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

Worksheet author(s)

E. Brooke Lerner	**Date Submitted for review:** 2/17/09

Clinical question. In adult and pediatric patients with out-of-hospital cardiac arrest (including residential settings) (P), does implementation of a public access AED program (I) as opposed to traditional EMS response (C), improve successful outcomes (O) (eg. ROSC, survival)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? intervention
State if this is a proposed new topic or revision of existing worksheet: revision

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).

Medline/ovid search - 49 relevant articles identified Search strategy below:

#	Searches	Results
1	public access.mp.	513
2	Defibrillators/	495
3	Public Facilities/	386
4	2 and 3	14
5	Emergency Medical Services/	23326
6	(hallstrom ap or hallstrom a).au.	195
7	1 and 6	6
8	4 not 7	13
9	4 or 7	19
10	Emergency Medical Services/	23326
11	2 and 10	105
12	11 and 1	19
13	12 not 9	16
14	9 or 13	35
15	Heart Arrest/	17535
16	15 and 3	20
17	16 not 14	8
18	17 or 14	43
19	Cardiopulmonary Resuscitation/	6931
20	19 and 3	7
21	20 not 18	0
22	19 and 1	66
23	22 not 18	52
24	23 or 18	95
25	15 and 1	96
26	25 not 24	32
27	26 or 24	127
28	Electric Countershock/	10412
29	28 and 3	17
30	29 not 27	2
31	28 and 1	112
32	31 not 27	33

ECC endnote library searched for “public access” in any field – 57 references identified: 41 relevant.

Cochrane Database search for "public access defibrillation" - 1 record found: preliminary report no abstract or report available

All reviewed articles had their reference sections hand reviewed and any relevant articles were obtained. The author also searched her personal reference library for relevant articles.

Search re-run 10/2/09 – 0ne additional paper identified

• State inclusion and exclusion criteria

No exclusion criteria were applied to the search strategy. For the article review only studies that discussed research were considered for the evidence table. Further, that research had to directly answer the worksheets clinical question and relate to responders who are not part of the formal EMS system including police and fire fighters. That is if responders were dispatched to the scene by emergency number (e.g., 911) dispatchers the study was excluded.

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

A total of 93 articles were reviewed.

Summary of evidence

Evidence Supporting Clinical Question

Good	**Peberdy, 2006 E Hallstrom, 2004 C**	**Colquhoun, 2008C Capucci, 2002 D**		**Culley, 2004 C &E Caffrey, 2002 D Page, 2000 D Valenzuela, 2000 C**	
Fair		**Sana, 2008 C**	**Fleischhackl, 2007 C**	**Davies, 2005 C O'Rourke, 1997 C**	**Pell, 2002 E**
Poor		**Kuisma, 2002 E**		**Jorgenson, 2003 C**	
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation endpoint
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other
Italics = Animal studies

Evidence Neutral to Clinical question

Good	Bardy, 2008 B				
Fair		**Eisenberg, 1989 D**			
Poor					
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation endpoint
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other
Italics = *Animal studies*

Evidence Opposing Clinical Question

Good					
Fair					Nanthakumar, 2006 E
Poor					
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation endpoint
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other
Italics = *Animal studies*

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

The AHA has previously defined 4 levels of public access defibrillation: level 1 traditional first responder (police/fire), level 2 nontraditional first-responder (security guard, flight attendant), level 3 citizen CPR (trained lay-providers), and level 4 minimally trained witness.(Nichol, Hallstrom et al. 1998 pg1309). This worksheet focused on response outside of the traditional EMS system, levels 2, 3, and 4. The key study is the PAD trial (LOE 1), which demonstrated that twice as many cardiac arrest patients survived when PAD was available (93% CI 1.07-3.77) (Hallstrom, Ornato et al. 2004 pg 637) and that PAD programs were generally safe for both the patient and the rescuer.(Peberdy, Ottingham et al. 2006 pg59). PAD is also supported by four LOE2 studies, one LOE3, and 7 LOE4 studies. There is a single case study that illustrates an inappropriate shock being advised by an AED device, which is considered a negative study.(Nanthakumar 2006 pge672) However, this single negative case is far outweighed by the numerous positive studies with much larger sample sizes.

While there are no documented cases of harm being caused by a lay-provider using an AED, the cost and most logical deployment strategies are not clear and may vary by site and circumstances. For a PAD program to be effective it must be integrated into the formal EMS system. However, evidence shows that this is not consistently being done(Myers, French et al. 2005 pg339).

Initiating PAD programs is not without challenges. A study found that attrition of volunteer responders was 36% and that some locations do not have a ready pool of volunteer responders.(Richardson, Gunnels et al. 2005 pg688) Further, a large percent of lay-volunteers associated with a formal PAD program may not participate in retraining efforts, but the retention of CPR skills among lay volunteers may be high.(Riegel, Nafziger et al. 2006 pg254) (Cummins, Schubach et al. 1989pg143) (Christenson, Nafziger et al. 2007 pg52) But during an actual cardiac arrest event the number of CPR actions that are actually preformed by lay responders may be low.(Hedges, Sehra et al. 2006 pg659)

The cost effectiveness of placing an AED in a given location must also be considered. Research has shown that they are cost-effective when placed on commercial airplanes(Groeneveld, Kwong et al. 2001pg1482) or other high incidence areas(Nichol, Hallstrom et al. 1998 pg15); Nichol 2003 pg697); (Cram, Vijan et al. 2003pg745); (Gold and Eisenberg 2007 pg1); (Folke, Lippert et al. 2009 pg510); but they may not be cost effective in low incidence areas.(Pell, Walker et al. 2007 pg5) Several studies have looked at the location of cardiac arrests to try to predict high incidence locations.(Becker, Eisenberg et al. 1998 pg2106); (Engdahl and Herlitz 2005 pg171); (Friedman, Dowler et al. 2006 pg407); (Muraoka, Ohishi et al. 2006 pg827) Prior to initiating a PAD program it is recommended that the likely incidence of cardiac arrest in that location be determined.

Use of AED's in the home by survivors of anterior-wall myocardial infarction showed that the presence of a home AED demonstrated no significant improvement in survival.(Bardy, Lee et al. 2008 pg1793) However, the event rate in this population was low. The study did find that use of the AED in the home by lay-providers was feasible; it terminated ventricular fibrillation and did not result in inappropriate shocks. Therefore, home use of an AED is not harmful and potentially helpful, but because of the low likelihood of its use distribution to those who survive an anterior- wall myocardial infarction is unlikely to be cost effective or improve overall survival rates.

Acknowledgements:

Citation List

Articles used as Evidence

Bardy, G. H., K. L. Lee, et al. (2008). "Home use of automated external defibrillators for sudden cardiac arrest." N Engl J Med 358(17): 1793-804.

Reviewer's Comment: Use of AED's in the home by survivors of anterior-wall myocardial infarction showed that the presence of a home AED had demonstrated no significant improvement in survival. However, the event rate in this population was low. The study did find that use of the AED in the home by lay-providers was feasible; it terminated ventricular fibrillation and did not result in inappropriate shocks. Therefore, home use of an AED is not harmful and potentially helpful, but because of the low likelihood of its use distribution to those who survive an anterior- wall myocardial infarction is unlikely to be cost effective or improve overall survival rates.

Caffrey, S. L., P. J. Willoughby, et al. (2002). "Public use of automated external defibrillators." N Engl J Med 347(16): 1242-7.

Reviewer's Comment: This case series looked at the deployment of AED across all three Chicago airports (LOE 4). They had good follow-up and survival to one year (quality – good). 11 of 18 ventricular fibrillation patients survived to hospital discharge with good neurologic function. They estimate the cost of the program is $3,000 per patient or $7,000 per life saved.

Capucci, A., D. Aschieri, et al. (2002). "Tripling survival from sudden cardiac arrest via early defibrillation without traditional education in cardiopulmonary resuscitation." Circulation 106(9): 1065-70.

Reviewer's Comment: This non-randomized study recruited "lay-providers" who were taught to use an AED but were not taught CPR (LOE2 good quality). Thirty-nine AED's were then placed at 12 fixed locations (main public squares), 15 police and fire vehicles, and 12 public assistance vehicles. The authors then compared cardiac arrests treated by these providers over a 22 month period to those treated by EMS. This deployment method resulted in 40% of the 354 cardiac arrests being treated by the AEDs and found improved survival to hospital discharge and a higher rate of neurologically intact survival.

Colquhoun, M. C., D. A. Chamberlain, et al. (2008). "A national scheme for public access defibrillation in England and Wales: early results." Resuscitation 78(3): 275-80.

Reviewer's Comment: This non-randomized study compared static to mobile AED placement making it an LOE 2. There were 1,530 arrests studied and data was collected using a standardized report form making it a good quality study. Survival to hospital

discharge was the outcome and it was found to be higher in the group treated by the static devices.

Culley, L. L., T. D. Rea, et al. (2004). "Public access defibrillation in out-of-hospital cardiac arrest: a community-based study." Circulation 109(15): 1859-63.

Reviewer's Comment: This is referred to as a cohort study but there is no control group (LOE 4). They report survival to hospital discharge for the 50 cases of cardiac arrest that were treated by one of the 475 PAD AED's that are deployed within King County in a 4 year period. They identified patients who were treated by one of their registered AED's as well as those treated by unregistered AED's (quality good). They examined survival rates (76% admitted, 50% discharged from hospital alive), but their main focus was on device usage. They found that these devices had 5 uses per 100 years of AED exposure.

Davies, C. S., M. C. Colquhoun, et al. (2005). "A national programme for on-site defibrillation by lay people in selected high risk areas: initial results." Heart 91(10): 1299-302.

Reviewer's Comment: This is a case series (no control) that describes a PAD program initiated in London LOE 4. They had difficulty obtaining hospital information, but were able to obtain survival to hospital discharge for all but 2 patients (quality – fair). The survival rate was 28.3% to hospital discharge. The program had 681 AEDs that were used 172 times or one AED use for every 120 defibrillator months. Note the same data is presented in Whitfield 2005 only the Davies article was included on the evidence grid so as not to double count a single study.

Eisenberg, M. S., J. Moore, et al. (1989). "Use of the automatic external defibrillator in homes of survivors of out-of-hospital ventricular fibrillation." Am J Cardiol 63(7): 443-6.

Reviewer's Comment: This project had a non-randomized pilot phase, then a randomized phase, and then a phase where all participants were offered an AED. All of these phases were reported together because there were only 14 out-of-hospital cardiac arrests making it a fair quality LOE 2 study. There was only 1 survivor in each group, but given the small sample size it is not possible to draw any conclusions on survival. Although, it does indicate that home AEDs may be rarely used.

Fleischhackl, R., B. Roessler, et al. (2008). "Results from Austria's nationwide public access defibrillation (ANPAD) programme collected over 2 years." Resuscitation 77(2): 195-200.

Reviewer's Comment: This study used historical controls from 1996 making it a fair LOE 3 study. It reported that neurologic status was obtained but reports survival to hospital discharge.

Hallstrom, A. P., J. P. Ornato, et al. (2004). "Public-access defibrillation and survival after out-of-hospital cardiac arrest." N Engl J Med 351(7): 637-46.

Reviewer's Comment: This study was randomized at the community unit level (LOE 1). The number of actual arrests was far lower than what was expected. The program was detailed with good training for responders; therefore, the results only apply to programs with a training and response plan.

Jorgenson, D. B., T. Skarr, et al. (2003). "AED use in businesses, public facilities and homes by minimally trained first responders." Resuscitation 59(2): 225-33.

Reviewer's Comment: This survey asks AED owners about usage in the last year. The owners were identified though a single manufacturers customer database, the response rate was low (50-59%), and none of the patient outcomes were verified. Therefore, it was considered an LOE 4 study of poor quality.

Kuisma, M., M. Castren, et al. (2003). "Public access defibrillation in Helsinki--costs and potential benefits from a community-based pilot study." Resuscitation 56(2): 149-52.

Reviewer's Comment: This non-randomized study compared PAD sites to non-PAD sites. The sample size of cardiac arrests was small with 7 in the PAD group and 13 in the control group. All survivors were in the control group. There were no major adverse events reported. This study was considered LOE 2 because of the control group but of poor quality because of the small sample size which lead to the outcome being time to defibrillation.

Nanthakumar, K. and S. C. Toal (2006). "Images in cardiovascular medicine. "Shock advised": inappropriate public access defibrillation." Circulation 113(13): e672.

Reviewer's Comment: This is a case study of an inappropriate shock delivered by an AED. There is no outcome data provided for the patient and limited information regarding the incident.

O'Rourke, M. F., E. Donaldson, et al. (1997). "An airline cardiac arrest program." Circulation 96(9): 2849-53

Reviewer's Comment: This is a descriptive study that describes the PAD program initiated by Qantas Airlines for both its terminal and it large aircraft. The description is complete, although not a formal evaluation; therefore, it was rated as fair quality. They did obtain long term (2 year) patient outcomes.

Page, R. L., J. A. Joglar, et al. (2000). "Use of automated external defibrillators by a U.S. airline." N Engl J Med 343(17): 1210-6.

Reviewer's Comment: This is a case series of patients treated on a commercial airline with an AED (LOE 4). The patients are followed to hospital discharge and neurologic

outcome is measured. The records appear to be complete with the exception of some lost downloads, and all rhythms were analyzed by two specialists (quality good).

Peberdy, M. A., L. V. Ottingham, et al. (2006). "Adverse events associated with lay emergency response programs: the public access defibrillation trial experience." Resuscitation 70(1): 59-65.

Reviewer's Comment: LOE 1, good study, outcome is adverse events or E. This studied shows that during the PAD trial there were limited adverse events. Six additional references were identified in this article.

Pell, J. P., J. M. Sirel, et al. (2002). "Potential impact of public access defibrillators on survival after out of hospital cardiopulmonary arrest: retrospective cohort study." BMJ 325(7363): 515.

Reviewer's Comment: This is a mathematical modeling study that used actual patient data when no AED was available and then predicted how a PAD program could have improved survival, therefore it is LOE 5. The quality is fair because they were not able to determine type of location for all patients and the survival endpoint was not defined. An endpoint of E was used since the survival variable was not defined. While the authors conclude that the increase in survival may not be cost effective, they did show an improvement in survival. Therefore, it is being considered supporting evidence for PAD programs. Letters to the editor were reviewed as well, no new references identified.

Sanna, T., G. La Torre, et al. (2008). "Cardiopulmonary resuscitation alone vs. cardiopulmonary resuscitation plus automated external defibrillator use by non-healthcare professionals: a meta-analysis on 1583 cases of out-of-hospital cardiac arrest." Resuscitation 76(2): 226-32.

Reviewer's Comment: This meta-analysis included studies by Kellerman and van Alem which looked at first responder AED use and Hallstrom which look at layprovider AED use. This worksheet is looking at AED use compared to EMS response. First responder AED use is part of EMS response and thus these papers are actually comparing two different issues and for the purposes of this worksheet should not have been combined. Therefore, this does not provide any additional evidence for PAD programs beyond the contribution of the Hallstrom article.(2000)

Valenzuela, T. D., D. J. Roe, et al. (2000). "Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos." N Engl J Med 343(17): 1206-9.

Reviewer's Comment: This case series (LOE4) was designed to evaluate survival to hospital discharge, therefore it was rated as a good quality study. It illustrates that security guards in public settings can use AEDs with positive outcomes.

Whitfield, R., M. Colquhoun, et al. (2005). "The Department of Health National Defibrillator Programme: analysis of downloads from 250 deployments of public access defibrillators." Resuscitation 64(3): 269-77.

Reviewer's Comment: This paper was not included in the evidence grid since it presents the same data as Davies, 2005 and does not ask a different question. Therefore including it would be to double count this study.

Articles reviewed but not used as Evidence

(2000). "Public training in cardiopulmonary resuscitation and public access defibrillation." Ann Emerg Med 35(6): 640-1.

Reviewer's Comment: This is a policy statement from the American College of Emergency Physicians on PAD. There is no research presented and there were no references provided.

(2004). "Automated external defibrillators (AEDs)." Health Devices 33(6): 189-222.

Reviewer's Comments: This article is a consumer review of various brands of automatice defibrillators. No new references were identified.

Andresen, D., H. R. Arntz, et al. (2008). "Public access resuscitation program including defibrillator training for laypersons: a randomized trial to evaluate the impact of training course duration." Resuscitation 76(3): 419-24.

Reviewer's Comment: This study did not directly answer the worksheet question but it did show that a 2 hour CPR and AED course was enough to allow lay-responders to retain the training for one year.

Atkins, D. L., L. L. Bossaert, et al. (2001). "Automated external defibrillation/public access defibrillation." Ann Emerg Med 37(4 Suppl): S60-7.
Abstract: None available
Reviewer's Comment: Review article. Two additional references identified.

Bartimus, H. A., T. D. Rea, et al. (2004). "Prevalence of automated external defibrillators at cardiac arrest high-risk sites." Prehosp Emerg Care 8(3): 280-3.

Reviewer's Comment: This study determined the rate of AED placement within a community. While it is relevant to the worksheet question it does not directly answer the question.

Becker, L., M. Eisenberg, et al. (1998). "Public locations of cardiac arrest. Implications for public access defibrillation." Circulation 97(21): 2106-9.

Reviewer's Comment: This paper is relevant to the worksheet question but does not directly answer the question. Organizers of PAD programs should consider the incidence of cardiac arrest in a given location prior to starting a PAD program.

Beckers, S. K., M. Fries, et al. (2007). "Retention of skills in medical students following minimal theoretical instructions on semi and fully automated external defibrillators." Resuscitation 72(3): 444-50.

Reviewer's Comment: This study evaluated the length of training needed to teach a lay –responder to use an AED, this is relevant to this worksheet but does not address the worksheet question. One new reference was identified.

Caffrey, S. (2002). "Feasibility of public access to defibrillation." Curr Opin Crit Care 8(3): 195-8.

Reviewer's Comment: This is a review article. No new research is reported and no new references were identified.

Cairns, K. J., A. J. Hamilton, et al. (2008). "The obstacles to maximising the impact of public access defibrillation: an assessment of the dispatch mechanism for out-of-hospital cardiac arrest." Heart 94(3): 349-53.

Reviewer's Comments: This paper does not directly answer the worksheet question. However, the results of this trial (clinical trial number ISRCTN 07286796) are represented on this worksheet with the work by Moore.

Castren, M., J. Nurmi, et al. (2004). "Teaching public access defibrillation to lay volunteers--a professional health care provider is not a more effective instructor than a trained lay person." Resuscitation 63(3): 305-10.

Reviewer's Comment: This article looked at different training schemes. It does not address the worksheet question.

Christenson, J., S. Nafziger, et al. (2007). "The effect of time on CPR and automated external defibrillator skills in the Public Access Defibrillation Trial." Resuscitation 74(1): 52-62.

Reviewer's Comment: This article did not look at the worksheet question. However, it showed that AED skills could be retained for up to a year.

Clare, C. (2006). "Do public access defibrillation (PAD) programmes lead to an increase of patients surviving to discharge from hospital following out of hospital cardiac arrest?--a literature review." Int J Nurs Stud 43(8): 1057-62.

Reviewer's Comment : This is a review article. Two new articles were identified.

Colquhoun, M., C. S. Davies, et al. (2004). "Public access defibrillation--designing a universal report form and database for a national programme." Resuscitation 61(1): 49-54.

Reviewer's Comment: This paper discussed designing an incident report form for use when a PAD was used. It is not a research article.

Cooper, J. S., R. A. Swor, et al. (1998). "A critical evaluation of the potential benefits of public access defibrillation." Prehosp Emerg Care 2(1): 87-8.

Reviewer's Comment: This is a letter that describes the location of cardiac arrests within a single community and discusses AED placement. It is related to the worksheet question but does not directly address the question.

Cote, D. (1998). "Emergency cardiac care and public access to defibrillation in Canada." Can J Cardiol 14(1): 31-2.

Reviewer's Comment : This is a position paper from Heart and Stroke Canada. No new references were identified.

Cram, P., S. Vijan, et al. (2003). "Cost-effectiveness of automated external defibrillator deployment in selected public locations." J Gen Intern Med 18(9): 745-54.

Reviewer's Comment: This article demonstrates that PAD is likely cost effective in high incidence locations.

Crocco, T. J., M. R. Sayre, et al. (2004). "Mathematical determination of external defibrillators needed at mass gatherings." Prehosp Emerg Care 8(3): 292-7.

Reviewer's Comment: This study provides a mathematical model for the number of defibrillators needed to cover a stadium. It is related to AED placement but does not directly address the worksheet question.

Cummins, R. O., J. A. Schubach, et al. (1989). "Training lay persons to use automatic external defibrillators: success of initial training and one-year retention of skills." Am J Emerg Med 7(2): 143-9.

Reviewer's Comment: Does not directly relate to the worksheet question but shows that lay persons in community settings can be trained to use AED's, they are enthusiastic about being trained, and most could still use the AED after one year. However, it was difficult to re-contact trainees and few completed the retraining sessions at one year.

Davies, C. S., M. Colquhoun, et al. (2002). "Defibrillators in public places: the introduction of a national scheme for public access defibrillation in England." Resuscitation 52(1): 13-21.

Reviewer's Comment: This is an interim report on a PAD trial be established in England. There are no results in this paper and no new references were identified.

Davies, E., B. Maybury, et al. (2008). "Public access defibrillation: psychological consequences in responders." Resuscitation 77(2): 201-6.

Reviewer's Comment: This paper looked at psychological effects of responding, which is relevant but not the focus of this worksheet. Two additional references were identified.

Drezner, J. A. and K. J. Rogers (2006). "Sudden cardiac arrest in intercollegiate athletes: detailed analysis and outcomes of resuscitation in nine cases." Heart Rhythm 3(7): 755-9.

Reviewer's Comments: This Case series discusses the presence of AED's but combines those that were used by EMS and those used by Athletic Trainers.

Engdahl, J. and J. Herlitz (2005). "Localization of out-of-hospital cardiac arrest in Goteborg 1994-2002 and implications for public access defibrillation." Resuscitation 64(2): 171-5.

Reviewer's Comment: This study is relevant to the worksheet question but does not answer the worksheet question. When considering PAD programs it is important to understand the potential impact this will have on the population. That is are these expensive devices likely to be used.

Fedoruk, J. C., W. L. Currie, et al. (2002). "Locations of cardiac arrest: affirmation for community Public Access Defibrillation (PAD) Program." Prehosp Disaster Med 17(4): 202-5.

Reviewer's Comment: This study looked at the locations of local cardiac arrests for the purpose of resource placement. It is relevant to the worksheet question but does not directly address the question.

Finn, J. C., I. G. Jacobs, et al. (2001). "Outcomes of out-of-hospital cardiac arrest patients in Perth, Western Australia, 1996-1999." Resuscitation 51(3): 247-55.

Reviewer's Comment: This epidemiologic study did not consider PAD.

Fleischhackl, R., G. Foitik, et al. (2006). "Reaching the public via a multi media campaign as a first step to nationwide public access defibrillation." Resuscitation 69(2): 269-75.

Reviewer's Comment: This paper describes a public campaign to increase the number of PAD programs across Austria this is relevant but not directly related to this worksheet. Two additional references were identified.

Folke, F., F. K. Lippert, et al. (2009). "Location of cardiac arrest in a city center: strategic placement of automated external defibrillators in public locations." Circulation 120(6): 510-7.

Reviewer's Comment: Relevant to the worksheet but does not directly address the worksheet question.

Friedman, F. D., K. Dowler, et al. (2006). "A public access defibrillation programme in non-inpatient hospital areas." Resuscitation 69(3): 407-11.

Reviewer's Comment: This paper describes use of PAD in hospital out-patient settings. It does not directly answer the worksheet question because it does not address survival but does address location of arrests. Two additional references were identified in this article.

Gold, L. S. and M. Eisenberg (2007). "Cost-effectiveness of automated external defibrillators in public places: pro." Curr Opin Cardiol 22(1): 1-4.

Reviewer's Comment: This is a review paper on cost effectiveness. No new references were identified.

Groeneveld, P. W., J. L. Kwong, et al. (2001). "Cost-effectiveness of automated external defibrillators on airlines." JAMA 286(12): 1482-9.

Reviewer's Comment: This study is not directly related to the worksheet question but it illustrates that airline PAD programs are cost effective.

Groh, W. J., M. M. Newman, et al. (2001). "Limited response to cardiac arrest by police equipped with automated external defibrillators: lack of survival benefit in suburban and rural Indiana--the police as responder automated defibrillation evaluation (PARADE)." Acad Emerg Med 8(4): 324-30.

Reviewer's Comment: This paper illustrates an unsuccessful police AED program. It does not address PAD response since it is within the EMS system.

Groh, W. J., M. M. Newman, et al. (2001). "Limited response to cardiac arrest by police equipped with automated external defibrillators: lack of survival benefit in suburban and rural Indiana--the police as responder automated defibrillation evaluation (PARADE)." Acad Emerg Med 8(4): 324-30.

Reviewer's Comment: This paper evaluates police providers' attitudes toward participating in an AED program. It is relevant to this worksheet but does not directly apply to the question.

Groh, W. J., A. Birnbaum, et al. (2007). "Characteristics of volunteers responding to emergencies in the Public Access Defibrillation Trial." Resuscitation 72(2): 193-9.

Reviewer's Comment: Does not address the worksheet question. However, shows that the presence of an AED does not increase the likelihood of volunteer response.

Gundry, J. W., K. A. Comess, et al. (1999). "Comparison of naive sixth-grade children with trained professionals in the use of an automated external defibrillator." Circulation 100(16): 1703-7.

Reviewer's Comment: Does not address the worksheet question.

Hazinski, M. F., A. H. Idris, et al. (2005). "Lay rescuer automated external defibrillator ("public access defibrillation") programs: lessons learned from an international multicenter trial: advisory statement from the American Heart Association Emergency Cardiovascular Committee; the Council on Cardiopulmonary, Perioperative, and Critical Care; and the Council on Clinical Cardiology." Circulation 111(24): 3336-40.

Reviewer's Comment: Review article. No new references identified.

Hedges, J. R., R. Sehra, et al. (2006). "Automated external defibrillator program does not impair cardiopulmonary resuscitation initiation in the public access defibrillation trial." Acad Emerg Med 13(6): 659-65.

Reviewer's Comment: A sub-analysis of the PAD trial that does not directly answer the worksheet question but does evaluate the quality of CPR provided by lay-volunteer responders in a PAD program.

Kanz, K. G., M. V. Kay, et al. (2004). "Susceptibility of automated external defibrillators to train overhead lines and metro third rails." Resuscitation 62(2): 189-98.

Reviewer's Comment: This paper does not directly relate to the study question. However, it shows that AED function may be affected by the presence of electromagnetic interference. It may need to be considered when establishing PAD programs near these areas.

Karch, S. B., J. Graff, et al. (1998). "Response times and outcomes for cardiac arrests in Las Vegas casinos." Am J Emerg Med 16(3): 249-53.

Reviewer's Comment: This paper is not relevant to the worksheet question.

Kellermann, A. L., B. B. Hackman, et al. (1993). "Impact of first-responder defibrillation in an urban emergency medical services system." JAMA 270(14): 1708-13.

Reviewer's Comment: This article demonstrated no improvement in survival when AED's are given to fire fighter first responders. This article was not considered to apply to the worksheet question since fire fighter response is part of the EMS system and not truly a PAD program. However, it is an early indication that lay-providers can successfully use AED's.

Ko, P. C., M. H. Ma, et al. (2004). "Impact of community-wide deployment of biphasic waveform automated external defibrillators on out-of-hospital cardiac arrest in Taipei." Resuscitation 63(2): 167-74.

Reviewer's Comment: This article is relevant to the worksheet but it describes survival rates when AED's are used by EMS personnel. Therefore, it was not included as evidence.

Lubin, J., S. S. Chung, et al. (2004). "An assessment of public attitudes toward automated external defibrillators." Resuscitation 62(1): 43-7.

Reviewer's Comment: This study is relevant but does not directly answer the worksheet question.

Marenco, J. P., P. J. Wang, et al. (2001). "Improving survival from sudden cardiac arrest: the role of the automated external defibrillator." JAMA 285(9): 1193-200.

Reviewer's Comment: This is a review article. No new references were identified.

Moore, M. J., A. J. Hamilton, et al. (2008). "The Northern Ireland Public Access Defibrillation (NIPAD) study: effectiveness in urban and rural populations." Heart 94(12): 1614-9.

Reviewer's Comment: This article demonstrated no improvement in survival when AED's are given to lay and police first responders who are paged to cardiac arrest related requests for emergency aid. This article was not considered to apply to the worksheet question since in this case the lay and police responders were part of the formal EMS system. However, the study indicates that lay-providers can successfully use AED's.

Mosesso, V. N., Jr., E. A. Davis, et al. (1998). "Use of automated external defibrillators by police officers for treatment of out-of-hospital cardiac arrest." Ann Emerg Med 32(2): 200-7.

Reviewer's Comment: This article demonstrates improved survival when AED's are given to police. This article was not considered to apply to the worksheet question since police response is part of the EMS system and not truly a PAD program. However, it is an early indication that lay-providers can successfully use AED's.

Muraoka, H., Y. Ohishi, et al. (2006). "Location of out-of-hospital cardiac arrests in Takatsuki City: where should automated external defibrillator be placed." Circ J 70(7): 827-31.

Reviewer's Comment: This paper is relevant to the worksheet question but does not directly answer the question. Organizers of PAD programs should consider the incidence of cardiac arrest in a given location prior to starting a PAD program.

Myerburg, R. J., J. Fenster, et al. (2002). "Impact of community-wide police car deployment of automated external defibrillators on survival from out-of-hospital cardiac arrest." Circulation 106(9): 1058-64.

Reviewer's Comment: This article demonstrates improved survival when AED's are given to police. This article was not considered to apply to the worksheet question since police response is part of the EMS system and not truly a PAD program. However, it is an early indication that lay-providers can successfully use AED's.

Myers, J. B., D. French, et al. (2005). "Lack of integration of automated external defibrillators with EMS response may reduce lifesaving potential of public-access defibrillation." Prehosp Emerg Care 9(3): 339-43.

Reviewer's Comment: This study looked at whether community based AED's had been registered with the local EMS agency. While it does not directly answer the worksheet question it illustrates that these AED's are not being integrated with the EMS system as is recommended.

Nichol, G., A. P. Hallstrom, et al. (1998). "American Heart Association report on the second public access defibrillation conference, April 17-19, 1997." Circulation 97(13): 1309-14.

Reviewer's Comment: AHA proceedings article that describes the 4 levels of PAD. This review will focus on levels 2, 3, and 4.

Nichol, G., A. P. Hallstrom, et al. (1998). "Potential cost-effectiveness of public access defibrillation in the United States." Circulation 97(13): 1315-20.

Reviewer's Comment: This was a cost analysis.

Nichol, G., T. Valenzuela, et al. (2003). "Cost effectiveness of defibrillation by targeted responders in public settings." Circulation 108(6): 697-703.

Reviewer's Comment: This article demonstrates that PAD is likely cost effective.

Ornato, J. P. and D. G. Hankins (1999). "Public-access defibrillation." Prehosp Emerg Care 3(4): 297-302.

Reviewer's Comment: This is a review article. No new references were identified.

Ornato, J. P., M. A. McBurnie, et al. (2003). "The Public Access Defibrillation (PAD) trial: study design and rationale." Resuscitation 56(2): 135-47.

Reviewer's comment: This is a methods paper on the PAD trial which is included in the evidence grid with the article by Hallsstrom.

Pell, J. P., A. Walker, et al. (2007). "Cost-effectiveness of automated external defibrillators in public places: con." Curr Opin Cardiol 22(1): 5-10.

Reviewer's Comment: This is a review article on the cost-effectiveness of a PAD trial. No new articles identified.

Powell, J., L. Van Ottingham, et al. (2004). "Public defibrillation: increased survival from a structured response system." J Cardiovasc Nurs 19(6): 384-9.

Reviewer's Comment: This article is a review of the PAD trial it does not report any new analyses but summarizes the study's findings. This data is already captured by the Hallstrom article.

Ragin, D. F., J. A. Holohan, et al. (2005). "Shocking a community into action: a social marketing approach to cardiac arrests." J Health Soc Policy 20(2): 49-70.

Reviewer's Comment: This paper analyzes data from the PAD trial to determine if social marketing can improve cardiac arrest response. It is related to the worksheet question but does not address the effectiveness of PAD programs for survival.

Richardson, L. D., M. D. Gunnels, et al. (2005). "Implementation of community-based public access defibrillation in the PAD trial." Acad Emerg Med 12(8): 688-97.

Reviewer's Comment: This paper analyzes data from the PAD trial to determine barriers to implementing PAD. It is related to the worksheet question but does not address the effectiveness of PAD programs for survival.

Riegel, B. (1998). "Training nontraditional responders to use automated external defibrillators." Am J Crit Care 7(6): 402-10.

Reviewer's Comment: This is a review article on training to use an AED.

Riegel, B., A. Birnbaum, et al. (2005). "Predictors of cardiopulmonary resuscitation and automated external defibrillator skill retention." Am Heart J 150(5): 927-32.

Reviewer's Comment: This is a sub-analysis of the PAD trial looking at skill retention by providers. It is relevant but does not directly answer the worksheet question.

Riegel, B., V. N. Mosesso, et al. (2006). "Stress reactions and perceived difficulties of lay responders to a medical emergency." Resuscitation 70(1): 98-106.

Reviewer's Comments: This study looked at stress levels and other issues related to responding to a cardiac arrest for bystanders. It does not directly address the worksheet question but does provide information on the effect of responding on by-standers.

Riegel, B., S. D. Nafziger, et al. (2006). "How well are cardiopulmonary resuscitation and automated external defibrillator skills retained over time? Results from the Public Access Defibrillation (PAD) Trial." Acad Emerg Med 13(3): 254-63.

Reviewer's Comments: A sub-study of the PAD trial looking at skill retention among volunteers. Does not answer the worksheet question but is relevant.

Ross, P., J. Nolan, et al. (2001). "The use of AEDs by police officers in the City of London. Automated external defibrillators." Resuscitation 50(2): 141-6.

Reviewer's Comments: This article is relevant to the worksheet question, however because it does not address response outside the EMS system it is not considered evidence in the evaluation. Further, it does not compare outcomes and only services to illustrate that a police AED program is feasible.

Sayre, M. R., A. H. Travers, et al. (2004). "Measuring survival rates from sudden cardiac arrest: the elusive definition." Resuscitation 62(1): 25-34.

Reviewer's Comment: This was a sub-analysis of the PAD trial, looking at the effect of changing definitions on the study outcome. It was not included as evidence since it is already represented by the Hallstrom paper.

Sternbach, G., J. Varon, et al. (2003). "Defibrillation." Critical Care & Shock 6: 50-54.
Abstract: None available.
Reviewer's Comment: This is a position paper from Heart and Stroke Canada. Two new references were identified.

Valenzuela, T. D., D. J. Roe, et al. (1997). "Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model." Circulation 96(10): 3308-13.

Reviewer's Comment: Not relevant to the worksheet question.

van Alem, A. P., R. H. Vrenken, et al. (2003). "Use of automated external defibrillator by first responders in out of hospital cardiac arrest: prospective controlled trial." BMJ 327(7427): 1312.

Reviewer's Comments: This article is relevant to the question but does not address PAD use outside of the EMS system.

Wassertheil, J., G. Keane, et al. (2000). "Cardiac arrest outcomes at the Melbourne Cricket Ground and shrine of remembrance using a tiered response strategy-a forerunner to public access defibrillation." Resuscitation 44(2): 97-104.

Reviewer's Comment : This article is relevant to the worksheet question, however because it does not address response outside the EMS system it is not considered evidence in the evaluation. It examines AED use by ambulance service personnel at a mass gathering event.

Weaver, W. D., D. Hill, et al. (1988). "Use of the automatic external defibrillator in the management of out-of-hospital cardiac arrest." N Engl J Med 319(11): 661-6.

Reviewer's Comment: This article demonstrates improved survival when AED's are given to firefighters. This article was not considered to apply to the worksheet question since firefighter response is part of the EMS system and not truly a PAD program. However, it is an early indication that lay-providers can successfully use AED's.

Weisfeldt, M. L., R. E. Kerber, et al. (1996). "Public access to defibrillation. The Automatic Defibrillation Task Force." Am J Emerg Med 14(7): 684-92.
Abstract: None available
Reviewer's Comments: Review article.

White, R. D. (1997). "Optimal access to- and response by-public and voluntary services, including the role of bystanders and family members, in cardiopulmonary resuscitation." New Horiz 5(2): 153-7.

Reviewer's Comment: This paper describes the proceedings from a panel discussion. No new references identified.

White, R. D., D. G. Hankins, et al. (1998). "Seven years' experience with early defibrillation by police and paramedics in an emergency medical services system." Resuscitation 39(3): 145-51.

Reviewer's Comment: This is a case series looking at a police AED program. It is relevant to the question but does not address PAD use outside of the EMS system.

White, R. D. (2001). "Technologic advances and program initiatives in public access defibrillation using automated external defibrillators." Curr Opin Crit Care 7(3): 145-51.

Reviewer's Comment: This is a review article. No new references were identified.

Woollard, M. (2001). "Public access defibrillation: a shocking idea?" J Public Health Med 23(2): 98-102.

Reviewer's Comment: This is a review article. No new research is reported and no new references were identified.