

Training Mothers in Infant Cardiopulmonary Resuscitation With an Instructional DVD and Manikin

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Financial Disclosures: None reported.

Support: This study was supported and funded by Lehigh Valley Hospital, Allentown, Pennsylvania.

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Submitted December 14, 2012; revision received January 19, 2013; accepted February 1, 2013.

Context: Classes in infant cardiopulmonary resuscitation (CPR) can be time consuming and costly.

Objective: To determine whether mothers in an obstetric unit could learn infant CPR by using a 22-minute instructional kit and to assess the value and confidence they gained by learning CPR.

Design: Quasi-experimental study with enrollment between January and December 2008.

Setting: Obstetric unit in Lehigh Valley Hospital, a suburban teaching hospital in Allentown, Pennsylvania.

Participants: Mothers at least 18 years old who had given birth within the previous 24 hours.

Intervention: The experimental group included mothers without prior CPR training who watched a 22-minute instructional DVD and practiced on a manikin. The control group included mothers with prior conventional CPR training.

Main Outcome Measures: In both groups, knowledge and proficiency were assessed with written and practical examinations developed by certified CPR instructors. Participant surveys were conducted at 3 times: immediately before dissemination of course materials, within 24 hours after the mother agreed to participate in the study, and 6 months after initial evaluation.

Results: A total of 126 mothers were enrolled in the study: 79 in the experimental group, 25 in the control group, and 22 who withdrew from the study. Written and practical examinations were used to determine proficiency, and composite scores were generated, with a maximum composite score of 12. The composite scores were statistically significantly higher in the experimental group than in the control group, with median scores of 10 and 7, respectively ($P < .001$). Twenty-two mothers (21%) had been previously offered CPR training. In the experimental group, 76 mothers (96%) felt more confident as caregivers after learning CPR. Before training in both groups, 84 mothers (81%) stated that learning CPR was extremely important, compared with 100 mothers (96%) after training ($P = .001$).

Conclusion: Use of an instructional kit is an effective method of teaching CPR to new mothers. Mothers reported that learning CPR is extremely important and that it increases their confidence as caregivers.

J Am Osteopath Assoc. 2013;113(7):538-545
doi:10.7556/jaoa.2013.005

The American Heart Association teaches cardiopulmonary resuscitation (CPR) to more than 9 million persons annually.¹ It is especially important for parents to be trained in infant CPR; 2230 infants younger than 1 year died of sudden infant death syndrome in 2005, making it the third leading cause of death in infants.² Drake³ found that parents considered CPR a priority when asked to rank discharge teaching topics in order of importance. Others have found that CPR classes not only educate parents but also improve their self-confidence.^{4,5} Despite all these reasons to learn CPR, however, many barriers prevent its widespread dissemination.⁶

Conventionally, CPR is taught by using a combination of didactic instruction and hands-on practice, followed by a written test. Substantial barriers to acquiring and retaining CPR skills include the cost and length of instruction, performance anxiety, overuse of medical terminology, and limited time to practice learned skills on a manikin. The inability to retain learned CPR skills has been researched, and studies^{7,8} have documented deficits in retention and performance skills beginning as early as 2 weeks after initial instruction, with continued deterioration up to 1 year later. It has therefore been determined that 3 to 6 months after initial instruction is the optimal timeframe for recertification,⁸ but barriers of cost and inconvenience alone would prevent laypersons certified in CPR from becoming recertified that soon.

The International Guidelines 2000 Conference for CPR and Emergency Cardiovascular Care⁹ acknowledged the overwhelming consensus that CPR instruction for laypersons needs to be simplified and standardized to help participants focus on learning and practicing CPR skills. As a result, a kit (Infant CPR Anytime; Laerdal) consisting of a 22-minute instructional DVD and a latex-free, inflatable infant manikin was developed for the general public to increase awareness and knowledge of CPR. The objective of our study was to determine whether mothers in an obstetric unit could learn infant

CPR by using this kit and to assess the value and confidence they gained by doing so.

Materials and Methods

Study Design

The present quasi-experimental study used a convenience sample of mothers aged 18 years or older who were admitted to the obstetric unit at a 700-bed suburban, nonprofit teaching hospital in Pennsylvania. For inclusion in the study, participants must have given birth in the prior 24 hours to a newborn receiving care in the obstetric unit nursery or in the neonatal intensive care unit. The study was approved after review by the hospital's institutional review board. Written informed consent was obtained from study participants, who were enrolled from January through December 2008. Mothers currently trained in any type of CPR served as the comparison group; "currently trained" was defined as having successfully completed an accredited CPR class within 2 years before enrollment. Mothers were excluded if they had been hospitalized as inpatients for more than 24 hours, if they were physically incapable of performing CPR, if they were unable to provide informed consent, if their current pregnancy resulted in fetal death, if they did not speak English, or if they had previously participated in the study or educated themselves in CPR by using the instructional DVD and manikin. Participants were enrolled on weekdays between 7 AM and 5 PM, when trained CPR research coordinators and instructors were available.

Interventions

Mothers who had never received CPR instruction or who had not received instruction within the past 2 years were assigned to the experimental (CPR training kit) group. Mothers in this group were given the 22-minute instructional DVD and infant manikin and asked to view the DVD and complete the training within 24 hours. Mothers

in the comparison group did not receive any CPR materials or manikins. After the 24-hour period, certified CPR instructors returned to the bedside to administer written and practical examinations that assessed the infant CPR skills of all participants. To ensure interrater reliability for validation of participants' proficiency in CPR, research staff independently scored a series of mock CPR proficiency scoring scenarios, which were compared by the statistician and found to be excellent ($\kappa=0.72$).

Outcome Measures

Knowledge and proficiency were measured with written and practical examinations developed by certified CPR instructors. The multiple-choice written examination tested knowledge of key points learned during instruction and was concordant with standardized CPR examinations (approximate fifth- to sixth-grade level). The practical examination consisted of 2 scenarios (infant CPR and choking) presented to mothers by the instructor, for which mothers were asked to demonstrate their reactions. To ensure consistency in evaluation, the same scenarios and skills checklist were used for all participants. No prompting or remedial education was offered during written or practical examinations. The instructors evaluated each participant for 12 distinct proficiencies to create a proficiency composite score (Table 1). Each proficiency was given a value of 1 if observed or 0 if not. A participant could achieve a maximum score of 12 if all proficiencies were observed. The Cronbach reliability coefficient for this composite score was 0.75. Instructors were blinded as to the participant's study group.

The study team also sought to determine whether mothers had been offered CPR training during pregnancy or the peripartum period, whether learning CPR affected their confidence as caregivers, and how they rated the value, convenience, quality, and effectiveness of their CPR course. Participant surveys were conducted at 3 times: immediately before dissemination of course materials (PRE survey), within 24 hours after the mother agreed to participate in the study (POST-1

survey), and 6 months after initial evaluation (POST-2 survey). Surveys were designed by the researchers and based on common themes found in the literature and participant CPR education history. They included questions on previously completed CPR instruction, importance of knowing infant CPR, confidence as a caregiver, previous CPR instruction offerings, and preferred method of learning CPR. Pilot testing was completed to validate all survey instruments.

Mothers were asked in the PRE survey to indicate whether they were offered CPR training during their pregnancy or during their current hospital stay. Their confidence as caregivers for their infants was measured in that survey by asking them whether learning CPR would make them more confident as caregivers for their infants. Their assessments of the value of learning CPR and the convenience, quality, and effectiveness of their CPR course were measured in the PRE and POST-1 surveys according to a 5-point Likert reference scale (with scores of 1 and 5, respectively, indicating "not important at all" and "very important" for value of learning, "inconvenient" and "very convenient" for convenience, "poor quality" and "excellent quality" for quality, and "ineffective" and "very effective" for effectiveness).¹⁰ A phone-based survey after 6 months (POST-2) asked whether participants had needed to use their infant CPR skills in the previous 6 months, inquired about their overall confidence in performing infant CPR, and asked whether they had shared their kit with family or friends (educational multiplier effect).

Data Analysis

The overall goal of our analyses was to describe and compare knowledge and proficiency in infant CPR between mothers who received a 22-minute instructional DVD and infant manikin and those who learned it through the conventional didactic approach. We also sought to describe changes in the perceived importance of infant CPR and confidence in performing it between study time points.

Table 1.
Cardiopulmonary Resuscitation (CPR) Proficiencies by Study Group
Evaluated Within 24 Hours After Review of Course Materials

Proficiency Observed	Participants, No. (%)		P Value
	CPR Training Kit Group (n=79)	Comparison Group (n=25)	
Tap and shout	69 (87)	12 (48)	.001
Call 911	68 (86)	17 (68)	.04
Open airway	68 (86)	17 (68)	.04
Check for breathing	63 (80)	24 (96)	.06
Give 2 breaths	71 (90)	16 (64)	.002
Locate finger position	78 (99)	19 (76)	.001
Give 30 compressions	70 (89)	11 (44)	.001
Give 2 breaths (second time)	72 (91)	12 (48)	.001
Back: head lower than feet	64 (81)	20 (80)	.91
Give 5 back blows	72 (91)	17 (68)	.004
Front: head lower than feet	48 (61)	11 (44)	.14
Give 5 chest compressions	48 (61)	10 (40)	.07

^a The median composite proficiency scores were 10 (range, 3-12) in the CPR kit group and 7 (2-12) in the comparison group ($P < .001$).

Descriptive frequencies were used to describe survey responses. Cross-sectional comparisons between the study groups were performed with Pearson χ^2 and Wilcoxon rank sum tests. Differences between study time points were evaluated with McNemar χ^2 tests and conditional logistic regression analysis. Significance was set at $\alpha < .05$, and all statistical tests were 2 sided. Stata (version 10.1; StataCorp) and SPSS (version 15; SPSS Inc) software were used for all analyses.

Results

A total of 126 mothers were enrolled. Twenty-two participants were excluded (18 mothers did not complete the CPR kit training, 2 did not want to be evaluated, 1 was too ill for evaluation, and 1 was discharged before the evaluation was completed). Seventy-nine mothers were

enrolled in the CPR kit group and 25 in the comparison group. Of the 104 study participants, 99 (95%) were contacted at the 6-month follow-up (POST-2). Not all participants answered all survey questions.

Table 2 shows the prevalence and assessments of previous CPR training by study group. Forty-nine mothers in the CPR kit group (62%) reported prior CPR training before study enrollment. In the CPR kit group, 8 participants (10%) reported being offered CPR training during their current pregnancy and 9 (11%) reported receiving CPR training during their current hospital stay. Findings for the comparison group were similar; 2 participants (8%) reported receiving training during pregnancy, and 3 (12%) reported receiving training during their current hospital stay. Mothers in the conventional group reported a mean time of 10 months since completing conventional CPR training (range, 0-23 months).

Table 2.
Characteristics and Assessments of Previous Cardiopulmonary Resuscitation (CPR) Training by Study Group Before Dissemination of Course Materials

Response	Participants, No. (%)		P Value
	CPR Training Kit Group (n=79)	Comparison Group (n=25)	
Previous CPR training (yes)	49 (62)	25 (100)	.001
Previous course quality (excellent)	11 (22) ^a	8 (32)	.72
Previous course convenience (very convenient)	17 (35) ^a	11 (44)	.50
Previous course effectiveness (very effective)	5 (10) ^a	7 (28)	.19
Importance of CPR Training (extremely important)	65 (82)	19 (76)	.49
Expectation That CPR Training Would Increase Confidence as a Parent (yes)	76 (96)	24 (96)	.40
Offered CPR Training During Pregnancy (yes)	8 (10)	2 (8)	.81
Offered CPR Training During Hospital Stay (yes)	9 (11)	3 (12)	.85
Completion Card Important (yes)^b	21 (27)	10 (40)	.23

^a For these questions, n=49 for the CPR kit group.

^b Completion cards are provided to individuals who successfully complete a conventional CPR course. These cards are not provided to individuals who complete the CPR training kit.

Table 3 presents the assessments of current CPR training by study group. Overall, the CPR kit was well received. By comparing mothers in the CPR kit group with those in the comparison group, 57 (72%) and 8 (32%), respectively, rated their training quality as excellent ($P=.001$), 72 (91%) and 12 (48%) rated their training as very convenient ($P=.001$), 63 (80%) and 11 (44%) rated their training as very effective ($P=.001$), and 76 (96%) and 21 (84%) were more confident as caregivers immediately after learning infant CPR ($P=.003$). Overall in both groups, 84 of 104 mothers (81%) stated at the PRE survey that learning CPR was extremely important, compared with 100 (96%) at the POST-1 survey ($P=.001$).

Table 1 shows proficiency in skills, as noted by the CPR instructor. Differences were observed between the study groups, with mothers in the CPR kit group scoring statistically significantly higher on 8 of the 12

proficiencies, compared with the mothers in the comparison group. The only proficiency for which the mothers in the kit group scored lower was “check for breathing,” which was performed correctly by 63 (80%) of the participants in the CPR kit group vs 24 (96%) of those in the conventional CPR training group ($P=.06$). The overall proficiency composite scores were significantly higher in the CPR kit group than in the comparison group, with median scores of 10 and 7, respectively ($P<.001$).

The perceived importance of infant CPR instruction was measured before instruction (PRE survey) and immediately after proficiency evaluation (POST-1 survey). The perceived importance increased significantly for both study groups, with no between-group differences observed ($P=.54$). In addition, confidence in performing infant CPR was measured immediately after the proficiency evaluation (POST-1 survey) and 6

Table 3.
Characteristics and Assessments of Current Cardiopulmonary Resuscitation (CPR) Training by Study Group After Training

Response	Participants, No. (%)		P Value
	CPR Training Kit Group (n=79)	Comparison Group (n=25)	
Current course ease (very easy)	58 (73)	13 (52)	.39
Current course quality (excellent)	57 (72)	8 (32)	.001
Current course convenience (very convenient)	72 (91)	12 (48)	.001
Current course effectiveness (very effective)	63 (80)	11 (44)	.001
Importance of CPR training (extremely important) ^a	76 (96)	24 (96)	.18
Confidence as a parent increased because of CPR training (yes)	76 (96)	21 (84)	.003
Confidence in performing CPR (yes)	74 (94)	20 (80)	.046

^a The importance of CPR training in both groups combined was rated as extremely important by 84 participants (81%) at the survey before dissemination of materials to the kit group and 100 (96%) at the first posttraining survey ($P < .001$).

months later (POST-2 survey). Nonsignificant declines in confidence were reported for both groups, with no between-group difference ($P = .75$). After 6 months (POST-2 survey), nearly all participants in the CPR kit group (75 of 76 [99%]) were satisfied with their training while in the hospital, 26 mothers in that group (26 of 76 [34%]) reported watching the DVD again, and 37 of 75 (49%) reported having family members or friends view the DVD, including the infant's father for 16 of 75 participants (21%).

Comment

Training in infant CPR is important for new parents and should be offered as part of prenatal or perinatal care. The present study demonstrates an alternative method of teaching infant CPR that is effective and convenient. If the burden is placed on new parents to seek out educational opportunities, they may forego CPR education altogether. Twenty-two of the 104 mothers (21%) reported being offered CPR training during either their

pregnancy or their current hospital stay, which suggests the need for alternative ways to offer infant CPR instruction as part of prenatal or perinatal care.

We confirmed that training using a kit with a 22-minute instructional DVD and infant manikin is an effective and convenient way to teach new mothers infant CPR. They can complete training when most convenient while being able to learn and practice on a manikin at their own pace. Tailoring education to patients' educational and physical needs (medical issues), time constraints, and understanding risk has been previously shown to improve attitudes toward learning and implementing CPR.⁹ New parents' concerns about caring for their child in an emergency, coupled with the convenience of the kit, may motivate them to learn infant CPR. An additional benefit of using the kit is the ability to re-educate oneself at any given time, when confidence begins to decline or when one feels the need to refresh CPR skills. Retraining in the conventional CPR education model requires planning, money, a time commitment, and a location for training. Despite a known

decline in retention of CPR skills over time, research has shown that these skills can rapidly be refreshed by prompts (eg, from a 911 operator) or by review of educational material, such as posters, skills reminder cards, or, in this case, the infant CPR kit.¹¹ The kit allows learners to refresh skills whenever they wish, at their convenience and at no additional cost, and the kits can also be shared among family, friends, or other caregivers. One previous study¹² showed that an average of 2.5 persons learned CPR for every CPR kit used.

This study was conducted at a suburban hospital's obstetric unit during dayshift hours on weekdays, when CPR instructors and research coordinators were available. Therefore, our results may not be generalizable. Moreover, the comparison group was small, and results may not be reflective of results with conventional CPR instruction. Additionally, we did not compare the conventional group's PRE- and POST-1 survey responses regarding quality, convenience, and effectiveness to assess whether their answers remained consistent.

A majority of mothers in the CPR kit group (62%) had previously completed CPR training, which enabled participants to compare the CPR kit training with their prior conventional CPR training. Mothers in the comparison group, however, had no other training to compare with their conventional CPR training, so the findings for this group may be biased toward conventional instruction. These limitations suggest that future studies may be more aptly designed by using 3 groups: (1) mothers with current conventional CPR training (ie, completed training within 2 years); (2) mothers with previous conventional CPR training (ie, completed training >2 years ago); and (3) mothers who have never received conventional CPR training.

Our study did not collect any information on study participants' race or ethnicity. Non-English-speaking women were excluded because we lacked consistent access to interpreters and the instructional kit was not available in other languages at the time of the study. The kits are now available in English and Spanish versions,

so future investigators may want to evaluate the kit's success across non-English-speaking populations.

Another limitation of our study was that mothers in the experimental group underwent testing (written and practical) immediately after training with the DVD kit, but those in the control group were tested up to 2 years after their initial training, by which time many learned skills may already have been lost. There was marked variability in the training experience of the 18 mothers who self-reported the date and training length of their most recent CPR course. The type of training reported was also variable in regard to location, cost, and class length. These differences must be considered when evaluating the results.

Teaching techniques differed between groups because conventional training is designed using a "watch, then practice" technique. The instructor shows a video that outlines a skill and then the video is paused, giving the learner time to practice the skill with the instructor providing immediate feedback.⁹ The CPR kit uses a slightly different approach—the "practice while you watch" technique—which requires the learner to practice skills while watching the DVD, without an instructor present to provide feedback. Notably, previous research has shown that video (DVD)-based instruction can adequately teach CPR.⁹ No formal evaluation material is available yet for the kit, so written and practical tests tailored to the specific materials were developed by certified CPR instructors. The kit used for this study provided instruction in infant CPR only, not in CPR for children or adults.

Conclusion

Our study suggests that infant CPR training using a kit containing a 22-minute instructional DVD and infant manikin is an effective and convenient way to teach infant CPR to new mothers in an obstetric unit. The advantages associated with this novel teaching tool may benefit new parents and other caregivers using infant

CPR in the future. Programs could be developed within private practices or institutions to offer this kit to new parents, providing an alternative to conventional CPR courses that require large time commitments.

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