

WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

Worksheet author(s)

Deems Okamoto, M.D.

Date Submitted for review:

Clinical question.

In BLS providers (lay or HCP) requiring AED Training (P), are there any specific training interventions (I) compared with traditional lecture/practice sessions (C) that increase outcomes (eg. Skill acquisition and retention, actual AED use, etc.) (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? *Intervention/Therapy*

State if this is a proposed new topic or revision of existing worksheet:

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? *No.*

Search strategy (including electronic databases searched).

Cochrane database for systematic reviews, Central Register of Controlled Trials: *MESH and keyword:* {[MESH] Teaching OR [MESH] Education OR (AED training) OR (training interventions)} AND {(AED) OR (CPR) OR (cardiopulmonary resuscitation)} **131 records**

PUBMED: *MESH and keyword:* {"automated external defibrillators" OR "AED" OR "resuscitation" OR "CPR" OR "cardiopulmonary resuscitation"} AND {"AED training" OR "training" OR "training interventions"} AND {[randomized controlled trials] OR [systematic]} **422 records**

OVID MEDLINE: *MESH and keyword:* {"CPR" OR "resuscitation" OR "cardiopulmonary resuscitation"} AND {"AED" OR "automatic external defibrillator"} AND {"training" OR "training interventions" OR "AED training"} **10 records**

CINAHL: *MESH, Boolean and keyword:* {"CPR" OR "cardiopulmonary resuscitation" OR "automated external defibrillators" OR "heart arrest"} AND {"AED" OR "AED training" OR "training interventions"} **65 records**

ECC EndNote X Master Library and CPR Training Master Library: keywords "AED", "AED training", "training interventions", "training", "CPR", "cardiopulmonary resuscitation" (7)

IMPORTED: Cochrane, PUBMED, MEDLINE, CINAHL (using "AED" delimiter): 297 records

EMBASE: ((automated AND external AND ('defibrillators'/exp OR 'defibrillators') AND [2005-2009]/py) OR (aed)) AND (('resuscitation'/exp OR 'resuscitation') OR (cardiac AND arrest) OR (cardiopulmonary AND ('resuscitation'/exp OR 'resuscitation')) OR (cpr)) AND ((aed AND ('training'/exp OR 'training')) OR ('training'/exp OR 'training') OR (('training'/exp OR 'training') AND interventions)) AND (((resuscitation'/exp OR 'resuscitation') OR (cardiac AND arrest) OR (cardiopulmonary AND ('resuscitation'/exp OR 'resuscitation')) OR (cpr)) OR (public AND access AND ('defibrillation'/exp OR 'defibrillation')))) **168 records**

EndNote Library combining the above: 182 records

Review of C2005, W191A_Young: 17 records

Review of C2005, W191B_Celenza: 37 records

Hand search of EndNote library and eliminating duplicates: **116 records**

Review of abstracts and culling inappropriate, irrelevant articles: **31 records**

• State inclusion and exclusion criteria

Surrogate Outcome: Recognition of arrest state; successful application and operation of an Automated External Defibrillator by a BLS Provider to a human or mannequin to deliver or not deliver a defibrillation shock.; correct application of defibrillation pads; safety issues

Dates of Searches: 1985 to the present.

Excluded were all animal and non-human studies; all CPR and AED training not mentioning AED within the title or text; non-peer reviewed popular press articles/commentaries/opinions expressing public perceptions of AED use in resuscitation; studies not available except in abstract format and studies not in English or translated to English.

Included were mannequin training studies mentioning AED use in training and landmark reviews of AED training and training programs. Also included were articles relating to AED use in pediatric resuscitation.

• Number of articles/sources meeting criteria for further review: **32 records**

LOE1= 12 studies; LOE2= 9 studies; LOE3= 1 studies; LOE4= 6 studies; LOE5= 4 studies

Summary of evidence

Evidence Supporting Clinical Question

Good	De Vries2008E1,E2,E6,E8 Harve2007E1,E7 Meischke2001E1,E3,E5,E6,E7 Monsieurs2005E1,E2,E7 Nurmi2005E1,E2 Roppolo2007E1,E2,E3,E4,E7,E8 Wik2003E1,E3,E5	Castren2004E1,E7,E8 Jerin1998E1,E3,E7,E8 Reder2006E1,E2,E3,E4,E5,E7,E8		Harrison-Paul2006E5,E7	Riegel2006E4,E6,E7
Fair	Fromm1997E1,E3,E5	Andresen2008E1,E3,E8 Beckers2005E1,E2,E5,E6,E7 Beckers2007E1,E2,E3,E5,E6,E7 Kelley2006E1,E3,E5,E7,E8 Uray2003E1,E3,E4,E5,E6,E7,E8 Younas2006E1,E4,E5,E6,E7		Eames2003E1,E4 Timmons2007E5,E6,E7	
Poor				Robak2006E1,E2,E4,E5,E6,E7	
	1	2	3	4	5
Level of evidence					

- A = Return of spontaneous circulation
- B = Survival of event
- E1 Immediate skill acquisition
- E2 Superior skill acquisition
- E3 Skill retention
- E4 Cognitive acquisition
- E5 Willingness to use AED
- E6 Increased motivation
- E7 Acceptance
- E8 Cost and resource conservation

- C = Survival to hospital discharge
- D = Intact neurological survival

- E = Other endpoint
- Italics = Animal studies*

Evidence Neutral to Clinical Question

Good	Christenson2007E1,E3,E4,E5,E6 Hedges2006E1,E3,E4,E5,E6,E7 Rittenberger2006E1,E5 Woolard2006E1,E3				Groh2007E1,E2,E3,E5,E6,E7
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Fair					De Jesus2005E5,E7,E8
Poor				England2005E1,E5,E6,E7 Warwick1995E1,E5,E6,E7	Cummins1985E1,E3,E4,E5,E6,E7
	1	2	3	4	5
Level of evidence					

A = Return of spontaneous circulation
 B = Survival of event
 E1 Immediate skill acquisition
 E2 Superior skill acquisition
 E3 Skill retention
 E4 Cognitive acquisition
 E5 Willingness to use AED
 E6 Increased motivation
 E7 Acceptance
 E8 Cost and resource conservation

C = Survival to hospital discharge
 D = Intact neurological survival

E = Other endpoint
Italics = Animal studies

Evidence Opposing Clinical Question

Good			Harve2009E1,E3,E5,E7,E8		
Fair					
Poor					
	1	2	3	4	5
Level of evidence					

A = Return of spontaneous circulation
 B = Survival of event
 E1 Immediate skill acquisition
 E2 Superior skill acquisition
 E3 Skill retention
 E4 Cognitive acquisition
 E5 Willingness to use AED
 E6 Increased motivation
 E7 Acceptance
 E8 Cost and resource conservation

C = Survival to hospital discharge
 D = Intact neurological survival

E = Other endpoint
Italics = Animal studies

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

BEST OUTCOMES

In the narrowest interpretation of BLS providers requiring AED training, the best outcomes occur with the shortest, most focused courses [Andresen2008] that are visual and not necessarily instructor-led [Beckers 2005][Beckers 2007][Wik2003] involving the safest devices [Beckers2005][Beckers2007][Fromm1997][Monsieurs2005] and the most motivated providers [Harve 2007][Harve2008][Uray2003]. With current technology, this would include visual prompts by the device as well as those imprinted on the pads [Eames2003][Fromm1997], and require only the single human intervention

of properly applying the pads to the suspected victim without any further human intervention [Beckers 2005][Beckers 2007][Eames2003]. Further treatment, including CPR, would then be given by advanced providers in a tiered response with the AED provider being the first to intervene [DeJesus2005].

ALTERNATIVE COURSES

Numerous studies of alternative AED training courses have shown equivalent or better outcomes as compared to standardized instructor-led and directed courses [Andresen2008][Beckers 2005][Beckers 2007][deVries2008][Eames2003][Fromm1997][Meischke2001][Reder2006][Uray2003][Wik2003]. In some studies, instructor-led courses used non-standardized teaching methods and techniques [Castren2004][Kelley2006][Uray2003] such as computer-based training [Meischke2001] and retraining [Jerin1998] with good results. One course utilized intensive, highly trained and motivated instructors, such as medical students, to provide individualized and personalized training experiences to cardiac arrest survivors and their families [Robak2006]. Another study utilized secondary school teachers who were neither BLS instructors nor providers to deliver classroom-based didactics to students followed by CPR and AED practice workshops facilitated by experienced healthcare educators, again with good training outcomes [Younas2006].

A study was conducted comparing the standard American Heart Association HS-AED course lasting 3-4 hours, with the training involving AED skills practice, versus a 30 minute “watch-while-you-practice” video based CPR course providing only a verbal discussion of the AED without a skills practice. The investigators found that the shorter training course resulted in better performance of AED skills at the immediate post-instructional and 6 month testing episodes than did the standard length American Heart Association course. Most importantly, the investigators conjecture that the use of an AED is mostly a cognitive skill and that this would be amenable to video or internet training, resulting in better initial performance and a longer retention of skills as compared to the traditional instructor-led training course which emphasizes the psychomotor aspects of AED use. The implication from this is that cognitive training and device driven instructions are more important to initial and long term performance than psychomotor training when using a device such as an AED [Roppolo2007].

Others studies using variant training ventures, such as distribution of only written or oral materials, resulted in comparable outcomes of AED performance when compared to standardized instructor led courses [Beckers 2005][Beckers 2007][deVries2008][Fromm1997][Wik3003]. One study compared computer based training which subsequently outperformed standard instructor led training in CPR-AED didactic knowledge among high school lay providers [Reder2006]. Another example used a very simple written instruction to direct untrained lay providers in providing only defibrillation during a simulated cardiac arrest. This was then followed by a 20 minute training event involving only the operation of an AED or manual defibrillator. On immediate retesting, the now-trained AED and manual defibrillator providers recorded excellent performance, but only the AED trained individuals retained sufficient operational skills at the 10 month reevaluation to be considered competent [Fromm1997]. A study utilizing cartoons to instruct 6-7 year-old children proved quite successful and was limited only by location, time and funding [Uray2003]. Two other studies utilized dispatcher-assisted CPR-AED with adequate performance of the AED using dispatcher verbal prompts [Harve2007][Harve 2009][Uray2003]. And, finally, a single study comparing visual images directing the positioning of the apical pad showed superior placement outcomes when a lateral image of the torso was used [Nurmi2005].

An analysis of the traditionally taught, instructor led North American PAD Trial proposed that modification of the teaching method used for the lay providers might have improved their participation and performance in sudden arrest events had the training been made more congruent with their social, employment, ethnic and personal backgrounds. The comment was made that training that is more content and skills driven rather than

being formally didactic and technical would transfer the educational content into actual practice better had the training been more individualized and congruent [Groh2007].

AED USE IN REAL-TIME EVENTS

The largest, most comprehensive study, the North American PAD Trial, [Christenson2007][Riegel 2006] demonstrated the effectiveness of standardized training for lay volunteer providers. Numerous other small studies have shown that AED use under real time events can be successfully accomplished by both HCPs and lay providers [deVries2004][England2005] with little or no prior training and that their performance improved with subsequent traditional or non-traditional retraining [Jerin1998].

SUMMARY

In summary, for lay and healthcare BLS providers requiring AED training, the simpler the better [Beckers 2005][Beckers2007][Eames2003][Fromm1997][Kelley2006][Roppolo2007] both for initial performance and skills retention [Wik2003]. Because of the cognitive nature of AED training [Roppolo2007] and the guidance provided by the device itself [Beckers2005][Beckers2007] [Castren2004] [Fromm1997] [Monsieurs2005], the only significant effect of instructor intervention was in the placement of the pads [Nurmi2005][Woolard2006] and the encouragement given to the providers to actually use the device [Timmons2007][Uray2003].

Also, concurrent CPR training might have mitigated the effectiveness of AED training and consideration should then be given to separating them as AED training alone resulted in better skills retention as compared to that achieved with concurrent CPR-AED training [Cummins 1985][Harve2007][Rittenberger2006].

Alternative methods of AED training offered an opportunity for comparable outcomes at a considerably lower cost to the individual provider, the sponsoring institution and the healthcare environment as a whole [Andresen2008][Beckers2005][Beckers2007] [Castren2004][deVries2008][Kelly2006][Meischke2001][Reder2006][Wik2003][Woolard 2006]. Several studies [Fromm1997][Groh2007] have shown that simple instructions resulted in excellent AED provider performance and skills retention [Kelley2006][Roppolo2007] whereas standardized instructor driven courses better served the AED providers when they addressed their individual backgrounds, work environment and other personal needs [Harrison-Paul2006][Riegel2006][Warwick1995].

Regardless of training method, the use of the AED in an actual Sudden Cardiac Arrest event is the defining measure of training success. Traditional training of HCP and lay providers has shown excellent outcomes, but alternative training modalities have also been highly successful. So, regardless of the means of training, and in answer to the PICO, the overall outcome of survival from an SCA depends not on the method of training but on who, when, where and what type of device is present and whether it is used. The HCP and lay providers must be convinced that the AED is effective, trustworthy and should be used [Timmons2007] by whatever means available. Ultimately, that is the goal of training.

In 1985, Cummins, RO; Eisenberg, MS; et. al. identified, in a landmark paper, the need for AED resuscitation, the challenges of implementation and the training, psychologic barriers, etc. to be overcome if recovery from out of hospital cardiac arrest was to be successful. Twenty five years later, we are still only partway to answering that call [Cummins1985].

Acknowledgements: None

Citation List

Andresen D, Arntz HR, Grafing W, Hoffmann S, Hofmann D, Kraemer R, et al. Public access resuscitation program including defibrillator training for laypersons: A randomized trial to evaluate the impact of training course duration. *Resuscitation*2008;76(3):419-24.

- Level of Evidence : LOE 2; randomized, but according to groups; standardized; prospective; interventional; mannequin based; moderate sized
- Relevance to the question asked: Indirect. Standardized training with mannequins with time of instruction variation; assessment of skill and knowledge retention; no novel training techniques
- Methodological quality: Fair-Good, not all individuals accounted for at re-testing but attempt to account for them by statistical weighting
 - Were comparison groups clearly defined? Yes
 - Were outcomes measured in the same (preferably blinded), objective way in both groups?Yes
 - Were known confounders identified and appropriately controlled for? No. Large attrition rate due to environment of recruitment (businesses)
 - Was follow-up of patients sufficiently long and complete? Yes
- Outcome(s) assessed: Appropriate outcome assessed: Correct performance of CPR and AED skills at completion of course, 6months and 12 months retesting.
- Magnitude of any observed effect: Percentages and p-value weighting for missing subjects
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. Standardized training in 2h, 4h and 7h courses with comparable outcomes. Skill refreshers of kinesthetic retraining lasting minutes at 6 months sufficed to maintain competency. (Reviewer's comments: Alternative training under ERC guidelines of standard 7 h course having comparable outcomes of 2 h courses with a 6 month minimal refresher.)

Conflict of interest: Disclosures: DA, HRA and SH have received speaking fees from Medtronic. The other authors report no disclosures.

Beckers S, Fries M, Bickenbach J, Derwall M, Kuhlen R, Rossaint R. Minimal instructions improve the performance of laypersons in the use of semiautomatic and automatic external defibrillators. *Critical care*2005 04//;9(2):R110-6.

Level of Evidence: LOE 2; small study; randomized; cohort; linear prospective; observational; control group consisted of same providers before and after a short, non-standard but instructor-led training session; mannequin; lay with highly motivated, intelligent providers

- Relevance to the question asked: Relevant; no prior exposure but possibly biased by nature and background of study group -- highly selective and motivated
- Methodological quality: Fair; all trainees accounted for; control group same providers before training session and assigned to same device for testing; selected population not representative of the public; study design adequate
 - Were comparison groups clearly defined?Yes
 - Were outcomes measured in the same (preferably blinded), objective way in both groups?Yes
 - Were known confounders identified and appropriately controlled for?Yes
 - Was follow-up of patients sufficiently long and complete?No. One week followup by study design
- Outcome(s) assessed: Primary endpoint: Time to first shock. Secondary: Correct pad placement and safety.
- Magnitude of any observed effect: SD, percentages, t-testing; commercial statistical software SPSS 11,0; p-values

- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. Very. Untrained medical students tested in a mannequin scenario without instruction, then with a minimal general theoretical instruction performed very appropriately in AED use. The authors give a long editorial opinion with referencing to current AED training as having no established content or time limits [to 2005] and they do not validate the SAED over the FAED except to comment that the latter is a better public device. (Reviewer's comments: small study of highly motivated and well educated but untrained lay providers to operate SAEDs and FAEDs without instruction, then retested with minimal instruction. Important in that this was done as a singular skill acquisition and without the confounders of CPR.) Conflict of interest: The author(s) declare that they have no competing interests. Medtronic Physio-Control, Germany Corp for loaning the AED trainer and electrode pads to the investigators of the study.

Beckers SK, Fries M, Bickenbach J, Skorning MH, Derwall M, Kuhlen R, et al. Retention of skills in medical students following minimal theoretical instructions on semi and fully automated external defibrillators. *Resuscitation* 2007 Mar;72(3):444-50.

- Level of Evidence: LOE 2; small study; randomized; cohort; linear prospective; observational; control group consisted of same providers before and after a short, non-standard but instructor-led training session; mannequin; lay with highly motivated, intelligent providers
- Relevance to the question asked: Relevant; no prior exposure but possibly biased by nature and background of study group -- highly selective and motivated
- Methodological quality: Fair; all trainees accounted for; control group same providers before training session and assigned to same device for testing; selected population not representative of the public; study design adequate
- Were comparison groups clearly defined? Yes
- Were outcomes measured in the same (preferably blinded), objective way in both groups? Yes
- Were known confounders identified and appropriately controlled for? Yes
- Was follow-up of patients sufficiently long and complete? No. 6 month followup with other quoted studies to 17 months
- Outcome(s) assessed: Primary endpoint: Time to first shock. Secondary: Correct pad placement and safety.
- Magnitude of any observed effect: SD, percentages, t-testing; commercial statistical software; p-values
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. Very. Untrained medical students tested in a mannequin scenario without instruction, then with a minimal general theoretical instruction performed very appropriately in AED use. The authors give a long editorial opinion with referencing to current AED training as having no established content or time [to 2005] and they do not validate the SAED over the FAED except to comment that the latter is a better public device. (Reviewer's comments: See Beckers 2005. This study continuation affirms the excellent 6 month retention of AED skills and safety.) Conflict of Interest: The investigators of the study obtained the AED trainer and electrode pads from Medtronic Physio-Control Germany Corp. (Duesseldorf, Germany) and confirm that no additional governmental, nor commercial financial support that could influence the work, was granted to any of the listed authors. Medtronic Physio-Control Germany Corp. for lending the AED-trainer and electrode pads to the investigators for the study.

Castren M, Nurmi J, Laakso JP, Kinnunen A, Backman R, Niemi-Murola L. Teaching public access defibrillation to lay volunteers--a professional health care provider is not a more effective instructor

than a trained lay person. Resuscitation2004 Dec;63(3):305-10.

- Level of Evidence: LOE 2; randomized but not clearly stated; linear; lay and non-cohort; control group of well trained first aide providers; mannequin
 - Relevance to the question asked: Relevant; standard training but with lay instructors versus HCP's; trainers HCP and lay; outcome of trainees equivalent but less than first aide trainees
 - Methodological quality: Good but lacking long follow up and testing
 - Were comparison groups clearly defined?Yes
 - Were outcomes measured in the same (preferably blinded), objective way in both groups?Yes
 - Were known confounders identified and appropriately controlled for? Yes; confounders identified in a controlled study with blind assessments
 - Was follow-up of patients sufficiently long and complete?Yes, by the study protocol of immediate testing of lay providers without follow up or of retention
 - Outcome(s) assessed: Performance on two scenarios with a checklist
 - Magnitude of any observed effect: small group; percentages; paired and unpaired t-tests; no CI or p-value
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; small study with limited numbers showing that inexperienced lay volunteers without CPR-AED experience can be taught to be instructors who then instruct other lay volunteers in the use of an AED. Comparative analysis of outcomes from these lay volunteers to those taught by HCPs were equivalent in standardized testing. (Reviewer's comments: This interesting study demonstrates the effectiveness of AED training by previously AED-innocent lay volunteers, promoting the concept of effective and cost-reducing AED instruction to lay providers.)
- Conflict of Interest: This study was supported by the Red Cross.

Christenson J, Nafziger S, Compton S, Vijayaraghavan K, Slater B, Ledingham R, et al. The effect of time on CPR and automated external defibrillator skills in the Public Access Defibrillation Trial. Resuscitation2007;74(1):52-62.

- Level of Evidence: LOE 1; randomized, non-crossover; substudy of a larger study [North American PAD Study]; linear; interventional; real-time; control group; lay; mannequin
- Relevance to the question asked: Relevant to question asked; standard instruction; question of AED skill retention over two years after standardized training, retraining and refresher.
- Methodological quality: Good; concealment of trainee groups not possible; evaluation consistent for all groups
 - Was the assignment of patients to treatment randomised?Yes
 - Was the randomisation list concealed?Yes
 - Were all patients who entered the trial accounted for at its conclusion?Yes
 - Were the patients analysed in the groups to which they were randomised?Yes
 - Were patients and clinicians "blinded" to which treatment was being received?No, determined by the study protocol
 - Aside from the experimental treatment, were the groups treated equally?Yes
 - Were the groups similar at the start of the trial?Yes
- Outcome(s) assessed: Overall competence of CPR and AED skills; secondarily successful demonstration of individual skill components
- Magnitude of any observed effect : Sub group of large, controlled randomized study; percentages; SD, appropriate, standard statistical testing and analysis of data obtained, confounders address; CI and p-values generated but no RR
- Direction of support or otherwise for the question asked, according to the specific outcomes that have

been assessed: Neutral of question asked; standard instruction proving effectiveness of standard instruction. AED skill remained high and did not deteriorate over the time of the study. Interestingly, some groups performed better than others based on age, sex, race, English speakers, type of employment and prior exposure to life threatening emergencies. Although a small subset of the originally trained cadre, all retained competency in AED use at one year after initial training. (Reviewer's comments: Although not explicitly stated, the rate of CPR skill acquisition and retention needs constant attention, which, when compared to AED skill retention, probably needs little or no attention over the period of study. The authors do comment on the advancement of AED technology as pre-empting the need for formal AED training. The authors do comment about the testing environment does not necessarily translate to performance in an actual SCA event.)

Conflict of Interest: This study was supported by contract #N01-HC-95177 from the National Heart, Lung, and Blood Institute (Bethesda, MD), with additional support from the American Heart Association (Dallas, TX); Guidant Corporation (Indianapolis, IN); Medtronic Inc. (Minneapolis, MN); Cardiac Science/Survivalink Inc. (Minneapolis, MN); Medtronic Physio-Control (Redmond, WA); Philips Medical Systems, Heartstream Operation (Seattle, WA); and Laerdal Medical Corporation (Wappingers Falls, NY).

None of the authors have conflicts of interest.

Cummins RO, Eisenberg MS, Moore JE, Hearne TR, Andresen E, Wendt R, et al. Automatic external defibrillators: clinical, training, psychological, and public health issues. *Ann Emerg Med* 1985;14(8):755-60.

- Level of Evidence: LOE 5; comment/opinion;
- Relevance to the question asked: Relevant for lay and HCP; mention of training as individualized utilizing verbal prompts, visual aids, demonstrations, participation and role playing; retraining consisting of frequent retesting and telephone reminders
- Methodological quality: Poor but mention of case studies: Fair
 - Good = randomised controlled trials (equivalent of LOE 1)
 - Fair = studies without randomised controls (equivalent of LOE 2-3)
 - Poor = studies without controls (equivalent of LOE 4)
- Outcome(s) assessed: Outcome not assessed but proposed;
- Magnitude of any observed effect : No study performed
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; commentary/opinion but no actual study performed; attempt to identify best training methods, although the authors use a highly individualized instructor driven training schedule. Mention is also made of performance dictated by the device protocols of these early machines. Otherwise, the article is a compilation of current thoughts and unknowns to be answered as AED use and distribution increases. (Reviewer's comments: It is interesting to note that even with this early study [1985] that the authors propose eliminating CPR in favor of device operation, especially in terms of training.)

Conflict of Interest; Supported in part by grants from the National Center for Health Services Research (HS-05174, HS-04894), the Cardiac Resuscitator Corporation, Wilsonville, OR; the Physio-Control Corporation, Redmond, WA; and the Laerdal Foundation, Stavanger, Norway,

de Vries W, Schelvis M, Rustemeijer I, Bierens JJLM. Self-training in the use of automated external defibrillators: The same results for less money. *Resuscitation* 2008;76(1):76-82.

- Level of Evidence: LOE 1; small group; single study; randomized; non-cross-over; cohort; interventional; standardized vs alternative; mannequin
- Relevance to the question asked: Relevant; traditional training versus self-directed, proscribed learning

materials not instructor-based. Mandated training for motivated trainees; HCP.

- Methodological quality: Good; meets most of requirements
 - Was the assignment of patients to treatment randomised? Yes
 - Was the randomisation list concealed? No
 - Were all patients who entered the trial accounted for at its conclusion? Yes
 - Were the patients analysed in the groups to which they were randomised? Yes
 - Were patients and clinicians "blinded" to which treatment was being received? No
 - Aside from the experimental treatment, were the groups treated equally? Yes
 - Were the groups similar at the start of the trial? Yes
 - Outcome(s) assessed: Relevant for skills testing; no human intervention data
 - Magnitude of any observed effect : Median analysis using ordinals; conventional statistical tools such as SPSS; percentages with CI and p-values
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; small study; constrained to proscribed materials and technique; no human instructor intervention; single intervention training only. Cost savings was mentioned prominently. Mannequin based testing and no comment on relevance to actual practice or separation of trainees who actually participated in a resuscitation. (Reviewer's comments: Using this alternative, self-directed alternative course with motivated trainees [all had mandatory renewals] the cost savings generated would imply more trainees would be trained overall, benefitting the system overall.)
- Conflict of Interest: No author has a conflict of interest in regard to the AED devices or manikins mentioned in this manuscript.

DeJesus PW. Charging up the public for automated external defibrillators. *Critical Care* 2005;9(2):147-8.

- Level of Evidence: LOE 5; comment/opinion/informational
 - Relevance to the question asked: Not relevant; issue of type of training not addressed
 - Methodological quality: Fair; most of the studies mentioned are of LOE 1-3
 - Good = randomised controlled trials (equivalent of LOE 1)
 - Fair = studies without randomised controls (equivalent of LOE 2-3)
 - Poor = studies without controls (equivalent of LOE 4)
 - Outcome(s) assessed: No actual performance measure; comment/opinion only
 - Magnitude of any observed effect : None; no statistical evidence generated or quoted
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; no specific training or alternatives mentioned or assessed. (Reviewer's comment: Interesting editorial with reasonably good references. Supposition that AED training be predicated on location and that very simplified or no training be given with the current devices directing use through prompts. Also comments on status of AEDs as over-the-counter devices and approaching status of appliances.)
- Conflict of Interest: The author(s) declare that they have no competing interests.

Eames P, Larsen PD, Galletly DC. Comparison of ease of use of three automated external defibrillators by untrained lay people. *Resuscitation* 2003;58(1):25.

- Level of Evidence: LOE 4; non-randomized; potentially biased as same individuals tested all three machines; regardless of randomization, the use of any machine subsequent to first use will bias time to onset of sequencing; cohort; no control group; mannequin; untrained lay provider.
- Relevance to the question asked: Relevant; AED-training innocent lay providers without any training other than the prompts of each machine; potentially biased as each subsequent machine tested is more understandable to completion of tasking

- Methodological quality: Fair-Good
- Were outcomes measured in an objective way? Yes
- Were known confounders identified and appropriately controlled for? Yes
- Was follow-up of patients sufficiently long and complete? No
- Outcome(s) assessed: Relevant; testing of time to defibrillate, pad position and safety of all units; reviewed by videotape
- Magnitude of any observed effect: Machine testing only with defined end-points; no p-values, RR, CI or risk ratio able to be assessed
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; intrinsic bias as noted; important study; alternative training method is by machine only without human intervention; no comparison of performance in actual arrest. (Reviewer's comments: A study based on device prompting of use with subject intervention of turning machine on, placement of pads and defibrillating mannequin. No comment on correlation to real arrest. Significant in the use of untrained and device innocent lay providers. An unanswered question is how much the most critical skill that was performed the most poorly, the placement of the defibrillator pads, would improve with training. This is partially addressed by the study when better placement of the pads occurred as each tested subject moved to the next device.)

Conflict of Interest: The Medtronic Physio-control Lifepak CR plus was supplied by PDI Medical, New Zealand, who are the New Zealand distributor for Medtronic Physio-Control. The Zoll AEDPlus was supplied by Zoll Medical, New Zealand, and the Philips/Laerdal HeartStart Onsite Defibrillator was supplied by Laerdal, Australia.

England H, Hoffman C, Hodgman T, Singh S, Homoud M, Weinstock J, et al. Effectiveness of automated external defibrillators in high schools in greater Boston. *American Journal of Cardiology* 2005;95(12):1484-6.

- Level of Evidence: LOE 4; non-randomized, non-controlled intervention and study; lay providers; cohort; observational
- Relevance to the question asked: Relevant; traditional training using AHA guidelines and courses
- Methodological quality: Poor
- Were outcomes measured in an objective way? Yes
- Were known confounders identified and appropriately controlled for? No
- Was follow-up of patients sufficiently long and complete? No
- Outcome(s) assessed: Relevant; successful defibrillation of SCA
- Magnitude of any observed effect: Percentages only. No risk ratio, CI and p-value not mentioned.
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; small intervention with conventional instructor training according to established training protocols of the AHA and ARC. (Reviewer's comment: Interesting in that some involved school districts were constrained by lack of community support, fear or unwillingness to use the AED, and community reservations about the device. Legal liability and lack of understanding of the device were not barriers to implementation.)

Conflict of Interest: No conflict noted

Fromm RE, Jr., Varon J. Automated external versus blind manual defibrillation by untrained lay rescuers. *Resuscitation* 1997 Jan;33(3):219-21.

- Level of Evidence: LOE 1; small study of randomised untrained participants to AED or manual defibrillator, each group not compared to control of trained operator; cohort; linear; prospective; observational
- Relevance to the question asked: Relevant; untrained lay volunteers asked to use manual defibrillator

or fully automated AED without introduction or prior exposure; then trained and retested. Training consisted of step-by-step use of the devices only.

- Methodological quality: Fair; not all initial volunteers accounted for; environment of testing same; evaluators not blinded
 - Was the assignment of patients to treatment randomised? Yes
 - Was the randomisation list concealed? Yes
 - Were all patients who entered the trial accounted for at its conclusion? No
 - Were the patients analysed in the groups to which they were randomised? Yes
 - Were patients and clinicians "blinded" to which treatment was being received? No; unable by design of study
 - Aside from the experimental treatment, were the groups treated equally? Yes
 - Were the groups similar at the start of the trial? Yes
 - Outcome(s) assessed: Relevant; delivery of shock and time to defibrillation in a simulated VF arrest; identification of arrest state previously made; CPR in progress and not an issue; assessment of application and use of manual defibrillator versus a fully automated AED; retesting immediately after videotape and 10 months later
 - Magnitude of any observed effect: p-values significant; percentages and CI; no RR
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; Small study; difficult to generalize; no comparison to actual cardiac event; no comment of participant involvement with a real event where he had to use his assigned machine with an important outcome and conclusion relating duration of instruction to appropriate application and use of AED versus manual defibrillation; assessment of identification of arrest previously made; CPR in progress. (Reviewer's comment: Small but important study; compared use of an AED versus blind manual defibrillation by untrained lay volunteers during a simulated SCA with CPR in progress. Their only duty was to defibrillate with one of the machines using an instruction sheet during the event, then followed by a twenty minute training session. Following this short training period, they were retested immediately and again at 10 months. The outcome of successful use of an AED remained strongly positive as compared to a manual defibrillator at the initial testing through training and retesting to 10 months. The authors suggest that use and training of lay providers, with and without BLS skills can be made with simple and very short training interventions, not necessarily instructor driven.)
- Conflict of Interest: The authors wish to thank the Laerdal Corporation for provision of the automatic external defibrillator and associated equipment.

Groh WJ, Birnbaum A, Barry A, Anton A, Mann NC, Peberdy MA, et al. Characteristics of volunteers responding to emergencies in the Public Access Defibrillation Trial. *Resuscitation* 2007;72(2):193-9.

- Level of Evidence: LOE 5; large, randomized, national study in mixed public venue; subset analysis to identify volunteer characteristics in real-time arrest situations; cohort; interventional; real-time; lay providers; standardized training; descriptive study from data extracted from a LOE 1 study
- Relevance to the question asked: Relevant to question; identifies volunteer characteristics of participants in a sudden cardiac arrest event; clarifies definition of trained lay provider
- Methodological quality: Good
- Good = randomised controlled trials (equivalent of LOE 1)
- Fair = studies without randomised controls (equivalent of LOE 2-3)
- Poor = studies without controls (equivalent of LOE 4)
- Outcome(s) assessed: Volunteer characteristics of participation in sudden cardiac arrest event; observational;
- Magnitude of any observed effect: no p-values, CI or risk ratios this is an observational study of a

previously established LOE 1 study; potentially volatile social, political and, indirectly, economic issues and confounders of standardized training

- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; standard instructor training with measured outcomes; identifies characteristics of lay volunteer AED providers, their diverse backgrounds, their propensity for participation or non-participation and the venue of that participation; (Reviewer's comments: Descriptive study of data extracted from the American PAD study identifying characteristics of lay providers and trying to address their particular training needs according to their personal, social and employment backgrounds. In the concluding statement, the authors speculate that alternative training interventions may make a difference in performance, state that further study is needed [2006].)

Conflict of Interest: Supported by contract number N01-HC-95177 from the National Heart, Lung, and Blood Institute, Bethesda, MD, with additional support from the American Heart Association, Dallas, TX; Guidant Corporation, Indianapolis, IN; Medtronic, Inc., Minneapolis, MN; Cardiac Science/Survivalink, Inc., Minneapolis, MN; Medtronic Physio-Control, Redmond, WA; Philips Medical Systems, Heartstream Operation, Seattle, WA; Laerdal Medical Corporation, Wappingers Falls, NY. No real or perceived conflict of interest is present for the authors associated with the current work.

Harrison-Paul R, Timmons S, Schalkwyk W Dv. Training lay-people to use automatic external defibrillators: Are all of their needs being met? *Resuscitation* 2006;71(1):80-8.

- Level of Evidence: LOE 4; interview; lay providers; no randomization; no controls; cohort
- Relevance to the question asked: Relevant; directly addresses issues of specific training intervention needs; attitudinal
- Methodological quality: Good, considering that this is an interview
- Were outcomes measured in an objective way? Yes, considering that this is a qualitative study
- Were known confounders identified and appropriately controlled for? Yes with the authors acknowledging that any such study is highly subjective
- Was follow-up of patients sufficiently long and complete? Yes, considering that this was a singular interview and not intended to provide intervention
- Outcome(s) assessed: Interview; attitudes; situational; difficulties of providing service; anxieties about boundaries and qualifications; concerns about individual provider needs
- Magnitude of any observed effect : Interview; attitudinal; subjective; no CI, OR or p-values; "Constant Comparative Method"
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; small study; semi-structured; subjective feelings and opinions with objective end-points; recommendations for training; interviews of providers involved in actual events; Issues found by the interviewers: Training should be as realistic and localized as possible, even to consideration of the mannequins used in training; debriefing and the emotional trauma involved of a real incident with the need to know the victim's outcome, possibly affecting future use of the AED by the provider; questions of length of qualification to use the device according to the training received; issues of potential litigation; and first responder schemes. (Reviewer's comments: the most important outcome of this interview study is the authors' comment that the acquisition of practical skills seems to have overridden the need to prepare the providers for the feelings, attitudes and support they will need to initiate AED use and the aftermath of resuscitation effort, successful or not, implying that not addressing these issues would affect the performance of the provider.)

Conflict of Interest: We would like to thank the Resuscitation Council (UK) for providing the funding for this study.

No author conflict of interest

Harve H, Jokela J, Tissari A, Saukko A, Okkolin T, Pettila V, et al. Defibrillation and the quality of

layperson cardiopulmonary resuscitation-Dispatcher assistance or training?
Resuscitation2009;80(2):275-7.

- Level of Evidence: LOE 3; small study; randomization at subsequent testing; historic control using the same cohort in prior scenarios; cohort; prospective; non-interventional; mannequin based; lay providers. See prior LOE 2 study by same authors.
- Relevance to the question asked: Relevant; lay providers before and after training in AED use, then retested at 6 months; dispatcher training used in the untrained phase
- Methodological quality: Good
- Were comparison groups clearly defined? Yes
- Were outcomes measured in the same (preferably blinded), objective way in both groups? Yes
- Were known confounders identified and appropriately controlled for? Yes; confounders identified but by the nature of the study, could not be completely controlled
- Was follow-up of patients sufficiently long and complete? Yes, for the type of study
- Outcome(s) assessed: Time from collapse to first shock; hands-off time, quality of CPR
- Magnitude of any observed effect: Standard statistical evaluation tools; p-values; SPSS; no CI or RR
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Opposed; dispatcher assistance for use of an AED and performance of CPR initially followed by formal CPR-AED training and retesting in 6 months with a result of improvement of breathing, but without a substantial improvement of CPR-AED delivery. Contrary to expectations, retention of AED skills did not improve with the training and retesting. (Reviewer's comments: The authors speculate the the lack of improvement in this study was possibly due to a lack of need or motivation to perform CPR and use an AED. They also speculate that training such a cadre of unselected participants is costly as compared to other health initiatives.)

Conflict of Interest: There are not conflicts of interest declared by any author of this manuscript.

Harve H, Jokela J, Tissari A, Saukko A, Räsänen P, Okkolin T, et al. Can untrained laypersons use a defibrillator with dispatcher assistance? Acad Emerg Med 2007 07

Accession Number: 2009616879. Entry Date: In Process. Publication Type: journal article. Journal Subset: Biomedical; Online/Print; Peer Reviewed; USA. Special Interest: Emergency Care. No. of Refs: 23 ref. NLM UID: 9418450.;14(7):624-8.

- Level of Evidence: LOE 1; randomized; concurrent; unblinded; small study; lay; created duty to treat; cohort; mannequin
- Relevance to the question asked: Relevant; specific training intervention of dispatcher assisted CPR and AED
- Methodological quality: Good
- Was the assignment of patients to treatment randomised? Yes
- Was the randomisation list concealed? Yes;
- Were all patients who entered the trial accounted for at its conclusion? Yes
- Were the patients analysed in the groups to which they were randomised? Yes
- Were patients and clinicians "blinded" to which treatment was being received? Yes; the evaluators were blinded
- Aside from the experimental treatment, were the groups treated equally? Yes
- Were the groups similar at the start of the trial? Yes
- Outcome(s) assessed: Time interval from collapse to first shock; hands-off time; quality of CPR
- Magnitude of any observed effect: percentages; SPSS and Mann-Whitney U test; p-values; no CI, RR
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; CPR performance was poor when dispatcher led but AED performance was judged

reasonable with almost 2/3 of the tested teams defibrillating within 5 minutes of the onset of the cardiac arrest. Concurrent use of the AED did not compromise the performance of CPR. (Reviewer's comment: An important study finding that relatively motivated young males were unable to provide adequate CPR by dispatcher guidance, but were able to apply and use an AED with moderate success. No comment on retention is noted in the study)

Conflict of Interest: No conflicts noted by author

Hedges JR, Sehra R, Van Zile JW, Anton AR, Bosken LA, O'Connor RE, et al. Automated External Defibrillator Program Does Not Impair Cardiopulmonary Resuscitation Initiation in the Public Access Defibrillation Trial. *Academic Emergency Medicine* 2006;13(6):659-65.

- Level of Evidence: LOE 1; PAD Trial substudy; cohort; randomized; controlled; prospective; real time; lay public; standardized training
 - Relevance to the question asked: Relevant; use of AED by traditionally trained providers; no alternative training mentioned
 - Methodological quality: Good with the exception that, by study design, blinding to use or non-use of an AED was not possible
 - Was the assignment of patients to treatment randomised? Yes
 - Was the randomisation list concealed? Yes
 - Were all patients who entered the trial accounted for at its conclusion? Yes
 - Were the patients analysed in the groups to which they were randomised? Yes
 - Were patients and clinicians "blinded" to which treatment was being received? No. Not possible by study design
 - Aside from the experimental treatment, were the groups treated equally? Yes
 - Were the groups similar at the start of the trial? Yes
 - Outcome(s) assessed: Primary outcome; performance of compressions and ventilation in OOH-CA; Secondary: mouth-to-mouth, chest compressions; any CPR; CPR dependent on whether AED turned on
 - Magnitude of any observed effect : Means and SD; OR; CI; P-values; SPSS
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; CPR performed more often in the CPR-AED arm; AED did not interfere with the provision of CPR. The authors also mention the lay public's fear of incorrect use of the device and the fear of legal liability. (Reviewer's comments: The authors note that the CPR performed in both arms was suboptimal , but was performed more frequently in the CPR-AED arm. Of particular note, the AED was only used 50% of the time by the CPR-AED arm, despite intensive traditional training. Also mentioned were the moderately high drop-out rates of the volunteers; a significant problem over the three years of the program.)
- Conflict of Interest: Supported by the National Heart, Lung, and Blood Institute, Bethesda, MD, under contract #N01-HC-95177; American Heart Association, Dallas, TX; Medtronic/Physio-Control Corp., Redmond, WA; Cardiac Science/Survivalink, Inc., Minneapolis, MN; Philips Corp./Heartstream Operation, Seattle, WA; Guidant Corp., Minneapolis, MN; and Laerdal Corp., Minneapolis, MN.

Jerin JM, Ansell BA, Larsen MP, Cummins RO. Automated external defibrillators: skill maintenance using computer-assisted learning. *Acad Emerg Med* 1998 Jul;5(7):709-17.

- Level of Evidence: LOE 2; small study; assigned randomization; HCP; cohort; prospective; control
- Relevance to the question asked: Relevant; training and testing of HCP's previously traditionally trained with instructors vs computer software program
- Methodological quality: Good; small study
 - Were specific objectives of the review stated (based on a specific clinical question in which

patient, intervention, comparator, outcome (PICO) were specified) Yes

- Was study design defined? Yes
- Were selection criteria stated for studies to be included (based on trial design and methodological quality)? Yes
- Were inclusive searches undertaken (using appropriately crafted search strategies)? Yes
- Were characteristics and methodological quality of each trial identified? Yes
- Were selection criteria applied and a log of excluded studies with reasons for exclusion reported? Yes
- Outcome(s) assessed: pre and post skills performance testing comparing computer assisted versus instructor led methods comparing speed or performance of defibrillation
- Magnitude of any observed effect : Mean changes; p-values; RR and CI not assessed; cost analysis; standard statistical tools
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; HCP traditional then instructor vs computer program using pre and post study skills performance test; additional cost analysis evaluation by the authors finding equivalence or retraining and renewal by computer based methods are equivalent to instructor-based, hands on training. (Reviewer's comments: This important study compares a computer based retraining of previously traditionally trained EMT-D's with an instructor led retraining encounter, finding equivalence of a video based encounter not utilizing any ancillary or real equipment to be equivalent in both training and real-time experience.. Of interest is that the authors feel that the initial training must involve a "hands-on, practical experience that duplicates the skills and actions required during real field resuscitations." Comment is made that they see few alternatives by manufacturers to simplify initial training or use of AEDs. This portends poorly for the largest user group, the lay bystander.)

Conflict of Interest: The Center for Evaluation of Emergency Medical Services receives both categorical and noncategorical grant support from a number of sources, including foundations, several defibrillator manufacturers, and other companies that manufacture products for EMS use. No specific financial support was provided from any defibrillator manufacturer for this program or project

Kelley J, Richman PB, Ewy GA, Clark L, Bulloch B, Bobrow BJ. Eighth grade students become proficient at CPR and use of an AED following a condensed training programme. Resuscitation 2006;71(2):229-36.

- Level of Evidence: LOE 2; Small study; linear, prospective interventional; control group consisted of same students prior to training and testing; convenience sample; mannequin; lay provider; cohort;
- Relevance to the question asked: Relevant; condensed one hour course emphasizing continuous CPR and AED with good retention and improved test; standardized testing of alternative training
- Methodological quality: Fair
- Were comparison groups clearly defined? Yes; same students prior to training
- Were outcomes measured in the same (preferably blinded), objective way in both groups? Yes; same tests; unblinded by nature of study
- Were known confounders identified and appropriately controlled for? Yes
- Was follow-up of patients sufficiently long and complete? No. Reevaluation at four weeks only
- Outcome(s) assessed: Percentage of students correctly performing continuous CPR and application with operation of an AED in a mock adult cardiac arrest scenario initially and at 4 weeks retesting.
- Magnitude of any observed effect: percentages; CI; p-values; Student-t test; SAS software; no RR
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; alternative compressed course teaching psychomotor, kinesthetic skills with didactic knowledge to lay providers of teenagers. Authors considered the program a success. (Reviewer's

comments: in the discussion, the authors gave detailed statistical data from Arizona of lay participation in a SCA, citing low numbers of events involving CPR and AED use. They note as some of the barriers a reluctance to perform mouth-to-mouth breathing and fears of harming the victim. They note barriers to conventional CPR-AED training as cost, convenience and the need for volunteer to present themselves. They make a plea for simplifying the training by not including extraneous information such as stroke, pediatric use, etc; instead concentrating on adult chest compression and AED use which is the intent of their one hour course.)

Conflict of Interest: The authors are grateful to Mr. Marc Ashton, Ashton Safety and the Zoll Medical Corporation for providing AEDs and manikins for the project,

Meischke HW, Rea T, Eisenberg MS, Schaeffer SM, Kudenchuk P. Training seniors in the operation of an automated external defibrillator: a randomized trial comparing two training methods. *Ann Emerg Med* 2001 Sep;38(3):216-22.

- Level of Evidence: LOE 1; moderate-sized study; randomized with similar testing and re-testing ; cohort; interventional; observational; mannequin; controlled
 - Relevance to the question asked: Relevant; instructor vs video-based training with seniors
 - Methodological quality: Good, overall. The method and logistics precluded blinding, but this was accounted for by having neutral evaluators
 - Was the assignment of patients to treatment randomised? Yes
 - Was the randomisation list concealed? No
 - Were all patients who entered the trial accounted for at its conclusion? Yes
 - Were the patients analysed in the groups to which they were randomised? Yes
 - Were patients and clinicians "blinded" to which treatment was being received? No
 - Aside from the experimental treatment, were the groups treated equally? Yes
 - Were the groups similar at the start of the trial? Yes
 - Outcome(s) assessed: Speed and quality of AED performance after initial training and three months later with similar performance measure assessed
 - Magnitude of any observed effect : Percentages and CI; no RR, or p-values; standard statistical software SPSS 10.1
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; alternative training vs standardized training; similar outcomes initially, with equivalent three month performance with all showing equivalent skills degradation. The study utilized seniors with mannequin training. Both instructor and alternative training methods truncated at 45 minutes total. (Reviewer's comments: Most importantly, this moderately-sized, somewhat biased study found the most significantly persistent error to be poor placement of the pads at the second testing. The authors admit that their criteria were rigid and that the majority of pad placements would probably be effective. More difficult to explain is why 1/3 of the elders did not shock even when the device indicated a shock was needed.)
- Conflict of Interest: Supported by a grant from the Medic One Foundation and by unrestricted research contributions from the Asmund S. Laerdal Foundation for Acute Medicine, Agilent Technologies, and Medtronic Physio-Control.

Monsieurs KG, Vogels C, Bossaert LL, Meert P, Calle PA. A study comparing the usability of fully automatic versus semi-automatic defibrillation by untrained nursing students. *Resuscitation* 2005 01//;64(1):41-7.

- Level of Evidence: LOE 1; randomized, untrained HCPs; control; cohort; linear; prospective; interventional; small study

- Relevance to the question asked: Relevant; untrained HCPs without any training in BLS and AED using FAED and SAED
- Methodological quality: Good
- Was the assignment of patients to treatment randomised? Yes
- Was the randomisation list concealed? Yes
- Were all patients who entered the trial accounted for at its conclusion? Yes
- Were the patients analysed in the groups to which they were randomised? Yes
- Were patients and clinicians "blinded" to which treatment was being received? No. The evaluators were the ones assigning randomization
- Aside from the experimental treatment, were the groups treated equally? Yes
- Were the groups similar at the start of the trial? Yes
- Outcome(s) assessed: Performance regarding efficacy and safety in a simulated cardiac arrest scenario (mannequin); BLS; AED time intervals; pad placement; BLS following AED
- Magnitude of any observed effect : Percentages, p-values; no CI or RR; Mann-Whitney U test; chi square; Fisher exact; Statistica for Windows
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; randomized, untrained HCPs without BLS or AED training ("near-Lay") operating fully automatic external defibrillators and semi-automatic external defibrillators with good outcomes, but better with fully automated machines. Better compliance with the AED verbal protocol in FAED than the SAED. Strongly supportive of NO training. Implicates that fully automatic machines are preferred. (Reviewer's comments: A small, somewhat biased, but important study using highly motivated nursing students, some of whom were completely innocent of BLS and AED protocols and actions. The major outcome of the study demonstrated better protocol compliance using an FAED as versus a SAED as preferred by current ILCOR guidelines. Of note, the highest error rate occurred in pad placement followed by safety issues during defibrillation. The authors also conclude that AED training could be truncated to distribution of written materials as noted in one study by Fromm and Varon, but this seems applicable only to BLS trained individuals per Wik. Untrained individuals routinely had poor pad placement per Bradley and Mattei and in this study.)
Conflict of Interest: Medtronic provided the AEDs for the study

Nurmi J, Castren M. Layperson positioning of defibrillation electrodes guided by pictorial instructions. Resuscitation 2005 02//;64(2):177-80.

- Level of Evidence: LOE 1; small study; randomized; four control groups; single event training; lay providers using mannequins; cohort; linear; prospective
- Relevance to the question asked: Relevant; important; non-trained or retrained lay providers randomly using four commercial pads compared to the study pad
- Methodological quality: Good
- Was the assignment of patients to treatment randomised? Yes
- Was the randomisation list concealed? Yes
- Were all patients who entered the trial accounted for at its conclusion? yes
- Were the patients analysed in the groups to which they were randomised? yes
- Were patients and clinicians "blinded" to which treatment was being received? No. not possible by the type of study and study protocol
- Aside from the experimental treatment, were the groups treated equally? Yes
- Were the groups similar at the start of the trial? Yes
- Outcome(s) assessed: Evaluate the positioning of defibrillation electrodes on a mannequin; commercial manufacturers versus test electrodes made for study
- Magnitude of any observed effect : p-values; percentages; CI and RR evaluated

- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; limited study of placement of electrodes only; possibly the only human-dependent necessity of AED use; comparison of commercial and study-made electrodes; visual aided technology use. (Reviewer's comments: Important small study comparing four commercially available pads for PAD versus a made-for pad used in the study. Appropriately correct positioning of pad with test pad showing lateral view of victim occurred more often than with the commercial comparison pads. No training given prior to use and bodes well for untrained lay bystander PAD of a cardiac arrest victim, perhaps answering in part the issue of consistently poor pad placement in untrained AED users.).
- Conflict of Interest:** This study was financially supported by The Laerdal Foundation for Acute Medicine. The Laerdal Finland Oy provided equipment needed in the study.

Reder S, Cummings P, Quan L. Comparison of three instructional methods for teaching cardiopulmonary resuscitation and use of an automatic external defibrillator to high school students. *Resuscitation* 2006;69(3):443-53.

- Level of Evidence: LOE 2; randomization according to classrooms of lay high school students in a three-legged study including a control group; mannequin based; cohort; interventional; prospective;
- Relevance to the question asked: Relevant; computer based course progressing to traditional instructor led course
- Methodological quality: Good
- Were comparison groups clearly defined? Yes
- Were outcomes measured in the same (preferably blinded), objective way in both groups? Yes, although the students were informed of their group prior to the instruction
- Were known confounders identified and appropriately controlled for? Yes
- Was follow-up of patients sufficiently long and complete? No, but not a major disability since the follow up was dictated by the current school year of training and retesting
- Outcome(s) assessed: CPR and AED knowledge, performance of psychomotor actions; kinesthetic CPR skills; evaluation at 2 days and 2 months
- Magnitude of any observed effect : percentages; mean differences; no CI, p-values or RR; Strata Software
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive: randomized training using computer training only, blended computer and instructor training and traditional instructor led training in CPR and AED use. AED training and use comparable and better than non-trained control group; CPR skills difficult and challenging. (Reviewer's comments: AED training comparable using all methods but with higher results of knowledge when using a computer program rather than standard instructor led training. All were considered superior to no training. Yet, 46%-63% of untrained students still managed to initiate a shock when directed by the device. Confounder is CPR training, but unnecessary for question posed)

Conflict of Interest: No conflict reported by authors

Riegel B, Mosesso VN, Birnbaum A, Bosken L, Evans LM, Feeny D, et al. Stress reactions and perceived difficulties of lay responders to a medical emergency. *Resuscitation* 2006;70(1):98-106.

- Level of Evidence: LOE 5; original study (PAD Trial) LOE 1; qualitative analysis of lay person responses from study trial ; prospective, randomized, cohort, interventional
- Relevance to the question asked: Relevant; qualitative study from highly organized randomized trial
- Methodological quality: Good; data extracted from LOE 1 North American PAD Study
 - Good = randomised controlled trials (equivalent of LOE 1)

- Fair = studies without randomised controls (equivalent of LOE 2-3)
- Poor = studies without controls (equivalent of LOE 4)
- Outcome(s) assessed: Perceived difficulty relating to layperson personal characteristics, situation, victim characteristics; and layperson feelings and thoughts
- Magnitude of any observed effect : means and median on a 0-5 scale; no CI, RR, p-values or percentages; Strata statistical software
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; descriptive study using data from a large, well run randomized study about individual characteristics of lay providers and a call to make individual training more realistic and useful. The highest stress levels occurred in non-English speakers, women and during a cardiac event. Overall, the stress levels were low, although the volunteers were self-selected with a desire to participate. (Reviewer's comments: Interesting study extracted from the North American PAD Trial finding low levels of stress involved while participating in an arrest event, but, as noted by the study authors, the bystanders were not interviewed. No conclusion could be made about bystander feelings or needs to participate in an arrest event. Interestingly, the providers with the least stress were involved in security, indicating selection of particular individuals according to their job description might predict better training outcomes, although the type of training for such individuals is not mentioned. The authors also suggest that an important selection bias was not interviewing witnessing but non-participating bystanders.)

Conflicts of Interest: Supported by contract #N01—HC—95177 from the National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, MD. Additional support by: American Heart Association, Dallas, TX; Medtronic, Incorporated, Minneapolis, MN; Guidant Foundation, Indianapolis, IN; Cardiac Science/Survivalink, Incorporated, Minneapolis, MN; Medtronic Physio-Control Corporation, Redmond, WA; Philips Medical Systems, Heartstream, Seattle, WA; Laerdal Medical Corporation, Wappingers Falls, NY.

Rittenberger JC, Guimond G, Platt TE, Hostler D. Quality of BLS decreases with increasing resuscitation complexity. Resuscitation 2006 Mar;68(3):365-9.

- Level of Evidence: LOE 1; small, prospective randomized observational study; CPR controls; mannequin testing: HCP (Paramedics)
- Relevance to the question asked: Not relevant; AED training not mentioned as all participants competent in AED; no alternative training noted
- Methodological quality: Good-Fair
- Was the assignment of patients to treatment randomised? Yes
- Was the randomisation list concealed? Yes
- Were all patients who entered the trial accounted for at its conclusion? Yes
- Were the patients analysed in the groups to which they were randomised? Yes
- Were patients and clinicians "blinded" to which treatment was being received? No, not possible by study design
- Aside from the experimental treatment, were the groups treated equally? Yes
- Were the groups similar at the start of the trial? Yes
- Outcome(s) assessed: Artificial ventilation and chest compressions with and without AED availability
- Magnitude of any observed effect : t-test; ANOVA, Mann-Whitney U-test; p-values
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral; decremental performance of paramedics when mixing skills (Reviewer's comments: decremental performance of airway and CPR skills when AED added. Implies specific, simplified AED instruction or fully automated machine as prompt may assist in skills performance)

Conflict of Interest: No conflicts noted by authors

Robak O, Kulnig J, Sterz F, Uray T, Haugk M, Kliegel A, et al. CPR in medical schools: learning by teaching BLS to sudden cardiac death survivors--a promising strategy for medical students? *BMC Med Educ*2006;6:27-.

- Level of Evidence : LOE 4; case study; non-randomized; prospective observational and questionnaire based; mannequin
- Relevance to the question asked: Relevant; problem-based "learning-by-teaching" of medical students as trainers and cardiac arrest survivors as trainees; alternative trainer and trainee methods and strategy; individualized
- Methodological quality: Poor; no controls
 - Were outcomes measured in an objective way?No. Subjective answers with statistical analysis
 - Were known confounders identified and appropriately controlled for?Yes
 - Was follow-up of patients sufficiently long and complete?No. By the design of the study, skills evaluation and retention not tested
- Outcome(s) assessed: Acceptability of alternative instructional strategy by trainers and trainees; no standardized testing of trainers or trainees
- Magnitude of any observed effect : Percentages, p-values; no RR, CI; SPSS 12.0
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; alternative individualized strategy with active involvement of trainer and trainee in AED and CPR with defibrillation; acceptability of instructional method evaluated by questionnaire only (Reviewer's comments: case study of individualized instruction; highly personnel, time and material intensive with outcomes evaluated by questionnaire only. This is an interesting study for a select small population requiring considerable personal effort of both trainer and trainee)

Conflict of Interest: Funding of this trial was done by Austrian Nationalbank Anniversary Foundation, Bjoern Steiger Foundation Germany, Lions Club Vienna, Medical Scientific Foundation by the Mayor of Vienna, Ministry of Science and Traffic, Austria for EC program, Philips Medical Systems and The Laerdal Foundation for Acute Medicine.

Non-financial competing interests: None

Roppolo LP, Pepe PE, Campbell L, Ohman K, Kulkarni H, Miller R, et al. Prospective, randomized trial of the effectiveness and retention of 30-min layperson training for cardiopulmonary resuscitation and automated external defibrillators: The American Airlines Study. *Resuscitation*2007;74(2):276-85.

- Level of Evidence: LOE 1; moderate sized, prospective, interventional, observational, randomized; cohort; control group; identical training scenarios; mannequin
- Relevance to the question asked: Relevant; directly, important; comparative of standard vs "innovative" 30 minute video course for CPR, but 5 minute discussion of AED use
- Methodological quality: Good; randomized, concealed, non-crossover
- Was the assignment of patients to treatment randomised?Yes
- Was the randomisation list concealed?Yes
- Were all patients who entered the trial accounted for at its conclusion?Yes
- Were the patients analysed in the groups to which they were randomised?Yes
- Were patients and clinicians "blinded" to which treatment was being received?Yes
- Aside from the experimental treatment, were the groups treated equally?Yes
- Were the groups similar at the start of the trial?Yes
- Outcome(s) assessed: Individual scenario testing of skills performance: CPR, respirations, AED use; effectiveness and retention after training and at 6 months
- Magnitude of any observed effect: Percentages; p-values; ANOVA and Chi-square; no RR or CI

- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; 30 minute course concentrating on CPR with an instructor directed discussion of choking and AED outperformed the traditional Heartsaver-AED course both in immediate and 6 month testing. (Reviewer's comments: Innovative short course concentrating on basic CPR, airway and AED skills had better outcomes and retention than traditional course for lay providers. Both groups tested only at 6 months. The AED training was instructor driven and did not allow physical use of the AED during the short course. Retention of AED skills at 6 months actually higher than with traditional training -- the authors conjecture that operating an AED is mostly a cognitive rather than a psychomotor skill, accounting for the better initial performance and retention as versus the standard course that emphasizes the psychomotor skills of handling the device. They further conjecture that video training and use of the internet may be viable options to learn the cognitive skills necessary for AED use and retention. They also point out that following three instructions to identify the problem, activate or open the device and follow the instructions are the only necessary steps to operation of the device. This implies that instruction that is cognitive and machine based has better outcomes and retention than psychomotor manipulation of a particular device. Time to rethink the needs of the lay vs HCP provider)

Conflict of Interest: The Laerdal Medical Corporation, Wappingers Falls, New York, supplied the CPR training kits, training manikins, related software, and videotaping equipment. Philips Medical Systems, Seattle, Washington, supplied the HeartStart Trainer Automated External Defibrillator training device and related equipment.

Timmons S, Harrison-Paul R, Crosbie B. How useful is AED training as a determinant for the utilisation of Automatic External Defibrillators by lay people? *Journal of Emergency Primary Health Care* 2007;5(4), 1-6.

- Level of Evidence : LOE 4; small study; qualitative, semi-structured interview based study; no control group; lay; non-cohort; non-peer;
 - Relevance to the question asked: Relevant. Discusses lay providers trained to use AED's and their trainers. Mentions use by lay providers with no training; no actual training and no actual use of the device.
 - Methodological quality: Fair
 - Were outcomes measured in an objective way? No; semi-structured interview
 - Were known confounders identified and appropriately controlled for? Yes
 - Was follow-up of patients sufficiently long and complete? No; not possible in interview
 - Outcome(s) assessed: Attitudes and trust of lay volunteer providers to use the AED; primary question of "Is training necessary?"
 - Magnitude of any observed effect : no percentages, CI, RR or p-values
 - Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. Important qualitative investigation of personal issues of trained lay volunteer providers encouraging or prohibiting them from using an AED. Interviewers found that trusting the AED was an important attribute and that training plays a key role in imparting that trust. Most significant was the author's findings that meeting the instructors face-to-face imparted a sense of trust, expertise, and integrity to the trainees. (Reviewer's comments: This interview article points out that trusting the device and the trainers was the most important interaction that convinced lay providers to use the device in the future, although they had not use it in an actual event to the time of the interview. The authors contend that the style of delivery and the ability to convince rather than the content is the proper focus of instructor-based training.)
- Conflict of interest: This study was funded by the Resuscitation Council (UK). The organisation had no involvement in the study design, in the collection, analysis and interpretation of data; in the writing of the manuscript; or in the decision to submit the manuscript for publication.**

Uray T, Lunzer A, Ochsenhofer A, Thanikkel L, Zingerle R, Lillie P, et al. Feasibility of life-supporting first-aid (LSFA) training as a mandatory subject in primary schools. *Resuscitation* 2003 11//;59(2):211.

- Level of Evidence : LOE 2; linear progressive non-randomized study; cohort; children; lay; interventional; observational; children acted as their own prior control group; mannequin training;
- Relevance to the question asked: Relevant. Young age; pre and post evaluation of simplified training; AED training by visual example and hands-on; age appropriate training and follow up
- Methodological quality: Fair-Good
- Were comparison groups clearly defined? Yes
- Were outcomes measured in the same (preferably blinded), objective way in both groups? Yes
- Were known confounders identified and appropriately controlled for? Yes; limited by working with a public school agency and various governmental and private agencies
- Was follow-up of patients sufficiently long and complete? No; by study design, short follow up
- Outcome(s) assessed: Appropriate use of AED; correct placement of defibrillator pads
- Magnitude of any observed effect : Percentages; medians; interquartile; 95% CI; no RR, p-values
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. Alternative, simplified training for children to use an AED. (Reviewer's comment: age of training for AED use does not seem to be a problem, with alternative training methods being used by necessity. The authors do note that AED training is simplified to be easily accessible to children and ask the question of why it is not included in BLS and First Aid training in Austria. The authors also make a long comment on the current social, governmental, economic and political environment for doing such instruction in Austria, Vienna and Europe as a whole. The question of whether these same children will respond in a real time event is unanswered)

Conflict of interest: The University of Vienna, Austria has awarded the project the Bank Austria Foundation Prize 'Interdisziplinäre Lehrveranstaltungen' Innovation in Teaching (€4000)

Warwick JP, Mackie K, Spencer I. Towards early defibrillation--a nurse training programme in the use of automated external defibrillators. *Resuscitation* 1995 Dec;30(3):231-5.

- Level of Evidence: LOE 4; HCP AED training; non-randomized; non-standardized (early date); cohort; interventional
- Relevance to the question asked: Relevant. Pre-standardized training to HCPs using ERC guidelines; training and practice done on mannequin
- Methodological quality: Poor
- Were outcomes measured in an objective way? No; measured subjectively by authors and instructors
- Were known confounders identified and appropriately controlled for? Yes
- Was follow-up of patients sufficiently long and complete? No. Follow up in 6 months, but outcomes of retraining and descriptions of retention lacking
- Outcome(s) assessed: Initial initiative to train in AED use; mannequin based; real time competency not assessed;
- Magnitude of any observed effect : no percentages, CI, RR or p-values
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral. One of the first instances of AED training, and probably before standardization, but instructor and trainee contact based. (Reviewer's comment: Interesting from a historic perspective as one of the earliest courses to be taught and later to be standardized as it was added to a standardized BLS course. Interesting in that the authors discussed the need to tailor the course to the needs of the institution, a small hospital in a remote location, and the nursing staff who do not do ACLS and rarely see a cardiac arrest.)

Conflict of Interest: No conflicts noted by authors

Wik L, Dorph E, Auestad B, Andreas Steen P. Evaluation of a defibrillator-basic cardiopulmonary resuscitation programme for non medical personnel. *Resuscitation*. 2003 Feb;56(2):167-72.

- Level of Evidence: LOE 1; randomized; control groups equal; cohort; interventional and observational; mannequin testing
- Relevance to the question asked: Relevant; cohort groups tested pre- and post-traditional ERC AED-BLS course
- Methodological quality: Good
 - Was the assignment of patients to treatment randomised?Yes
 - Was the randomisation list concealed?Yes
 - Were all patients who entered the trial accounted for at its conclusion?Yes
 - Were the patients analysed in the groups to which they were randomised?Yes
 - Were patients and clinicians "blinded" to which treatment was being received?No; all were trained and the when tested it was known where in the cycle they were
 - Aside from the experimental treatment, were the groups treated equally?Yes
 - Were the groups similar at the start of the trial?Yes
- Outcome(s) assessed: Primary end point: time to first shock from entry into room. Secondary end points: quality of CPR; pad positioning; clearing mannequin when instructed
- Magnitude of any observed effect : p-values; Wilcoxon-Mann-Whitney test; no RR or CI
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive. CPR trained lay providers without training then with training demonstrated safe and efficient use of an AED with good retention of skills after one year, although there were deteriorations in CPR noted. Interestingly, 56% of those tested pre-course successfully used the AED without training. (Reviewer's comments: because of the ease of use of the current devices and the fact that 56% of untrained lay providers successfully used the device without training, the authors suggest that "complex and time-consuming training programmes may not be necessary" and that a better use of training encounters would be to assist the lay provider in performing during the arrest scenario than in learning a skills-intensive intervention. They also propose frequent training and mention recertification base on the noted deterioration of speed and quality of CPR.)

Conflict of Interest: The study was supported by grants from the Norwegian Air Ambulance and the Laerdal Foundation. We thank the cabin attendants of Braathens for participating, and the instructors of the airline, particularly Tove Finstad for letting us test their students. The resuscitation manikin, AED, and electrode pads were on loan from Laerdal Medical.

Woollard M, Whitfield R, Newcombe RG, Colquhoun M, Vetter N, Chamberlain D. Optimal refresher training intervals for AED and CPR skills: A randomised controlled trial. *Resuscitation*2006;71(2):237-47.

- Level of Evidence : LOE 1; randomized; non cross over; lay providers; mannequin based; standardized courses; cohort; interventional and observational; control was same individual prior to and following refresher
- Relevance to the question asked: Relevant. Marginally. Standardized courses, refreshers and evaluation. No alternative courses performed. Assessment made on intent-to-treat. Pre- and post-refresher assessment of skills
- Methodological quality: Good
 - Was the assignment of patients to treatment randomised? Yes
 - Was the randomisation list concealed?Yes
 - Were all patients who entered the trial accounted for at its conclusion?Yes

- Were the patients analysed in the groups to which they were randomised?Yes
- Were patients and clinicians "blinded" to which treatment was being received?No; by the necessity of the study design
- Aside from the experimental treatment, were the groups treated equally?Yes
- Were the groups similar at the start of the trial?Yes
- Outcome(s) assessed: Skill retention for CPR and AED use after traditional training followed by refresher courses at 7 and 12 months compared to a single refresher course at 12 months
- Magnitude of any observed effect : no percentages, Sample size calculation using StatsDirect software, 2.2.1 for an alpha of 0.05 and SPSS 10.0.to randomize the participants.. Analysis by SPSS utilizing CI and Mann-Whitney U and t-tests.
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Neutral. Standardized courses with no alternative courses or refreshers utilized. Most importantly, the AED skills, other than placement of pads, were maintained irrespective of the time between initial course and one year. (Reviewers comments: Although AED skills of shock delivery were maintained to one year with the standardized course, the CPR skills deteriorated or remained poor. Most disturbing was the less than perfect, but still appropriate, placement of the pads which did not improve with refresher courses. No comment was made about the device pads, machine prompts or pictographs. This indicates that time, effort and funds are better spent in training other than AED skill acquisition)

Conflict of Interest: Funded by the Department of Health, England

Younas S, Raynes A, Morton S, Mackway-Jones K. An evaluation of the effectiveness of the Opportunities for Resuscitation and Citizen Safety (ORCS) defibrillator training programme designed for older school children. *Resuscitation*2006;71(2):222-8.

- Level of Evidence: LOE 2; cohort students; observational; interventional; lay; student; mannequin; control group untrained; non-randomized as evaluation group had prior training
- Relevance to the question asked: Relevant. Secondary school students, aged 14-16, were instructed with a teacher/healthcare consortium and hospital health care educators instructing 2 hour workshops directed towards CPR, AED and CAD. The course is part of a national curriculum of "personal, social and health education".
- Methodological quality: Fair
- Were comparison groups clearly defined? Yes; although not completely comparable
- Were outcomes measured in the same (preferably blinded), objective way in both groups?Yes; but not blinded due to the design of the study
- Were known confounders identified and appropriately controlled for?Yes; unfortunately three schools were used and confounders could not be completely accounted for due to the small size of the study
- Was follow-up of patients sufficiently long and complete?No. This was a one-time study which the authors admit needs repetition and enlargement
- Outcome(s) assessed: Performance checks of assessment; CPR, AED use
- Magnitude of any observed effect : Scores of check sheet; two sided Mann-Whitney U-test with p-values two tailed to 5%; percentages, and CI. StatsDirect software for statistical analysis
- Direction of support or otherwise for the question asked, according to the specific outcomes that have been assessed: Supportive; Non-traditional, but standardized, training course utilizing a healthcare/education consortium to instruct secondary school children in CAD, BLS and AED use in the classroom with secondary school instructors teaching didactics and hospital healthcare educators facilitating practical workshops of CPR and AED. Outcomes compared of untrained students and trained students demonstrated better CPR and AED use, although the trained students used the AED correctly only 27% of the time, although this might be tainted and too low as some of the trained students had only BLS/CPR and not AED prior to testing using the "Resuscitation Guidelines for the Citizen, 2000, of the UK Resuscitation Council. (Reviewer's comments:

Factors other than lack of skill prevented AED use by the trained children, possibly reflected in their being taught by non-healthcare workers or CPR-AED providers.. This study affirms the hesitancy of untrained lay volunteers to attempt to use the device, some citing the fear of making the situation worse.. Of note, the authors propose placing AEDs like firehoses or extinguishers and of using trained children as the agents of their use through national policy. Also, the authors needed to survey the children to identify the issues of hesitancy and non-performance -- too much liberty was taken in scoring the testing algorithm.)

Conflict of interest: none. No industry support.