Remember fast, act skillfully

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6 Instructor retraining and poster retraining are equally effective for retention of BLS and AED skills of lifeguards.

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Abstract

Introduction: More than a million people in the United States and Europe suffer a Sudden Cardiac Arrest each year. Thousands of people have to be trained in delivering help in such a situation.

This cluster randomised study compared two refresher training methods for Basic Life Support (BLS) and use of an Automated External Defibrillation (AED): a traditional instructor-led course, and self-instruction by poster.

Methods: One hundred and thirty nine lifeguards were assigned to one of two groups. Group A (n=79) received a one-and-a-half-hour, instructor-led refresher training course, whereas group B (n=60) were advised to refresh their own knowledge with a poster, a manikin, and an AED training device. The lifeguards were assessed 3, 6, and 12 months after the initial training.

Results: Seventy-five percent of the lifeguards in each group were deemed competent after 3 months. After 6 months, 78% in group A and 75% in group B were considered competent. After 12 months, this was 71% and 76% respectively. Young and less experienced lifeguards performed better than older and more experienced lifeguards.

Conclusions:

Refresher self-training by the use of a poster was as effective as, and more flexible than, scheduled, instructor-led refresher training.

Introduction

Each year over a million people in the United States and Europe suffer a Sudden Cardiac Arrest. Laypersons who witness such an arrest can safe lives. It is stated that "Early defibrillation: CPR plus defibrillation within 3-5 min of collapse can produce survival rates as high as 49-75%".[1,2] Training in resuscitation techniques is a major instrument to reduce the annual number of death due cardiac arrests.

It is known that BLS skills can be learned in a three hour course. However, the skill retention decreases fast after the training.[3,4] Retraining every six months is therefore advised, but time consuming for the lay-providers. The skill for using an AED is rather simple to apply and there is hardly any decrease in skill retention.[5,6]

Considering the large numbers of people that are annually trained in BLS/AED, it is becoming increasingly important to identify training programmes that are cheap, restricted in training time and effective. It is recommended that training methods should not be limited to traditional instructor based training.[7] Different methods of training have been attempted, like self-instruction using video or Digital Versatile Disc (DVD), with a manikin[8,9] or without a manikin,[10] using voice assistance,[11,12] computers[13] and micro simulation.[14]

A previous study has shown that for the initial training of AED-skills, self-training by means of a poster by nurses is both effective and cost effective in the acquisition of AED skills.[15] This method of training seems promising as an alternative method to increase the number of competent providers in the lay public. Except for this evidence for initial training, no studies to date have been published of poster self training for refreshing either BLS or AED skills, as far as we know.
The objective of this study was to compare the effectiveness of a traditional, instructor-led, BLS/AED refresher course, versus self-instruction refreshment training by a poster. If the poster training would prove to be as effective as instructor based training, the first training method would be more efficient, as it saves time and can save money.

Materials and methods

Study population
The study population consisted of lifeguards who were on duty in four geographically separated, regions in The Netherlands. (Figure 1)
The location, the estimated annual numbers of visitors and the number of included lifeguards during the summer period from May to October at these beaches are shown in figure 1.

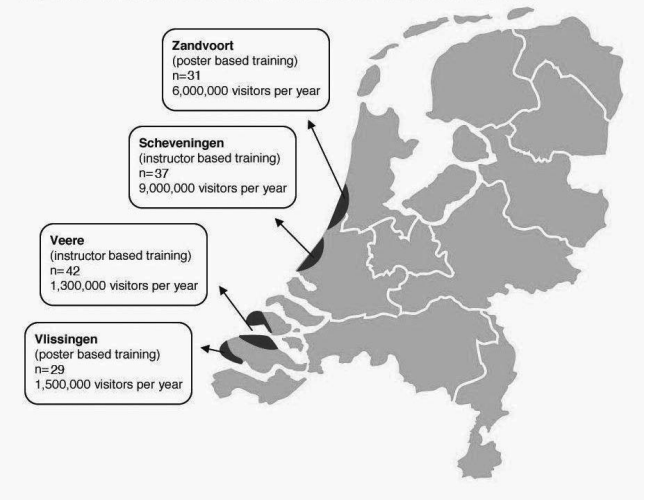

Figure 1.
Location of the lifeguards stations involved in the study.
The location, the estimated annual numbers of visitors and the number of included lifeguards during the summer period from May to October.

Before the start of the training, it was decided by randomisation which retraining method would be appointed to which region. Each region received a unique identification number. Each number was appointed to one of the two training methods with a web based randomization programme.[16] Veere and Scheveningen were appointed a traditional instructor-led refresher training course (Group A). Vlissingen and Zandvoort had to refresh their knowledge with the help of a poster, a manikin, and an AED training device (Group B).
All participants were informed that they were expected to participate in the study that would last for 12 months. The training took place between 1 February 2003 and 30 October 2005.

Training
All lifeguards received an initial BLS/AED course from experienced BLS/AED certified ambulance nurses in April or May of the year they entered the study. This course was based on the BLS/AED training program according to the official ERC guidelines.[17,18]
The instructor-led refresher training courses were delivered immediately after the first summer period, and at the start of the second summer period. To assess the level of skill acquisition of the individual lifeguards during the training session, instructors used continuous assessment, sometimes called learning potential assessment.[19,20,21] This means that the lifeguards were assessed on interval basis, instead of at the end of the training period.
For the poster based refresher method a training room with a poster, a manikin, and an AED training device was available over the summer period (June – October) at each of the group B locations. The poster was commercially available, and had been shown in a previous study to be educationally effective.[15] (see page 56 of this thesis) Peer tutoring was allowed during training, but only in pairs.
During the winter period (November – April) none of the groups received any instructor training, or had access to the poster and manikin.

Assessment
After successfully completing the initial instructor-based BLS/AED training, the lifeguards in both groups were assessed 3 (June), 6 (October), and 12 months (April/May) later. Different assessment scenarios were used on each occasion to avoid lifeguards being able to copy their performance from the previous tests.[21]
The assessments after 3 and 12 months were with a multiple-shock scenario: the AED, after being connected, starts analysing. After analyse, the AED advises a shock and starts analysing again after the shock is delivered.

This cycle repeat twice (total of three shocks), after which the AED prompt the lifeguard to start CPR. The assessments after 6 months were with a single-shock scenario: the AED, after being connected, start analysing. After analysis, the AED advises a shock and starts analysing again after the shock is delivered and prompt the lifeguard to start CPR.
Each lifeguard was assessed by one of seven certified BLS/AED instructors. None of these instructors was involved in the initial training but they were aware of the type of refresher training undertaken.
A score sheet with 17 skills on a 7-point VAS scale was used for the assessments (Figure 3; see appendix 1 on page 110 of this thesis).[15,23,24] Qualitative assessment of most BLS skills and time to shock were measured by the evaluation mode of the computer software of the manikin (items 7-11, 17). Qualitative assessment of the other BLS-skills (items 4-6) and AED-skills (items 1-6, 12-16), was done by the instructor. Both 'pulse-check' items and 'check breathing after pulse is found' were deleted from the original version, as pulse check is no longer a criterion to start CPR. For skills 1-6, 10 and 13-15, 1 represents the poorest performance and 7 represents the best. The scores were dichotomised to *competent* or *not competent*. Lifeguards were considered to be competent in these skills if they scored >5.5. For skills 7-9, 11, 12 and 16 the best scores were in the middle of the range, and competency was therefore set at 2.5-5.5. For item 17 competency was set at 90 seconds or less. Differences in the scores of the skills were analysed on ordinal level.
Uniformity of assessment was ensured by four quality-control measures: all instructors were informed about the necessity of uniform training and assessment; all were trained in using the assessment forms; one author (WdV) was present as a non-participating observer during each assessment; 15% of randomly selected assessments were videotaped. These cases were selected by using randomisation software.[16] These videos were studied afterwards by one of the authors (WdV) to check for any significant differences in quality of assessment between the seven instructors.
The training, assessments, and quality-control measures were identical for all the lifeguards whether they entered the study in 2003 (n=65), 2004 (n=44), or 2005 (n=30).

Materials
The AMBU Man C manikins (AMBU AS, Ballerup, Denmark) and Lifepak Cr+ AED training devices (Medtronic PhysioControl Corp., Redmond, USA) were used for the refresher training of all groups. For the assessment the AMBU Man C was connected to a computer with CPR Software Kit 2.3 (AMBU AS, Balerup, Denmark).

Statistics
The calculated minimum sample size per group is 51, with effect size of 0.5, alpha 0.05 and power 0.80 for differences between two independent groups, using G*Power 3.0.10.[25]

The Kruskal Wallis test was used to analyse differences in BLS/AED skills between the groups. Time intervals were expressed as medians. Significance was accepted when a two-sided p-value was < 0.05 or when confidence intervals did not include unity.
The Mann-Whitney test was used to analyse differences between male and female, younger and older, less experienced and more experienced lifeguards. To distinguish the young from the old age lifeguards, the median value of the age at the moment a lifeguard entered the study, was used. To distinguish between less and more experience, the boundary line was arbitrary set at two or less summer periods for less experienced lifeguards.
Correlations between all skills were calculated. A relevant correlation was accepted when the Pearson Correlation was ≥ 0.7.
Statistics were performed in SPSS® 12.0.1 for Windows (SPSS Inc. Chicago, USA).

Results

The characteristics of lifeguards in group A and B were comparable, except for the years of experience. This was 7.9 years for group A and 10.3 for group B. (Table 1)

	Mean group A (instructor based)	Mean group B (poster based)
Number of lifeguards included	79	60
Age in years	27,6	28,8
Gender (% male/%female)	68/32	72/28
Average number of hours per week on the beach during summer	26,1	23,1
Summer seasons active as lifeguard	7,9	10,3
Valid first aid certificate (years)	7,7	10,4
Participation in a resuscitation attempt (in years ago)	4,5	4,6

Table 1.
Characteristics of lifeguards in group A and B.

When assessed 3 months after initial training, 75% of lifeguards in each group were deemed competent in all the skills tested. Six months after initial training, 78% of group A and 75% of group B lifeguards were deemed competent in all skills. Twelve months after initial training, before the beginning of the second summer period, 71% of group A and 76% of group B lifeguards were deemed competent in all skills.
When looking to the separate skills of the assessment there were statistical significant differences between the two groups after 6 months. There was a difference for 'rhythm of compression' in favour of group A, and in 'CPR integration' in favour of group B. After 12 months, there were no longer any significant differences between the groups.
Lifeguards in group B declared that they had practised between 3 and 12 times during the summer months, with an average training time of 30 minutes per session.
There were no differences found in overall skill acquisition between the different regions. No significant correlation was found between performance and instructor, or the year in which a lifeguard entered the study.
There were differences related the gender, age and experience of the lifeguards. Male lifeguards compressed the chest more deeply than female lifeguards when tested after 3 months. This difference disappeared during the subsequent assessments.
Younger lifeguards (n=67; average age 20.7; SD 2.66) performed better than older lifeguards (n=72; average age 35.6; SD 8.24) (Table 2). And less experienced lifeguards (n=51; average experience 1.85 years; SD 1.35) performed better than more experienced lifeguards (n=88; average experience 13.2 years; SD 7.52) on each occasion, and for all skills tested except 'depth of chest compression' which, at 6 months, was performed significantly better by more experienced lifeguards. (Table 2)
A Chi-square calculation showed a significant relation between age and experience (Chi square 6,867; p=0.009). In other words, younger lifeguards are less experienced and older lifeguards are more experienced.

Discussion

The objective of this study was to compare the results on skill acquisition of two different BLS/AED refresher training methods for non-healthcare professionals: a traditional instructor-led course, and self-instruction by poster. The study shows that unscheduled, refresher self-training in BLS/AED skills, with the help of a poster, manikin, and AED training device is as effective as scheduled, refresher training by an instructor. Both method of retraining show no significant decrease in total performance and the same pattern of decrease in retention of separate skills with time.

The results of this study can be of help to find the most efficient and effective refreshment training for lay people to keep themselves competent in BLS/AED skills. For lay persons who do not need external stimulus from an instructor, but who are internally motivated to refresh their CPR-skills, poster training has the potential to be a more efficient alternative.

Previous studies on the retention of BLS skills have been consistent in the conclusion that BLS skills decrease between 6 weeks and 9 months after initial training.[3,4] We did not find a large decrease. Seventy five percent of the providers assessed 3 months after initial training kept their skill acquisition on or above the set level. Only during the test after 12 months there was a decrease to 71% in group A, and none in group B. This might be because these previous published studies were based on instructor based courses with more back ground information and less hands on training, while our training was according to the updated training method with less background information and more hands-on time. An alternative explanation might be the fact that in the actual guidelines during this study, the BLS-algorithm is simplified compared to older guidelines.

We did not measure the time that students in group B took for refreshment training.

Students indicated that they practised average 30 minutes together. This means that students in group B could have more practical hands on training than the students in group A. This might be another advantage for the poster based refreshment training.

Previous studies on the retention of AED skills found minimal decay of AED skills after 6 and 12 months as we did in our study.[5,6] It seems that AED skills are easy to retain. A previous study with a poster-based AED training programme showed that a poster-based AED training programme for nurses was equally as effective as an instructor-led programme, but cheaper to run.[15]

		Between younger and older	
	Range for competency	Mean younger lifeguards	Mean older lifeguards
Retention after 6 months			
Workspace	5.5 - 7.0	6,25 (SD 0,983)	5,62 (SD 1,539)
Check for signs of circulation	2.5 - 5.5		
Depth of chest compression	2.5 - 5.5		
AED position	2.5 - 5.5		
Position of electrodes	5.5 - 7.0		
Retention after 12 months			
Workspace	5.5 - 7.0		
Shout and shake	5.5 - 7.0	6,72 (SD 0,759)	6,40 (SD 1,003)
Check breathing	5.5 - 7.0	6,15 (SD 1,496)	5,67 (SD 1,422)
Raise an alarm	5.5 - 7.0	6,10 (SD 1,683)	5,27 (SD 2,149)
Handposition	2.5 - 5.5		
Rescue breathing	5.5 - 7.0	5,97 (SD 1,460)	4,73 (SD 1,946)
Clearing during analysis	5.5 - 7.0	6,26 (SD 1,371)	5,73 (SD 1,258)

Table 2.

Significant differences between age and experience.

Between novice and experts		Significane	
Mean novice lifeguards	Mean experieced lifeguards	Mann-Whitney U	Asymp. Sig. (2-tailed)
		1706	0,01
3,8 (SD 0,619)	3,43 (SD 1,092)	1718	0,04
4,48 (SD 0,863)	4,11 (SD 0,777)	1626	0,01
3,98 (SD 0,715)	3,41 (SD 1,135)	1475	0,01
6,13 (SD 0,859)	5,49 (SD 1,441)	1616	0,02
6,46 (SD 1,043)	5,78 (SD 1,497)	425,5	0,03
		442	0,03
		412	0,02
		416	0,02
3,92 (SD 0,433)	3,65 (SD 0,661)	460	0,04
		337,5	0,01
		387,5	0,01

As our findings showed that young lifeguards are less experienced and older lifeguards are more experienced, interesting observations can be made related to the differences between both groups. All skills that showed significant differences were in favour of the younger, less experienced lifeguards. We hypothesise that younger lifeguards can retrieve their skills and knowledge faster than older lifeguards because they are more used to receiving and retaining new information, and are more eager to learn because they can not rely on their experience.
Beach lifeguards were chosen as the study population as many lifeguard stations are equipped with AEDs, and the episodic nature of their emergency duties means that they have periods of relative inactivity which can be used for self-instruction. Since lifeguards have a duty to respond, it was anticipated that they would have the discipline and internal motivation for autonomous self instruction. The variety in age makes this group comparable with other dispatched first responders such as police forces and fire brigades.
Poster training seems as effective as instructor based training. And, in addition, cost less as no or less instructor hours have to be paid for retraining. For some other target groups, unproductive periods in their everyday life or work, can profitably be used for retraining with the help of a poster.

Limitations
During the instructor based training, continuous assessment was used. Continuous assessment is not an objective way of assessing. It can be influenced by the personal opinion or interpretation of the individual instructor. This is one of the assessment forms accepted for the official ERC BLS/AED training program.[26] We let instructors use this way of assessment to rule out any testing effect.
During the post and retention tests, most BLS skills are assessed objectively with the computer registration of the manikin, however, some BLS-skills and the AED skills, except for the time to shock, are assessed subjectively. With the current training devices objective assessment of all BLS/AED related skills is not possible during classroom training. However, the reliability of our data was improved by the four described quality-control measures (information to the instructors, additional assessment training, present of main investigator, randomly taken videos). Multiple controls allows for data triangulation, which improves the validity and reliability of the data.[27].
Although the study shows that lifeguards are able to perform BLS/AED skills effectively in a simulated simulation, we do not know if this is indicative of competency during a real-life event.[24]

During the assessment after 3 and 6 months after initial training, lifeguards might have received some feedback of the assessors on their performance, by the non-verbal reactions. This might have induced some learning effect in both groups.
There is a difference in the mean number of years experienced between both groups. We believe that this difference between 8 and 10 years of experience is not clinical relevant.

Conclusion
This study shows that lifeguards are able to perform BLS and to use an AED after appropriate training, and that unscheduled, autonomous, and flexible refresher training by the use of a poster is as effective as scheduled, instructor-led refresher training. The poster-based retraining method fits well with the daily activities of lifeguards, but will also be an attractive alternative for other non-health care professionals with a duty to respond in cardiac arrest situations. The method reduces cost and time as no instructor is needed and unproductive hours are used.
For lay public refreshment training is necessary to avoid retention decrease and to be able to respond accurate in a sudden cardiac arrest situations. For a large number of people, poster training may also be as effective as instructor based refreshment training. Therefore more studies to understand the efficacy of posters for retraining the general public are desirable.
The study also shows that young, less experienced lifeguards performed better than older, more experienced lifeguards. This observation deserves further in-depth study.

Conflict of interest
Neither author has a conflict of interest with regard to the training devices mentioned in this article.

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References

1. International Liaison Committee on Resuscitation.2005 International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Part 2: Adult basic life support. Circulation 2005;112:III-5-III-16.
2. Handley AJ, Koster RW, Monsieurs K, Perkins GD, Davies S, Bossaert LL. European Resuscitation Council Guidelines for Resuscitation 2005. Section 2. Adult basic life support and use of automated external defibrillators. Resuscitation 2005;67S1:S7-S23.
3. Weaver FJ, Ramirez AG, Dorfma SB, Raizner AE. Trainee‘s retention of cardiopulmonary resuscitation: how quickly they forget. JAMA 1979;242:901–3.
4. Chamberlain D, Smith A, Woollard M, et al. Trials of teaching methods in basic life support (3): comparison of simulated CPR performance after first training and at 6 months, with a note on the value of re-training. Resuscitation 2002;53:179-87.
5. Cummins RO, Schubach JA, Litwin PE, Hearne TR. Training lay persons to use automatic external defibrillators: success of initial training and one-year retention of skills. Am J Emerg Med 1989;7:143-9.
6. Woollard M, Whitfield R, Smith A, et al. Skill acquisition and retention in automated external defibrillator (AED) use and CPR by lay responders: a prospective study. Resuscitation 2004;60:17-28.
7. International Liaison Committee on Resuscitation.2005 International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Part 8: interdisciplinary topics. Resuscitation 2005;67:305-14.
8. Todd KH, Braslow A, Brennan RT, et al. Randomized, controlled trial of video self-instruction versus traditional CPR training. Ann Emerg Med 1998;31:364—9.
9. Lynch B, Einspruch EL, Nichol G, Becker LB, Aufderheide TP, Idris A. Effectiveness of a 30-min CPR self-instruction program for lay responders: a controlled randomized study. Resuscitation 2005;67:31—43.
10. Brennan RT, Braslow A. Video self-instruction for cardiopulmonary resuscitation. Ann Emerg Med 2000;36:79—80.
11. Wik L, Myklebust H, Auestad BH, Steen PA. Twelve-month retention of CPR skills with automatic correcting verbal feedback. Resuscitation 2005;66:27-30.
12. Hostler D, Wang H, Parrish K, Platt TE, Guimond G. The effect of a voice assist manikin (VAM) system on CPR quality among prehospital providers. Prehosp Emerg Care 2005;9:53—60.
13. 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;69:443-53.
14. Monsieurs KG, Vogels C, Bossaert LL, et al. Learning effect of a novel interactive basic life support CD: the JUST system. Resuscitation 2004;62:159—65.

15. De Vries W, Schelvis M, Rustemeijer I, Bierens JJ. Self-training in the use of automated external defibrillators: The same results for less money. Resuscitation 2008;76:76-82.
16. http://www.randomizer.org/form.htm
17. Baskett PJF, Nolan JP, Handley AJ, Soar J, Biarent D, Richmond S. European Resuscitation Council Guidelines for Resuscitation 2005 Section 9. Principles of training in resuscitation. Resuscitation 2005 ;67 :S181-9.
18. Hoke RS, Chamberlain DA, Handley AJ. A reference automated external defibrillator provider course for Europe. Resuscitation 2006;69:421-33.
19. Pressley M, McCormick CB. Cognition, teaching and assessment. New York, HarperCollege Publishers; 1995; Chapter 17.
20. Atkin JM, Black P, Coffey J (Eds). Classroom Assessment and the National Science Education Standards. Washington, National Academy Press. 2001 (http://www.nap.edu/openbook.php?isbn=030906998X)
21. Jarvis P. Adult and continuing education; Theory and practice. London: Routledge 2000; Chapter 5.
22. Knowles MS, Holton III EF, Sanson, RA. The Adult Learner. London: Elsevier; 2005; Chapter 9.
23. Kooij FO, van Alem AP, Koster RW, de Vos R. Training of police officers as first responders with an automated external defibrillator. Resuscitation 2004;63:33-41.
24. De Vries W, Van Alem AP, De Vos R, Van Oostrom J, Koster RW. Trained first-responders with an automated external defibrillator: how do they perform in real resuscitation attempts? Resuscitation 2005;64:157-61.
25. Faul F, Erdfelde, E, Lang AG & Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods 2007;39:175-91.
26. European Resuscitation Council. Basic Life Support and Automated External Defibrillation Instructor Manual. Antwerp: European Resuscitation Council Secretariat VZW; 2007. p 27.
27. Johnson RB. Toward a new classification of nonexperimental quantitative research. Educational Researcher 2001;30(2):3–13.