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# Importance and Implementation of Training in Cardiopulmonary Resuscitation and Automated External Defibrillation in Schools: A Science Advisory From the American Heart Association

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AHA Science Advisory

# Importance and Implementation of Training in Cardiopulmonary Resuscitation and Automated External Defibrillation in Schools

## A Science Advisory From the American Heart Association

*Endorsed by the American Academy of Pediatrics, the American College of Emergency Physicians, the National Association of School Nurses and the Society of State Directors of Health, Physical Education and Recreation*

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In 2003 the International Liaison Committee on Resuscitation published a consensus document on education in resuscitation that strongly recommended that "…instruction in CPR [cardiopulmonary resuscitation] be incorporated as a standard part of the school curriculum."[1] The next year the American Heart Association (AHA) recommended that schools "…establish a goal to train every teacher in CPR and first aid and train all students in CPR" as part of their preparation for a response to medical emergencies on campus.[2]

Since that time there has been an increased interest in legislation that would mandate that school curricula include training in CPR or CPR and automated external defibrillation. Laws or curriculum content standards in 36 states (as of the 2009 to 2010 school year) now encourage the inclusion of CPR training programs in school curricula. The language in those laws and standards varies greatly, ranging from a suggestion that students "recognize" the steps of CPR to a requirement for certification in CPR. Not surprisingly, then, implementation is not uniform among states, even those whose laws or standards encourage CPR training in schools in the strongest language. This statement recommends that training in CPR and familiarization with automated external defibrillators (AEDs) should be required elements of secondary school curricula and provides the rationale for implementation of CPR training, as well as guidance in overcoming barriers to implementation.

## Background

Sudden cardiac arrest is a leading cause of death in the United States and Canada. It is estimated that each year emergency medical services (EMS) personnel assess 294 851 (quasi-

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confidence intervals, 236 063 to 325 007) out-of-hospital cardiac arrests (OHCAs) in the United States. Survival, which is defined as being discharged alive from the hospital, varies widely by region (3.0% to 16.3%; median, 8.4%), but the overall average rate of survival to discharge from the hospital is estimated to be 7.6% to 7.9%.[3,4] Provision of bystander CPR is known to be a critical determinant of survival from OHCA.[4–13] The SOS Kanto investigators[13] documented an odds ratio of 2.4 (95% confidence interval, 1.6 to 3.4) for a favorable 30-day neurological outcome associated with victims who received any form of bystander CPR with or without ventilation. A meta-analysis by Sasson et al[4] shows that the relative impact of bystander CPR can be even higher, depending on the baseline survival (that of victims not receiving CPR) in a community: an odds ratio of 1.23 (95% confidence interval, 0.71 to 2.11) in the studies with the highest baseline survival rates to 5.01 (95% confidence interval, 2.57 to 9.78) in the studies with the lowest baseline rates. The same meta-analysis also expressed the impact of bystander CPR in terms of the number of victims needed to treated with bystander CPR to save one life and it too varied with baseline survival rates: needed to treated was 24 in areas with high baseline survival rates and 36 with the lowest baseline survival. Even though the potential benefit of this relatively simple intervention is clear, in many areas of the United States and Canada, fewer than 1 in 3 victims of OHCA receive this lifesaving help from a bystander.[3,14]

Many cardiac arrests are precipitated by lethal heart arrhythmias that can be reversed only by delivery of a shock to the victim's chest with a defibrillator. The sooner the shock is delivered, the higher the probability of the victim's survival. If no other care is provided, the chance of survival from OHCA decreases by 7% to 10% for every minute of delay.[6] Effective CPR can prolong the window of opportunity for successful defibrillation,[9] but it is the shock, not CPR, that will reverse the lethal arrhythmia.

People who are not healthcare professionals can provide lifesaving shocks with an AED. AEDs are designed for use by the general public so that defibrillation can be delivered before EMS personnel arrive at the scene. AEDs can increasingly be found in the workplace, other public locations, and schools. In the Public Access Defibrillation trial,[15,16] survival rates for victims of OHCA doubled in areas where AEDs were available and cardiac arrest emergency response plans were implemented. No inappropriate shocks and no failures to shock when indicated were reported from that 3-year study, in which 260 presumed cardiac arrests occurred at 622 facilities with AEDs (95% upper bound for probability of inappropriate shock or failure to shock=0.0012).[16] Other studies have also demonstrated survival rates much higher (from 47.6% to 53.0%) than the estimated overall average rate of survival from out-of-hospital cardiac arrest (7.9%), using a variety of strategies for early defibrillation in which AEDs were used by responders who were not healthcare professionals.[15,17–19]

In recognition of the effectiveness of this technology, advocacy groups have lobbied state legislators to mandate programs to raise public awareness of the importance of CPR and the use of AEDs to increase the percentage of the population trained in their use. Many of the resulting legislative and policy efforts have focused on CPR and AED education and training in schools (see Table 3 and the Appendix for summaries of existing state legislation and curriculum content standards). This scientific statement presents evidence to support those efforts and recommends that training in CPR and familiarization with AEDs should be required elements of secondary school curricula.

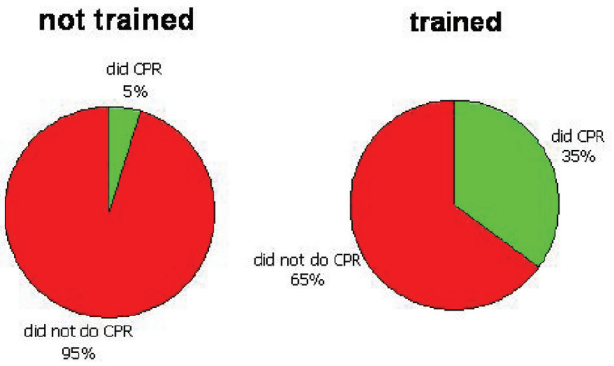



**Figure 1.** Bystander actions at actual out-of-hospital cardiac arrest events. The chart on the left indicates bystanders who had no training in cardiopulmonary resuscitation (CPR) (n=314); the chart on the right indicates bystanders who had received some training in CPR at any time in their lives (n=370). Green indicates the percentage of cardiac arrests in which bystanders performed CPR; red indicates the percentage of cardiac arrests in which bystanders did not perform CPR. Data shown are adapted from Swor et al[14] with permission of the publisher. Copyright © 2006, Society for Academic Emergency Medicine.

## Rationale for Teaching CPR to Secondary School Students

In 2003 the International Liaison Committee on Resuscitation strongly recommended that CPR training be incorporated into the standard school curriculum.[1] That recommendation was based in part on the opinion that over the long term, children trained in CPR contribute significantly to the number of adults trained in CPR in the community. The expected direct benefit of increasing the number of people trained to perform CPR is to increase the likelihood that a victim of OHCA promptly receives CPR. This assumes that bystanders trained in CPR are more likely to take action than those who are not trained, an assumption that is supported by data from a study that interviewed bystanders at the scene of OHCAs.[14] Any previous training in CPR was shown to be a strong predictor of whether bystanders acted to provide CPR to the victim, as was CPR training within the previous 5 years (Figure 1).

Pelinka et al[20] also observed an effect of first aid training (including CPR) on the incidence and quality of bystander performance of critical first aid skills (correct extrication, positioning, and control of hemorrhage) to help victims of trauma in actual emergencies. When compared with bystanders who were not trained in first aid, the skills performance of bystanders who had received first aid training increased with the level of training (basic, advanced, and professional) they received, and the number of victims who did not receive care decreased.

Increasing the percentage of the population trained in CPR is an integral part of an overall strategy to improve community response to OHCA. Schools provide excellent access to a large part of the community: among 5- to 14-year-olds, compliance with required attendance is nearly universal at 97.4%; among 15- to 19-year-olds, compliance is 76.5%.[21] Therefore, over time, a significant percentage of the overall community will receive training. Programs in which students can share materials used in school-based programs at home with family members can further increase the program's yield in terms of the total number of members of the community trained per unit of class time expended.[22,23]

## Short-Term Impact: Adolescents as Potential Rescuers

The potential benefit of training secondary school students in CPR differs from that of training adults in CPR. In the short term, children are not as likely as adults to witness an OHCA and potentially help a victim because of the relatively low risk of OHCA associated with their age group. Lotfi et al[24] published an analysis of the incidence of EMS-treated, nontraumatic OHCA in schools in Seattle/King County, Washington over 15 years (from January 1, 1990 to December 31, 2005). They estimated an incidence of OHCA (per 100 000 person-school-years) of 0.18, 0.19, and 0.15 for elementary, middle, and high school students, respectively, and 4.51 per 100 000 person-years for faculty and staff. Other studies documenting voluntary reports of OHCA among high school athletes suggest an incidence ranging from 0.28 to 1 death per 100 000 athletes annually nationwide,[25–27] compared with the estimated overall incidence of OHCA in the United States of 96.8 per 100 000 people annually.[3]

Although the risk of an OHCA event occurring in a school is relatively low, the emotional costs associated with the sudden death of a child are enormous. Increasing the percentage of students, staff, and faculty trained in CPR increases the likelihood of someone promptly initiating time-critical CPR for a victim of OHCA.

In addition, a child trained in CPR could be present at the scene of a medical emergency requiring CPR in a location other than school. For example, a 2003 retail market analysis estimates that the average American teenager (12 to 17 years old) spends 58 hours per month in shopping malls.[28] Becker et al[29] identified large shopping malls as having the third highest incidence rate of OHCA (0.6 events annually per facility) of 23 categories of commercial and civic establishments examined in the Seattle/King County, Washington area. Children of secondary school age may also encounter respiratory or cardiovascular emergencies as caregivers of younger children (eg, siblings).

## Long-Term Impact: Training for the Future

No longitudinal research has specifically assessed the impact of school-based CPR training on the probability that students trained in CPR will provide CPR as adults if they encounter a victim of OHCA. Many published studies of retention of CPR psychomotor skills suggest that early training can contribute to higher skill levels later. However, these studies vary in measures and results. In one of the longest-term CPR skills–retention studies undertaken, half of adults who received conventional 1-time training in CPR performed satisfactorily in manikin-based assessments at 12 months in the critical skill of chest compressions: hand placement, 47%; compression depth, 44%; and compression rate, 59%.[30] Similar or worse levels of performance were observed in other studies of populations that would be expected to have a higher than normal probability of encountering a cardiac arrest victim: parents of infants,[31] medical students,[32] and family members of cardiac patients.[33]

Several studies have reported performance of CPR psychomotor skills by school-age children at a variety of post-training times. Hill et al[34] assessed CPR skills among 10- and 11-year-olds who performed CPR (at compression-ventilation ratios of 15:2 and 30:2) 2 months after initial training. Their performance of chest compressions at a compression-ventilation ratio of 30:2 over 3 minutes was not ideal: only 22% to 26% of students achieved an average compression depth of ≥38 mm. Moore et al[35] reported that 11- and 12-year-olds who had been trained to give mouth-to-mouth rescue breathing 5 years earlier performed significantly better than their peers who had not received training, but the authors estimated that only 37% of the group who had received training might have been able to sustain life in an actual emergency. One recent study compared skills retention among schoolchildren with that of adults 3 months after training using the same self-directed training system.[22] The data show that adults had a higher overall score (57.5% versus 50% of the possible total score using the Cardiff Test[36]). That difference may be partly due to a difference in physical size, as evidenced by the lower percentage of children with a mean compression depth in the target range of 40 to 55 mm (30% of children versus 61% of adults).

Until further longitudinal studies of school-age trainees have been conducted, long-term degradation of psychomotor skills should be considered a potential problem common to all age groups and should serve as a challenge to researchers to identify more effective training strategies. Concerns over long-term skills retention, however, should not preclude current efforts to train any specific age range (assuming that trainees are at an age when they are likely to be physically capable). The evidence shows that previous training, at any interval before there is a need to use the skills learned, will increase the likelihood that a bystander will provide appropriate care to a victim.[14]

Several behavioral studies help define the long-term benefits of prospective training for medical emergencies and complement the findings from actual emergencies reported by Swor et al[14] and Pelinka et al.[20] Many of those studies address the multidimensional barriers that prevent bystanders from helping in actual emergencies. Some have shown that prospective training ("induced competence") as an experimental variable significantly reduced psychosocial barriers to exhibiting "helping behavior" (in this case, providing first aid) in a mock emergency, whether subjects were acting alone or in a group.[37–39] These studies were relatively short term,

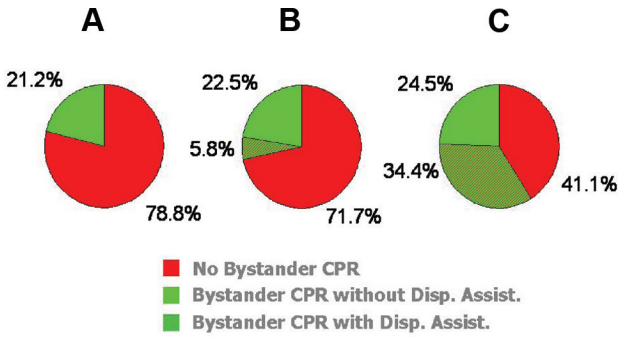



**Figure 2.** Impact of dispatcher-assisted cardiopulmonary resuscitation (CPR) on performance of bystander CPR rates in **(A)** Detroit, Michigan (n=684); **(B)** the Kanto region of Japan (n=1151); and **(C)** Seattle/King County, Washington (n=404). Light green indicates the percentage of cardiac arrests in which bystanders performed CPR "spontaneously" (CPR was initiated without instructions from the EMS dispatcher); dark green indicates the percentage of cardiac arrests in which bystanders are known to have performed CPR following instructions from the EMS dispatcher; and red indicates the percentage of cardiac arrests in which bystanders did not perform CPR. Disp. Assist indicates dispatcher assistance. Data shown are adapted from (A) Swor et al[14] with permission of the publisher, copyright © 2006, Society for Academic Emergency Medicine; (B) SOS-Kanto Study Group[13] with permission of the publisher, copyright © 2007, Elsevier; and (C) Hauff [40] with permission of the publisher, copyright © 2003, The American College of Emergency Physicians.

separating subject training and subsequent exposure to a mock emergency by only 3 to 9 weeks, depending on the study.

Yet these studies reveal an important concept, as described by Pantin and Carver,[37] that has relevance to the longer term. Specific knowledge of "what to do" is required for a bystander to take the final step in a multistep decision-making process that leads to effective direct action (eg, performing CPR). Training also facilitates an even earlier critical step in that process, a bystander's initial interpretation of the situation. By sensitizing trainees to the need for immediate intervention when presented with a specific medical emergency, training increases the likelihood that a bystander will interpret the situation appropriately and will at least take effective indirect action to help, such as calling 911 (an action that does not require mastery of a psychomotor skill).[37] In many instances, in a real emergency, the indirect action of calling 911 would allow the bystander to receive instructions for performing CPR from the 911 dispatcher. This in turn can increase the chance that the victim will receive bystander CPR. Hauff et al[40] reported that dispatcher-assisted CPR accounted for more than half of all incidents of bystander CPR performed for adult OHCA handled by EMS personnel in the Seattle/King County area from July 1, 2000 to June 30, 2002 (Figure 2). The odds ratio of implementing telephone CPR for the eligible patients in this study was as high as 1.39 (the interquartile 25th to 75th range) for longer (9-minute) basic life support response intervals. Many standard emergency dispatch protocols for operators answering calls related to medical emergencies now include "dispatcher-assisted CPR."[40,41]

## Rationale for Including AED Awareness or Skills Training With CPR Training for School-Age Children

In 2000 the Cardiac Arrest Survival Act (Public Law 106-505) was signed into federal law. The intent of Cardiac Arrest Survival Act was to reduce barriers to the placement and use of AEDs in public areas and thus improve systems of care for OHCA in the community. Since passage of Cardiac Arrest Survival Act, all 50 states have implemented legislation promoting lay rescuer programs and providing "Good Samaritan" protection for lay rescuers who use AEDs.[42] AEDs are now available in many public locations such as airports, shopping malls, exercise facilities, and federal buildings,[29] thus increasing the likelihood that a bystander will have direct access to an AED or that a second bystander will get an AED from a nearby location and bring it to the side of a cardiac arrest victim. To help an unresponsive victim, though, a bystander must know the purpose of an AED and understand how it functions. Otherwise, indecision and discussion with other bystanders could delay or even prevent the use of the AED altogether. It is reasonable, then, that all CPR training should explain the purpose and basic function of an AED to all trainees regardless of age.

The AHA encourages the inclusion of AED skills practice during CPR training. Furthermore, the AHA recommends the use of an AED or AED trainer when the CPR training is part of an overall response plan at a specific location where AEDs have been installed, including schools. The AHA has previously recommended that, where AEDs have been implemented as part of a school's medical emergency response plan, CPR and AED training should be provided to any anticipated rescuer.[43]

## Recommendations for Implementing CPR or CPR/AED Training in Schools

### Target Audience

Targeting the appropriate student population is of foremost importance. Students' physical size is a major consideration in this respect. Jones et al[44] assessed the physical ability of schoolchildren in Cardiff, Wales, to achieve adequate chest compression depth for an adult victim. The children in the study ranged in age from 9 through 14 years; only the 13- to 14-year-olds performed chest compressions as well as adults. Achieving the target compression depth in adult victims of cardiac arrest requires the application of about 50 kg.[45] In the United States the 50th percentile weights of boys and girls become ≥50 kg at 165.5 months (13.8 years) and 170.5 months (14.2 years), respectively.[46] Flexion at the hip joints contributes to the total force generated when a person performs chest compressions during CPR.[47] Therefore, a total body mass of <50 kg does not by definition limit a person's ability to perform compressions but would necessitate much more exertion from that person than someone with greater body mass. As mentioned above, data from Isbye et al[22] suggest that the body mass of 12- to 14-year-olds in their study may in part account for their lower average compression depth compared with adults who used the same self-directed training kits (manikin and video). Given the impor-

tance of delivering high-quality compressions and the possibility that trainees, who are physically unable to perform those compressions to the desired standard during training, might become discouraged or disinterested, it is reasonable to limit practice of adult CPR chest compression skills to children in middle school (≈13 years old) and older.

## Critical Teaching Points in CPR Training

The core skills of conventional CPR (for adults, children, and infants) and hands-only CPR (for adult victims of witnessed cardiac arrest) are outlined in Part 4 of the 2010 AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care and the 2008 AHA advisory statement on hands-only CPR, respectively.[48,49] Any program designed to teach conventional CPR for adult, child, or infant victims or hands-only CPR should include the core skills described there. The most critical of those skills, recognition of the emergency ("interpretation") and provision of high-quality chest compressions, deserve further emphasis.

### *Recognition of the Emergency*

The multistep decision-making process of effecting a response includes appropriate interpretation of the situation, or recognition of the emergency. Bystanders must recognize the nature and severity of the victim's condition. When uncertainty or ambiguity in an emergency situation increases, the probability of a bystander taking action decreases.[38,50,51] CPR training programs should therefore provide simple and unambiguous criteria for starting the steps of CPR.[52] The AHA's criteria for lay rescuers to start conventional CPR are simple: victim should be unresponsive ("tap and shout") and has absent or abnormal breathing (ie, only gasping).[48] For a witnessed sudden cardiac arrest in an adult, there is only one criterion for starting hands-only CPR: "When an adult suddenly collapses…."[49]

Recognition of the victim's condition is often complicated by the presence of seizure-like activity or agonal breathing or "gasping." Gasping is a reflexive behavior that results from hypoxia in the brain stem[53,54] and commonly occurs in the first few minutes of cardiac arrest.[55] Among victims of OHCA, the reported incidence of gasping ranges from 30% to 40%.[56–59] Gasping leads to ambiguity for a bystander who is trying to determine whether the victim is breathing. Previously cited data have shown that gasping may deter a bystander from starting CPR in an actual OHCA.[40,58,60] When first-year medical students received explicit teaching about agonal breathing, or gasping, as part of their training in basic life support, their accuracy in diagnosing cardiac arrest improved compared with a control group (90% versus 78%, $P=0.03$) and increased the likelihood of CPR being initiated (sensitivity 90% versus 78%, $P=0.02$).[61] These data collectively demonstrate the importance of emphasizing "absent or abnormal breathing (ie, only gasping)" as criteria for initiating CPR for an adult victim by introducing the concept of gasping (agonal breathing) and reinforcing that gasping should not be mistaken for normal breathing.

### *Providing High-Quality Chest Compressions*

Provision of high-quality chest compressions with minimal interruptions is recommended when performing either conventional or hands-only CPR.[48,49] The quality, depth, and rate of compressions and the duration of interruptions to compressions have a direct impact on outcome of cardiac arrest.[5,8,62–69] Performance of high-quality chest compressions should therefore be the core psychomotor skill taught in any CPR training program, with emphasis on correct depth and rate, full chest recoil, and minimal interruptions in compressions. When teaching hands-only CPR for adults who have suddenly collapsed, providing high-quality chest compressions is the *only* psychomotor skill that needs to be taught.

### *Skills Practice*

Chest compressions and rescue breathing are psychomotor skills that are best learned through practice.[70,71] The level of proficiency in performing CPR skills gained from training is directly related to the amount of time provided for skills practice during training. Studies that have assessed CPR skills among trainees in programs that do not offer psychomotor skills practice sessions ("cognitive-only" CPR training) have consistently shown that trainees do not, on average, achieve an acceptable standard level of proficiency (J. Potts, oral communication, 2009).[52,72–74] To optimize skills performance, psychomotor skills practice should be an essential component of CPR training programs.

## Critical Teaching Points in AED Awareness or AED Skills Training

AEDs are simple and easy to use. When the AED is turned on, it provides voice prompts and visual cues to guide the user through all the appropriate steps. Gundry and colleagues[75] used a mock simulation of cardiac arrest to familiarize sixth-grade students who had no previous training with the use of an AED. They compared time to defibrillation, pad placement, and compliance with AED prompts to stand clear of the patient during shock delivery between the sixth graders and emergency medical technicians and paramedics. The mean time to defibrillation was 90 seconds for the sixth graders and 67 seconds for the professionals. Both the sixth graders and professionals placed the pads correctly and stood clear of the patient during shock delivery. Lawson et al[76] assessed third graders' use of an AED after explaining only the mechanics of peeling off the backing from the pads. Those students successfully used the AED on a manikin but, after a 2-minute, one-on-one orientation, their performance was significantly faster in a second trial. These studies dramatize the ease of AED use by even the very young and, in the latter instance, minimally trained users.

The findings from these studies are also consistent with other findings that AED use primarily requires only cognitive knowledge.[73,77] The only psychomotor skills required to use an AED are to turn on the device and correctly place the pads on the victim's bare chest.[78] Minimal training exercises have been shown to adequately improve performance of this skill.[76,77,79,80] One step that users often fail to perform properly during simulated use of an AED is checking to make sure that no one is touching the patient ("clearing the patient") during the 2 critical stages of rhythm analysis and

**Table 1. Two Sample Formats for Delivering CPR Training**

| Delivery Format | Certification Card | Approximate Time | Sample Course (AHA) | Course Content | Model 1 Cost per Student* | Model 2 Cost per Student* With Volunteer Instructor/Evaluator | Model 3 Cost per Student* (Equipment & Supplies Only) | Additional Comments |
|---|---|---|---|---|---|---|---|---|
| Instructor | No | 1.25 h | Family & Friends CPR | Core modules<br>• Adult/Child CPR<br>• Adult/Child Choking<br>Optional module (1.25 h):<br>• Infant CPR and Choking | $12.71 ($11.35)<br>With optional module: $14.79 ($13.39) | $7.33 ($5.94)<br>With optional module: $9.42 ($8.02) | $5.83 | • Skills practice but no testing |
| | Yes | 2 h | Heartsaver CPR in Schools | Core modules<br>• Adult/Child CPR<br>• Adult/Child Choking<br>Optional modules (2 h):<br>• Adult/Child AED<br>• Infant CPR and Choking<br>• Use of Face Mask/Shield | $20.74 ($12.84)<br>With optional modules: $26.54 ($18.64) | $15.33 ($7.43)<br>With optional modules: $20.43 ($12.52) | $5.83 | • Program optimized for schools<br>• Skills practice *and* testing<br>• Skills testing can also be performed by a skills evaluator or by use of an authorized computerized manikin system |
| Self-directed | No | 22 min | Family & Friends CPR Anytime | Core module:<br>• Adult CPR<br>Optional modules (11 min):<br>• Adult/Child Choking<br>• Child CPR<br>• Use of Face Mask/Shield | $25<br>With reuse option: $10 per subsequent reuse of kit | N/A | N/A | • Individual, self-contained training kit, each with DVD and manikin<br>• Training can be conducted in a group with a facilitator (peer, staff, or faculty)<br>• Allows use at home by others<br>• Skills practice but no testing |
| | Yes | 1.5–2.0 h | Heartsaver CPR/AED Online + Heartsaver CPR Anytime + Skills Assessment | Core modules<br>• Adult CPR<br>• Adult/Child Choking<br>• Use of Face Mask/Shield<br>Optional modules (15 minutes):<br>• Child CPR<br>• Adult/Child AED | $54.78 ($46.88)<br>With optional modules: $55.39 ($47.49) | $51.53 ($43.63)<br>With optional modules: $52.14 ($44.24) | N/A | • Same as CPR Anytime except that E-learning cognitive component and skills testing are added<br>• Skills testing can be performed by a skills evaluator (as is assumed in this example) or by use of an authorized computerized manikin system |

CPR indicates cardiopulmonary resuscitation; AED, automated external defibrillator.

*Approximate cost is based on analysis of training 200 students per year with 2 instructors over 3 years. Total includes approximate costs associated with maintenance of instructor/evaluator certification of staff or faculty where applicable; equipment purchase and maintenance; reusable training materials; training materials meant for individual or 1-time use; and cost of self-directed training products where applicable (based on volume pricing). Reuse of books is not recommended, but approximate costs, based on the assumption that books are to be reused, are provided in parentheses.

NOTE: These are approximations of total costs for use in comparing these strategies only. Actual costs will vary. These approximations are not necessarily representative of expenses incurred by or charged by commercial providers of health and safety training.

shock delivery.[77,80] It is recommended that training programs that include AED skills practice emphasize reinforcing the skills of pad placement and clearing the patient.[81]

If a school does not provide skills training in the use of an AED during its CPR course, it is recommended that as a minimum the course should explain

- The purpose of AEDs: When available, an AED should be used with CPR by the general public to help a victim who is unresponsive and has absent or abnormal breathing (ie, only gasping).
- The simplicity and safety of AED use: While CPR is in progress, turn on the AED and follow the instructions. Stop CPR only when instructed to do so.

## Training Program Length

The recommended minimum length for a CPR training course in schools varies according to several factors, as follows:

- Mode of delivery (self-directed learning versus a traditional classroom course and inclusion of cognitive components to enhance psychomotor skills training)
- Number of sessions: whether the course is conducted in 1 session or over several sessions staged over time
- Certification: whether or not certification is desired (which requires more time for a final skills test)
- Student-to-manikin ratio
- Total time allowed for each trainee to practice psychomotor skills
- Additional topics or practice (child CPR, infant CPR, AED skills practice, relief of airway obstruction)

Several studies have demonstrated that trainees, including schoolchildren, can achieve acceptable levels of skills proficiency in adult CPR in 30 minutes or less through a self-directed video-based program.[81–83] The lesson plan for a typical CPR classroom course designed for schools and led by an instructor requires at least 2 or 3 hours if infant CPR is included.[84] Examples of total time required for various training strategies are shown in Table 1.

## Training Strategies

CPR training (with a psychomotor skills component) is most commonly delivered by 1 of 3 different methods: traditional instructor-led courses, traditional peer-led courses, and video-based self-directed training (no instructor). A facilitator is typically present when self-directed video-based training is used in a group setting. These methods have been compared in the literature. Peer-led and video-based training have been shown to be at least as effective as traditional instructor-led courses.[81,85–91] All 3 methods have been successfully implemented in schools.[86,92–94]

Some advantages have been noted for peer-led and video-based training that are worth consideration when planning a school program. Peer-led training generally reduces the demand for instructors, which can simplify logistics and reduce costs.[85–87] Likewise, self-directed video-based training eliminates the need for CPR instructors. Some of these programs, such as the video-based training kit described by Isbye et al[92] have the additional advantage of a short training time (≈22 minutes) and can be used at home by others.

The characteristics of some instructor-led and self-directed training program strategies that could be used in schools are summarized in Table 1.

Course delivery is shown in 2 sample formats: a traditional instructor-led course, with or without certification, and a self-directed video-based course, with or without certification. Sample courses, course content, and costs are shown for each format. In model 1, all costs are paid by the school; in model 2, the school pays for all books, supplies, and equipment but uses volunteer instructors (student peers or others); model 3 assumes that the school pays only for supplies and equipment. All samples fulfill minimum criteria for CPR training in secondary schools recommended in this statement. This information does not represent the full range of acceptable options for course content and delivery available from the AHA or other organizations. N/A indicates not applicable. Data are adapted from the American Heart Association 2010 Course Matrix[84] and Heartsaver CPR in Schools How-to Guide.[95]

Home use of self-directed skills training kits multiplies by >3-fold the total number of people trained in the community per unit of class time dedicated to the program and greatly expands the age distribution of those trained.[92]

As described above, use of an AED largely depends on cognitive knowledge, and therefore training can be easily provided online or through an e-learning strategy. When coupled with a self-directed CPR psychomotor skills training component, CPR/AED training can be fully self-directed.[79] If certification is desired, an instructor, a skills evaluator, or an approved electronic CPR manikin system is required.

Choice of a specific delivery method for CPR training should depend on the ultimate objectives of the program as discussed above (awareness versus skills training, certification by a recognized authority, AED use, or outreach to students' family and friends), and administrative issues as discussed below.

## Program Administration

The challenges of implementing CPR or CPR/AED training in schools go beyond choosing specific program content. A 2003 report from Reder and Quan characterizing high school CPR training programs in the state of Washington provides a useful summary of the barriers to teaching CPR and strategies to overcome those barriers.[96] Sixty-five percent of responding high schools provided CPR training to some proportion of their students. The reasons most frequently cited as the "most significant" barrier to providing training were time to teach CPR in the curriculum (24% [36/148]), lack of funds (16% [24/148]), and instructor scheduling difficulties (17% [25/148]). It is noteworthy that the same 3 factors were most commonly rated as significant barriers among head teachers in secondary schools in Barcelona, Spain (high and medium ratings were combined in that study).[97] Since the Reder and Quan survey was conducted, changes in recommendations and training options for CPR have mitigated some barriers that were identified, but unfortunately there have also been changes in the US educational system that heighten barriers, such as funding and time. Nonetheless, the barriers noted in the Reder and Quan study remain relevant and provide a useful framework for the following discussion of program administration.

### *Time*

The additional class time required to teach CPR was cited most often (24% of the time) as the most significant barrier to providing training among the Washington state high schools that responded to the Reder and Quan survey.[96] Since then, class time has become even more precious, because initiatives have been legislated to improve students' academic performance and increase the accountability of schools, the most notable example being The No Child Left Behind Act of 2001.[98]

In the same survey, a large majority (74% [98/132]) of the responding schools that offered training in CPR incorporated that training in health courses. In 48% of schools that require students to perform "community service" for graduation, CPR training would fulfill that requirement. Both strategies, alone or combined, are reasonable ways to efficiently include CPR training in the school curriculum. Further efficiency can be gained though the use of video-based, self-directed training programs that can deliver psychomotor skills training in CPR and use of AEDs to students in <30 minutes[23,83] and online or other e-learning programs that can deliver the cognitive domain of CPR and AED training in an average of 35 minutes.[79]

### *Funding*

Among the Washington state high schools that responded to Reder and Quan's survey, funding was 1 of the 3 factors most often cited as the most significant barriers to implementation of CPR training in schools.[96] It remains a challenge today. Even where CPR training has been mandated by state legislatures, there has been no commensurate allocation of funding to support those programs.* Interestingly, Massachusetts legislation encourages rather than mandates CPR training in schools, yet it offers funding for such training when included in a health education program.[100]

An informal survey conducted by AHA staff shows that schools that provide CPR training often rely heavily on external resources rather than on their own budgets to fund training. External funding or assistance often takes the form of collaborations between schools and private entities, such as foundations, civic organizations, or businesses, or between schools and other public agencies, such as fire departments or

*For the benefit of readers who are not in the field of education, it may be useful to put the approximate cost of providing CPR training in the context of overall total expenditures for public elementary and secondary schools in the United States. In the 2008–2009 school year, those expenditures averaged around $10,418 per student.[99] The range of costs of CPR training strategies compared in Table 1 can be used to calculate that providing CPR training once in a student's 12 years of education incurs an increase of only 0.0064% to 0.044% in the total cost of that student's education.

**Table 2. Examples of Funding Models for CPR Training in Schools**

| Model | Type of Funding | Examples | Comments |
|---|---|---|---|
| 1 | Internal | Shaker Heights High School (Ohio)<br>● Administered by school<br>● Funding by school budget | 360 ninth graders are taught CPR each year by school faculty who are also certified CPR instructors. Training is conducted in physical education classes and includes AED skills training. Certification cards are issued. |
| 2 | Internal/external | (Public-private collaboration)<br>Monroe County Community School Corporation (Bloomington, Indiana)<br>● Administered by individual schools in the district<br>● Supported by Bloomington Hospital<br>● Funded by private donations and school budget | Private donations provide equipment. The local hospital provides instructor training/updates/renewals. Individual schools maintain the program, typically as part of a health class. |
| 2 | Internal/external | (Public-private collaboration)<br>Glen Falls City School District (New York)<br>● Administered by individual schools in the district<br>● Supported by Glens Falls Hospital<br>● Funded by private donations and school budget | Private donations provide equipment and initial instructor training for teachers. The local hospital provides instructors with updates/renewals. Individual schools maintain the program, which is typically included as part of a health class. |
| 3 | External | (Public-private collaboration)<br>Medic II Program<br>● Administered by community volunteers<br>● Supported by Seattle Fire Department<br>● Funded by private donations | Private funds support volunteers from Fire Department staff and others who provide CPR training to the public, including in schools. |
| | | (Public-public collaboration)<br>King County Student CPR/AED Program[102]<br>● Administered by Department of Public Health, EMS Division, Seattle/King County, Washington<br>● Funded by EMS tax levy | Public funds pay for teacher and firefighter CPR instructor training, equipment, and training materials. Funds are allocated based on enrollment and performance (percentage of enrollment actually trained the previous year). |

CPR indicates cardiopulmonary resuscitation; AED, automated external defibrillator; EMS, emergency medical services.

EMS systems. Table 2 summarizes examples of various types of funding strategies.

Cost per student may greatly influence the choice of a training strategy (Table 1). When traditional training strategies are used to teach the core content of an adult CPR course, the cost per student depends heavily on the cost of the student manual. This sometimes drives schools to reuse books to reduce their overall program cost. This approach has several disadvantages: it reduces the chance that others will have access to information about CPR and AEDs, it is more difficult for students to review materials at a later date, and it precludes students from retaining ancillary materials that might be included with their books, such as pocket reminder cards and computer media. However, the reuse of books is a viable strategy for reducing the cost of CPR training in schools.

Integration of self-directed components may reduce the cost of maintaining instructor certification of staff or faculty and mitigate some logistic challenges but will likely increase the per-student cost of training because of the additional cost of online or other e-learning programs and self-directed CPR skills training kits. The cost of using self-directed skills training kits should also be considered in the wider context of the potential to increase training among students' friends and families, which yields even greater improvement in the capacity of a community to respond to victims of OHCA.

### *Instructor Training and Scheduling*

Like time and funding, this factor was 1 of the 3 barriers most often cited as most significant by the Washington state high schools that responded to the Reder and Quan survey.[96] The use of certified instructors to conduct CPR training is particularly important in traditional instructor-led training courses or when certification is desired (for example, when students need CPR certification as a job requirement).

This barrier can be addressed by opting to use "outside" instructors for instructor-led training courses. Outsourcing training to a commercial entity may or may not increase overall costs compared with maintaining the instructor status of some staff and faculty. The use of volunteer instructors almost certainly will reduce program costs (Table 1).

Since the Reder and Quan survey, another option has evolved that does not remove, but in part lowers the certified instructor barrier. The AHA now offers the certified CPR Skills Evaluator option, which requires ≈8 to 12 fewer hours of training than that required for certification as a CPR instructor.[101] The skills evaluator may perform skills testing for certification of trainees but may not conduct the training program. Use of skills evaluators in a large school or multiple schools within a district may mitigate the logistic challenges and costs of providing CPR training that leads to certification.

Skills evaluators may also be used to certify students who have completed their cognitive and psychomotor training through self-directed programs. Although such a strategy can significantly lower the instructor certification barrier, it may come at a substantially greater cost compared with traditional training because of the cost of self-directed skills training kits (Table 1).

### *Class Scheduling*

In the Reder and Quan survey, class scheduling was cited by some schools (9%) as the most significant barrier to implementation of CPR training.[96] This barrier can be mitigated by including CPR training as part of the lesson plan for a required course, such as health or physical education. Traditional or self-directed training can be distributed over several class periods or short self-directed video-based training can be offered in a single class period. Integration of CPR training into the curriculum of a required course may also help preserve the CPR program over the long term by "institutionalizing" that training.

### *Equipment*

The purchase and maintenance of CPR training manikins and AED simulators are a significant part of training costs and have been identified as a significant barrier to implementing CPR training in high schools.[100] Beyond the initial purchase, storage and maintenance (dismantling, disinfection, and reassembly) of manikins between courses consumes measurable resources. It is possible to mitigate this cost by having volunteers such as students or Parent-Teacher Association members perform these tasks. Since the Reder and Quan survey was conducted, many new manikin designs are available, some at significantly lower cost than those available in 1999. Schools should consider 4 important factors when choosing manikins: durability, maintenance (cleaning, disinfection, and cost of replacement parts), cost of nonreusable elements if any (such as face shields or lungs), and functional characteristics. Manikins used for conventional CPR skills training (rescue breathing and chest compressions) should mimic the human airway in requiring the head tilt–chin lift maneuver to allow air to enter the lungs, the capacity of the human lungs, and characteristics of the human thorax in providing surface landmarks to teach correct hand placement and appropriate chest compliance to teach proper chest compressions.

Use of self-directed, video-based training kits that include personal manikins eliminates all issues of equipment maintenance and storage but may increase the per-student cost of training. This cost can be mitigated with the use of self-directed skills training kits that are designed for reuse (CPR Anytime reuse option, model 1, Table 1).

## Current Status of Legislation and Education Content Standards Mandating CPR or CPR/AED Training in Schools

An Internet-based search of existing state legislation and relevant documents from state departments of education was conducted by AHA staff in September 2009 and updated in February 2010 to identify requirements and recommendations for teaching CPR to the general student population. The results of that search are summarized in Table 3. Details can be found in the Appendix, which is available online, with states grouped by the language in their legislation or curriculum content standards, annotated with relevant standards and legislation identifiers (where they could be found in this search). Links are provided to all states' curriculum content standards or relevant legislation. Excerpts of documents in which teaching CPR to the general student population is mentioned are also provided.

Thirty-six states currently have legislation, state department of education curriculum content standards, or frameworks that refer to teaching CPR in schools. Most of those relevant state standards reflect the principle expressed by Standard 7 of the National Health Education Standards: "Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks."[103] Only 6 states explicitly require CPR training courses that routinely include skills practice. In those states, schools are required to provide CPR training as part of the mandatory health education curriculum for all students. In the other 30 states, laws or curriculum content standards describe training expectations for students in a variety of less rigorous ways. Seventeen states refer to students "demonstrating" their CPR skills as the goal of the class lesson, and in other states students are expected to simply "describe," "know," "understand," or "recognize" the steps of CPR. In the remaining 14 states and the District of Columbia, CPR training in schools is not mentioned in legislation or curriculum content standards.

Only 2 states have legislation that addresses funding. Massachusetts State Administrative Code, Part I, Title XII, Chapter 71, Section 1, directly addresses the costs incurred by some schools by stating that "The department of education shall pay for the cost of any such instruction in cardiopulmonary resuscitation… [in the event that]… a school committee may by majority vote decide that such instruction shall not be offered." In Iowa, legislation containing the General Accreditation Standards for schools[104] indirectly addresses funding by including language that is "permissive" of a collaborative model of implementation: one using volunteer instructors. It states "A course that leads to certification in CPR may be taught during the school day by either a school or school district employee *or by a volunteer*, as long as the person is certified to teach a course that leads to certification in CPR." No other instance of states mitigating the "unfunded mandate" dilemma was found in this search.

It is the recommendation of the AHA that training in CPR be a requirement for graduation from secondary schools. Specific essential components that define acceptable CPR training have been detailed above and are summarized in the next section. State legislation and educational content standards should unequivocally require and provide for the meaningful support and enforcement of a requirement for CPR training for graduation.

**Table 3. Results of a Search of State Legislation Referring to Teaching CPR to the General Student Population**

| | |
|---|---|
| **A. Recommends a Type of Training Course That Would Require Skills Practice (Mandatory for Graduation)** | |
| Alabama | Code of Alabama, 1975, §16-40-8 |
| Indiana | Administrative Rule, 511 IAC 6.1-5-4 |
| Iowa | Ch 12, General Accreditation Standards, 281-12.5(20) |
| Louisiana | Standard (health) §309, B 741:2.105.09, B 741:2.105.15 |
| North Carolina | Healthful Living Goal 2.03 (grade 8) |
| Rhode Island | Statute §16-22-15 R16-21-SCHO - §5.1.2 |
| **B. Recommends CPR Certification But Without Explicit or Implicit Mention of Training That Includes Skills Practice** | |
| Nebraska | Health Education Frameworks 3.5c |
| Oklahoma | SB 618 Department of Health Standards for School Health |
| Tennessee | Standard No.: 5.6 Safety & First-Aid |
| **C. Student Must Demonstrate CPR Skills** | |
| Arizona | Standard 3 3CH-P5. PO 2. |
| California | Standard 7: 7.3.S |
| Connecticut | CT Framework: K-12 Content Standard 2 |
| Florida | Statute 1003.43 Content Standard PE.912.M.1.17 |
| Hawaii | HCR163 Benchmark HE.6-8.1.4 |
| Illinois | Performance Standard 22A.4c |
| Kentucky | Standard for ″Practical Living″ Safety section |
| Maryland | Standard (health) 5.0 A.1.b |
| Massachusetts | General law 71.1 |
| Minnesota | HPE-QTN Grade 10. Standard 4 |
| Missouri | Ch 167 Pupils and Special Services Section 167.624 |
| Texas | TEKS §115.23. Hlth Ed b.5.G (grade 7–8) |
| Utah | Health Education I & II Standard 4.2.b |
| Vermont | Standards (health) HE1 b (Grades 7–8) HE1 a (Grades 9–12) |
| Virginia | Standard (health) 10.3 (Grade 10) 9.3 (Grade 9) |
| Washington | Standards (health) 2.4.2 (Grades 7–12) |
| West Virginia | Board of Education Policy 2520.5: HE.7.1.05 & HE.8.1.05 |
| **D. Student Must Describe, Know, Understand, or Recognize Steps of CPR** | |
| Arkansas | Content Standard 10 HW 10.6.10 |
| Georgia | QCC Standard 43 |
| Maine | Standard Chapter 127 Health & Physical Education |
| New Hampshire | Standards Injury Prevention (High School) |
| New Jersey | Standards (health) 2.1A & 2.1F |
| New York | Standards Guidance Document ORH.C.4 |
| North Dakota | Health Content and Achievement Standard 2:9-12.2.7 (grades 9–12) |
| Oregon | Standards Maps High School |
| Pennsylvania | Standard 10.3.12(B) |
| South Carolina | Standards (health) I-5.1.2 & I-7.1.2 |

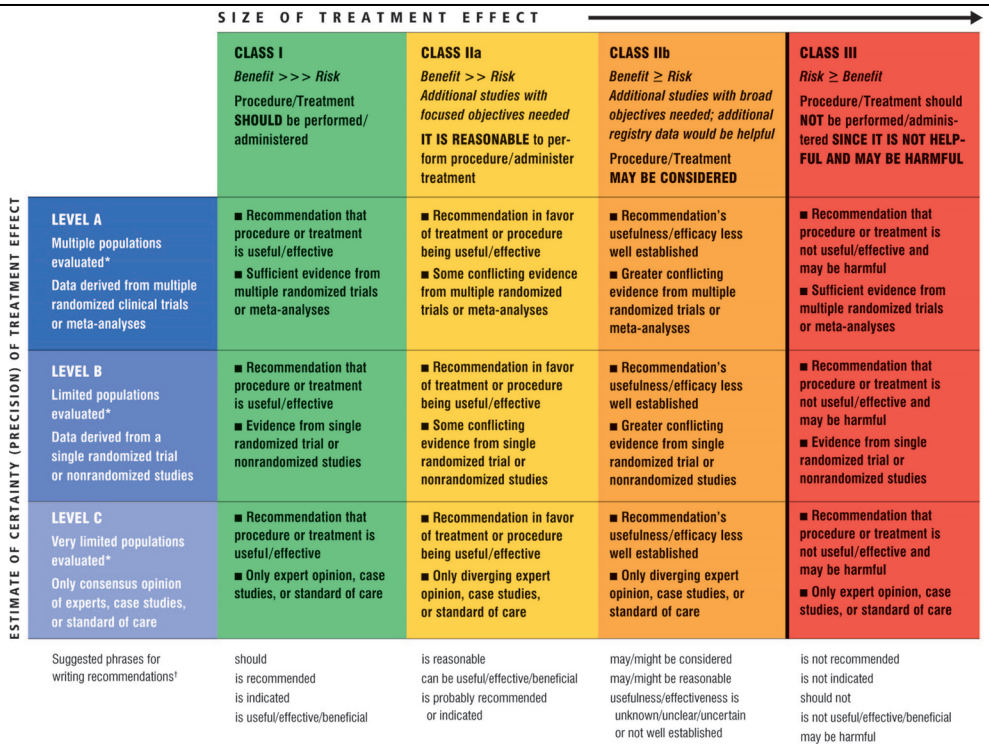
**E. No Mention of CPR**

| | |
|---|---|
| Alaska | Nevada |
| Colorado | New Mexico |
| Delaware | Ohio |
| Idaho | South Dakota |
| Kansas | Washington, DC |
| Michigan | Wisconsin |
| Mississippi | Wyoming |
| Montana | |

The search results are grouped as follows: (A) Six states require CPR training, including skills practice, as part of mandatory health education. (B) Three states recommend CPR training that leads to certification but do not require inclusion of skills practice during training. (C) Seventeen states recommend CPR training that requires students to "demonstrate" their CPR skills. (D) Ten states recommend CPR training that enables students to "describe," "know," "understand," or "recognize" the steps of CPR. (E) In 14 states and the District of Columbia, there is no mention of CPR training in schools in legislation or curriculum content standards.

CPR indicates cardiopulmonary resuscitation. See also supplemental data located at http://circ.ahajournals.org/cgi/content/full/10.1161/CIR.0b013e31820b5328/DC1.

**Table 4. Applying Classification of Recommendations and Level of Evidence**




*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Even though randomized trials are not available, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

†For recommendations (Class I and IIa; Level of Evidence A and B only) regarding the comparative effectiveness of one treatment with respect to another, these words or phrases may be accompanied by the additional terms "in preference to" or "to choose" to indicate the favored intervention. For example, "Treatment A is recommended in preference to Treatment B for. . . " or "It is reasonable to choose Treatment A over Treatment B for. . . . " Studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

## Summary of Recommendations

The American Heart Association makes the following recommendations for CPR training in schools.

### Primary Recommendations†

CPR training (as defined below) should be required for graduation from secondary school (***Class I; Level of Evidence B).*** CPR training that is meant to comply with this mandate should at minimum:

- Conform to the core teaching objectives for lay provider training described in the most current AHA Guidelines for CPR and ECC (including any interim updates), **with special emphasis on:**
  - Recognizing the need to initiate CPR (including cautions that "gasping" is not "normal breathing") (***Class I; Level of Evidence A*****).**
  - Performing high-quality chest compressions with minimal interruptions (***Class I; Level of Evidence B*****).**
- Provide an opportunity to practice and master psychomotor skills related to CPR **by use of an appropriate surrogate for the victim.**
- Make students aware of the **purpose of an AED and the ease and safety of using an AED.**

### Secondary Recommendations

In schools that provide a CPR training program that includes AED skills practice (a CPR/AED course), students should be given an opportunity to practice and master all steps of CPR and AED use (***Class I; Level of Evidence B*****),** with special emphasis on:

- Minimal interruptions in performance of CPR
- Correct application of pads to an appropriate surrogate for the human thorax
- Proper "clearing" of the patient (checking to see that no one makes contact with the patient) when so instructed by the AED.

## Appendix

The online data supplements for this advisory contain a supplement to Table 3 with excerpts from and links to state legislation and curriculum content standards and also state data mapped to National Health Education Standards (NHES).

Another useful link is the Be the Beat Web site, which was developed by the AHA as part of its youth CPR awareness campaign. It contains activities for children as well as lesson plans for integrating those activities into school CPR awareness and training programs.

†The system (Table 4) used in this section for classifying recommendations and the level of evidence supporting them are consistent with those first described in Anderson et al.[105]

# Disclosures

## Writing Group Disclosures

| Writing Group Member | Employment | Research Grant | Other Research Support | Speakers' Bureau/ Honoraria | Expert Witness | Ownership Interest | Consultant/ Advisory Board | Other |
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| Jeff Beeson | EPAB EMS | None | None | None | None | None | None | None |
| Alison Ellison | Children's Hospital of Atlanta | None | None | None | None | None | None | None |
| Andrew Gregory | Vanderbilt University | None | None | American Academy of Pediatrics*; Contemporary Forums*; Advanced Wilderness Life Support* | Expert witness to a very few patients of my own* | None | None | None |
| Mary Fran Hazinski | Vanderbilt University School of Nursing—Professor; AHA ECC Product Development—Senior Science Editor (compensation from the AHA to write and edit the AHA Guidelines for CPR and ECC and resuscitation statements and training materials)† | None | None | None | None | None | None | None |
| Loren F. Hiratzka | Cardiac Vascular and Thoracic Surgeons, Inc, (Cardio-thoracic and vascular surgical group) TriHealth, Inc. | None | None | None | None | None | None | None |
| Keith G. Lurie | Advanced Circulatory Systems Inc. | None | None | None | None | Inventor of the ResQPOD and may benefit from sales if this device is discussed in article† | None | None |
| Laurie J. Morrison | Li Ka Shing Knowledge Institute, University of Toronto, Department of Medicine, Division of Emergency Services | Canadian Institutes of Health Research, Epistry component of the Resuscitation Outcomes Consortium†; AHA Laerdal Foundation for Acute Medicine–grant to compare training strategies for children in grade 9 to acquire CPR and AED skills–CPR Anytime Anyschool-Principal Investigator*; HSFC Knowledge translation grants in resuscitation–(1) Gender bias in post arrest care-GENDER PAC (PI), (2) Premature termination of resuscitation in post arrest care-PREMATOR PAC (Co-I), (3) Post arrest consult team; a KT intervention to improve post arrest care-PACT (Co-I)*; Laerdal Foundation for Acute Medicine–Centre Support Program, Center for Resuscitation Science and Knowledge Translation-CRS-KT*; Heart and Stroke Foundation of Canada, Strategies for post arrest care–The "SPARC" Network Project* | None | None | None | None | None | None |

(*Continued*)

**Continued**

| Writing Group Member | Employment | Research Grant | Other Research Support | Speakers' Bureau/ Honoraria | Expert Witness | Ownership Interest | Consultant/ Advisory Board | Other |
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| Jerald Potts | American Heart Association | None | None | None | None | None | None | None |
| Ricardo A. Samson | University of Arizona | None | None | None | Reviewed patient records and provided expert medical opinion from a pediatric cardiology perspective regarding a wrongful death suit-case was settled out of court, deposition was never taken and not called to testify* | None | American Heart Association, Consultant* | None |
| Michael R. Sayre | Ohio State University | None | None | None | None | None | None | None |
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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10,000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10,000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

**Reviewer Disclosures**

| Reviewer | Employment | Research Grant | Other Research Support | Speakers' Bureau/Honoraria | Expert Witness | Ownership Interest | Consultant/Advisory Board | Other |
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This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit. A relationship is considered to be "Significant" if (a) the person receives $10,000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10,000 or more of the fair market value of the entity. A relationship is considered to be "Modest" if it is less than "Significant" under the preceding definition.

†Significant.

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KEY WORD: AHA Scientific Statements ■ cardiopulmonary resuscitation ■ defibrillation ■ heart arrest ■ resuscitation ■ schools