

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

### Worksheet author(s)

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### Clinical question.

"In ALS and PALS providers (P), are there any specific intervals for update/retraining (I) compared with standard practice (ie. 12 or 24 monthly) (C) that increase outcomes (eg. skill acquisition and retention) (O)?"

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

**State if this is a proposed new topic or revision of existing worksheet:** New 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).

PubMed: "heart arrest" or "resuscitation" (MeSH) or "ALS" (text word) and (education or training or competency) 2464 refs; "ALS" and refresher (text) 16 refs; "Neonatal Resuscitation Program" and ("education" or "retention" )

EMBASE; "training" and "pediatric advanced life support" 2 refs; "resuscitation" and "education" 3524 refs (4 unique)

ERIC: "resuscitation" or "CPR" no new references identified

AHA EndNote Master library 5 unique hits, Cochrane Database for Systematic Reviews, Central Register of Controlled Trials, DARE 0

Date of initial search: 9/25/08 Date of most recent update: 9/25/09

### • State inclusion and exclusion criteria

Excluded: Studies that did not assess maintenance of skills after initial training; studies involving only BLS (i.e., basic CPR) or AED training, studies that compared retention among 2 groups but did not compare skills immediately post-training with skills at a subsequent time point.

• Number of articles/ sources meeting criteria for further review: 25

# Summary of evidence

## Evidence Supporting Clinical Question

<b>Good</b>	*Stross 1983 E3A		Duran 2008 E3N	Grant 2007 E1P Hammond 2000 E2A	
<b>Fair</b>			*Nadel 2000 E3P	Anthony pillai 1992 E1A Boonmak 2004 E3A Duran 2007 E1N *Kaye 1987 E3A Kaye 1990 E3A O'Steen 1996 E3A Skidmore 2001 E3N Smith 2008 Trevisanuto 2005 E1N	Azcona 2002 Birnbaum 1994 Makker 1995
<b>Poor</b>				Young 2000 E3A	
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Level of evidence</b>					

E1= Cognitive knowledge assessed  
E2 =Skills assessed

E3 = Knowledge and skills assessed  
A, P, N = ACLS, PALS, NRP

\* = study with refresher intervention

## Evidence Neutral to Clinical question

<b>Good</b>					
<b>Fair</b>				Durojaiye 2002 E1P Miotto 2008 E1A Wayne 2006 E2A Wolfram 2003 E1P	
<b>Poor</b>					Blumenfeld 1998
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Level of evidence</b>					

E1= Cognitive knowledge assessed  
E2 =Skills assessed

E3 = Knowledge and skills assessed  
A, P, N = ACLS, PALS, NRP

\* = study with refresher intervention

## Evidence Opposing Clinical Question

<b>Good</b>					
<b>Fair</b>	*Kaczorowski 1998 E3N *Su 2000 E3P				
<b>Poor</b>					
	1	2	3	4	5
<b>Level of evidence</b>					

E1= Cognitive knowledge assessed  
E2 =Skills assessed

E3 = Knowledge and skills assessed  
A, P, N = ACLS, PALS, NRP

\* = study with refresher  
intervention

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

Discussion: Five studies specifically examined the effects of refresher training at a specified time after initial course participation on retention of skills. Three studies (LOE 1, Stross, 1983, 3339; LOE 3, Nadel, 2000, 1049; LOE 4, Kaye, 1987, 55) showed improved knowledge and/or skills retention after refresher training. Two LOE 1 studies (Kaczorowski, 1998, 99; and Su, 2000, 779) found that refresher training did not improve knowledge or skills performance at the time of final testing. The remainder of the studies compared level of performance on knowledge and/or skills testing at course completion and at one or more times after training. Time between training and re-testing ranged from 6 weeks to 18 months. Twelve studies demonstrated a significant decline in performance at later time points compared to results immediately after completion of training (LOE 3, Duran, 2008, 644) and 11 LOE 4 studies (Anthonypillai, 1992, 180; Boonmak, 2004, 1311; Duran, 2007, 153; Grant, 2007, 433; Hammond, 200, 99; Kaye, 1990, 51; O'Steen, 1996,66; Skidmore, 2001, 31; Smith, 2005, 59; Trevisanuto, 2005, 944; Young, 2000, 7). These results were interpreted as identifying a time frame within which knowledge an/ or skills declined, implying that a refresher intervention would have to be implemented prior to that time point in order for providers to maintain skills. Several studies reported no significant decline in either knowledge (LOE 4 Durojaiye, 2002, 241; Miotto, 2008, 244; Wolfram, 2006, 475) or skills (LOE 4 Wayne 2006, S9;) for as long as a 2-year observation period. Although several studies found that performance of skills declined more than knowledge, this was not universally reported. The refresher interventions used varied from providing printed material for review to participation in simulated resuscitation scenarios.

### Acknowledgements:

None

### *Citation List*

**Anthonypillai F. Retention of advanced cardiopulmonary resuscitation knowledge by intensive care trained nurses. Intensive Crit Care Nurs. 1992;8:180-4.**

*LOE 4. Supportive. Fair. Interview method. Small sample (18 nurses). Theoretical knowledge only, no skills tested. Decline in knowledge > 4 months after training.*

**Azcona LA, Gutierrez GE, Fernandez CJ, Natera OM, Ruiz-Speare O, Ali J. Attrition of advanced trauma life support (ATLS) skills among ATLS instructors and providers in Mexico. J Am Coll Surg. 2002 Sep;195(3):372-7.**

*LOE 5. Supportive Fair. Observational study. MDs, varying levels of training and experience. Skill deterioration after two years was noted. Experience did not affect retention.*

**Birnbaum ML, Robinson NE, Kuska BM, Stone HL, Fryback DG, Rose JH. Effect of advanced cardiac life-support training in rural, community hospitals. Crit Care Med. 1994 May;22(5):741-9.**

*LOE 5 Supportives Fair. Observational study. Large sample (325 nurses and doctors) – unknown number retested. No decrease in cognitive test results at 1-2 years but decline in skills beginning at 3 months.*

**Blumenfeld A, Ben Abraham R, Stein M, Shapira SC, Reiner A, Reiser B, Rivkind A, Shemer J. Cognitive knowledge decline after Advanced Trauma Life Support courses. J Trauma. 1998 Mar;44(3):513-6.**

*LOE 5; neutral, Poor. ATLS or ACLS training; MDs in Israeli army. Score of 80% considered acceptable; >4 years before 20% of subjects had decline to 80% score.*

**Boonmak P, Boonmak S, Srichaipanha S, Poomsawat S. Knowledge and skill after brief ACLS training. J Med Assoc Thai 2004 Nov; 87(11):1311-4.**

*LOE 4 Supportive (knowledge component) Fair Nurse anesthetists assessed for knowledge and skills 3 months after 1-hr ACLS course. Knowledge scores declined but skills scores were equal to post-course level.*

**Duran R, Aladağ N, Vatansever U, Küçükuğurluoğlu Y, Süt N, Acunaş B. Proficiency and knowledge gained and retained by pediatric residents after neonatal resuscitation course. Pediatr Int. 2008 50:644-7.**

*LOE 3 Supportive, Good. Pediatric residents evaluated with written test and intubation of manikin. Knowledge decreased by 6 months, then was stable to 12 months; intubation skill decreased between 6 and 12 months.*

**Duran R, Sen F, Aladağ N, Vatansever U, Acunaş B. Knowledge gained and retained by neonatal nurses following neonatal resuscitation program course. Turk Pediatri Arsivi 2007 42(4): 153-55.**

*LOE 4 Supportive Fair. Neonatal nurses assessed 6 months after NRP course. Test scores decreased by 40%.*

**Durojaiye L, O'Meara M. Improvement in resuscitation knowledge after a one-day paediatric life-support course. J Paediatr Child Health. 2002 38:241-5.**

*LOE 4 Neutral Fair-telephone survey to collect data. House staff/resident medical officers took pediatric life support course; knowledge test given by phone at 2 wk, 2 mo, and 4 mo after course. No significant decline in knowledge detected.*

**Grant EC, Marczynski CA, Menon K. Using pediatric advanced life support in pediatric residency training: does the curriculum need resuscitation? Pediatr Crit Care Med. 2007 8:433-9.**

*LOE 4 Supportive Good Pediatric residents evaluated before, immediately after, and 12 months after PALS course. Concrete knowledge did not decline, but significant decline in performance on “short answer questions” regarding clinical scenarios at 12 months (to less than pre-course levels).*

**Hammond F, Saba M, Simes T, Cross R. Advanced life support: retention of registered nurses' knowledge 18 months after initial training. Aust Crit Care. 2000 13:99-104.**

*LOE 4. Supportive, Fair. Observational study. Small sample (40 nurses). Psychomotor skills deteriorated over 18months; theoretical knowledge maintained.*

**Kaczorowski J, Levitt C, Hammond M, Outerbridge E, Grad R, Rothman A, et al. Retention of neonatal resuscitation skills and knowledge: a randomized controlled trial. Fam Med. 1998 Nov-Dec;30(10):705-11.**

*LOE 1 Opposing Fair Family Medicine residents randomized after NRP course to video refresher, hands-on refresher, or neither at 3-5 months, evaluated at 6-8 months. Overall, the 3 groups performed equally on re-test, although group that had hands-on booster reportedly made fewer errors in “life-supporting” skills. Since n was only about 15 per group, study may not have had sufficient power to detect overall significant difference.*

**Kaye W, Mancini ME, Rallis SF. Advanced cardiac life support refresher course using standardized objective-based Mega Code testing. Crit Care Med. 1987 15:55-60.**

*LOE 4. Supportive, Fair. Observational study. Small sample (32 medical students and nurses). Skills declined after initial training, but time not specified. The length of time from refresher training to retesting was within 2 - 4 months and refresher course did improve skills and knowledge.*

**Kaye W, Wynne G, Marteau T, Dubin HG, Rallis SF, Simons RS, Evans TR. An advanced resuscitation training course for preregistration house officers. Journal of the Royal College of Physicians of London 1990 24(1): 51-4.**

*LOE 4 Supportive, Fair. Small group sizes; recently qualified physicians. No significant change in knowledge; some decline in skills but magnitude not clear.*

**Makker R, Gray-Siracusa K, Evers M. Evaluation of advanced cardiac life support in a community teaching hospital by use of actual cardiac arrests. Heart Lung. 1995 24:116-20.**

*LOE 5 Supportive, Fair. Evaluated patient outcomes during resuscitation after cardiac arrest; more errors made by MDs who had been trained >6 months prior to performing resuscitation.*

**Miotto HC, Couto BRGM, Goulart EMA, Amaral CFS, Moreira MdCV. Advanced Cardiac Life Support Courses: Live actors do not improve training results compared with conventional manikins. Resuscitation. 2008;76(2):244-8.**

*LOE 1 Neutral, Fair. 50% of subjects did not complete full protocol. Looked at 2 different methods of teaching ACLS; tested retention at 6 months post-course; no significant decline in scores.*

**Nadel FM, Lavelle JM, Fein JA, Giardino AP, Decker JM, Durbin DR. Teaching Resuscitation to Pediatric Residents: The Effects of an Intervention. Arch Pediatr Adolesc Med. 2000 October 1, 2000;154(10):1049-54.**

*LOE 1 Supportive, Fair. Did not account for differences in clinical experience during study period.*

**O'Steen DS, Kee CC, Minick MP. The retention of advanced cardiac life support knowledge among registered nurses. J Nurs Staff Dev. 1996 Mar-Apr;12(2):66-72.**

*LOE 4 Supportive Fair. Study suggests that retraining interval should be <12 months.*

**Skidmore MB, Urquhart H. Retention of skills in neonatal resuscitation. Paediatrics and Child Health. 2001;6:31-5.**

*LOE 4 Supportive, fair. Only about half of subjects participated in 6 and 12 month assessments. Skills declined more rapidly than knowledge.*

**Smith KK, Gilcreast D, Pierce K. Evaluation of staff's retention of ACLS and BLS skills. Resuscitation. 2008 Jul;78(1):59-65.**

*LOE 4 Supportive Fair Suggests retraining needed in first 3 months. Subjects differed in previous experience; randomization not equal. Skills lost more quickly than knowledge with significant decline in performance at 3 months; retention also related to previous experience of subjects.*

**Stross JK. Maintaining competency in advanced cardiac life support skills. JAMA. 1983 Jun 24;249(24):3339-41**

*Level 1. Supportive Good. Adequate sample size –MDs as subjects. Quarterly refresher activities (not hands on). Skill and knowledge decayed in the control group over 12 months; the two intervention groups had better retention of knowledge but no improvement in retention of skill vs control.*

**Su E, Schmidt TA, Mann NC, Zechnich AD. A randomized controlled trial to assess decay in acquired knowledge among paramedics completing a pediatric resuscitation course. Acad Emerg Med. 2000 Jul;7(7):779-86.**

*Level 1 Opposing Fair (small n) Paramedics randomized after initial PALS course to repeat knowledge test, mock code, both, or neither at 6 months post-course, tested at 12 months. All groups with equal significant decrease in knowledge and skills level at 12 months, so refresher, if effective, would have to be earlier than 6 months after course..*

**Trevisanuto D, Ferrarese P, Cavicchioli P, Fasson A, Zanardo V, Zacchello F. Knowledge gained by pediatric residents after neonatal resuscitation program courses. Paediatr Anaesth. 2005 Nov;15(11):944-7.**

*LOE 4 Supportive Fair Pediatric residents retested 6 months after NRP course; results of written test less than post-course score but higher than pre-course score. Larger decline seen in scores on questions related to chest compressions and medication administration. No evaluation of skills performance.*

**Wayne DB, Siddall VJ, Butter J, Fudala MJ, Wade LD, Feinglass J, et al. A longitudinal study of internal medicine residents' retention of advanced cardiac life support skills. Acad Med. 2006 Oct;81(10 Suppl):S9-S12.**

*LOE 4 Neutral Good. Performance of ACLS skills by internal medicine residents followed for 14 months after ACLS course including simulations; no decline over study period.*

**Wolfram RW, Warren CM, Doyle CR, Kerns R, Frye S. Retention of Pediatric Advanced Life Support (PALS) course concepts. J Emerg Med. 2003 Nov;25(4):475-9.**

*LOE 4 Neutral Fair Paramedics retested 2 years after PALS course; only 25% actually passed, but 40% within 1 SD; this was considered acceptable. Thus authors concluded retention was sufficient at 2 years even though 35% had scores >1 sd below passing level.*

**Young R, King L. An evaluation of knowledge and skill retention following an in-house advanced life support course. Nurs Crit Care. 2000 Jan-Feb;5(1):7-14.**

*LOE 4. Supportive Poor Only 10 nurses studied. ALS skills declined by 6 weeks and decreased further by 12 weeks.*