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TRAINING AND EDUCATIONAL PAPER

Assessment of BLS skills: Optimizing use of instructor and manikin measures[☆]

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Summary
Background: The primary objective of layperson CPR training is to ensure that learners achieve minimal competence to provide aid that improves the odds of survival of victims of out-of-hospital sudden cardiac arrest. During CPR courses, pronouncement of a learner's competence typically depends entirely on judgments made by an instructor; yet previous research strongly suggests that these judgments — particularly of chest compressions — are not sufficiently precise or accurate to ensure valid assessments. Comparisons of instructors' subjective assessments with objective data from recording manikins provide one means of understanding the magnitude and type of instructor errors in assessment.
Method: Eight hundred and twenty-six laypersons between 40 and 70 years old participated in CPR training. Performance of five discrete skills was tested in a scenario format immediately afterward: assessing responsiveness, calling the emergency telephone number 911, delivering ventilations of adequate volume, demonstrating correct hand placement for compressions, and delivering compressions with adequate depth. Thirteen AHA-certified instructors assessed these five skills and rendered a global performance rating; sensored Resusci Anne™ manikins with SkillReporting™ software recorded ventilation and compression data.
Results: Instructors' ratings of the ventilation skills were highly accurate; ratings of compressions were correct about 83% of the time; yet inadequate compression depth was rated adequate 55% of the time, and incorrect hand placement was rated adequate 49% of the time.
Conclusion: Instructors' judgments alone are not sufficient to determine learners' competence in performing compressions. Assessment, technology, and guidelines must be better aligned so that learners can receive accurate feedback.

☆ A Spanish translated version of the summary of this article appears as Appendix in the final online version at 10.1016/j.resuscitation.2007.07.018.

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Introduction

Delivery of chest compressions is the CPR skill most likely to improve survival from out-of-hospital cardiac arrest[1]; therefore a method for valid determination of rescuers' competence to perform this skill should be of prime importance to CPR training organizations. Indeed, AHA guidelines[2] increasingly emphasize simplification of CPR instruction to focus on competence in the small set of skills most strongly associated with the victim's survival.

CPR instructors must visually assess and aggregate mentally all of the skills and iterations of learners' skill performance, and then determine how much coaching is needed to bring inadequate performance to the required standards. But practice time in CPR courses can be quite limited, particularly when instructors deviate from the intended format. Assessing ventilations and compressions visually on a scale of inches or millimeters is a complex task, and sources of assessment error include short-term memory limitations, subjective and inconsistently applied criteria; and personal biases in assessing learners whom one has just trained. Instructors without access to assistive technology, such as recording manikins, may increase greatly their odds of both false positive (pronouncing a learner competent when she is not competent) and false negative (pronouncing a learner incompetent when she is competent) errors.

This is a secondary analysis of a previously reported randomized trial that evaluated video self-instruction versus standard or no CPR training in the lay public. The primary objective of the present study was to investigate the relationship between instructors' judgments and objective manikin data on compressions and ventilations performed by laypersons who have just completed CPR training. Specific study objectives included: description of the pattern and stability of error in instructors' assessments of global performance as a function of individual skill assessments and of participant characteristics (e.g., age and sex); and the use of findings, along with previous research, to make practical recommendations likely to improve the validity of CPR competency assessment.

Materials and methods

Study design and participant recruitment

The methods of random assignment and the details of the training interventions have been described previously[3] and are summarized briefly below. The data collection was conducted in downtown Portland, Oregon, in two separate waves (W1 and W2), as part of two separate, but related studies. W1 occurred between February and May of 2004 and included 224 learners, and W2 occurred between November 2004 and June 2005 and included 602 learners. In both W1 and W2, the learners were adults between 40 and 70 years of age who were recruited via advertisements in newspapers, flyers in various public sites, and word of mouth from the participants themselves. Advertisements described the project as a ''CPR training study''. The only exclusion criteria other than age were participation in CPR training within the previous 5 years and professional status as a health-care provider (e.g., physician, nurse, EMT). Learners in W1 and W2 did one of the following: took an AHA Heartsaver course that lasted approximately 3 h, participated in a CPR Anytime session (AHA's 22-min video self-training for laypersons [www.CPRAnytime.org, on 7/4/2006]), or received no training. The variables of interest for this study are the assessments of learners' CPR skill performance (assessing responsiveness, calling 911, providing ventilations of adequate volume, and providing compressions of adequate depth and with correct hand placement) immediately after training. These assessments were conducted according to the same protocol in W1 and W2; therefore, assessment data from the two waves were combined for the purpose of the present study.

The study conformed to the principles of the Declaration of Helsinki and the protocol was approved by Portland State University's Human Subjects Research Review Committee. Informed consent was obtained from both instructor and learner subjects. Instructors were recruited via e-mail solicitations to American Heart Association Community Training Centers in Oregon and southwest Washington. The solicitation described the study only in general terms, and during screening, instructors were told that they might serve in any of the following roles: *instructor* (teaching a Heartsaver adult CPR class); *facilitator* (helping subjects as they learned CPR); *observer* (silently witnessing and documenting subjects' CPR training); and *examiner* (testing subjects' CPR skills). Instructors did not know until they appeared for training what their role(s) would be. The single instructor inclusion criterion was current certification to teach Heartsaver CPR. We chose this criterion to ensure that all instructors would be qualified to teach Heartsaver CPR if they were assigned to that intervention, and also to allow a common frame of reference for observations of a layperson's CPR learning experience. There were no exclusion criteria. Instructors each attended training sessions in which general issues such as safeguards to experimental integrity (e.g., not discussing the study with other instructors or with subjects) and ethical treatment of subjects were discussed. Later, separate training sessions for the specific roles were held such that instructors were only aware of information relevant to their own roles. The training sessions lasted 1—2 h, depending on the number of instructors being trained and the complexity of the role. Sessions included scenarios and discussion to ensure that instructors understood and could comply with their roles. Both instructors and learners were paid for their participation. Care was taken to minimize subjects' and instructors' inappropriate exposure to information about the study.

Interventions

Control (C)—These subjects proceeded directly to the CPR skill assessment without training, to provide a benchmark against which to measure the effects of training.

Heartsaver (HS)—These subjects participated in a 3-h Heartsaver adult CPR class taught by one of five instructors.

Self-training (ST)—These subjects all participated in a pilot version of *CPR Anytime*™, a self-training with a brief video, an inflatable mini-manikin, and one of several types of devices that provide feedback about the appropriate