. Opened other or maintained—Rescuer successfully opens the airway but achieves head tilt and chin lift using methods different from the ones described above.
2. Visibly attempted—Rescuer attempts to open the airway but fails.
1. Not performed—No attempt is made to open the airway.

Methods

Maker should look at video to see if the airway appears to have been opened. Confirm airway has been opened by viewing successful ventilations in PDF file.

Two initial rescue breaths

4. Successful—Rescuer performs all of the above description and achieves rise and fall of the chest exactly twice in a maximum of 5 attempts.
3. Incorrect—More than 2 inflations—Rescuer attempts to perform all of the above description but gives more than 2 inflations, which result in a rise and fall of the chest. Rescuer makes more than 5 attempts to give initial rescue breaths.
2. Ineffective—Rescuer attempts inflations but does not achieve rise and fall of the chest or makes fewer than 2 attempts.
1. Not performed—Rescuer does not attempt to deliver rescue breaths.

Average inflation volume (PDF+VAM). Physiological variables can all be obtained from the VAM data. Please insert measurement into appropriate assessment box/circle score in appropriate assessment box on the assessment sheet.

Methods

Open relevant PDF file. Visually assess the 2 initial rescue breaths. Take the number from the bottom of the flow chart that corresponds with the end of the 2 initial rescue breaths. This number relates to the number of seconds that the VAM skill meter has been acquiring data. Now open the SPSS or equivalent database. Scroll right until the corresponding moving average (MA) for tidal volume is found, for example "MA Tidal Volume T090 [/min]." The T number corresponds with the number taken from the PDF file from above. Note, MAs are recorded every 15 seconds. Record figure in book (insert exact mean score) and circle appropriate box.

STEP 6—Check signs of circulation

DESCRIPTION

The rescuer should (while keeping the airway open) look, listen, and feel for breathing (more than an occasional gasp or weak attempts at breathing):

Look for chest movement

Listen at the victim's mouth for breath sounds

Feel for air on rescuer's cheek

Look, listen, and feel for no more than 10 seconds to determine if the victim is breathing normally

Method to open the airway

Rescuer places 1 hand on the victim's forehead and gently tilts the head back (the thumb and index finger are kept free to be able to close the victim's nose if rescue breathing will be required).

Rescuer removes any visible obstructions from the victim's mouth (for example, dislodged dentures).

Rescuer lifts the victim's chin. This is done by placing 2 fingertips under the point of the victim's chin (on the bone, not the soft tissue) and gently lifting the chin.

Method for checking circulation

Rescuer should look, listen, and feel for normal breath, cough, or movement of the victim.

Pulse check

The "gold standard" sign of cardiac arrest is an absent carotid (or other large artery) pulse. It has been shown, however, that assessment of the carotid pulse is time consuming and leads to an incorrect conclusion (present or absent) in up to 50% of cases. For this reason, training in detection of the carotid pulse as a sign of cardiac arrest is no longer recommended for non-healthcare persons.

GUIDE FOR MARKING

Video assessment and use of a stopwatch. Enter verbal/visual checks in comments box at the end of the assessment form.

Open airway

4. Performed as ERC guide or maintained—Rescuer performs the procedures described above.
3. Performed other or maintained—Rescuer successfully opens the airway but achieves head tilt and chin lift using methods different from the ones described above.
2. Visibly attempted—Rescuer attempts to open the airway but fails.
1. Not performed—No attempt is made to open the airway.

Check for circulation (look, listen, and feel)

4. Correct—Rescuer performs the procedures described above. Two out of 3 actions can be marked as correct.
3. Incorrect—Rescuer performs circulation check other than above.
2. Ineffective—Rescuer performs check without opened airway.
1. Not performed—Rescuer makes no attempt to check for signs of circulation.

Pulse check

3. Not performed—As new ERC guidelines indicate.
2. Checked carotid—Rescuer checks for carotid pulse.
1. Checked other—Rescuer checks for a pulse other than the carotid pulse.

Part 2: AED Sequence Shocks 1 through 3

If rescuer does not use AED, move to Part 3.

STEP 7—Switching on AED

DESCRIPTION

The AED should be switched on as taught.

GUIDE FOR MARKING

Video assessment

2. Performed—Rescuer switches on defibrillator correctly and as taught.
1. Not performed—Rescuer fails to switch on defibrillator.

STEP 8—Correct attachment of electrode pads

DESCRIPTION

Electrode pads should be attached as taught to the correct positions on the victim's chest: upper right and lower left side of the victim's chest.

GUIDE FOR MARKING

Video assessment. Assess video and use chest grid to guide judgment of exactly where the rescuer places the electrode pads. Place a mark on the corresponding grid of the marking sheet.

7. Both electrodes completely in areas.
6. One electrode completely in area, 1 crossing the border of area.
5. Both electrodes crossing the border of area.
4. One electrode completely in the area, 1 electrode completely outside area.
3. One electrode crossing the border of area, 1 completely outside the area.
2. Both electrodes outside the areas.
1. Electrodes not attached or not plugged into the AED.

STEP 9—Automatic AED analysis, visual and verbal checks by rescuer

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during AED analysis.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

3. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during AED analysis.
2. Incorrect—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during AED analysis.
1. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during AED analysis.

STEP 10—Safety of researcher

DESCRIPTION

Researcher provokes contact with the manikin by placing a hand on the left lower quadrant before the shock is administered by the rescuer. Rescuer should ensure the safety of the researcher by asking him or her to stand clear of the victim.

GUIDE FOR MARKING

Video assessment

2. Performed—Rescuer asks the researcher to stand clear of the victim.
1. Not performed—Rescuer fails to ask the researcher to stand clear of the victim.

STEP 11—Shock button pushed as directed and shock safety

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during the administration of a shock.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

4. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during the administration of a shock.
3. Not performed—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during the administration of a shock.
2. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during the administration of a shock.
1. Shock button not pushed.

STEP 12—Time to first shock

DESCRIPTION

Time taken, from the start of the scenario, to perform all necessary tasks before the first shock is administered (in seconds).

GUIDE FOR MARKING

Video assessment. Marker can time the candidate using a stopwatch provided; time is measured in seconds.

STEP 13—Automatic AED analysis, visual and verbal checks by rescuer

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during AED analysis.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

3. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during AED analysis.
2. Incorrect—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during AED analysis.
1. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during AED analysis.

STEP 14—Shock button pushed as directed and shock safety

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during the administration of a shock.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

4. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during the administration of a shock.
3. Not performed—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during the administration of a shock.
2. Not Performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during the administration of a shock.
1. Shock button not pushed.

STEP 15—Automatic AED analysis, visual and verbal checks by rescuer

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during AED analysis.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

3. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during AED analysis.
2. Incorrect—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during AED analysis.
1. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during AED analysis.

STEP 16—Shock button pushed as directed and shock safety

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during the administration of a shock.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

4. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during the administration of a shock.
3. Not performed—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during the administration of a shock.

2. Not Performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during the administration of a shock.
1. Shock button not pushed.

STEP 17—Check signs of circulation

DESCRIPTION

As indicated by AED

The rescuer should (while keeping the airway open) look, listen, and feel for breathing (more than an occasional gasp or weak attempts at breathing):

Look for chest movement

Listen at the victim’s mouth for breath sounds

Feel for air on rescuer’s cheek

Look, listen and feel for no more than 10 seconds to determine if the victim is breathing normally

Method to open the airway

Rescuer places 1 hand on the victim’s forehead and gently tilts the head back (the thumb and index finger are kept free to be able to close the victim’s nose if rescue breathing will be required).

Rescuer removes any visible obstructions from the victim’s mouth (for example, dislodged dentures)

Rescuer lifts the victim’s chin. This is done by placing 2 fingertips under the point of the victim’s chin (on the bone, not the soft tissue) and gently lifting the chin.

Method for checking circulation

Rescuer should look, listen, and feel for normal breath, cough, or movement of the victim.

Pulse check

The “gold standard” sign of cardiac arrest is an absent carotid (or other large artery) pulse. It has been shown, however, that assessment of the carotid pulse is time consuming and leads to an incorrect conclusion (present or absent) in up to 50% of cases. For this reason, training in detection of the carotid pulse as a sign of cardiac arrest is no longer recommended for non-healthcare persons.

GUIDE FOR MARKING

Video assessment and use of a stopwatch. Enter verbal/visual checks in comments box at the end of the assessment form.

Open airway

4. Performed as ERC guide or maintained—Rescuer performs the procedures described above.
3. Performed other or maintained—Rescuer successfully opens the airway but achieves head tilt and chin lift using methods different from the ones described above.
2. Visibly attempted—Rescuer attempts to open the airway but fails.
1. Not performed—No attempt is made to open the airway.

Check for circulation (look, listen, and feel)

4. Correct—Rescuer performs the procedures described above. Two out of 3 actions can be marked as correct.
3. Incorrect—Rescuer performs circulation check other than above.
2. Ineffective—Rescuer performs check without opened airway.
1. Not performed—Rescuer makes no attempt to check for signs of circulation.

Pulse check

3. Not performed—As new ERC guidelines indicate.
2. Checked carotid—Rescuer checks for carotid pulse.
1. Checked other—Rescuer checks for a pulse other than the carotid pulse.

Part 3: CPR Sequence

STEP 18—Perform CPR

DESCRIPTION

Rescuer performs CPR for 1 minute as directed by AED, in which case CPR will be timed by the AED. Alternatively,

rescuer does not attempt to use or is unable to use the AED but performs CPR.

GUIDE FOR MARKING

Video assessment. Marker should record the time that the rescuer performs CPR

3. Performed—Rescuer performs CPR as advised by AED. If rescuer performs CPR: Record the exact time in seconds and enter it into the assessment box.
2. Performed CPR only—Rescuer does not use the AED or attempts to use the AED unsuccessfully but performs CPR.
1. Not performed—Rescuer fails to perform CPR.

STEP 19—Average inflation volume

Physiological variables can all be obtained from the VAM data. Please insert measurement into appropriate assessment box/circle score in appropriate assessment box on the assessment sheet.

STEP 20—Average number of inflations delivered

Physiological variables can all be obtained from the VAM data. Please insert measurement into appropriate assessment box/circle score in appropriate assessment box on the assessment sheet.

Note, If rescuer has delivered successful rescue breaths at STEP 5, these must be subtracted from VAM data in average number of inflations delivered column to get true number during CPR.

STEP 21—Hand placement

DESCRIPTION

If there are no signs of circulation or if the rescuer is unsure, the rescuer should start chest compressions. Before chest compressions can be started, the rescuer must locate the correct position on the sternum. The following must be carried out:

Rescuer must kneel beside the victim.

Rescuer locates the lower half of the breastbone (sternum) by running the index and middle fingers of one hand up the lower margin of the ribcage and finding the notch where the ribs join.

Rescuer places the middle finger of the same hand into the notch, and places the associated index finger onto the breastbone above.

Rescuer slides the heel of the second hand down the breastbone until it reaches the index finger. The heel of the hand will then be in the middle of the lower half of the breastbone.

Rescuer removes the first hand and places it on top of the second hand. Interlocking fingers and preparing to deliver compressions.

GUIDE FOR MARKING (video assessment and VAM)

Total number of compressions delivered—Using VAM select relevant data.

Hand position too low, dangerous—Using VAM select relevant data.

Incorrect hand position—Using VAM, subtract hand position too low from incorrect hand position to get figure for placing in incorrect hand position in box in STEP 21.

For evaluating effectiveness of hand positioning, it will be necessary to calculate:

- (1) Total number delivered
- (2) Total number hand position too low (dangerous)
- (3) Total number hand position incorrect
- (4) Total number hand position correct

Whichever database is used to collect figures will have to have an extra column set up to collect figures.

STEP 22—Average compression rate

Physiological variables can all be obtained from the VAM data. This is calculated from the number of compressions given per minute, making an allowance for ventilations. Please insert measurement into appropriate assessment box/circle score in appropriate assessment box on the assessment sheet.

STEP 23—Average number of compressions per minute

Physiological variables can all be obtained from the VAM data. This is the number of compressions actually given per minute. Please insert measurement into appropriate assessment box/circle score in appropriate assessment box on the assessment sheet.

STEP 24—Average compression depth

Physiological variables can all be obtained from the VAM data. Please insert measurement into appropriate assessment box.

STEP 25—Compressions to rescue breaths

DESCRIPTION

After hand placement, the rescuer must deliver chest compressions. This involves depressing and releasing the breastbone (sternum). The recommended number of compressions is 15 in each cycle. Chest compressions are combined with rescue breaths, so after 15 chest compressions, 2 rescue breaths must be delivered. This ratio of 15:2 must be continued for the remainder of the resuscitation effort. It is worth noting that some rescuers actually count out loud while delivering the chest compressions. This is useful to maintain a rhythm and to ensure the correct count.

GUIDE FOR MARKING

Video assessment

Ratio 15:2

Marking is based on the number of chest compressions to rescue breaths (15:2). (Part 2 of the marking sheet will provide the physiological measurements to judge how effective the delivery of these skills has been.)

4. Correct—Rescuer delivers 15 compressions and then delivers 2 rescue breaths. Continues this cycle until the end of the test.
3. Incorrect (specify)—Rescuer delivers a different ratio of chest compressions and rescue breaths to the recommended 15:2. Marker should attempt to identify and note the different ratio.
2. Compression only—Rescuer performs chest compressions only, with no attempt to deliver rescue breaths.
1. Rescue breaths only—Rescuer performs rescue breaths only, with no attempt to deliver chest compressions.

Part 4: AED Sequence Shock 4

STEP 26—Check signs of circulation

DESCRIPTION

As indicated by AED.

The rescuer should (while keeping the airway open) look, listen, and feel for breathing (more than an occasional gasp or weak attempts at breathing):

Look for chest movement

Listen at the victim's mouth for breath sounds

Feel for air on rescuer's cheek

Look, listen, and feel for no more than 10 seconds to determine if the victim is breathing normally

Method to open the airway

Rescuer places 1 hand on the victim's forehead and gently tilts the head back (the thumb and index finger are kept free to be able to close the victim's nose if rescue breathing will be required).

Rescuer removes any visible obstructions from the victim's mouth (for example, dislodged dentures).

Rescuer lifts the victim's chin. This is done by placing 2 fingertips under the point of the victim's chin (on the bone, not the soft tissue) and gently lifting the chin.

Method for checking circulation

Rescuer should look, listen, and feel for normal breath, cough, or movement of the victim.

Pulse check

The "gold standard" sign of cardiac arrest is an absent carotid (or other large artery) pulse. It has been shown, however, that assessment of the carotid pulse is time consuming and leads to an incorrect conclusion (present or absent) in up to 50% of cases. For this reason, training in

detection of the carotid pulse as a sign of cardiac arrest is no longer recommended for non-healthcare persons.

GUIDE FOR MARKING

Video assessment and use of a stopwatch. Enter verbal/visual checks in comments box at the end of the assessment form.

Open airway

4. Performed as ERC guide or maintained—Rescuer performs the procedures described above.
3. Performed other or maintained—Rescuer successfully opens the airway but achieves head tilt and chin lift using methods different from the ones described above.
2. Visibly attempted—Rescuer attempts to open the airway but fails.
1. Not performed—No attempt is made to open the airway.

Check for circulation (look, listen, and feel)

4. Correct—Rescuer performs the procedures described above. Two out of 3 actions can be marked as correct.
3. Incorrect—Rescuer performs circulation check other than above.
2. Ineffective—Rescuer performs check without opened airway.
1. Not performed—Rescuer makes no attempt to check for signs of circulation.

Pulse check

3. Not performed—As new ERC guidelines indicate.
2. Checked carotid—Rescuer checks for carotid pulse.
1. Checked other—Rescuer Checks for a pulse other than the carotid pulse.

STEP 27—Stop CPR, automatic AED analysis, and visual and verbal checks by rescuer

DESCRIPTION

After 1 minute of performing CPR, the rescuer should wait for the AED to analyze the rhythm and should ensure nobody is in contact with the manikin during AED analysis.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and make a visual check to ensure the safety of bystanders and himself or herself.

3. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during AED analysis.
2. Incorrect—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during AED analysis.
1. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during AED analysis.

STEP 28—Shock button pushed as directed and shock safety

DESCRIPTION

Rescuer should ensure nobody is in contact with the manikin during the administration of a shock.

GUIDE FOR MARKING

Video assessment. Examiner should record whether the rescuer asks bystanders to stay clear of the victim and makes a visual check to ensure the safety of bystanders and himself or herself.

4. Performed—Rescuer makes both a verbal and visual check to ensure nobody is in contact with the victim during the administration of a shock.
3. Not performed—Rescuer makes either a verbal or visual check to ensure nobody is in contact with the victim during the administration of a shock.
2. Not performed—Rescuer fails to make either verbal or visual checks to ensure nobody is in contact with the victim during the administration of a shock.
1. Shock button not pushed.

STEP 29—Check signs of a circulation**DESCRIPTION**

As indicated by AED.

The rescuer should (while keeping the airway open) look, listen, and feel for breathing (more than an occasional gasp or weak attempts at breathing):

Look for chest movement

Listen at the victim's mouth for breath sounds

Feel for air on rescuer's cheek

Look, listen, and feel for no more than 10 seconds to determine if the victim is breathing normally

Method to open the airway

Rescuer places 1 hand on the victim's forehead and gently tilts the head back (the thumb and index finger are kept free to be able to close the victim's nose if rescue breathing will be required).

Rescuer removes any visible obstructions from the victim's mouth (for example, dislodged dentures).

Rescuer lifts the victim's chin. This is done by placing 2 fingertips under the point of the victim's chin (on the bone, not the soft tissue) and gently lifting the chin.

Method for checking circulation

Rescuer should look, listen, and feel for normal breath, cough, or movement of the victim.

Pulse check

The "gold standard" sign of cardiac arrest is an absent carotid (or other large artery) pulse. It has been shown, however, that assessment of the carotid pulse is time consuming and leads to an incorrect conclusion (present or absent) in up to 50% of cases. For this reason, training in detection of the carotid pulse as a sign of cardiac arrest is no longer recommended for non-healthcare persons.

GUIDE FOR MARKING

Video assessment and use of a stopwatch. Enter verbal/visual checks in comments box at the end of the assessment form.

Open airway

4. Performed as ERC guide or maintained—Rescuer performs the procedures described above.

3. Performed other or maintained—Rescuer successfully opens the airway but achieves head tilt and chin lift using methods different from the ones described above.

2. Visibly attempted—Rescuer attempts to open the airway but fails.

1. Not performed—No attempt is made to open the airway.

Check for circulation (look, listen, and feel)

4. Correct—Rescuer performs the procedures described above. Two out of 3 actions can be marked as correct.

3. Incorrect—Rescuer performs circulation check other than above.

2. Ineffective—Rescuer performs check without opened airway.

1. Not performed—Rescuer makes no attempt to check for signs of circulation.

Pulse check

3. Not performed—As new ERC guidelines indicate.

2. Checked carotid—Rescuer checks for carotid pulse.

1. Checked other—Rescuer checks for a pulse other than the carotid pulse.

Researcher indicates there are signs of circulation

STEP 30—Sequence performed in order?**DESCRIPTION**

This measurement is to determine whether the rescuer performs all necessary tasks in the correct order.

GUIDE FOR MARKING

Video assessment

2. Performed—Rescuer performs all necessary steps in the correct order.

1. Not performed—Rescuer fails to perform all necessary steps in the correct order.

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