Perhaps the most interesting findings of the survey were the declining proportion of LHDs that employed physicians as directors. In 1968 Myers, *et al,*[1] reported that among 762 full-time and 441 part-time Local Health Officers, 83 per cent and 94 per cent respectively were physicians. In this survey, 12 years later, only 40 per cent of the responding LHD directors were physicians.

Comparisons with prior surveys are handicapped by differences in the universes to which questionnaires were mailed and variations in response rates and in survey instrument. Nevertheless it seems probable that fewer LHDs are headed by physicians than was the case a decade ago.

REFERENCES

1. Myers B, Steinhardt BJ, Mosley ML, Cashman J: The medical care activities of local health units. Public Health Reports 1968; 83:757–769.
2. Miller CA, Brooks, EF, DeFriese GH, Gilbert B, Jain SC, Kavaler F: A survey of local public health departments and their directors. Am J Public Health 1977; 67:938.
3. Shonick W, Price W: Organizational milieus of local public health units: analysis of response to questionnaire. Public Health Reports 1978; 93:648.
4. Jekel JF, Dunaye TM, Siker E, Rossetti M: The impact of nonphysician health directors of full-time local health departments: results of a national survey. Public Health Reports 1980; 95:386.
5. Cameron CM, Kobylarz A: Nonphysician directors of local health departments: results of a national survey. Public Health Reports 1980; 95:386.
6. Nie NH, Hull CH, Jenkins JG, Steinbrenner K, Bent DH: Statistical Package for the Social Sciences. 2nd Ed. New York: McGraw-Hill, 1975, pp 218–248.

Impact on Retention: Comparison of Two CPR Training Programs

WILLIAM R. GOMBESKI, JR., MPH, MBA, DORRY M. EFFRON, BS, AMELIE G. RAMIREZ, MPH, AND THOMAS J. MOORE, MS

Abstract: CPR trainees who completed 8-hour, 3 session and 4-hour single session courses were studied for skill and cognitive retention one year after certification. Knowledge and performance scores were significantly higher for trainees from the long course, but performance skills for both groups were below certification level when compared to American Heart Association standards. The findings suggest the need for further evaluation of course components which could improve retention levels for all trainees. (*Am J Public Health* 1982; 72:849–852.)

Introduction

In recent years public interest in cardiopulmonary resuscitation (CPR) training has increased along with evidence that the effectiveness of bystander-initiated CPR can improve survival of out-of-hospital cardiac arrest victims.[1] Researchers in Seattle, Washington, where average Emergency Medical System (EMS) response time is three minutes, have documented that bystander-initiated CPR increased the victim's chances of survival in cases of ventricular fibrillation from 21 per cent to 43 per cent.[1] Yet, if CPR skills are inadequately learned or not retained, CPR may be performed needlessly, ineffectively, or in a manner injurious to the victim.[2–4] Therefore, the benefits of teaching CPR to a greater number of people in short courses (three to four hours) needs to be weighed against more comprehensive training provided in long courses (eight or more hours) which may attract fewer students.

We compared CPR performance levels of trainees from two American Heart Association (AHA) approved programs offering training to the public in long (eight-hour) courses in Tulsa, Oklahoma, and short (four-hour) courses in Houston, Texas, one year after initial training. A self-administered, illustrated quiz was also studied as a tool to help maintain CPR proficiency.

Methods

Although both programs taught the same resuscitation techniques and had similar instructor/student ratios, there

Address reprint requests to Amelie G. Ramirez, Director, Communications Core, Room 176B, Baylor College of Medicine, Houston, TX 77030, or to Dorry M. Effron, Executive Director, CPR Publishers, Inc., 4133 East 43 Street, Tulsa, OK 74135. Mr. Gombeski, formerly with the Communications Core at Baylor College, is now with the Cleveland Clinic Foundation, Cleveland, Ohio; Mr. Moore is with the communications Core at Baylor College. This paper, submitted to the Journal August 27, 1981, was revised and accepted for publication February 17, 1982.

TABLE 1—CPR Program Effect on Retention of CPR Performance and Knowledge*

	Control Group		
	4-Hour (n = 31) $\bar{X}$	8-Hour (n = 29) $\bar{X}$	P
Initial Performance Score	94.4	95.0†	.692
Follow-Up Performance Score	44.2	60.0	.006
Cognitive Test Score	58.1	73.3	.001

	Experimental Group		
	4-Hour (n = 22) $\bar{X}$	8-Hour (n = 32) $\bar{X}$	*P*
Initial Performance Score	92.7	95.0†	.110
Follow-Up Performance Score	38.8	61.5	.001
Cognitive Test Score	63.2	78.9	.001

*A standard t-test was used to compare experimental and control groups.
†A score of 95 was chosen to represent the initial skill proficiency level of both Tulsa groups.

were major differences. The eight-hour program was taught over three sessions, provided 5 to 5½ hours of mannequin practice, used a textbook, required performance testing on the two-person CPR, infant CPR, and obstructed airway techniques as well as the one-person CPR; complete mastery of all techniques before certification was required. The four-hour program was taught in one session, provided trainees with two hours of mannequin practice, did not use a text-

TABLE 2—Percent of Trainees Performing Individual CPR Components Correctly (One-Person CPR Technique)

	Control Group		Experimental Group	
Preliminary Assessment Skills	4-Hour (n = 31) %	8-Hour (n = 29) %	4-Hour (n = 22) %	8-Hour (n = 29) %
1. Establish Unresponsiveness	74.2	86.2	63.6	84.4
2. Open Airway	41.9	89.7	50.0	93.8
3. Establish Breathlessness	61.3	82.8	68.2	96.9
4. Begin Artificial Ventilations with 4 Breaths	41.9	69.0	45.5	78.1
5. Technique of Artificial Ventilation Satisfactory	41.9	75.9	31.8	81.3
6. Establish Pulselessness	38.7	89.7	50.0	84.4
7. Correct Hand Position	38.7	51.7	27.3	65.6
8. Correct Body Position	77.4	89.7	68.2	100.0
9. Compression-Ventilation Ratio 15:2	41.9	65.5	27.3	65.6
	t = −4.81	p .001	t = −5.84	p .001
Items 1–6 in sequence	6.5	24.1	18.2	53.1
Functional Skills				
10. 8 or More Ventilations Given in 1 Minute	41.9	31.0	22.7	25.0
11. 7 or More Ventilations Greater than 0.8 Liter	32.3	27.6	18.2	34.4
12. 60 or More Chest Compressions in 1 Minute	22.6	17.2	18.2	12.5
13. 56 or More Chest Compressions Greater than .38mm Deflection	16.2	10.3	13.6	12.5
	t = −.88	NS	t = −1.91	NS

TABLE 3—Per Cent of Respondents by Program Correctly Answering A Specific Question on the Written CPR Review Quiz

Question	4-Hour (n = 53)	8-Hour (n = 61)
1. Response to Warning Signs of Heart Attack	96.2	96.7
2. When Does Brain Damage Occur?	13.7	24.6
3. Identify Critical Decisions before Beginning CPR	92.5	96.7
4. ABCs of CPR	52.8	77.1*
5. Appropriate Action to Unresponsive Victim	81.1	95.1*
6. Response to Unconscious Accident Victim	67.9	96.7***
7. Simplest Technique to Open Airway	96.2	98.4
8. Results of Opening the Airway	77.4	80.3
9. Most Reliable Technique for Assessing Breathing	94.3	95.1
10. Next Step if Victim Not Breathing	84.9	95.1
11. When to Check Pulse	30.2	72.1***
12. Description of Proper Hand Position	58.5	57.4
13. Importance of Correct Body Position	90.6	95.1
14. Correct Compression Depth for Adults	45.3	68.9*
15. Compression Rate for One-Person CPR	28.3	47.5
16. Compression/Ventilation Ratio for One-Person CPR	52.8	77.1*
17. Components of Effective Cardiac Compression	54.7	72.1*
18. Management of Respiratory Arrest	45.3	73.8**
19. Arranging 8 Pictures of Steps in One-Person CPR in Sequence	17.0	72.1***
20. When to Stop CPR	22.6	77.1***

*$p \leq .05$
**$p \leq .01$
***$p \leq .001$

book, required performance testing on only the one-person CPR techniques, and required 75 per cent mastery of the one-person technique for certification.

All rescuers from both programs (540) who were initially certified in January and February of 1979 were placed in either a control or experimental group. The control groups in Tulsa (n = 125) and in Houston (n = 130) were composed of the January trainees. February trainees provided experimental groups of 166 in Tulsa and 119 in Houston. Experimental group trainees received a 20-question review quiz by mail six months after initial training. One year after initial certification, all trainees were invited for a refresher session when CPR performance and cognitive testing was conducted.

Results

Of the 540 certified trainees, 114 (21.1 per cent) returned one year later for the follow-up testing. This resulted in the following groups: four-hour course: control group 31, experimental group 22; eight-hour course: control group 29, experimental group 32. The age of the participants ranged from 14 to 70 with a mean age of 36.6 years; 60.5 per cent were women.

Table 1 shows that the eight-hour control and experimental groups scored significantly higher ($p \leq .006$) on the written and performance tests than the four-hour control and experimental groups respectively. Further analysis (see Table 2) of the performance scores shows that a higher per cent ($p \leq .001$) of the trainees from the eight-hour control and experimental groups performed the primary assessment skills (first nine steps) correctly than the trainees from the four-hour groups respectively. Further comparison by program showed that a higher per cent of the eight-hour trainees ($p \leq .001$) were more likely to perform all assessment items (Shake and Shout through Pulse Check, items 1–6) in sequence than members of the four-hour program. No significant differences were noted between the four-hour and eight-hour groups' functional skills (last four steps) when they were compared with AHA skill levels required for certification. When the two groups were compared to each other, the functional skills retained by the eight-hour trainees were significantly higher ($p \leq .001$) than those in the four-hour program. However, performance skills were below certification level for both groups.

Since the mailed review quiz produced no significant differences between the control and experimental groups by program, quiz scores were combined to illustrate program differences. Each question was answered correctly by a higher percentage of the eight-hour trainees with percentages significantly higher ($p \leq .05$) on ten of the questions (see Table 3).

Discussion

Some degree of caution may be necessary in interpreting the findings of this study since only 21.1 per cent of the original trainees returned for follow-up testing. This does, however, reflect the general public's disinterest in recertification. The study also documents that CPR performance skills were not maintained at the level of initial training over

the one-year period by trainees from either the four-hour or eight-hour groups. This skill decline is similar to retention losses documented by others.[5-8] Thus, further research is needed to determine what can be done to maintain CPR skill proficiency for the minimum of one year.

The higher retention level of preliminary assessment skills by the eight-hour trainees may be directly related to the number of hours available for mannequin practice in longer courses. However, since there were many differences in course structure between the eight-hour and four-hour programs, additional research needs to be conducted to identify specific components which may lead to improved CPR retention. Even though significantly higher levels of retained skills were documented by the eight-hour trainees, one should not immediately conclude that long courses are better than short courses. Each community's needs and resources must be considered before program directors can determine which length of training program is more appropriate. In areas with four-minute or less response time, greater value may be received by having many trained people able to provide early problem recognition, with prompt emergency medical service (EMS) access, and initiating CPR if necessary during the short wait for the ambulance. However, in areas where distances are great, a longer training course, which gives trainees a greater opportunity to perfect and retain their skills, may be more appropriate.

REFERENCES

1. Thompson RG, Hallstrom AP, Cobb LA: Bystander-initiated cardiopulmonary resuscitation in the management of ventricular fibrillation. Ann Int Med 1979; 90:737–740.
2. Braun P, Norman R, Florin A: Closed-chest resuscitation. New Engl J Med 1965; 272:1–6.
3. Messert B, Quaglieri C: Cardiopulmonary resuscitation, perspectives and problems. Lancet 1976; 2:410–412.
4. Lund I, Skulberg A: Cardiopulmonary resuscitation by lay people. Lancet 1976; 2:702–704.
5. Vanderschmidt H, Burnap T, Thwaites JK: Evaluation of a cardiopulmonary resuscitation course for secondary schools. Med Care 1975; 13:763–774.
6. Winchell S, Safar P: Teaching and testing lay and paramedical personnel in cardiopulmonary resuscitation. Anesth Anal 1966; 45:441–449.
7. Banasik Z, Sledzinski A, Arciszewska D, *et al*: The usefulness of Resusci-Anne manikin in teaching modern methods of resuscitation. Anesth Resus Inten Ther 1976; 4:131–137.
8. Weaver FJ, Ramirez AG, Dorfman S, *et al*: Trainees' retention of cardiopulmonary resuscitation. JAMA 1979; 241:901–903.

ACKNOWLEDGMENTS

The authors would like to acknowledge the assistance of Laerdal, Inc. for equalizing pressure of recording and non-recording mannequins for testing, and the outstanding cooperation of the Junior League of Houston instructors and the American Heart Association instructors in Tulsa who assisted in the evaluation.

This research was conducted by CPR Publishers, Inc., Tulsa, Oklahoma, and the Communications Core of the National Heart and Blood Vessel Research and Demonstration Center, Baylor College of Medicine, a grant-supported project of the National Heart, Lung, and Blood Institute, National Institutes of Health, Grant # HL 17269.

ASTHO Directory of Health Officials Available

The Association of State and Territorial Health Officials has recently published its *1982 Directory of State Public Health Agencies*. This directory, last published in 1980, provides a complete, up-to-date listing of key public health officials in each state, the District of Columbia, and the US Territories.

The 116-page book includes the names, addresses, and telephone numbers of such state health agency personnel as:

- Commissioner of Public Health
- Deputy Directors for Administration and Management
- Program Directors of: Maternal and Child Health, Nursing, Epidemiology, Vital Records and Public Health Statistics, Chronic Disease, Communicable Disease Control, Health Facility Licensure and Certification, and many more.

Also included are the Directors of other major health activities which may not be a part of the state health agency, such as the state's:

- Environmental Health Agency,
- Mental Health Agency,
- Medicaid Program,
- State Health Planning and Development Agency.

ASTHO's *1982 Directory of State Public Health Agencies* is available at $10 per copy prepaid, while supplies last, by writing to:

Association of State and Territorial Health Officials
1311A Dolley Madison Blvd.
Suite 3A
McLean, VA 22101