RETENTION OF BASIC CARDIAC LIFE SUPPORT SKILLS BY NURSES FOLLOWING RETRAINING

by

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ABSTRACT

Retention of Basic Cardiac Life Support Skills by Nurses Following Retraining

The expectation that nurses be competent in Basic Cardiac Life Support (BCLS) is today a forgone conclusion. The question is no longer should nurses be trained in BCLS, but how to ensure competency once initial training is complete. This study aspired to answer two questions: (a) after retraining to American Heart Association (AHA) standards, how long does it take for nurses' BCLS performance (on adults) to again drop below AHA standards, and (b), is there a relationship between nurses' demographic characteristics and their BCLS performance, upon retesting.

Skinner's operant conditioning theory guided the development of the research proposal. Skinner argues that reinforcement is the key to maintaining behavior in strength. Thus, it is important to identify when reinforcement of BCLS skills becomes necessary and what factors in nurses' backgrounds, or environments, if any, are possible sources of reinforcement.

Initially, nurses were trained in BCLS to AHA, level one standards, and data regarding their demographic characteristics were collected. These nurses were then asked to return for retesting (and further training as necessary) at 3, 6, and 9 week intervals. Due to attrition, it became necessary to analyze the data based on the actual time elapsed between tests (3 to 18 weeks). For example, if a nurse missed the 3 and 6 week tests and was then tested at what would have been the 9 week test the actual elapsed time between training and testing was 18 weeks (3+6+9=18).

BCLS performance data was collected in two forms--score and pass or fail. Analyses of the data demonstrated there to be no significant difference in the

number of nurses failing to meet AHA standards at each of the 3 week test intervals. Nurses failed BCLS tests as early as 3 weeks after inital retraining. No significant relationship was found between nurses' BCLS performance (retention) and age, education, position, specialty, prior BCLS training, number of exposures to, and participations in BCLS events, and recency of the last exposure to an obstructed airway. There did however appear to be a significant negative relationship between the number of years worked and BCLS performance and between number of years since graduation and BCLS performance. There also appeared to be a significant negative relationship between CPR performance and the recency of the last exposure to/participation in a cardiopulmonary arrest. Unfortunately, threats to internal validity, in particular attrition and small sample size limit confidence in the research findings. Findings supplemental to the research project are also outlined.

In view of the study findings, implications for BCLS education for nurses and implications for further research into BCLS retention are delineated.

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CHAPTER 1

STATEMENT OF THE PROBLEM

INTRODUCTION

Over the past 25 years interest in learning basic cardiac life support (BCLS) has gained momentum. Instruction in BCLS has expanded beyond the domain of medicine to permeate both the allied health professions and the general (lay) citizenry. A Gallup Poll conducted in 1977 indicated, by projection, that 12 million Americans had learned cardiopulmonary resuscitation (CPR), a component of BCLS, and a further 51 million wished to learn it. A major goal of the American Heart Association (AHA), in conjunction with other groups, is to train 20 to 25% of the American population in CPR.

The purpose of CPR is to restore breathing and circulation to victims of cardiopulmonary arrest. The effectiveness of CPR in reducing morbidity and mortality in cardiopulmonary arrest victims is well established. Research findings suggest that approximately 40% of cardiopulmonary arrest victims will be successfully resuscitated when CPR is initiated and combined with rapid provision (within eight minutes) of advanced cardiac life support (Bernhard, Turndorf, Cottrell, Vea, & Basak, 1979 ; Cobb, 1982; Copley, Mantle, Rogers, Russell, & Rackley, 1977; Thompson, Hallstrom and Cobb, 1979). This startling statistic is the direct result of widespread CPR training programs including both general citizenry and health professionals.

As evidence supporting the effectiveness of CPR has grown hospital accrediting agencies, professional associations and agencies involved in CPR training have become increasingly concerned that health care professionals not only be knowledgeable about, but also be proficient in, the administration of BCLS. Standard five of the Nursing Services section of the 1983 Accreditation Manual for Hospitals states: "Recognized cardiopulmonary resuscitation should be required for all nursing staff. . . ." (p. 30) A similar statement exists for the medical staff.

The expectation that health care professionals be competent in BCLS is today a foregone conclusion. The question is no longer should health care professionals be capable of BCLS, but how to ensure continued competency once initial training is complete. Substantial evidence now exists that following time lapses ranging between 3 months and 4 years after initial certification, individuals are unable to perform CPR at an acceptable standard (Mandel & Cobb, 1980; Mandel, Cobb & Mason, 1980; Nelson & Brown, 1984; Weaver, Ramirez, Dorfman, Raizner, 1980). The few studies aimed at improving CPR retention have yielded mixed results. Retention of obstructed airway (OA) managment skills has not been studied.

Information relative to the following two questions was sought: (a) after initial retraining to AHA standards, how long does it take for nurses' BCLS performance (on adults) to again drop below AHA levels? (b) is there a relationship between BCLS retention and each of age, education, length of time nursing, level of active employment (full-time, part-time or casual), prior BCLS

training, exposure to CPR and OA events, and participation in CPR and OA events?

It was hoped that findings from this study would assist BCLS instructors in planning training programs such that learner retention is maximized. This will in turn potentiate the long-term ability of BCLS trainees to improve survival rates of cardiopulmonary arrest victims. It was also hoped that the findings from this study would contribute to the body of knowledge regarding reinforcement of learning theory.

BACKGROUND INFORMATION

The typical BCLS program is 8 hours in length and includes instruction in risk factors and life style management, in adult and infant CPR and in management of an adult or an infant, conscious or unconscious, with an obstructed airway. Individuals can be certified at three different levels--heart saver, level one and level two. The difference between levels is explained by the amount of theory covered and by the desired quality of BCLS performance--level two being the highest level. The most obvious difference between level one and level two is that for level two individuals must produce a satisfactory manikin tape as proof of adequate CPR performance. Subjects in this study were tested at level one.

PROBLEM STATEMENT

CPR, if performed incorrectly, may complicate the resuscitation of cardiopulmonary arrest victims. Previous studies have focused on the ability of both lay persons and health professionals to perform adult CPR at various time intervals following

training. In all cases, a significant deterioration in both psychomotor skills and cognitive abilities was observed. Few studies have addressed how scheduled reinforcement influences retention of all BCLS skills. Specifically, the primary purpose of this study was to investigate the relationship between nurses' retention of BCLS skills and the recency of retraining. Possible correlations between nurses' backgrounds and BCLS retention were also explored.

OPERATIONAL DEFINITION OF TERMS

The following terms are defined to clarify their use in this study:

1. Basic Cardiac Life Support (BCLS): "external support of the circulation and respiration of a victim of cardiac arrest through cardiopulmonary resuscitation or the prevention of circulatory or respiratory arrest or insufficiency through prompt intervention" (AHA, 1980, p.7).

2. Cardiopulmonary Resuscitation: opening and maintaining an open airway, providing artificial circulation by means of external cardiac compressions.

3. CPR Event Exposure: present at a cardiac arrest but did not perform CPR, either chest compressions or artificial respiration or both.

4. CPR Training: all educational activities where the eight steps of CPR are reviewed and practiced.

5. Retention: the number of steps performed correctly at retesting when compared with the number of steps performed correctly upon completion of initial retraining, (Figure 1). 6. Nurse: licensed practical nurse, graduate nurse, nurse orderly or registered nurse.

7. Critical Care Area: Burn Unit, Cardiac Care Unit, Emergency, Intensive Care Unit, any "Step Down" Units, Operating Room, Recovery Room.

8. Pass/Fail: to fail is to perform one or more steps in the resuscitation sequence in a manner injurious to the victim, and/or to miss a step(s) crucial to the resuscitation process. If the steps of resuscitation are performed within the accepted guidelines (JAMA, 1980) and all steps critical to victim survival are performed the subject will be coded "pass".

$$\frac{\text{Pretest Score}}{\text{Maximum Possible Pretest Score}} \times 100 = \%\text{Retained}$$

Figure 1. Operational Definition of Retention

ASSUMPTIONS

The following assumptions form the base to the methodology used in this study:

1. Reinforcement is needed to maintain the learned response in terms of strength.
2. Information regarding performance (a) is necessary for learning to take place, (b) is reinforcing of effort and self-efficacy, and (c) contributes to retention of knowledge and skill.
3. Adults are reinforced by success.
4. Correct manikin recording tapes or verbal feedback or ECG tracings are positive reinforcers.
5. Correct management of an obstructed airway is reinforcing.

LIMITATIONS OF THE STUDY

The nature and characteristics of the target population, the setting, the skills involved and the available time frame placed certain limitations upon this study. They included:

1. The location of the study was limited to one major teaching hospital. Therefore, characteristics unique to the setting may have influenced subject performance. Generalization of results to a target population must be done cautiously.
2. No attempt is made to generalize the findings in this study to time periods greater than 18 weeks (the time of the last posttest).
3. Volunteer subjects were used in this study and it was known that "volunteer subjects are likely to be a biased sample of the target population since volunteers have been found in many studies to differ from nonvolunteers" (Borg & Gall, 1983, p. 251).
4. Only CPR and OA management in adults were investigated; therefore, the results are not generalized to children or infants.
5. Resusci-Annie recording manikins were used as test instruments in the absence of published data correlating performance on the manikin with equivalent performance on humans. CPR performed on a living human is dangerous and was therefore not considered.

ORGANIZATION OF THE THESIS

In this introductory chapter, the problem and background to the problem, definition of terms, assumptions and limitations of the study have been stated. Chapter Two reviews previous research into BCLS retention and outlines the

conceptual framework (operant conditioning) used to guide this research project. Chapter Two also details the research hypotheses. Chapter Three outlines the research methodology, and discusses details related to sample size and selection, internal and external validity, the data collection tools and data analysis, as well as, ethical considerations. Chapter Four presents an overview of statistical procedures and a description of findings pertinent to each hypothesis, as well as, supplemental findings. In the final chapter, the findings are summarized, conclusions are made, implications for BCLS education and research are identified and recommendations for further research are delineated.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter provides background for understanding the current state of the art in BCLS education and in research into retention of BCLS knowledge and skills. After establishing that retention of BCLS skills has not been fully explored attention turns to the theory, operant conditioning, as a conceptual framework to guide further research. This chapter concludes with a list of the hypotheses tested.

PRIOR RESEARCH INTO RETENTION OF BCLS KNOWLEDGE AND SKILLS

The variable receiving the most attention from researchers interested in BCLS is instructional technique. The most common research question being: does instructional technique affect retention of BCLS knowledge and performance? Given the large number of individuals requiring and desiring BCLS training and therefore the finances involved, it is not surprising that researchers are interested in finding the answer to this question.

The majority of studies describe the effect of various teaching techniques on knowledge and performance in the lay population (Gombeski, Effron, Ramirez, & Moore, 1982; Mandel & Cobb, 1980; Thompson et. al., 1979; Vanderschmidt, Burnap & Thwaites, 1976; Weaver et. al., 1979). The majority of literature reports describing teaching techniques and performance of health professionals are

narrative and anecdotal (Abendscohein & Willenkin, 1980; Lowenstein, Libby, Mountain, Hansbrough, Hill & Scoggin, 1981; Martin, Loomis & Lloyd, 1983; Matthewman & Terry, 1982).

Study of the effectiveness of modular self-instruction versus lecture-practice (the original and usual technique) has revealed no significant difference in trainees' initial mastery or retention of CPR at 3 month and 1 year intervals following training (Friesen & Stotts, 1984; Nelson & Brown, 1984; McSwain, Mahan, 1980; Safar, Bukebile, Scott, Esposito, Medsger, Ricci & Malloy, 1981). McSwain, Mahan and Herrin (1979) also reported modular teaching effective. Nonetheless, these studies have demonstrated that ability to perform CPR is not directly related to instructor supervision. As a result of these findings the authors have recommended that the circumstances (instructional setting) should dictate the choice of technique--modular or lecture-practice.

Wilson, Isfeld and Tweed (1980), explored the impact of overtraining (to an instructor level) of a police force on retention of CPR skills 1 and 2 years after initial training. They found "that deliberate overtraining of highly motivated and mature non-medical basic rescuers causes satisfactory skill retention for up to 2 years" (p. 165).

Computer simulation models for teaching CPR, another instructional technique, are still in their infancy. Hoffer, Barnett and Farguhar (1972) describe a model developed for the Massachusetts General Hospital whereby students are trained in the recognition of cardiopulmonary arrest and in the cognitive aspects of CPR.

Although Hoffer et. al. suggest that this technique has been enthusiastically received, they admit that it has yet to be proven effective and at best, for now, should only serve as an adjunct to demonstration-practice.

Interactive computer CPR training wherein a computer gives visual and verbal feedback to the student has been developed in the United States and is now being tested. Nonetheless, results of computer CPR training have yet to be reported in the literature.

A final instructional technique, also yet to be evaluated, is BCLS by telecourse. The program normally consists of 4 hours of television viewing followed by supervised practice in a centralized location and testing (Craren, 1980). The major advantages to this technique are its low cost and the large number of individuals who can participate (3525 in British Columbia in February 1984 and a further 7050 in February 1985) (Tetreault-Callahan, Note 1).

The second variable that has been manipulated in researching CPR instruction is time, that is, the program's length. Gombeski et. al. (1982) compared skills and cognitive retention, 1 year after certification, between CPR trainees who had completed 3-session (8 hours) and 1-session (4 hours) courses. "Knowledge and performance scores were significantly higher for trainees from the long course . . . ."(p. 849) The authors attributed this difference to "the number of hours available for mannequin practice in longer courses" (p. 852).

Other variables thought to influence initial mastery and retention of BCLS have

also been explored. At first sex was thought to be a significant parameter (as size and strength play a part in performing CPR). Nonetheless, the data did not support this (McSwain et. al., 1979; Martin et. al., 1983; Vanderschmidt et. al., 1976; Wilson, Brooks and Tweed, 1983 and Friesen & Stotts, 1984).

A weak negative relationship has been found when correlating age and performance with younger trainees achieving higher retention scores (Stross, 1983 and Wilson & Brooks, 1983). Wilson et. al., (1983) also found a weak positive relationship between previous first-aid training and higher retention scores.

For the most part, previous research has attempted to verify trainees initial mastery and then retention of CPR skills, but, performance criteria, when reported, have not been consistent. Although all authors of material reviewed claimed use of AHA standards, further examination of their reports reveal actual evaluation tools differed as did the standard for trainee success. For example, evaluation tools used to measure CPR performance divided CPR into anywhere from 11 to 22 steps. As well, criteria for passing written exams ranged from 70 to 85% between studies.

Furthermore, not all researchers measured learning in all components of BCLS. Cognitive learning was not consistently measured nor were skills related to airway management.

In addition, most researchers failed to measure student initiated review and practice of BCLS skills between initial mastery and retesting (McSwain et. al.,

1979; Stross, 1983; Nelson & Brown, 1984; Gass & Curry, 1983; Gombeski et. al., 1982 and Friesen & Stotts, 1984). In studies where student-initiated review of CPR was measured results indicated that both manikin practice and review of CPR materials aided the trainee in recalling the cognitive aspects of CPR and in enhancing follow-up psychomotor performance (Weaver et. al., 1979 and Weaver, et. al., 1980).

Lack of continuity between studies influences the degree that the literature related to CPR instruction can be considered cummulative. Nevertheless, one general conclusion has held constant across all studies. Regardless of the population, initial trainee performance or evaluation standards employed, retesting of trainees at 3 and 12 months demonstrates significant deterioration in both trainee cognitive and psychomotor skills. Further examination of retention scores reveals poor performance is equally distributed over all the steps in CPR. In other words, no portion of the CPR sequence was forgotten more often than another (Friesen & Stotts, 1984; Gombeski et. al., 1982; Weaver et. al., 1979 and Stross, 1983). Gombeski et. al. (1982) found that trainees from the 4 hour program were significantly less likely to perform the assessment items (shake and shout through to pulse check) than 8 hour trainees. In studies that included all BCLS components no particular component was better retained than another (Friesen and Stotts, 1984).

Beyond comparing initial training techniques, research into improving retention of CPR (adult) skills is limited. In this same context, research into all other BCLS activities (infant CPR and management of the obstructed airway) is nonexistant.

To date, most investigations have focused on the effectiveness of various one time only refresher programs, one year after initial training, in improving cognitive and psychomotor performance. Mandel and Cobb (1980) (Abstract) found three types of refresher programs equally effective including a 1 hour content review and manikin practice class, a 15 minute videotape (title not given) and a 3 page review that students read. Nelson and Brown (1984) found that refresher courses did not promote retention indefinitely. No significant difference was found 4 years after initial training between groups who had or had not participated in the refresher programs.

Conversely, Weaver, Bombeski, Ramirez, Schleuning, Moore, and Farge (1980) found that although a mailed questionnaire (3 months following initial training) appeared to be effective in maintaining cognitive scores, manikin practice was a necessary adjunct for CPR performance skills to be retained at an adequate level.

Unexplored are any relationships between the frequency or the recency or both the frequency and the recency of refresher training and retention of BCLS skills. Is BCLS performance a function of how long ago the individual was trained? How many times should BCLS skills be evaluated to ensure competence? Does the "retention curve" alter its slope with changes in the frequency of refresher training?

Replication studies (using the same methods and standards) examining the efficiency and effectiveness of planned reinforcement at different time intervals are necessary before BCLS instructors can make sound program planning decisions.

In summary, the literature reviewed substantiates that individuals trained in CPR can improve survival rates of adult cardiopulmonary arrest victims (especially when advanced cardiac life support is available), and a majority of individuals are unable to perform adult CPR to AHA standards 3 months following initial training, regardless of the type of training taken. Still to be thoroughly documented is the retention of skills related to infant CPR and management of the victim with an obstructed airway. Examination of the influence of various refresher programs on retention of adult CPR although promising, is as yet incomplete. Questions regarding both recency and frequency in relation to refresher training must still be answered. Therefore, it can be argued that further investigation into improving learner retention of BCLS is worthwhile.

CONCEPTUAL FRAMEWORK--OPERANT CONDITIONING

The conceptual framework that guided the development of the research problem and that provided the focus for data collection was operant conditioning. Skinner (1969) defines operant conditioning as increasing the probability of a response in a particular stimulus environment by following the response with reinforcement (p. 133). In operant conditioning behavior (the response) is considered voluntary and under the control of the individual. Reinforcement is defined as any and all stimuli that increases the probability of a response reoccurring (Skinner, 1972, p. 103). A positive reinforcer is a stimulus that, when added following an operant response, strengthens the probability of the response. A negative reinforcer is a stimulus that, when removed following an operant response, also strengthens the probability of the response. Thus, it is the effect of the stimulus on a response, not the nature of the stimulus that determines whether or not it acts as a

reinforcer. If the consequences are reinforcing, the behavior is more likely to be repeated; the consequences feed back into the organism to change the probability that the behavior that produced them will occur again. This concept of reinforcement accounts for the maintenance and strength of the behavior (Skinner, 1968).

Research based on this framework attempts to answer how the independent variables--types of reinforcement (positive or negative) and reinforcement schedules affect learning (the dependent variable). Theoretically, when human reinforcers are indentified they can be manipulated to control and thus predict behavior.

Most studies related to operant conditioning and contigencies of reinforcement focus on initial learning of animals, school children and therapy groups. "Results from these studies (studies using atypical classroom settings or atypical subjects) uniformly point to contingent rewards as being more effective as reinforcers than are noncontingent rewards" (Sharpley & Sharpley, 1981, p. 250).

In studying operant conditioning many different reinforcement regimes have been investigated, but basically they can all be categorized according to two dimensions: (a) the period between successive reinforcements is determined either by the number of intervening nonreinforced responses or by the elapsed time, and (b) the period between successive reinforcements is either regular or irregular. For example, research with animals has demonstrated that on a fixed interval schedule (reinforcement follows the first response emitted after a fixed time period measured from the last reinforcement) the organism's rate of

responding drops to nearly zero after a reinforcement and then increases at an accelerating pace as the end of the interval approaches (Skinner, 1972, p. 104).

Similar research on variable interval schedules (the number of reinforcements varies from one reinforcement to the next) demonstrates that animal response rates do not fluctuate to the same degree between reinforcements.

In contrast to interval schedules, research using fixed and variable ratio (reinforcement occurs after a predetermined number of nonreinforced responses, for example, the ratio of nonreinforced to reinforced responses is 5 to 1) schedules tend to produce rapid rates of responding. If the ratio is small, responding begins immediately after a reinforcement; when the ratio is large, there is a brief pause after each reinforcement followed by steady bursts of responding (Skinner, 1972). In a more practical example, Small (1970), in teaching undereducated adults elementary mathematics using computer assisted instruction, found subjects who received reinforcement (praise statements) on a 30% variable schedule did significantly better on the posttest than did a no reinforcement group. There was however, no significant difference between the 30% variable schedule group and the 100% continuous schedule group.

In reviewing operant theory several principles applicable to instruction were identified. They included:

1. Extremely complex performances may be reached through successive stages in the shaping process (Skinner, 1968).
2. In general, a given schedule has an effect upon the rate at which a

response is emitted (Skinner, 1968, p. 12).

3. The behavior of matching a correct response is reinforcing . . . immediate feedback is reinforcing (Skinner, 1972).

4. When a reinforcement ceases, the responses become less and less frequent until it becomes extinct. Resistance to extinction depends upon the conditioning or reinforcement contingencies (Skinner, 1972, p.146).

5. Behavior can be maintained in given stages of strength for long periods of time by varying the schedule of reinforcement (Skinner, 1968,p.10).

In this study learning was assumed to have already taken place as evidenced by achievement scores on the BCLS final exams. The objective was not to, as it had been in past research, measure the effect of different reinforcement schedules on initial achievement, speed of learning or subject error rates. Instead, the purpose of this study was to determine when further reinforcement might be necessary to maintain nurses' BCLS performance at AHA levels. According to Skinner (1972) "Reinforcements continue to be important , of course, long after an organism has learned how to do something, long after it has acquired behavior. They are necessary to maintain behavior in strength . . . ."(p. 146)

As it was unlikely that the BCLS course taken by the subjects would be their first exposure to, or experience with CPR, it was considered important to know the subjects' backgrounds. For example, a nurse working in an Emergency Department was likely to have already in place a built-in variable interval schedule of reinforcement as she or he was likely doing CPR on a frequent, but not predictable, basis. Thus, one could postulate that nurses in this setting would

more likely retain their ability to do CPR than nurses working in a setting where cardiac arrests are rare. Furthermore, nurses who regularly participate in BCLS training would be expected to retain their ability to do CPR as opposed to nurses who do not (all else being equal).

In summary, observations and research related to testing operant theory are largely directed towards elaboration of such variables as extinction rate, acquisition rate and rate of responding using animals. Research examining the effectiveness of reinforcement schedules in improving retention of BCLS skills by health professionals is nonexistent.

Operant theorists postulate that to maintain the strength of a behavior the reinforcers of the behavior must first be identified and then the behaviors must be reinforced at regular intervals. Examination of BCLS training reveals that the behavior is learned; but , that further opportunity for reinforcement is dependent upon circumstances that are beyond the control of either the learner or instructor (participation in a cardiac arrest or an OA). Thus oppportunities for reinforcement are not always forthcoming. Therefore, it is not surprising that a majority of subjects are unable to demonstrate CPR to AHA standards 3 months following initial training. Operant theorists would argue that what is necessary is to determine an adequate reinforcement schedule.

HYPOTHESES

In the introduction to this thesis two questions were identified as the focus of this study:

1. After intial retraining to AHA standards, how long does it take for nurses' BCLS performance (on adults) to again drop below AHA levels?
2. Is there a relationship between BCLS retention and each of age, education, position of employment, length of time nursing, level of active employment, prior BCLS training, exposure to BCLS events, and participation in BCLS events (prior to initial retraining and during the study)?

After reviewing the literature ten hypotheses were originally formulated. This number was expanded to eleven once the nature of the sample became apparent. As well, the hypotheses limited to examination of CPR performance were expanded to include OA performance once this oversight was recognized (following the first retest-training session).

The hypotheses related to Question One were:

In reference to Figure 2:

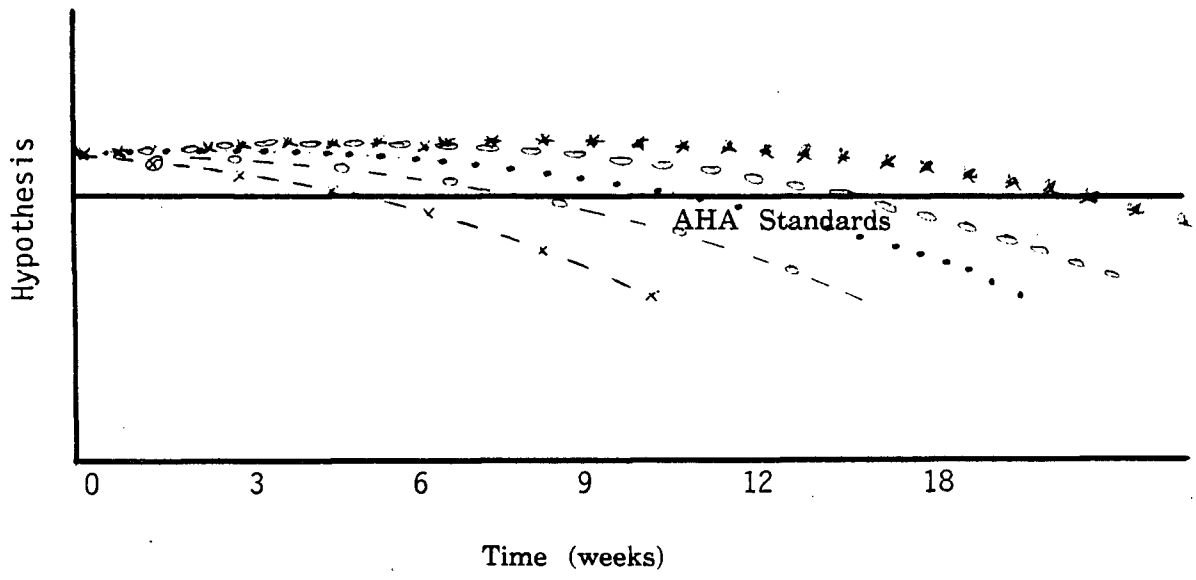
1. Subjects tested at 3 weeks would meet AHA standards but subjects tested at 6 weeks would not meet AHA standards.

2. Subjects tested at 6 weeks would meet AHA standards but subjects tested at 9 weeks would not meet AHA standards.

3. Subjects tested at 9 weeks would meet AHA standards but subjects

tested at 12 weeks would not meet AHA standards.

4. Subjects tested at 12 weeks would meet AHA standards but subjects tested at 18 weeks would not meet AHA standards.



Key

H1=x--x--x

H2=o--o--o

H3=.....

H4=o o o o

H5=*******

Figure 2. Retention Curve of BCLS Skills Over Time (H1-5)

The hypotheses related to Question Two were:

5. There is no significant relationship between nurses' retention of BCLS skills and their age, eduction, length of employment (measured as years since graduation and length of time employed at their current location) or

their level of active employment.

6. There is no significant relationship between nurses' retention of BCLS skills and position of present employment.

7. There is no significant relationship between retention of BCLS skills and the total number of times the nurse had had prior BCLS training.

8. There is no significant relationship between BCLS skill retention and the recency of BCLS training.

9(a) There is no significant relationship between retention of CPR skills and the number of exposures to cardiopulmonary arrests.
9(b) There is no significant relationship between retention of OA management skills and the number of exposures to an OA.

10(a) There is no significant relationship between retention of CPR skills and the number of times the nurse had actually done CPR.
10(b) There is no significant relationship between retention of OA management skills and the number of times the nurse had actually managed an OA.

11.(a) There is no significant relationship between retention of CPR skills and the recency of the last time CPR was actually performed.
11.(b) There is no significant relationship between retention of 0A management skills and the recency of the last OA a nurse had managed.

CHAPTER 3

METHODOLOGY

This chapter begins with a description of the sampling procedure, the sample and the research design. The study's inherent threats to internal and external validity are outlined. Data analyses related to statistical regression, history and experimental mortality are included in this outline. Next, test validity and reliability are discussed. Finally, ethical considerations pertaining to the topic under investigation and to the subjects themselves are considered.

SAMPLE

This study was conducted at a large metropolitan teaching hospital. The target population was nurses working in an acute care hospital. Subjects were all volunteer. It was recognized that "volunteer subjects are likely to be a biased sample of the target population since volunteers have been found in many studies to differ from nonvolunteers"(Borg & Gall, 1983, p.251). Nonetheless, all past research related to BCLS retention has been completed using volunteers and individuals do typically sign up for BCLS programs on a volunteer basis.

Most of the suggestions for improving the rate of volunteering as outlined by Borg and Gall (1983, p. 255) were incorporated into the sampling procedure. The appeal for volunteers was made as comprehensive and as interesting as possible. A multifaceted advertising program was conducted (Appendices A-D). The opportunity to participate in a research project (a "hot" item in nursing) was

highlighted. Also, subjects were offered the program at their place of work. The confidentiality of the subjects scores was stressed (a step that was repeated throughout the study). The theoretical and practical importance of the research was reinforced with subjects. The BCLS program was offered free to participants (the usual fee is fifteen dollars). Finally, it was arranged that the request for volunteers was made by all levels of the nursing hiearchy.

Sample Size

Accoring to Borg and Gall (1983) "it is desirable to have a minimum of 15 cases in each group to be compared" (p.257). In this study 4 groups were examined; therefore, a sample size of at least 60 was needed.

As well, a high rate of attrition was expected (given the experience of previous researchers--80% average at 1 year, and given the subjects work schedules with rotating shifts and days off). Also nurses could only participate in the posttests (when working) if patient demands (that could not be controlled) allowed.

Another fact that was considered was that the population was expected to be highly homogeneous on the variables being studied. The sample size was therefore increased so that persons having differing amounts of the characteristics might be represented.

In an attempt to allow for the forces described above (while maintaining a quality BCLS program) 88 subjects (more volunteered) were accepted into the study. Acceptance was determined on a first come, first serve basis. Waiting lists

were kept, and when a potential subject cancelled she was replaced. Unfortunately, only 49 subjects actually participated in the BCLS program.

The researcher attemped to minimize further experimental mortality in a number of different ways. First, reminder letters were sent to the participants (hand delivered, in person whenever possible) approximately four to five days prior to each review class (Appendices E-H). Notices were also placed in the hospital's newsletter (Appendix I). Extra test-retraining classes were added for subject convenience. Finally, the researcher followed up personally with nurses who missed a review class to determine if it could have been prevented. It is interesting to note that only twice did a subject forget their scheduled retest. The reasons for failure to be retested included holidays (most common), resignation and injury making BCLS impossible.

Description of Participants

The original study sample was composed of 49 female nurses. The actual study sample (those who completed at least one retest) was composed of 30 nurses. The demographic characteristics of the subjects who were and were not retested are summarized in Tables 1 and 2.

Examination of the data prior to analysis established that subject number 73 was an outlier. At age 57, she was 12 years older than the next oldest subject, (group mean [$\overline{X}$=30.5], with a standard deviation [SD] of 7.9). As well, number 73 had been a part of 60 more cardiopulmonary arrests than the next highest scoring individual (she had participated in 100 arrests; the group mean was 19).

In an attempt to recognize the influence subject 73 had upon the range, X and SD of the actual study sample a second set of calculations were made excluding her data (Tables 1-3).

TABLE 1

Range, Mean and Standard Deviation of Demographic Characteristics

	No Retest Group (n=19)			Retest Group With-Subject 73 (n=30)			Retest Group Without 73(n=29)		
Demographic Characteristics	Range	X	SD	Range	X	SD	Range	X	SD
Age (years)[a]	23-35	28.4	4.2	22-57	31.9	9.4	22-45	31.0	8.2
Years Worked	1-12	4.8	3.5	0-23	5.0	5.6	0-23	4.4	4.6
Years Since Graduation	2-12	5.7	3.0	0-24	7.1	6.7	0-24	6.6	6.1
Total Number of BCLS Courses (prior to study)	3-50	7.4	10.8	1-20	5.3	3.7	1-20	5.4	3.7
Time Elapsed Since Last BCLS Program (Months)	not collected			0-60	10.2	16.6	0-60	8.7	15.0

[a] Data missing from 2 cases retest group with subject 73.

In reference to Tables 1 and 2, it must be noted that the study sample is not normally distributed, but is instead skewed. This finding suggests that the study sample may not be representative of the target population and therefore the research findings must be interpreted with caution.

TABLE 2

Occurrence of BCLS Events Prior to and During Study

	No Retest Group (n=19)			Retest Group With Subject 73 (n=39)			Retest Group Without Subj. 73 (n=29)		
BCLS Event History	Range	X	SD	Range	X	SD	Range	X	SD
Number of Arrests Witnessed (prior to Study)	0-600	35.5	136.8	0-100	8.5	19.0	0-44	5.4	8.1
Number of Real-life Times CPR Actually Done(prior to study)	0-10	1.4	2.4	0-20	2.4	4.4	0-20	2.3	4.5
Time Elapsed Since Did Real-life CPR (Months)	not collected			6-99[a]	24.5	27.0	6-99[a]	24.5	27.7
Number of OAs Witnessed (prior to study)	not collected			0-99[b]	2.0	4.8	0-21[c]	1.9	4.6
Number of Real-life OAs Managed	not collected			0-21[b]	2.0	4.8	0-21[c]	1.6	0.3
Time Elapsed Since Last OA Manged	not collected			0-1[b]	0.1	0.3	0-1[c]	0.1	0.3
Number of Times During Study Did CPR	not collected			0-1[b]	0.1	0.3	0-1[c]	0.1	0.3

[a] Data missing from 2 cases in retest group with subject 73.

[b] n = 26

[c] n = 25

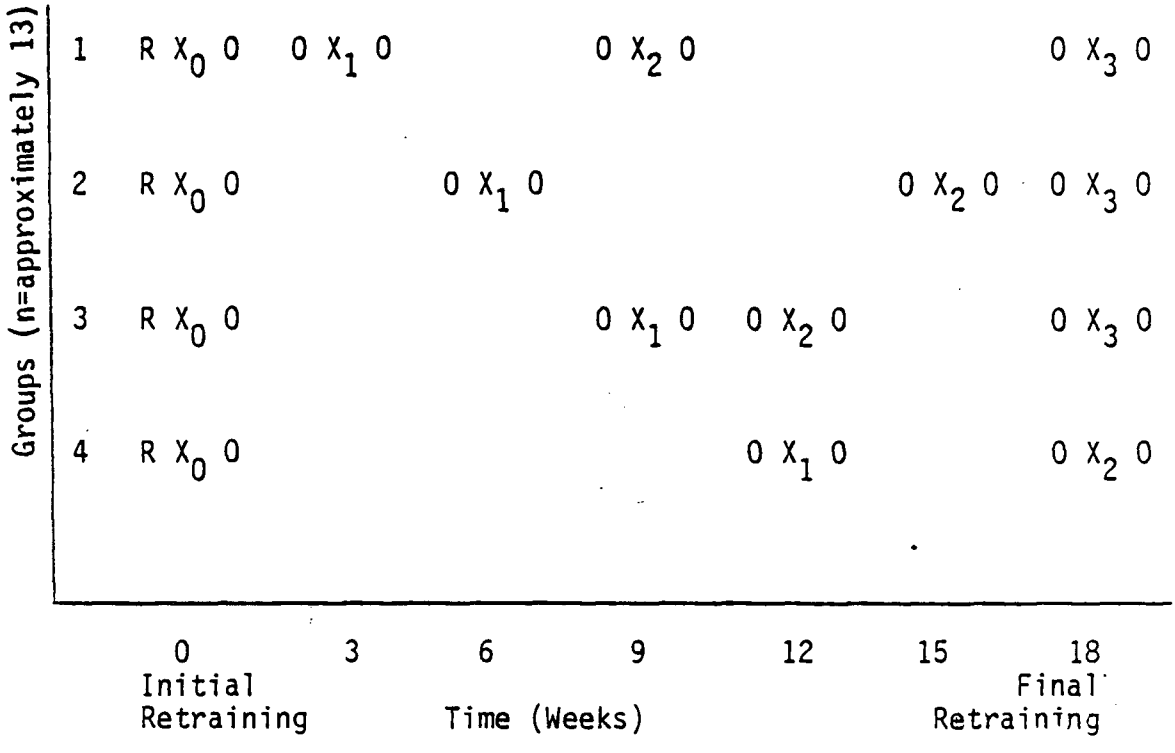
TABLE 3

Occupational and Educational Distribution

Demographic Characteristic	No Retest Group (n=19)	Retest Group with Subject 73 (n=30)	Retest Group Without Subject 73 (n=29)
	Frequency		
Specialty (Nursing--Area of Work			
Medical-Surgical	12	26	25
Critical Care	3	3	3
Long Term Care	1	0	0
Psychiatry	0	0	0
Education (Inservice, School of Nursing)	2	0	0
Clinical Specialist	1	0	0
Position			
Head Nurse	0	3	3
Instructor	2	1	1
Clinical Specialist	1	0	0
General Duty	15	25	24
Liceinsed Practical Nurse	1	1	1
Nurse Orderly	0	0	0
Level			
Full-time	15	23	22
Part-time	4	7	7
Casual	0	0	0
Education-Nursing (highest achieved)			
Baccalaureate	8	6	6
Post RN Certificate	0	5	5
RN Certificate	10	18	17
LPN/Orderly Certificate	0	1	1
None of the above	1	0	0
Education-Nonnursing (highest achieved)			
Masters	1	0	0
Baccalaureate	1	0	0
Certificate/Diploma	2	3	2
None of the above	15	27	27

RESEARCH DESIGN

The research design chosen for this study was a pretest-posttest design with random assignment (Figure 3) and incorporated into that design was the potential to go to a Latin Square Design (Figure 4).



Key

O = test

X_0 = initial retraining to AHA Level

X_1 = fitst test-retraining session

X_2 = second test-retraining session

X_3 = third test-retraining session

R = random assignment

Figure 3. Pretest-posttest Design with Random Assignment

Retraining Factor

	T_1	T_2	T_3
1	X_1	X_2	X_3
2	X_2	X_3	X_1
3	X_3	X_1	X_2

Key

X1 = test 3 weeks after last retraining or testing

X2 = test 6 weeks after last retraining or testing

X3 = test 9 weeks after last retraining or testing

Figure 4. Pretest-posttest Design with Random Assignment

The Latin Square Design would have been evoked if the data had revealed that a significant number of subjects failed to meet AHA standards during retesting. In the Latin Square Design, data collected from subjects in Group D would not have been utilized.

The purpose for moving to a Latin Square design was to counterbalance the order of treatment effects. In other words, this design may have determined which time interval (3, 6, or 9 weeks) was significant irrespective of the order of time intervals. The pretest-posttest design would only have indicated that one

of the time intervals was significant but would not have considered the effects of treatment order.

The dependent variable in this study was psychomotor performance as measured by scores on the 1980 AHA BCLS performance tests (Appendices J and K). Subjects' scores on the test of CPR could vary from 0 to 19 and from 0 to 9 on the obstructed airway test. Ultimately, however, subjects were also assigned a pass/fail grade.

The independent variable in this portion of the study was the time period (measured in 3 week intervals) from retraining.

The correlational method was chosen to measure the relationship between BCLS performance and nurses' demographic characteristics.

PROCEDURE

Once subjects had volunteered to participate in the study they were mailed a prereading package. This package contained a program announcement (Appendix L), the Heart Saver Basic Rescuer Manual, and the consent form (Appendix M).

Four BCLS programs were carried out during a one week period. At the beginning of each program subjects were read a statement outlining the purpose of the study and assured that their data would remain confidential (Appendix N). Subjects then completed the demographic data collection tool (Appendix O). Once these initial steps were completed the BCLS course was conducted.

Each course was coordinated by the researcher, used the same format (Appendix P), educational materials and Resusci Annies. A basic core of volunteer faculty (instructor-trainers) was utilized with at least one faculty member overlaping between programs. The student-instructor ratio was approximately five to one.

The educational materials were taken from the AHA guidelines, and the pretests and posttests were those developed by the AHA (JAMA, 1980). Criteria for the successful completion of each skill have previously been defined by the AHA (JAMA, 1980).

At the end of the BCLS programs, subjects were read a second statement asking them to not jeopardize the study's validity (Appendix Q).

Testing-Retraining Session and Schedule

Upon completion of the BCLS program subjects were asked to return for follow-up testing (and retraining as necessary) at predetermined time intervals. To facilitate planning (and simulate the "real world") subjects were informed, in writing, of their testing-retraining schedule (Appendix R).

Prior to their BCLS program each subject had been randomly assigned to a testing-retraining schedule (Group 1, 2, 3, or 4), (Figure 3). Group 1 nurses were tested at 3 weeks, 9 weeks and again at 18 weeks following their BCLS course. Nurses in Group 2 were tested at 6 weeks, then at 15 weeks, and finally 18 weeks after their BCLS course. Group 3 nurses were tested at 9, 12, and 18 weeks following their BCLS course. While Group 4 nurses were tested at

12 and 18 week intervals.

The testing-retraining sessions were offered on a drop-in basis. The same instructor-testers were used as in the BCLS programs. The outline of the session was individually determined by each subject, and based on their performance during testing.

During testing the subject was shown a standard, prearranged situation and asked to respond. For CPR they were shown a manikin and told "this lady has just collapsed". For the OA management test an instructor feinged the scenario. Subjects were given only one chance to perform and were not interrupted.

Subjects who passed both their CPR and OA management test on the first attempt did not stay for retraining. Subjects who did not meet AHA standards, worked one to one with an instructor until they were again able to perform both skills at AHA, level one standards.

Following their final testing (at 18 weeks) subjects were debriefed. This included: (a) desensitization--a review of any errors made, and (b) further data collection as to participation in BCLS events, and review or practice of BCLS materials since the beginning of the study, (Appendix S). Subjects who did not attend their final test session were mailed their debriefing form (3 out of 10 were returned).

PROCEDURE FOR RANDOM ASSIGNMENT

In this experiment random assignment was necessary on three separate occasions. In the first case, subjects were randomly assigned to either Group 1, 2, 3, or 4. Next, testers were randomly assigned to testing stations. In the final instance the testing configuration (time sequence of 3, 6 and 9 week intervals between testings) was drawn, at random, from all the possible 3 X 3 Latin Square configurations, ignoring Group 4. This was done to facilitate the possibility of moving to a 3 X 3 Latin Square design from the pretest-posttest design.

In each case a similar procedure for random assignment was used; however, for the sake of brevity only the first procedure used in the first case is outlined.

All subjects were first assigned a number from 0 to 88. Next, a table of random numbers was consulted. An arbitrary starting point was selected and the last three columns of each number were used. Moving down the columns the first number that corresponded to a subjects' number assigned that subject to Group 1. The second number that corresponded to the number of a subject assigned that subject to Group 2, and so on, until all the subjects had been assigned to a group.

THREATS TO EXTERNAL VALIDITY

Efforts to establish population validity wherein "the accessible population is reasonably representative of the target population" (Borg and Gall, 1983, p. 242) were not made during the study. Data on the critical variables were not available for most of the target population. Thus, for the purposes of this thesis

population validity must be considered unknown. Therefore generalization of the findings is limited to the experimentally accessible population.

Inherent in the pretest-posttest design with random assignment are two threats to ecological validity ("the extent to which the results of the experiment can be generalized from the set of environmental conditions created by the researcher to other environmental conditions": Borg and Gall, 1983, p. 640). First, is multiple-treatment interference wherein the exact same combinations of 3, 6 and 9 week tests must be present before the results collected at any of the test periods can be replicated. To control for this flaw the Latin Square design was built into the pretest-posttest design.

The second threat to ecological validity was the effect of Novelty and Disruption. In the experiment, with the exception of group 4, subjects received at least 4 training sessions spaced over 18 weeks. Normally, subjects would receive 1 training session per year. As the very purpose of this experiment was to determine a critical point in time for retraining this threat to ecological validity was irrelevant.

THREATS TO INTERNAL VALIDITY

In choosing a pretest-posttest design with random assignment it was recognized that a number of threats to internal validity would have to be considered, and where possible minimized. The threats to internal validity not applicable to this study (as there was no control group) were the John Henry effect, differential selection, selection-maturation and experimental treatment diffusion.

Random assignment of subjects to the four experimental groups was an important step in attempting to control the multiple threats to internal validity (the Hawthorne effect, maturation, history, statistical regression, the Pygmalion effect, experimental mortality, intrasession history and instrumentation) inherent in the pretest-posttest design.

Beyond randomly assigning subjects to a treatment group further steps were also taken to control as many of the forces threatening internal validity as was possible.

To determine the potential threat of history to internal validity, results from the final questionnaire were reviewed. The purpose of this questionnaire was to identify events, thought to be critical to retention of BCLS skills, that coincided with the study.

Earlier research has demonstrated that subjects who reviewed or practiced their BCLS between tests did better than those who did not (Weaver et. al. 1979, and Weaver et. al. 1980). In this study subjects had been asked not to discuss the research project, or to practice or to review the course materials. Subjects' self-reports regarding such discussions or reviews revealed that they complied with the researcher's request.

Also of interest, was whether or not subjects who participated in BCLS events during the course of the study performed differently than those who did not. Again small sample size limits confidence in the findings. Nonetheless, it is

interesting to note that all (n=3) who had participated in a cardiopulmonary arrest during the life of the study passed their performance test and with the exception of 2 nurses all (n=9) who had witnessed an arrest also passed, (Table 3). The same pattern (6 passed, 1 failed) was true for OA management performance (Table 4).

TABLE 4

Relationship Between BCLS Test Score and Occurrence of BCLS Events During Study

Time (Weeks)	Number of Subjects	No BCLS Event Pass	No BCLS Event Fail	1 BCLS Event Pass	1 BCLS Event Fail	2 BCLS Events Pass	2 BCLS Events Fail	Subscript =n Events Pass	Subscript =n Events Fail
				CPR Performance					
3	12	6	3	3	0	0	0	N/A	
6	17	6	4	4	2	1	0	N/A	
9	11	3	5	3	0	0	0	N/A	
12	7	1	0	2	1	2	0	N/A	
18	4	2	0	0	1	0	0	1_{0}	0_{6}
				CPR Actually Done					
3	12	9	3	0	0	0	0	N/A	
6	17	10	6	0	0	1	0	N/A	
9	11	6	5	0	0	0	0	N/A	
12	7	4	1	1	0	1	0	N/A	
18	4	2	2	0	0	0	0	0_{8}	1_{8}
				OA Witnessed or Managed					
3	12	7	4	1	0	0	0	N/A	
6	17	8	6	3	0	0	0	N/A	
9	11	2	8	1	0	0	0	N/A	
12	7[a]	3	2	1	1	0	0	N/A	
18	5[a]	0	5	0	0	0	0	N/A	

Note. 1 Subject unable to be retested on CPR due to a medical condition.

To control for the Pygmallion effect, instructor-testers were not given access to the demographic characteristics of the subjects. It is an unwritten expectation

that critical care nurses are better at BCLS than other groups of nurses. For this reason, testers did not know the speciality or demographic characteristics of subjects.

Statistical regression also threatened internal validity in this study. All subjects were required to pass (initially) the level one BCLS tests. Therefore it was doubtful that subjects' scores during the experiment would show extreme deviations from the mean ($\overline{X}$). Table 5 substantiates this conclusion.

TABLE 5

Distribution of BCLS Scores

		CPR		OA Management	
Time (Weeks)	n	$\overline{X}$	SD	$\overline{X}$	SD
3	13	17.2	2.8	6.5	1.9
6	19	16.9	2.1	6.8	2.4
9	13	15.8	3.9	5.0	2.1
12	7	17.7	1.4	5.8	1.8
18	5	14.8	4.8	4.0	1.4

Note. Manimum Score for CPR=19; for OA Management=9.

The extent that experimental mortality threatened internal validity was determined by comparing the demographic characteristics of those who dropped out (n=19)

with those who completed at least one retest (n=30). Examination of Tables 1-3 reveals that subjects who completed the study are different from subjects who did not, particularly with regard to number of cardiopulmonary arrests witnessed prior to the study. Thus, one can conclude that experimental mortality does threaten the internal validity of this study. The influence and extent of this threat is unknown.

Intrasession history was also considered a threat to internal validity in this study. It is logistically impossible to train 88 (the original sample) subjects at one time. Instead, the subjects were trained in 4 groups of approximately 13 subjects each. To help control for intrasession history, the same instructor-testers were used throughout the study and subjects were tested on an individual basis.

Finally, instrumentation also posed a threat to internal validity. The reason for this was that the pretest and posttest were exactly the same. To decrease the possible influence of instrumentation during the observation portion of the study interobserver agreement was established.

Interobserver Agreement

Interobserver agreement was established before the research began and throughout the study. All instructor-testers participated in a 2 hour training session approximately 1 week before the data collection began. At that time, the hypotheses, research methodology and role of the instructor-testers were reviewed. The last hour of the training session was spent on establishing interobserver

agreement.

As the instructor-testers were all familiar with the AHA test forms and standards little discussion was required prior to actually practicing observations and data collection. Instructor-testers were seated so they could not see each other's forms. They were then asked to score a live CPR and OA management performance. Disagreements between the instructor-testers were discussed and clarified. The instructor-testers then scored a second and a third live CPR and OA management performance (by different nurse volunteers). At this point 100% agreement was obtained between instructor-testers.

Interobserver agreement was calculated during the BCLS program for approximately one third of the CPR and OA management tests. Two (of the three) instructor-testers observed and scored a subject's performance and then these scores were compared. Instructors were randomly assigned subjects based on a number assigned to each testing station and instructor-tester. Interobserver agreement was again established at 100%.

Finally, interobserver agreement was measured for all the test-retraining performances. For each BCLS test the subjects' performances were observed and scored by an instructor-tester and by the researcher. Again 100% agreement was obtained.

During the initial BCLS programs (X_o) interobserver scores for CPR and OA management were collected separately. During the testing-retraining sessions

(X1-X3) the CPR and OA management were completed sequentially and so were the interobserver measures.

DATA COLLECTION TOOLS

The following data collection tools were used in this study:

1. Demographic Tool, (Appendix O).
2. Cardiopulmonary Resuscitation and Emergency Cardiac Care Performance tests for: One Rescuer CPR (adult), (Appendix J), Obstructed Airway--Conscious Victim, Sitting or Standing, (Appendix K).
3. Debriefing Form, (Appendix S).

The tools in 2 above were developed by the AHA (JAMA, 1980) and are the ones most often quoted by the authors reviewed. Thus, comparison between the results from this study and research findings already reported are possible.

The tests outlined in 2 above are criterion referenced. For the purposes of this research, only performance related to CPR and management of an obstructed airway in adults was investigated. Standardized procedures were used in both the administration and scoring of each test (Appendices N and O).

TEST VALIDITY

These BCLS (CPR and OA management) tests appear valid. They differentiate between subjects who have and have not "retained" BCLS skills, as evidenced by past research. Therefore, these tests can be said to have construct validity wherein the construct being measured is achievement of BCLS skills. Measures of content validity have not been established. Nonetheless, visual scanning of the

actual tests demonstrates that they match the course content. Finally, it is almost impossible to determine whether or not these tests have predictive validity. Opportunities to demonstrate BCLS skills in "real life" are rare. Nevertheless, research has conclusively demonstrated that BCLS training (using these BCLS tests) has improved long-term survival rates of cardiorespiratory arrest victims. One could therefore suggest that the criteria for predictive validity have been satisfied.

TEST RELIABILITY

The reliability of a criterion-referenced test is defined as "the consistency of the test in making estimates of the examinee's level of mastery of the test's domain" (Borg and Gall, 1983, p. 290). Reliability values (percentage agreements) are not available for the BCLS performance tests.

ETHICAL CONSIDERATIONS AND HUMAN RIGHTS

Permission to conduct this study was obtained from the Nursing Executive of the hospital concerned and the University of British Columbia screening committee for research and other studies involving human subjects.

Subjects were told the purpose of the study was to evaluate BCLS review programs. Confidentiality of all information received, the option of participation or nonparticipation and the right to withdraw from the study at any time without prejudice to current or future employment was explained, assured and recorded on the consent form.

Specifically, the confidentiality of subjects was ensured by the following procedures:

(a) Subjects names were not reported (other than to the Justice Institute of British Columbia for documentation of BCLS certification). Each subject was assigned a code number. Data collection tools were designed so that the respondents' name could be torn off as soon as the form was coded; prior to scoring (Appendices J, K, and S). This procedure was followed. The key to the code was destroyed following completion of the data collection.

(b) Individual test scores are not available to persons outside of the author's thesis committee.

(c) BCLS instructor-testers not associated with the hospital were utilized. The goal of this decision was to prevent any accidental bias on the part of one hospital employee towards another.

(d) Subjects were alone during testing.

As well, desensitization of subjects was incorporated into this experiment. Following each testing, subjects were informed of their errors and correct procedures were reviewed with them.

Finally, the author complied with the hospital's request to present her research findings to the nursing division and to provide a copy of the final thesis to the nursing library. The author also provided a summary of the research findings to the volunteer instructor-testers and provided a copy of the final thesis to the Justice Institute of British Columbia.

CHAPTER 4

FINDINGS

The purpose of this chapter is to outline the research findings as they relate to Questions A and B, Hypotheses one through eleven. The techniques employed in the data analysis are discussed. As well, findings supplemental to the initial research proposal are described.

Statistical analysis of the data collected during this study was problematic. As discussed in Chapter Three, attrition posed a serious threat to the study's validity, limiting confidence in the generalizability of results.

Eighty-eight subjects were originally accepted into the study. Forty-nine actually completed BCLS training: all passing with a minimum of level one competence. Of the 49 who did complete training, 30 returned for at least one retesting-training session, but only 16 fully completed all components of the study (1 from group 1, 2 from group 2, 7 from group 3 and 6 from group 4).

In an attempt to fully examine the available data the original plan for statistical analysis was amended. Group number (indicating a pre-assigned testing sequence) was eliminated as a variable. Instead, subjects were reassigned groups (1--5) based on the actual elapsed time between their retest-training sessions (3, 6, 9, 12, or 18 weeks: Figure 3). For example, subject number 70, original group 1 (preassigned retest-training sequence 3--6--9 weeks) was retested only on the dates

pre-assigned for the 3 and 9 week tests. In truth then, the gap between tests was 3 and 15 weeks (ie., she missed the 6 week test, 6 plus 9 equals 15 weeks). So rather than coding the data collected as incomplete for group 1 this subject's data was entered into the groups created for 3 and 15 weeks. Reorganization of all data resulted in 13 subjects tested-retrained at 3 weeks, 19 subjects at 6 weeks, 13 subjects at 9 weeks, 7 subjects at 12 weeks, 2 subjects at 15 weeks and 5 subjects at 18 weeks (table 6).

TABLE 6

Redistribution of Subjects According to Elapsed Time Between Testing

	Original Plan				Final Plan				
Time Elapsed Between Test (Weeks)	Group 1 (n=14)	Group 2 (n=13)	Group 3 (n=10)	Group 4 (n=13)	Group 1	Group 2	Group 3	Group 4	Group 5
3	$^{1}/_{4}$	$^{2}/_{4}$	$^{7}/_{7}$	/	13				
6	$^{1}/_{4}$	$^{2}/_{4}$	$^{7}/_{7}$	$^{6}/_{6}$		19			
9	$^{1}/_{5}$	$^{2}/_{4}$	$^{7}/_{8}$	$^{6}/_{7}$			13		
12	not applicable							7	
18	not applicable								5

$^{1}/_{4}$ 1 = Number who completed all retests.
4 = Number who were tested for that time sequence.

Because only 2 subjects were actually tested at the 15 week time interval the

data from this particular group was not examined. This decision was made because the probability of making a Type-II error was considered too great given there were only two subjects. It was also considered unreasonable to generalize , with confidence the performance of only 2 subjects over a 15 week time period.

Reorganization of the data was not without consequences. Firstly, subjects (data) were no longer randomly assigned to groups. Instead, they were assigned to groups based on when they had been retested. Hence, the internal validity of the study became of greater concern.

Secondly, the subjects in each group (3, 6, 9, 12, or 18 weeks) were no longer completely independent. In other words, it became possible for one subject to be in three (maximum) groups. For example, the data collected from subject 65 was placed into the groups created for 3,6, and 9 weeks. Therefore, subject 65 was represented three times. According to Hopkins and Glass (1978), this "dependence (between observations) would seriously affect the probability of a type-I error" (p. 321).

As originally planned, subjects' test scores were computer coded using 2 different methods--pass/fail and actual score for CPR and OA management.

To measure retention of BCLS skills, pass/fail percentages were calculated for each of the three week time intervals, (Table 7).

TABLE 7

Percentage of Subjects Failing BCLS

Time (weeks)	n	% Failed CPR	%Failed OA
3	13	30.3	30.8
6	19	36.8	36.8
9	13	46.2	69.2
12	7	14.3	42.9
18	5	50.0	100

As well, comparisons (using chi square for the pass/fail data and analysis of variance [ANOVA] for the total score data) were made among the subjects for the 3, 6,and 9 week test periods. Tables 8 and 9 show the results achieved through computer analysis of the data.

TABLE 8

Chi Square Values for BCLS Performance by Retest Time Interval

Crosstabluation	n	Fisher's Exact Test
CPR Performance by Time		
3 week by 6 week	11	0.6515
6 week by 9 week	11	0.17532
3 week by 9 week	10	0.3333
OA management Performance by Time		
3 week by 6 week	could not be calcualted	
6 week by 9 week	11	0.1212
3 week by 9 week	10	0.4667

Note. X^2 value = 3.841 (1 d.f.).

*p/ <.05.

TABLE 9

ANOVA Values for BCLS Performance by Group (Retest Time Interval)

Variable	Source	Sum of Squares	df	F Ratio	F Probability
CPR(3-6-9-12 Weeks	Between Groups Within Groups	26.0305 474.4887	3 48	0.8778	0.4593
OA Management (3-6-9-12 Weeks)	Between Groups Within Groups	36.2529 236.2663	3	2.4551	0.0744
CPR(3-6-9-12-18 Weeks)	Between Groups Within Groups	27.6184 557.2387	4 51	0.6319	0.6420
OA Management (3-6-9-12-18 Weeks)	Between Groups Within Groups	38.5127 261.0663	4 52	1.9178	0.1213

*p/ <.05.

The hypotheses that:

$1X_1$(3 weeks) would meet AHA standards, but $2X_1$(6 weeks) would not, $2X_1$(6 weeks) would meet AHA standards, but $3X_1$(9 weeks) would not, $3X_1$(9 weeks) would meet AHA standards, but $4X_1$(12 weeks) would not, $4X_1$(12 weeks) would meet AHA standards, but $5X_1$(18 weeks) would not, (Figure 2).

were rejected by analysis of scores using both chi square and ANOVA since no significant difference was found between any combination(s) or permutation(s) of groups. It may be inferred that although some subjects fail to meet AHA standards at all of the time intervals there is no significant change, that is

increase, in the number (percentage) failing over 3 week intervals.

Nonetheless, graphic representation of the percentage of subjects failing across time does suggest a trend, (Figure 5).

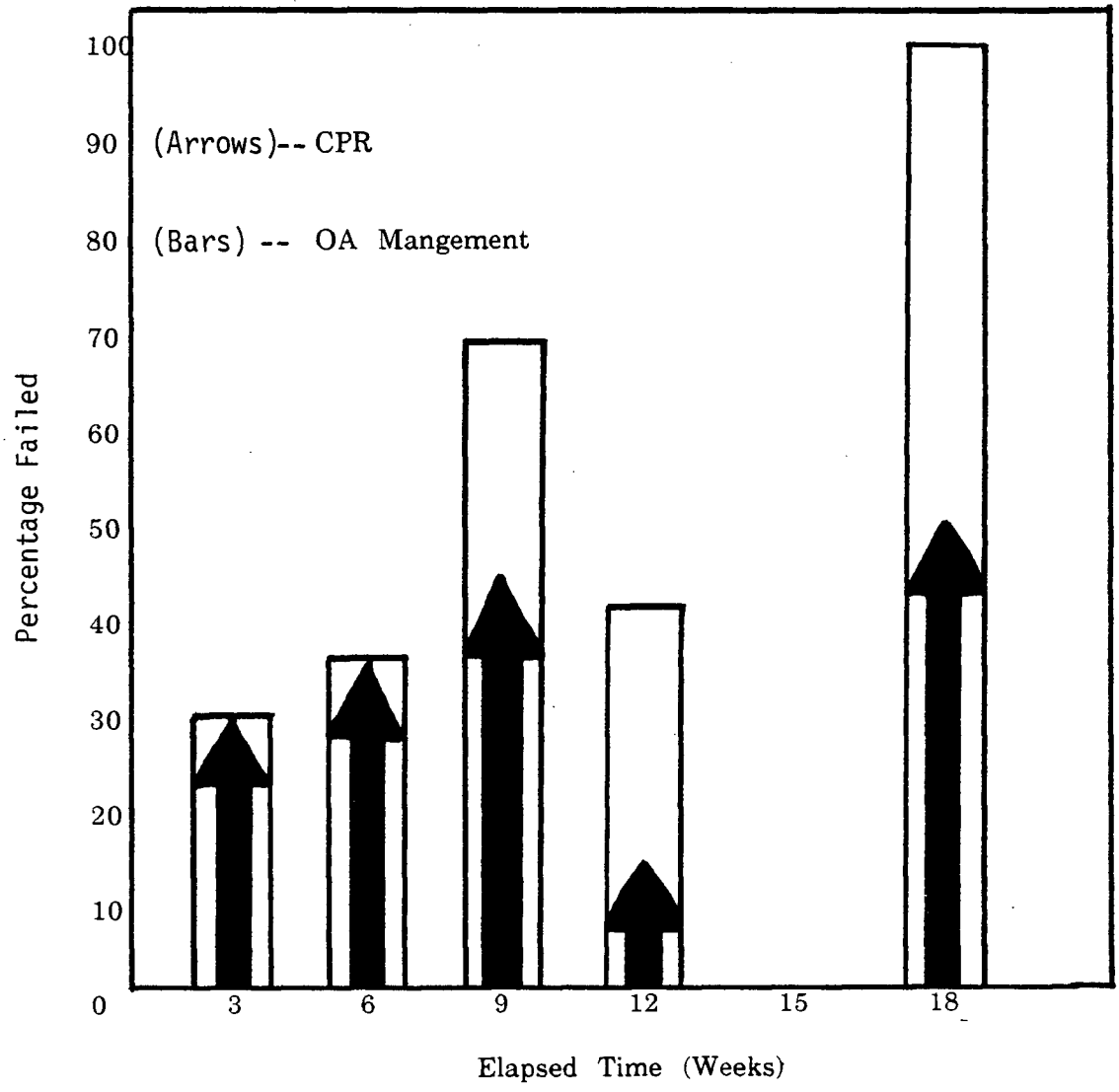


Figure 5. Percentage Failed BCLS Over Time

standards for both CPR and OA management. Figure 5 also appears to suggest that as time intervals between retraining-testing sessions increase a greater proportion of subjects are likely to fail OA management when compared to CPR.

In answer to Question A--after initial training how long does it take for nurse's BCLS performance (on adults) to again drop below AHA levels, the data demonstrates that as early as 3 weeks after retraining some subjects fail to meet AHA standards. The data also demonstrate that some subjects still meet AHA standards for CPR, though not for OA management, when retested 18 weeks (4.5 months) following initial retraining.

Correlation coefficients were calculated to measure the magnitude and direction of the relationship(s) between subjects' demographic characteristics and their BCLS performance. When BCLS performance was measured as pass/fail (1, 2) the biserial (r_{bis})† correlation coefficient was used, (Table 10 and 11). When BCLS performance was measured as a value out of a possible 19 (CPR test) or a possible 9 (OA test) the product-moment correlation coefficient (Pearson r) was used, (Tables 12 and 13). Correlation coefficents were calculated for each test time interval (3, 6, 9, 12 and 18 weeks; not 15 weeks).

As it had been determined that subject number 73 was an outlier (Chapter III), product moment correlation coefficients were calculated twice--first with subject

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†There is no statistical computer package to calculate r_{bis}. Following the advice of Dr. C. Lai, UBC, rbis was achieved by: calculating ANOVA using pass/fail (ie, group 1,2) as the independent variable and each demographic characteristic as the dependent variable. The Divided Sum of Squares between Groups was then divided by the Total Sum of Squares. Direction of the correlation was determined by visual analysis of the data.

73's score and then with subject 73's score excluded (r_{bis} was calculated without subject 73). Because of the obvious impact subject number 73 had upon the results, hypotheses 5 to 11 were evaluated considering the analyses made without subject 73's data, (Tables 14 and 15).

Once more, it must be recognized that small sample size, limits the generalizability of results. Compounding this problem is the range in magnitude of correlation coefficients (Tables 10 and 11, 14 and 15) observed across test periods. Ideally, one would expect the coefficients calculated for each pair of variables to remain fairly consistent across the study. In other words, the correlation coefficient determined for BCLS performance and age at 3 weeks should be equal to or close to the correlation coefficient determined at 12 weeks (as it would be unlikely that increasing ones age by 9 weeks would influence BCLS performance). This however was not always true. Consequently, the author weighed the sample size, the trend of the coefficient across time and the values measured by both r_{bis} and r when making the decision to accept or reject hypotheses 5 through 11.

The relationship between BCLS performance (retention) and age

The hypothesis that there would be no significant relationship between nurses' BCLS performance and their age was accepted. Analysis of correlation coefficients (Tables 10 and 14) suggestd that age is not correlated with BCLS performance.

The relationship between BCLS performance and education, nursing and other education

The hypothesis that there would be no significant relationship between nurses' BCLS performance and their educational level was accepted. Analysis of the

correlation coefficients (Tables 10 and 14) suggests that educational level and BCLS performance are not correlated.

The relationship between BCLS performance and length of employment (at their current place of employment)

The hypothesis that there would be no significant relationship between nurses' BCLS performance and the number of years they had worked was rejected. Analysis of the correlation coefficients (Tables 10 and 14) suggests that length of employment and BCLS performance are negatively correlated.

The relationship between BCLS performance and years since graduation

The hypothesis that there would be no significant relationship between nurses' BCLS performance and the number of years since they had graduated was rejected. Analysis of the correlation coefficients (Tables 10 and 14) also suggests that years since graduation and BCLS performance are negatively correlated.

TABLE 10

Biserial Correlation Coefficients for BCLS Performance and Demographic Characteristics (Excluding Subject 73)

Variable	3 Weeks (n = 12)	6 Weeks (n = 19)	9 Weeks (n = 12)	12 Weeks (n = 7)	18 Weeks (n = 5)
	CPR Performance				
Age[a]	-.0046	-.4322	-.4657	-.0007	-.5412
Education-Nursing	.0085	.0032	.1050	.1945	0
Education-Nonnursing	.1875	.0952	.0972	0	0
Level of Employment (eg. part-time)	-.0370	-.0823	-.0508	-.4166*	0
Position of Present Employment	.0117	.1094	.2063	.0278	0
Years Worked	-.2676	-.4030	-.2893	-.0900	.8181**
Years Since Graduation	-.1112	-.3809	-.3210	-.1171	.8181**
Specialty (eg. Critical Care)	.0714	.0610	.0630	.0278	.3333
Number of Previous BCLS Programs Taken	.0008	.1362	.0100	,2075	.3333
	OA Management Performance				
Age[a]	.0053	.1096	.2044	.0032	b
Education-Nursing	.0115	.0368	.1815	.3888	b
Education-Nonnursing	.0370	.0950	.1815	0	b
Level of Employment	.1875	.0823	.0004	.0008	b
Position of Present Employment	.2112	.1094	.2407	.1250	b
Years Worked	.0018	.1201	.0757	.2682	b
Years Since Graduation	.0259	.0974	.0360	.2725	b
Specialty	.0005	.0400	.0371	.2222	b
Number of Previous BCLS Programs Taken	.0084	.1175	.1084	.2222	b

[a] 1 Subject did not indicate their age.

[b] Could not be calculated due to insufficient data.

* $p/ < .05$.

** $p/ < .01$.

TABLE 11

Biserial Correlation Coefficient for BCLS Performance and BCLS Event History (Excluding Subject 73)

Variable	CPR Performance				
	3 Weeks (n = 12)	6 Weeks (n = 19)	9 Weeks (n = 12)	12 Weeks (n = 7)	18 Weeks (n = 5)
Number of Times Had Done CPR	.1230	.1148	.1400	.0010	.0196
Number of Arrests Witnessed	-.1032	-.0905	-.0773	-.3402	0
Recency of Last Time CPR Done (Months)	-.2513	-.4123	-.2935	-.7880**	-.6145**
Recency of Last BCLS Training (Months)	-.0028	-.0099	-.1591	-.0703	-.2418
	OA Management Performance				
Number of OAs Witnessed	.0633	.0792	.0071	.0093	a
Number of Times Had Managed an OA	.0869	.0076	.1590	.1311	a
Date of Most Recent OA Managed (Months)	.0274	.0005	.0010	.1616	a
Recency of Last BCLS Training (Months)	.0942	.1535	.0677	.0156	a

[a] Could not be calculated due to insufficient data.

* $p < .05$.

** $p < .01$.

TABLE 12

Product Moment Correlation Coefficients for BCLS Performance and Demographic Characteristics

Variable	CPR Performance				
	3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
Age[a]	-.6269*	-.5831**	-.6867**	-.0657	-.1297
	(12)	(19)	(12)	(7)	(4)
	p=.015	p=.004	p=.007	p=.444	p=.435
Education-Nursing	.3197	.1093	.5192*	.6038	
	(13)	(19)	(13)	(7)	b
	p=.143	p=.328	p=.034	p=.076	
Education-Nonnursing	-.6893**	-.5449**	-.3319		.3015
	(13)	(19)	(13)	b	(4)
	p=.005	p=.008	p=.134		p=.349
Level of Employment	.0439	-.1434	-.0952	-.6010	
	(13)	(19)	(13)	(7)	b
	p=.443	p=.279	p=.429	p=.077	
Position of Present Employment	-.1162	-.3148	-.8016**	-.0913	
	(13)	(19)	(13)	(7)	b
	p=.353	p=.095	p=.000	p=.423	
Years Worked	-.8709**	-.5875**	-.6237*	.4199	-.9639*
	(13)	(19)	(13)	(7)	(4)
	p=.000	p=.004	p=.011	p=.174	p=.018
Years Since Graduation	-.7113**	-.5249*	-.4260	.3600	-.9638*
	(13)	(19)	(13)	(7)	(4)
	p=.003	p=.011	p=.073	p=.241	p=.018
Specialty	.1741	.2352	.0466	-.2882	.0348
	(13)	(19)	(13)	(7)	(4)
	p=.285	p=.166	p=.440	p=.311	p=.483
Number of Previous BCLS Programs Taken	.0910	.3047	.5747*	.3134	.5919
	(13)	(19)	(13)	(7)	(4)
	p=.384	p=.102	p=.020	p=.247	p=.204

TABLE 12 CONTINUED

Variable	OA Management Performance 3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
Age[a]	-.5386* (11) p=.044	-.2292 (18) p=.180	-.5195 (11) p=.051	-.0815 (7) p=.431	.2852 (5) p=.321
Education-Nursing	.3183 (12) p=.157	.1340 (18) p=.298	.7636** (12) p=.008	.5517 (7) p=.100	b
Education-Nonnursing	b	b	b	b	-.6455 (5) p=.120
Level of Employment	.0816 (12) p=.401	-.4129* (18) p=.044	-.0962 (12) p=.383	-.0269 (7) p=.477	.3953 (5) p=.255
Position of Present Employment	-.4064 (13) p=.084	-.2481 (19) p=.153	-.5441* (13) p=.027	-.3475 (7) p=.222	b
Years Worked	-.2317 (13) p=.223	-.2454 (19) p=.156	-.3884 (13) p=.095	-.6394 (7) p=.061	.5810 (5) p=.152
Years Since Graduation	-.3531 (13) p=.118	-.2625 (19) p=.139	-.3536 (13) p=.118	-.6270 (7) p=.066	.5023 (5) p=.194
Specialty	-.3463 (13) p=.123	-.3564 (19) p=.067	.1707 (13) p=.289	-.3823 (7) p=.199	.3953 (5) p=.255
Number of Previous BCLS Programs Taken	-.1501 (13) p=.312	.2330 (19) p=.169	.4069 (13) p=.084	.4471 (7) p=.157	-.4941 (5) p=.199

[a] 1 Subject did not indicate their age.

[b] Could not be calculated due to insufficient data.

(n) number of subjects.

* $p < .05$.

** $p < .01$.

TABLE 13

Product Moment Correlation Coefficient for BCLS Performance and BCLS Event History

BCLS Event History	3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
CPR Performance					
Number of Times Has Done CPR	.3146 (13) p=.184	.4031* (19) p=.044	.3280 (13) p=.137	-.1809 (7) p=.349	.6840 (4) p=.158
Number of Arrests Witnessed	-.5615* (13) p=.023	-.4952* (19) p=.016	-.3071 (13) p=.154	.3966 (7) p=.189	.5427 (4) p=.229
Recency of Last Time CPR Done-(Months)	-.4019 (10) p=.125	-.4417 (14) p=.057	-.3916 (9) p=.149	-.9690* (6) p=.001	.6145 (4) p=.193
Recency of Last BCLS Training	.2239 (11) p=.254	.2203 (16) p=.206	-.3293 (10) p=.176	.0888 (7) p=.425	.1437 (4) p=.428
OA Management Performance					
Number of OAs Witnessed	.1180 (12) p=.357	-.2521 (17) p=.164	-.4095 (11) p=.106	-.4542 (7) p=.153	-.1705 (5) p=.392
Number of Times had Managed an OA	.1075 (11) p=.377	.1714 (16) p=.263	-.1375 (10) p=.352	-.5045 (7) p=.124	.7906 (5) p=.056
Date of Most Recent OA Management (Months)	.1443 (9) p=.356	.2242 (14) p=.221	.2520 (8) p=.274	-.3345 (7) p=.232	.1468 (5) p=.407
Recency of Last BCLS Training (Months)	-.5170 (11) p=.052	-.3406 (16) p=.098	.1739 (10) p=.315	.1659 (7) p=.361	-.2742 (5) p=.328
OA Management During the Study	.1075 (11) p=.377	.1682 (16) p=.267	.1375 (10) p=.352	-.0269 (7) p=.477	a

[a] Could not be calculated due to insufficient data.

(n) Number of subjects.

* p/ < .05.

** p/ < .01.

TABLE 14

Product Moment Correlation Coefficients for BCLS Performance and Demographic Characteristics (Excluding Subject 73)

	CPR Performance				
Variable	3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
Age[a]	-.3215 (11) p=.167	-.4021* (18) p=.049	-.4828 (11) p=.066	-.0657 (7) p=.444	-.1297 (4) p=.435
Education-Nursing	.2447 (12) p=.222	.0109 (18) p=.483	.5011* (12) p=.048	.6038 (7) p=.076	b
Education-Nonnursing	b	b	b	b	.3015 (4) p=.349
Level of Employment	-.0188 (12) p=.477	-.2652 (18) p=.144	-.1156 (12) p=.360	-.6010 (7) p=.077	b
Position of Present Employment	-.1160 (12) p=.360	-.3108 (18) p=.105	-.8498** (12) p=.000	-.0913 (7) p=.423	b
Years Worked	-.7770** (12) p=.001	-.3700 (18) p=.065	-.5647* (12) p=.028	.4199 (7) p=.174	-.9636* (4) p=.018
Years Since Graduation	-.5040* (12) p=.047	-.3593 (18) p=.072	-.3221 (12) p=.154	.3600 (7) p=.214	-.9636* (4) p=.018
Specialty	.1310 (12) p=.342	.2316 (18) p=.178	.0201 (12) p=.475	-.2282 (7) p=.311	.0348 (4) p=.438
Number of Previous BCLS Programs Taken	-.2218 (12) p=.244	.2167 (18) p=.194	.5319* (12) p=.038	.3134 (7) p=.247	.5919 (4) p=.204

TABLE 14 CONTINUED

Variable	OA Management Performance				
	3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
Age[a]	-.3883 (12) p=.106	-.3283 (19) p=.085	-.6432* (12) p=.012	-.0845 (7) p=.431	.2852 (5) p=.321
Education-Nursing	.2942 (13) p=.165	.1750 (19) p=.237	.6748** (13) p=.006	.5517 (7) p=.100	b
Education-Nonnursing	.0748 (13) p=.404	-.2597 (19) p=.142	-.3841 (13) p=.098	b	-.6455 (5) p=.120
Level of Employment	.0748 (13) p=.404	-.3581 (19) p=.066	-.0270 (13) p=.465	-.0269 (7) p=.477	.3953 (5) p=.256
Position of Present Employment	-.4115 (12) p=.092	-.2306 (18) p=.179	-.5893* (12) p=.022	-.3475 (7) p=.222	b
Years Worked	-.6505* (12) p=.011	-.1065 (18) p=.337	-.2075 (12) p=.259	-.6394 (7) p=.061	.5810 (5) p=.152
Years Since Graduation	-.5068* (12) p=.046	-.1633 (18) p=.259	-.2087 (12) p=.258	-.6270 (7) p=.066	.5023 (5) p=.194
Specialty	-.3409 (12) p=.139	-.3907 (18) p=.054	.1508 (12) p=.302	-.3823 (7) p=.199	-.3952 (5) p=.255
Number of Previous BCLS Programs Taken	-.1327 (12) p=.431	.1832 (18) p=.233	.3376 (12) p=.142	.4471 (7) p=.157	-.4941 (5) p=.199

[a] 1 Subject did not indicate their age.

b Could not be calculated due to insufficient data.

(n) Number of Subjects

*p/ < .05.

**p/ < .01.

The relationship between BCLS performance and level of active employment

The hypothesis that there is no significant relationship between nurses' BCLS performance and their level of active employment could not be addressed because of insufficient data. That is, only six nurses worked part-time and none worked casual.

The relationship between BCLS performance and position of present employment

The hypothesis that there is no significant relationship between nurses' BCLS performance and their position of present employment was accepted. Analysis of the correlation coefficients (Tables 10 and 14) suggests that position of present employment and BCLS performance are not correlated.

The relationship between BCLS performance and prior BCLS training

The hypothesis that there is no significant relationship betweeen nurses' retention of BCLS skills and the total number of times they had had previous BCLS training was accepted. Analysis of the correlation coefficients (Tables 10 and 14) suggests that BCLS performance and the number of prior BCLS trainings are not correlated.

The relationship between BCLS performance and the recency of BCLS training

The hypothesis that there is no significant relationship between the recency of the last BCLS training (prior to the study) and BCLS performance was accepted. Analysis of the correlation coefficients (Tables 11 and 15) suggests that BCLS performance and the recency of BCLS training are not correlated.

The relationship between CPR performance and exposure to cardiopulmonary arrests

The hypothesis that there is no significant relationship between CPR performance and the number of exposures to cardiopulmonary arrests was accepted. Analysis

of the correlation coefficients (Tables 11 and 15) suggests that CPR performance and number of exposures to cardiopulmonary arrests are not correlated.

The relationship between obstructed airway management and the number of exposures to actual obstructed airway events

The hypothesis that there is no significant relationship between retention of OA managment skills and the number of exposures to OA events was accepted. Analysis of the correlation coefficients (Tables 11 and 15) suggests that OA management performance and number of exposures to OA events are not correlated.

The relationship between CPR performance and the number of times in real life CPR was actually performed

The hypothesis that there is no signficant relationship between CPR performance and the number of times in real life CPR had actually been performed was accepted. Analysis of the correlation coefficients (Tables 11 and 15) suggests that CPR performance and the number of times in real life CPR was actually performed are not correlated.

The relationship between obstructed airway management and the number of real life times obstructed airway was actually performed

The hypothesis that there is no significant relationship between OA management and the number of times in real life the skill had actually been performed was accepted. Analysis of the correlation coefficients (Tables 11 and 15) suggests that OA management and number of times in real life an obstructed airway had actually been managed are not correlated.

TABLE 15

Product Moment Correlation Coefficient for BCLS Performance and BCLS Event History (Excluding Subject 73)

BCLS Event History	3 Weeks	6 Weeks	9 Weeks	12 Weeks	18 Weeks
CPR Performance					
Number of Times Had Done CPR	.1727 (12) p=.296	.1021 (18) p=.343	.1787 (12) p=.289	.3581 (7) p=.215	.9400* (4) p=.030
Number of Arrests Witnessed	.2181 (12) p=.248	.1603 (18) p=.263	.0716 (12) p=.412	.3966 (7) p=.189	.5427 (4) p=.229
Recency of Last Time CPR Done (Months)	-.6395* (9) p=.032	-.6777* (13) p=.005	-.6297* (8) p=.047	-.9690** (6) p=.001	.6145 (4) p=.193
Recency of Last BCLS Training	-.1509 (12) p=.320	-.3793 (17) p=.067	-.6808* (11) p=.011	.0888 (7) p=.425	.1437 (4) p=.428
OA Management Performance					
Number of OAs Witnessed	-.1869 (12) p=.280	.1838 (18) p=.233	-.0066 (12) p=.492	-.0755 (7) p=.436	-.5379 (5) p=.175
Number of Times Had Managed an OA	.1350 (12) p=.338	.0457 (17) p=.431	-.0424 (11) p=.451	-.5054 (7) p=.124	.7906 (5) p=.056
Date of Most Recent OA Managed (Months)	-.0719 (10) p=.480	.0013 (15) p=.498	-.4560 (9) p=.109	-.3345 (7) p=.232	.1468 (5) p=.407
Recency of Last BCLS Training (Months)	-.4212 (12) p=.086	-.4223* (17) p=.046	-.3029 (11) p=.183	.1659 (7) p=.361	-.2742 (5) p=.328
OA Managed During Study	-.0977 (12) p=.381	.1938 (17) p=.228	.1671 (11) p=.312	-.0269 (7) p=.477	a

[a] Could not be calculated due to insufficient data.

(n) Number of subjects

* p/ < .05.

** p/ < .01.

The relationship between CPR performance and the recency of the last time CPR was actually performed.

The nypothesis that there is no significant relationship between CPR performance and the recency of the last time CPR was actually performed was rejected. Analysis of the correlation coefficients (Tables 11 and 15) suggests that CPR performance and the recency of the last time CPR was performed are negatively correlated.

The relationship between OA management and the recency of the last time an OA was managed.

The hypothesis that there is no significant relationship between OA management and the recency of the last time OA was managed was accepted. Analysis of the correlation coefficients (Tables 11 and 15) suggests that OA management and the recency of the last time an OA was managed are not correlated.

The answer to question B is that there does not appear to be a significant relationship between BCLS performance (retention) and age, educational level (nursing and nonnursing), position, area of work, prior BCLS training, number of exposures to, and participations in BCLS events, and recency of the last exposure to an obstructed airway. There does however appear to be a significant negative relationship between CPR performance and the recency of the last cardiopulmonary arrest. There also appears to be a significant negative relationship between the number of years worked and BCLS performance and number of years since graduation and BCLS performance (Tables 10 and 11, 14 and 15).

In addition to the analyses outlined in the original research proposal four further research findings were discovered. Firstly, it was noted by the instructor-trainers (research assistants) and the researcher that no matter how poorly a subject performed, the amount of time needed to return their level of performance to AHA standards was minimal. For CPR, usually one and no more than two reviews including return demonstrations (taking no more than 5 minutes) was all that was needed. Obstructed airway management took a little longer--approximately 8 to 10 minutes and involved an average 2 to 3 return demonstrations before a subjects' performance again reached AHA standards. The difference in time is probably explained by the fact that subjects had to relearn more intricate and time consuming skills when returning their OA management to AHA levels than they did when relearning their CPR.

Secondly, examination of the steps that were failed during CPR, shows that steps 5, 7, 8, and 14 were most often failed and steps 9 and 12 were least often failed (Table 16). As well, if subjects failed steps at more than one test period they were likely to fail the same steps over again. For example, subject number 70 at her 3 week test failed steps 14 and 16, at her 6 week test failed steps 11 and 16, and at her 9 week test failed steps 14 and 16.

TABLE 16

Frequency of Steps Failed in CPR Sequence

Step	Action	Freqeuncy
1	Shake and Shout	1
2	Allows sufficient time	7
3	Correct Body Alignment	5
4	Head Tilt	5
5	Adequate Assessment	10
6	4 Breaths	7
7	Pulse Check	11
8	Adequate Time Assessment	12
9	Proper Body Position	2
10	Landmark Check Each Time	4
11	Proper Hand Position	6
12	Vertical Compressions	1
13	Says Mnemonic Out Loud	5
14	Proper Rate	12
15	Proper Ratio	5
16	No Bouncing	7
17	Ventilates Properly	8
18	Check Pulse and Breathing After 4 cycles	5
19	Keeps Airway Open During Check	8

Thirdly, it was noted that during obstructed airway management all subjects remembered to assess the victim and do the four back blows. Subjects had the most problems with remembering to do either the chest thrusts and/or the abdominal thrusts and in particular finding the correct hand position. As well, subjects approached their CPR test with far more confidence than they did their obstructed airway test. They were less hesitant to start the rescue and seemed more sure of themselves when performing CPR.

Finally, it was realized that there was no discernable pattern to subjects' performance across the study. In other words, subjects' performances fluctuated across the various test periods. For example, subject number 23 scored 17/9 at 9 weeks (first retest), 17/9 at 3 weeks (second retest) and 11/19 at 6 weeks (last retest). It is curious that she was able to retain 17 steps of CPR over 9 weeks but only 11 steps over a period of 6 weeks.

CHAPTER 5

SUMMARY AND DISCUSSION

In this final chapter a summary of the study is presented, major conclusions are drawn and discussed, and implications for BCLS research and education are delineated.

To reiterate, past BCLS research has demonstrated that lay persons and health professionals (graduate nurses not examined) fail to meet AHA standards for BCLS performance as early as 3 months following training. Few studies have addressed how scheduled reinforcement influences BCLS skill retention. This study was designed to answer two questions: (a) after initial retraining to AHA standards, how long does it take for nurses' performance (on adults) to again drop below AHA levels, and (b) is there a relationship between BCLS skill retention and age, educational level, length of time nursing, level of active employment, prior BCLS training, exposure to BCLS events and participation in BCLS events. It was recognized that knowledge based on research about nurses' retention of BCLS skill and the variables linked to that retention would provide a valid base for decision making in the areas of BCLS education and research.

Skinner's (1969) conceptual framework (operant conditioning) guided development of the research questions and provided the focus for data collection and analysis. Skinner conceptualized that retention of a learned skill (for example, BCLS) can be predicted and controlled once the necessary reinforcers and reinforcement

schedule are identified. Thus, Skinner's theory of operant conditioning pointed the researcher in two directions.

First, before a reinforcement schedule can be determined, it is necessary to know when extinction of BCLS skills begins. In other words, before an educator can know when to reinforce BCLS skills they must know when students begin to loose those skills. Are nurses the same as populations already studied or is their extinction rate different?

Next, it interested the researcher to know if BCLS events (mock or real life scenarios) influence retention and could therefore be considered plausible sources of reinforcement.

To answer the research questions a pretest-posttest design using random assignment with the option of moving to a Latin Square Design was originally planned. Unfortunately, due to subject attrition the research methodology was changed to a pretest-postest design without random assignment.

Subjects were first trained in BCLS to level one, AHA standards. Data regarding their demographic characteristics and past experience with BCLS were collected. Subjects were then assigned to groups according to the amount of time elapsed (3, 6, 9, 12 or 18 weeks) between testings. Subjects who failed to meet AHA standards during retesting spent time with an instructor reviewing their performance until they were again able to meet AHA standards. At the end of the study data were collected updating each subjects' BCLS experience.

Data were separated as to the research question being asked and then analyzed. Chi square (when the data was pass/fail) and ANOVA (when the data were scores) were used to measure the relationship between time elapsed and BCLS performance. Biserial correlation coefficients (when the data were pass/fail) and product moment correlation coefficients (when the data were scores) were calculated to measure the relationships between subjects' demographic characteristics and their BCLS performance.

CONCLUSIONS

In view of the research findings the following conclusions can be drawn:

1. Some nurses trained to AHA, level one standards in BCLS will fail to meet that standard as early as 3 weeks after initial retraining.
2. Other nurses (from the same initial retraining groups) will still meet AHA standards (for adult CPR) 18 weeks after retraining.
3. The closer a nurse is to having just graduated from her RN program, the more likely it is that her BCLS performance will meet AHA standards. Perhaps linked to this conclusion, is the fact that nurses who graduated in the past 2 years have had mandatory BCLS training and recertification in their curriculum. Thus, it is plausible to suggest that years since graduation from RN training and BCLS performance may be indirectly linked to the recency of BCLS training.
4. A greater proportion of nurses tend to fail BCLS, at AHA level one standards, as time progresses from retraining. This trend is logical if one accepts the concept of recency as a factor in predicting BCLS performance.

5. As time between test-retest increases nurses tend to fail OA management more often than CPR, (Figure 5). Recency of exposure to the corresponding event (cardiac arrest or OA) does not account for this difference in failure rates (time elapsed since last OA event--X=10.4 months, SD=16.8 months, time elapsed since the last cardiopulmonary arrest--X=24.5 months, SD=27.7 months). In other words, on average, nurses' exposure to an OA was more recent than their exposure to a cardiorespiratory arrest; yet, they failed OA management more often than CPR.

One explanation might be that the sample is biased. That if a second, more substantial sample was tested there would be no difference in failure rates between CPR and OA management.

An alternate explanation is that the number of times the nurse has been exposed to the corresponding event may account for the difference in retention between skills. This is not to say that number of prior exposures to a BCLS event predetermines BCLS performance. Nurses' average number of witnessed arrests was 5.4 with a SD of 8.1, compared to an average of 1.6, SD of 4.6 for OA events. Nurses' average number of times actually doing CPR was 2.3, (SD of 4.5), compared to an average of 1.6, (SD--4.6) for management of an OA.

6. The number of times a nurse has had BCLS training, has witnessed a BCLS event, or has participated in a BCLS event is not predictive of BCLS performance.

7. Age, educational level and position also do not appear to be predictive of BCLS performance.

8. Area of work (general medical/surgical unit versus critical care unit) does not appear to be predictive of BCLS performance.

9. Finally, the more recent a nurses' exposure to, or participation in a real life cardiopulmonary arrest the more likely it was that her performance would meet AHA standards.

Small sample size and experimental mortality posed serious threats to the validity and potential reliability of the research conclusions. The research conclusions only address BCLS performance on adults (mannikins) in mock, test environments 3 to 18 weeks after retraining. In addition, the research conclusions are limited to volunteer nurses working in a hospital setting, on general medical/surgical or critical care units. As well, it must be remembered that data analyzed using correlational statistics measure degree of association and do not imply a causal relationship.

Nonethless, this study has provided futher evidence that research into BCLS retention is worthwhile. Examination of the original sample (n=49) demonstrates that nurses are called upon to do BCLS. Participation in cardiac arrests ranged from 0 (n=8) to over 100 (X=5.4, SD=7.9). Nurses had actually performed CPR a range of 0 (n=19) to 20 times (X=2, SD=3.7). Participation in OA events (sample size = 24) was less (range = 0 [n=14] to over 100, X=6.1, SD=20.3), as was actual intervention (range =0 [n=16] to 21, X=2.1, SD=5.0).

IMPLICATIONS FOR FUTURE RESEARCH

This study has provided further knowledge about BCLS retention. Were the author to attempt this study again she would change the methodology. Most noticeably, the author would not attempt to assign testing time frames, but rather allow subjects to choose a test sequence compatible with their personal and work schedules--a test sequence they would commit to. This decison would have to be balanced by the consequences of increasing the threat to internal validity (as subjects would no longer be randomly assigned to groups) within the study.

Surprisingly, shift work and days off did not seem to interfere with nurses returning for testing. The largest hinderances were resignation and vacation--factors that could be accomodated if subjects were allowed to choose their test sequence. Committment would need to be stressed to subjects upon volunteering, and if it could not be assured then the author would recommend replacing the subject.

Besides trying to reduce experimental mortality, the author would attempt to broaden the spectrum of nurses involved in the study. For example, the author would ask for nurses from more than one hospital and from other work environments (occupational and community agencies) to participate; thereby, increasing the generalizability of the research findings.

Furthermore, the author would substitute the word "observed" for the word "witnessed" on all the data collection tools. In nursing, "witnessed" is a jargon

word used to mean: a cardiopulmonary arrest that happens in the presence of nurse, and therefore the term became confusing to subjects.

There are many implications for future BCLS research that can be derived from this study. Further exploration of the relationships between recency and frequency of retraining and BCLS performance is indicated. As yet unclear is what, if any, the frequency of BCLS exposure, be it through training, or real life situations, has upon retention. If BCLS is practiced often enough does the retention curve alter its slope? Is there a saturation point beyond which retraining is no longer necessary?

Skill loss is also an area worthy of further investigation. Do subjects tend to fail the same steps over and over again? Do subjects performances deteriorate to a certain, perhaps predictable level, and then plateau? Or, does performance continue to deteriorate until the subject fails every step?

Reinforcement of BCLS skills to maintain performance is also an area worthy of further study. One interesting finding from this study was that between 5 and 10 minutes review with an instructor was all that was needed to return subjects' BCLS performance to AHA standards. Replication of this particular set of findings is necessary before program planning decisions related to recertification could be made.

IMPLICATIONS FOR BCLS EDUCATION FOR NURSES

More than sixty-eight percent of nurses in this study had participated in a cardiopulmonary arrest, fourty-two percent in managing an OA. These statistics lend credibility to the argument that nurses must be proficient in BCLS. Unclear is whether nurses, given their background, need the same kind and length of training and retraining programs as other populations. These are questions that must be answered by further research.

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REFERENCE NOTE

1. Tetreault-Callahan, A. (CPR Nurse Consultant--Justice Institute of British Columbia) interview, 24 February, 1985.

APPENDIX A

MULTIFACETED ADVERTISING PROGRAM

APPENDIX A

Multifaceted Advertising Program

1. The research proposal was presented to all Head nurse groups at the hospital. At that time, each Head Nurse was supplied with recruitment letters for each member of their nursing staff (excluding Nursing Unit Clerks), (Appendix B).

2. Posters were placed on all appropriate bulletin boards throughout the hospital by Public Relations and a notice was placed in the hospitals newsletter (Appendices C and D).

APPENDIX B

RECRUITMENT LETTER

APPENDIX B

Recruitment Letter

Retention of BCLS Skills by Nurses Following Retraining

To Members of the VGH Nursing Staff:

My name is Kelly Gill, I am a Registered Nurse and at present I am a student in the Master of Adult Education Program at the University of British Columbia. I am doing a study to evaluate the effectiveness of Basic Cardiac Life Support training programs in helping nurses to cope in cardiac arrest situations.

From my experience in working on general surgical units and from my reading I have found that most nurses would like to be better prepared to cope in a cardiopulmonary arrest.

I would like you to participate in a BCLS Level II certification course, and two or three review classes (of approximately one hour each). All programs will be offered to you free of charge. Information about any past CPR training you have and your experience with cardiac arrests will be collected. Please note, previous experience is not required.

All information received from you will be confidential and will be grouped so that individual contributions will not be indentifiable. To receive your certification documents, your name will need to be submitted to the Justice Institute of British Columbia. No names will be included in my report. Your decision to

APPENDIX C

BCLS PROGRAM POSTER

APPENDIX C

BCLS Program Poster

BASIC CARDIAC LIFE SUPPORT LEVEL II COURSES

NO REGISTRATION FEE

NO PREVIOUS TRAINING NEEDED

NURSES NEEDED TO PARTICIPATE IN RESEARCH EXAMINING RETENTION OF BCLS SKILLS

You will be asked to complete a BCLS certification program plus 3 short (approximately 20 minute) review programs given at spaced intervals.

DATES: for BCLS Certification Programs

DECEMBER 13, 16, 18 or 20th

Dates for review classes will be announced at the BCLS course.

PLACE: HOSPITAL, specific location TBA

For further details ask your Head Nurse or phone: 3043

TO REGISTER PHONE: 3043

THANK YOU FOR YOUR SUPPORT OF THIS NURSING RESEARCH PROJECT

KELLY GILL

APPENDIX D

NEWSLETTER ANNOUNCEMENT

APPENDIX D

Newsletter Announcement

CPR

BCLS LEVEL II Certification courses will be held December 13, 16, 18 and 20. These courses are free. Volunteer nurses are needed to participate in a study examining learning of CPR skills. Volunteers will also be expected to participate in 2 or 3 review classes and provide a history of their experience with CPR. NO previous experience is necessary. For further information, or to register call local 3043.†

---

†VGH Information Bulletin. October 11, 1985, p. 1.

APPENDIX E

REMINDER LETTER ONE

APPENDIX F

REMINDER LETTER TWO

APPENDIX G

REMINDER LETTER THREE

APPENDIX H

REMINDER LETTER FOUR

APPENDIX I

NEWSLETTER REMINDER

APPENDIX I

Newsletter Reminder

KELLY GILL'S RESEARCH PROJECT,

Kelly Gill would like to thank all those who have participated in her research project. The last review class is scheduled for either May 14th or 16th from 1400--1600 hours in Room 9A of the VGH Residence. Participants are asked to drop in, it takes only 15 minutes. Even those who have missed all the review classes so far are asked to attend. Your contribution is crucial to the validity of this study. For further information, call Kelly Gill at Local 2838.†

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†VGH Information Bulletin. May 7, 1986, p.2.

APPENDIX J

AHA PERFORMANCE TEST FOR ONE PERSON CPR

APPENDIX J

AHA Performance Test for One Person CPR

Retention of BCLS Skills by Nurses Following Retraining

AMERICAN HEART ASSOCIATION

CARDIOPULMONARY RESUSCITATION AND EMERGENCY CARDIAC CARE

PERFORMANCE TEST FOR ONE RESCUER CPR (Level One)

NAME:---------- CODE:----------

DATE:----------

Elapsed Time Min	Max.	Activity and Time (Seconds)	Critical Performance	P	F
4	10	Establish unresponsiveness and call out for help. Allow 4-10 sec. if face down and turning is required.	Tap, gently shake and shout "Are you OK?" Call out--"Help!" Turn if necessary.		
			Adequate time		
7	15	Open airway. Establish breathlessness. (Look, Listen, and Feel) (3 - 5 sec.)	Kneels properly		
			Head tilt with one hand on forehead and neck lift or chin lift with other hand.		
			Ear over mouth, observe chest. (time element)		
10	20	Four Ventilations (3 - 5 sec.)	Ventilate properly 4 times and observe chest rise.		
15	30	Establsih pulse and simulate activation of EMS system (7-10sec.)	Fingers palpate for pulse on near side (other hand on forehead maintains head tilt		

Elapsed Time Min	Max.	Activity and Time (Seconds)	Critical Performance	P	F
			Adequate time		
69	96	Four cycles of 15 compressions, 2 ventilations (54-66 sec.)	Proper body position		
			Landmark check each time		
			Position of hands		
			Vertical compression		
			Says mnemonic out loud		
			Proper rate		
			Proper ratio		
			No bouncing		
			Ventilates prpperly		
72	101	Check for return of pulse and spontaneous breathing. (Pupil check optional (7 - 10 sec.)	Check pulse and breathing. If no pulse, resume one cycle of ventilations and compressions.		
			Keep airway open during check		

Number of compressions 60 Number of Ventilations 12

Instructor_____

(check) Pass_____ Fail_____

Copied from: AHA A Manual for Instructors of Basic Cardiac Life Support, p.75.

APPENDIX K

AHA PERFORMANCE TEST FOR OA MANAGEMENT

APPENDIX K

AHA Performance Test for OA Management

Retention of BCLS Skills by Nurses Following Retraining

AMERICAN HEART ASSOCIATION

CARDIOPULMONARY RESUSCITATION AND EMERGENCY CARDIAC CARE

PERFORMANCE TEST FOR OA MANAGEMENT (Level One)

NAME:---------- CODE:----------

DATE:----------

Elapsed Time Min.	Max.	Activity and Time (Seconds)	Critical Performance	P	F
2	3	Rescuer asks: "Can you speak?"	Rescuer must identify complete airway obstruction by asking victim if she is able to speak		
			Gain control of person. eg. grasp under axilla to opposite shoulder.		
5	8	4 Back Blows*	Send for help		
			Deliver 4 sharp blows rapidly and forcefully to tha back between the shoulder blades; support the victims's chest with other hand. Victim's head is down.		

Elapsed Time Min.	Max.	Activity and Time (Seconds)	Critical Performance	P	F
9	13	4 Abdominal Thrusts (4 - 5 sec.) followed by:	Stand behind victim and wrap your arms around. Grasp one fist with your other hand & place thumb side of your fist in the midline between the xiphoid process & umbilicus; below the rib cage. Press fist into abdomen with quick inward and upward thrusts.		
		4 Chest Thrusts (4 - 5 sec.) Order of chest thrusts and abdominal thrusts immaterial Must do a min. of 2 sets of each	Stand behind victim & place your arms under victim's armpits to encircle the chest. Landmark as if for CPR & then go up 1½ to 2 inches. Grasp one fist with other hand and place thumb side of sit on breastbone. Press with quick backward thrusts.		
			Reassess victim		
			Counsel victim to visit Dr.		

Note. Although the above sequence of back blows followed by manual thrusts is preferred, the reverse sequence of manual thrusts followed by back blows is acceptable.

Copied from: AHA A Manual for Instructors of Basic Cardiac Life Support, p. 78.

APPENDIX L

PROGRAM ANNOUNCEMENT

APPENDIX M

CONSENT FORM

APPENDIX M

Consent Form

Retention of BCLS Skills by Nurses Following Retraining

I, the undersigned, agree to participate in a study that is designed to evaluate learning of Basic Cardiac Life Support Skills. I understand that this study is under the direction of Mrs. Kelly Gill (phone .....).

I agree to participate in a Basic Cardiac Life Support Course, free of charge, and, on later dates, to participate in two or three Basic Cardiac Life Support review courses, of approximately one hour each.

I understand that my performance throughout the study is confidential, but that my name will be submitted to the Justice Institute of British Columbia so that I may receive my certification documents. All information received from me will be coded and any reference to me will be destroyed following the study. I understand that the data will be grouped so that individual contributions will not be identifiable.

I understand that information obtained in the study will be written in a paper and shared with colleagues in the health disciplines, but my name will not appear in any place and that reference to me will be destroyed when the study is complete.

I understand that I may refuse to participate or withdraw from the study at anytime without affecting my current or future employment.

All my questions have been answered. I may ask questions during the study.

I acknowledge receipt of this consent form and I consent to participate in this study.

Date:---------- Signature:----------

Witness:----------

APPENDIX N

STATEMENT TO PRECEDE THE DEMOGRAPHIC DATA COLLECTION

APPENDIX N

Statement to Precede the Demographic Data Collection

Retention of BCLS Skills by Nurses Following Retraining

The Demographic Data Collection Tool will be completed at the beginning of the BCLS training program. Subjects will each be given a copy of the attached questionnaire. The following statement will then be read to the subjects.

Hello, my name is Kelly Gill and I am the person conducting this study. I would like you to complete the questionnaire that has just been handed out. The purpose behind this questionnaire is to try to identify if nurses with different backgrounds have different learning needs regarding BCLS. I would like to remind you that your decision to participate in this study or to not participate, will not affect your current or future employment and that you are free to withdraw from the study at any time. I have collected all your consent forms and will further assume your consent if you complete this questionnaire.

To ensure the confidentiality of your answers, your name will be removed from the questionnaire once I have assigned you a code number. This same procedure will be followed for your BCLS score sheets. Only I have access to the sheet that identifies you with your code number and this sheet will be destroyed once the study is complete. Please note: my name and telephone number are printed on the blackboard at the front of the class. Are there any questions?

APPENDIX O

DEMOGRAPHIC DATA COLLECTION

APPENDIX O

Demographic Data Collection Tool

Retention of BCLS Skills by Nurses Following Retraining

Code:_____ Name:_____

BACKGROUND INFORMATION		
Sex	M	F
Age at last birthday		

PRESENT EMPLOYMENT: Primary Area of Responsibility (check one box only)	
Direct Patient Care	
Medical/Surgical General	
Critical Care, eg. ICU, PAR, ER, WCTU, CCU	
Psychiatry	
Family Practice	
Long Term Care	
General Practice, ie. float to all areas	
Operating Room	
Other, specify	
Education	
Clinical Specialist	
Inservice Education	

Administration

Nursing Services Administration	
Nursing Education Administration	
Other Administration, specify	

PRESENT EMPLOYMENT: Position (check one box only)	
Director	
Supervisor/Assistant Supervisor	
Clinical Specialist/Clinician	
Head Nurse/Assistant Head Nurse	
Staff/General Duty Nurse	
Instructor	
Other, specify	

KIND OF EMPLOYMENT: (check one box only)	
Full-time	
Part-time	
Casual	
Date commenced employment at hosptial (month and year)	
Years/Months worked since Graduating from basic licensing program eg. RN	

EDUCATION: (check one box only in each section)
Nursing LPN/Orderly Training Certificate
RN Certificate
Post RN Certificate/Diploma
Baccalaureate Degree
Master's Degree
None of the above
Other than Nursing Certificate/Diploma
Baccalaureate Degree
Master's Degree
None of the above

1. To the best of your recollection, HOW MANY TIMES have you:

   attended a program or inservice on CPR?----------

   actually practiced CPR?----------

2. To the best of your recollection, HOW MANY

   cardiopulmonary and/or respiratory arrests have you witnessed?----------

   Of this number (mark N/A if you have never seen an actual arrest), in HOW MANY CASES did you actually do CPR?--------

Researcher: Kelly Gill, phone .....

APPENDIX P

BCLS COURSE OUTLINE

APPENDIX P

BCLS Course Outline

		Who	Time
1.	Registration sign in on form hand in consent form pick up name tag pick up dates for review classes	Researcher	0745-0810
2.	Introduction thank participants introduce instructors discuss handling of questions, location of bathrooms, smoking policy, no coffee breaks review course outline	Researcher	0810-0820
3.	Demogrpahic Data Collection read statement handout and collect questionnaires	Researcher	0820-0840
4.	One Person CPR Videotape	Researcher	0840-0850
5.	Use of mannikins discuss cleaning, colds, cold sores, lipstick, gum, candy, lightboxes, tapes (not to be used unless OKed by instructor)	Researcher	0850-0900
6.	One Person CPR	Instructors	0900-1000
7.	Demonstration of 2 Person CPR	Instructors	1000-1010
8.	Practice of 2 Person CPR	Instructors	1010-1040
9.	Demonstration of Change-over	Instructors	1040-1050
10.	Practice of 2 Person CPR with change-over	Instructors	1050-1130
11.	Lunch		1130-1215
12.	Practice of One and Two Person CPR Discussion of Risk Factors	Instructors	1215-1300

13. Demonstration of Conscious OA	Instructors	1300-1310
14. Practice	Instructors	1310-1330
15. Split into 3 groups		
A.--will go over written test	Groups will rotate between experiences	
B.--will go over unconscious adult with an obstructed airway		
C.--will do baby, infant CPR and management of the OA for same	Instructors will remain at 1 station	1330-1530
16. Thank for the day Read statement	Researcher	1530-1535

APPENDIX Q

STATEMENT TO BE READ AT THE END OF THE BCLS PROGRAM

APPENDIX Q

Statement to be Read at the End of the BCLS Program

The validity of the data collected in this study is extremely important. Future BCLS program decisions may be based on the results collected. Therefore, it is very important that the performance you provide in your future review classes be free from bias. Practicing or reviewing the material covered today, between review classes could jeopardize the truthfulness of the data. So please do NOT practice or review material from now until the end of the study.

We also ask you to NOT discuss any details of the study with your colleagues until after the study is over.

APPENDIX R

REVIEW CLASS SCHEDULE

APPENDIX R

Review Class Schedule

To:----------

Regarding: Nursing Research Study on BCLS

The dates for your review classes are:

1. ----------
2. ----------
3. ----------

These classes will last anywhere from 15 to 45 minutes. They will work on a drop-in basis from 1400 to 1600. Meaning, that anytime between 1400 and 1600, whatever is most convenient to you, you can come in for your review. I recognize that your work schedule will dictate your availability but hope that you will make every effort possible to attend the review classes. If you do not participate in the review classes the results of the study will not be as meaningful as they could be.

In the review classes you will again be tested on your BCLS skills and will have an opportunity to practice your skills with the help of an instructor.

The review classes will be in classrooms 9A and 10 in the VGH Residence (the same place as before).

APPENDIX S

DEBRIEFING FORM

Debriefing Form

An Experiment Examining Retention of BCLS Skills by Nurses Following Retraining

Name:---------- Code:----------

1. HOW MANY Obstructed Airways have you:

   (a) witnessed?----------

   (b) assisted in?----------

   Of this number, HOW MANY occured WHILE this study has been in progress? (between December 1985 and now)----------

2. Since the Beginning of this study in December 1985, HOW MANY respiratory or cardiac arrests have you:

   (a) witnessed?----------

   (b) performed CPR in?-------

3. WHEN was the last arrest you witnessed and/or participated in?----------
   Mark N/A if you have never witnessed or participated in a real cardiac or respiratory arrest.

4. WHEN was the last obstructed airway you witnessed and/or participated in?----------

5. Prior to the beginning of this study,WHEN was your last CPR training?----------

6. Since the beginning of this study, have you, at anytime, reviewed and/or practiced the course materials/content?-----

If your answer was yes, please describe what you did and the amount of time involved.

_____

_____

7. Since the beginning of this study, have you, at anytime, discussed any part of this study with any other participants? ----------

If your answer was yes, what did you discuss?

_____

_____