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Retention of Cognitive Skills in Advanced Cardiac Life Support Training

Sangeeta Srivastava Mathur
Walden University

Walden University

College of Education

This is to certify that the doctoral study by

Sangeeta S. Mathur

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Review Committee
Dr. Mary Ramirez, Committee Chairperson, Education Faculty
Dr. Earl Thomas, Committee Member, Education Faculty
Dr. Elsa Gonzalez, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2020

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Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Respiratory therapists (RTs) and registered nurses (RNs) who work at a local hospital in the state of Maryland have expressed difficulty retaining the knowledge required to renew their advanced cardiac life support (ACLS) certification. The retention of skills is very important in responding to a life-threatening event, such as cardiac arrest. The ACLS is a key clinical competency for these clinicians, suggesting a need to understand how their retention and learning can be improved. Accordingly, the purpose of this qualitative study was to better understand the factors that may affect RNs and RTs in learning and retaining knowledge and skills needed to renew the ACLS recertification. The conceptual framework was based on Kolb's experiential learning and Gurbin's information-processing theory. The research questions focused on the difficulties that RTs and RNs described in retaining the knowledge and skills from the ACLS recertification course and the strategies that RTs and RNs perceive in helping them to retain the knowledge and skills. The study was carried out through in-person, qualitative semistructured interviews with 5 RTs and 5 RNs. Interview data were analyzed through qualitative thematic analysis. As a result, there were themes developed and the outcome was that regular training and recertification in the knowledge and skills required to provide safe, effective care is essential. The study promotes social change by giving an opportunity to healthcare providers to practice and translate evidence-based practice into clinical practice. The results revealed that in order to successfully retain cognitive skills, educational programs need to be improved to enhance patient outcomes from better ACLS retention.

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APA 6

Dedication

I dedicate my project study to my family and friends. A special feeling of gratitude to my loving parents, the late Dr. K.P. Srivastava and late Kusum Srivastava, have been my pillars of strength and their unwavering trust in me till their last breath. My sisters, Namrata and Shweta, have been a source of strength. My husband, Sunil Mathur, my son, Saahil Mathur, and my two fur babies, Sosa and Snoopy, who never left my side, for their endless support, love, and understanding. I dedicate this work and give special thanks to my life mentor, Manju Varma whose words of encouragement and perseverance ring in my ears. My family's unwavering patience and understanding has allowed me to attain my personal goals. I also dedicate this project study to my many friends who have supported me throughout the process. I will always appreciate all they have done for me. Without my family and friends' constant love and support, this amazing accomplishment would not have been possible.

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Section 1: The Problem

Respiratory therapists (RTs) and registered nurses (RNs) who work at a local hospital in the state of Maryland have expressed difficulty in retaining the knowledge required to renew their advanced cardiac life support (ACLS) certification with the existing educational training. According to the project site administrators, the problem reported by 60% to 70% of the RTs and RNs at this location is that over time, they do not remember the material needed for ACLS following the 1-day class. Indeed, project site administrators at the study site reported that 30% of RNs and 70% of RTs said they prefer a 2-day renewal class because they cannot recall the information needed to renew their ACLS license. Difficulty expressed by the RTs and RNs in retaining information given during the class represents a larger problem because they are unable to pass the exam to renew their ACLS license required to continue practicing, according to project site administrators at the study site. The completion of a 1-day renewal ACLS class, therefore, may not ensure long-term knowledge or proficiency.

Performance and competency maintenance are challenging in the context of dynamic, complex acute care hospital settings (Scott & Mensik, 2010). While this challenge is not new, it is receiving a great deal of attention as third-party payers and healthcare reformers are pushing the healthcare providers to improve patient outcomes and reduce the length of stay. Regular training and recertification in knowledge and skills is required to in order provide safe, effective care. At the local hospital, there is currently a 2-year gap between certification training periods. When RNs and RTs initially undergo

education trained in ACLS—which requires remembering, reasoning, analyzing, calculating, problem-solving, critical thinking, and self-evaluation skills—they are expected to attend a 2-day class, after which they are only required to participate in a 1-day training class every 2 years to renew their licenses by passing the recertification exam. Currently, the ACLS license is an instructor-led training course that provides RTs and RNs with information concerning the identification, care, and treatment of cardiac arrest, acute dysrhythmia, stroke, and acute coronary syndrome, in addition to other material.

According to previous researchers, retention problems related to the ACLS recertification course are an issue experienced by healthcare providers and institutions across the country (McEvoy et al., 2014). In the present study, the focus was on an institution in Maryland State. However, little is known about why the local RTs and RNs have difficulty in retaining the knowledge needed to pass the required exam. It may be that the educational practices used in the training contribute to this lack of knowledge retention (Nambiar, Nedungalaparambil, & Aslesh, 2016; Rajeswaran, Cox, Moeng, & Tsima, 2018). Further study was needed to better understand how the teaching and learning techniques used in the local healthcare institutions are perceived by participants to best meet their learning needs and long-term retention and practice. Furthermore, the results of this study may help practitioners in the field to better understand why they are encountering difficulty on retaining or developing a deep conceptual understanding of information needed to pass the ACLS recertification exam.

Rationale

One of the most critical objectives of the American healthcare industry is meeting the required standards of patient safety (Ratnapalan & Uleryk, 2014). The standards associated with the ACLS license are observed as the established protocol for patient care (McEvoy et al., 2014). Healthcare providers must be competent professionals who are appropriately skilled to hold their positions (Ratnapalan & Uleryk, 2014). It is essential, therefore, to maintain the knowledge and skills needed for ACLS in order to deliver high-quality care. The American Safety and Health Institute (ASHI:n.d.), however, has stated that 25% of healthcare professionals failed electrocardiogram (EKG)—a test that calculates the electrical activity of the heart—written tests in the ACLS renewal class. Moreover, 30% of healthcare professionals need help determining which medications to administer to patients, particularly during their ACLS renewal (ASHI, n.d.).

The process of retaining information is arguably critical in all fields. In the context of healthcare, such retention could mean the difference between life and death. Even though the healthcare industry is constantly changing, RNs and RTs must remain up-to-date with their knowledge and practice to best serve patients. Smithey (2019) stated that a dynamic, constantly adapting curriculum is needed for healthcare professionals to retain their skills. This pattern holds true when it comes to ACLS certification and renewal courses. Comprehending the variables that may influence the classroom learning in the hospital environment is an important step towards creating effective clinical education for achieving optimal outcomes.

The purpose of this qualitative study was to better understand the factors that affect RNs and RTs in learning and retaining the knowledge and skills needed to renew the ACLS recertification. Better understanding of the training techniques that have proven successful for participants, coupled with information from participants in the areas of difficulty associated with retaining information from the course, may provide a better understanding of the overall issue and may affect how the ACLS course is taught in the future. This deeper understanding of factors concerning learning and strategies of teaching could be valuable for creating a more effective education for RNs and RTs, which is ultimately associated with the betterment of the patients' health prospects.

Definition of Terms

Advanced cardiac life support (ACLS): ACLS refers to a group of approaches used to treat life-threatening cardiac conditions quickly and effectively (Rajeswaran et al., 2018).

Cardiopulmonary resuscitation: Cardiopulmonary resuscitation is one of the key outcomes that ACLS addresses. It refers to the combination of chest compression with ventilation to preserve brain function and prevent brain death from loss of blood/oxygen flow (Waldron et al., 2016).

Respiratory therapists: RTs are medical personnel who specialize in the pulmonary systems (Hess, 2017).

Significance of the Study

The results of this study may provide a better understanding of the factors involved in deep learning that leads to long term retention and practice of knowledge and skills that is taught during the educational training course for ACLS certification among critical care RNs and RTs. According to the American Heart Association (AHA), about 2,300 Americans die from cardiovascular disease every day (approximately 840,000 annually), while coronary heart diseases account for one out of every seven deaths nationwide (as cited in Benjamin et al., 2018). The information collected from this study may help educators in designing effective educational training to ensure that RNs and RTs are equipped to not only pass the recertification exam but also to practice what they have learned when caring for patients presenting with these conditions, thereby providing high quality, highly trained professionals who are up-to-date with necessary information.

Research Questions

In alignment with the problem and the purpose of the project, I sought a better understanding of the perceptions of RNs and RTs who have participated in the 1-day recertification class for ACLS. To accomplish this, I developed research questions (RQs) surrounding the difficulties RNs and RTs have in retaining knowledge and skills needed to pass the recertification exam and what strategies they believe could help them be successful.

Research Question (RQ)1: What difficulties do RNs and RTs describe in retaining the knowledge and skills from the ACLS recertification course?

RQ2: What strategies or learning environments do the RNs and RTs perceive would be most effective to help them retain the knowledge and skills needed to pass the ACLS recertification exam?

Review of the Literature

To inform the study and offer insight into the larger scholarly context surrounding the problem, I carried out a review of the scholarly and practical literature. Over the course of this review, I drew upon resources, including the Walden University Libraries, PubMed, and Google Scholar. The literature search was carried out using keywords including *ACLS, cardiac, certification, recertification, respiratory therapy, respiratory therapist, nurse, registered nurse, training, course*, and appropriate combinations thereof. The following review provides an overview of the broader problem within the literature.

Conceptual Framework

The conceptual framework of this study was based upon two theories: experiential learning and information-processing theory. Kolb and Kolb's (2005) experiential learning theory represent a four-stage cycle comprised of learning as a process by which knowledge is created through the transformation of experience. These four stages of learning include (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation (Kolb & Kolb, 2005). Concrete experience provides the basis for learning, whereby the learner has the experience, either in real life or in a simulated manner (Kolb & Kolb, 2005). Reflective observation refers to the process in which a personal internally reviews and analyzes on a prior experience

to make sense of it (Kolb & Kolb, 2005). Abstract conceptualization occurs when the learner develops reasoning as to why the action occurred and understands the situation (Kolb & Kolb, 2005). Active experimentation requires developing solutions from the concepts learned and applying them (Kolb & Kolb, 2005). The RNs and RTs in this study had the prior experience of ACLS recertification class. According to Sewchuk (2005), experiential learning is a continuous process in which knowledge is created by transforming experience into existing cognitive frameworks, thus changing the way a person thinks and behaves.

Gurbin's (2015) information-processing theory provided part of the conceptual framework for this study. The information processing theory was the framework that underpinned this study. The information processing theory includes the facets of sensory and memory response, focus, pattern acknowledgement, working memory, coding, recall, and long-term memory (Gurbin, 2015). Gurbin stated that the processes of when humans learn, interpret, remember, and recall information are similar. This information-processing model involves the following steps, according to Gurbin:

1. Information is collected through the senses, otherwise known as sensory memory.
2. Sensory memory is accrued when a person pays attention to a subject or stimuli and recognizes patterns.
3. Attention and pattern recognition lead to the development of working memory.
4. Working memory is subject to ongoing coding and recall processes, which leads to long-term memory. Through a constant process of coding and recall, taking

place with working memory, it becomes long-term memory. This phase is ongoing.

Information processing theory is relevant and pertinent to the present study because it provided a framework by which to understand how long-term memory is accrued, and perhaps could be used as a basis by which to develop effective training programs. In ACLS, the memory combines new material with old material to present and interpret the information collected in a new way. According to Gurbin (2015), it can be obvious knowledge of information we retain, and knowledge of specific events, including the time and place. In order to couple information with theory, humans need to combine theory with prior research, which directly leads to practical use. RNs and RTs should be able to synthesize and integrate the data to form new concepts or behaviors. By identifying potential factors that may obstruct this path of recognition and process, the application could indicate areas of additional strategic focus when developing the ACLS certification program. The identification and understanding of the impediments in retaining the knowledge and skills required to recertify the ACLS license is the first step in creating more effective education for RNs and RTs in the local hospital setting.

Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation is one of the key outcomes that ACLS addresses. The existing body of literature offers some insights into this outcome. Nambiar et al. (2016) studied the effectiveness of basic and advanced cardiac life support (BLS/ACLS) methods to revive unresponsive patients. The results of the study, which involved 461

healthcare professionals, indicated the professionals lacked the necessary knowledge of BLS/ACLS information, revealing a gap in current training methods that requires research attention (Nambiar et al., 2016). This gap helps to set up the need for the current study. Similarly, Sutton, Nadkarni, and Abella (2012) discussed new approaches to improving cardiac arrest resuscitation performance are reviewed. The focus was on a continuous quality improvement paradigm highlighting improving training methods before actual cardiac arrest events, monitoring quality during resuscitation attempts, and using quantitative debriefing programs after events to educate frontline care providers (Sutton et al., 2012).

One approach that Waldron et al. (2016) suggested to improve training for cardiopulmonary resuscitation is video-based education. These researchers argued that there is inadequate documentation of the decision-making process going into cardiopulmonary resuscitation and tested a video intervention to improve that documentation and the decision-making process itself in terms of escalation of care (Waldron et al., 2016). Researchers have also examined different approaches to resuscitation, such as Kim, Kim, Lee, Ahn, and Lee (2016), who compared traditional and extracorporeal resuscitation, finding that the extracorporeal approach has better outcomes at the 3- to 6-month mark, although this was an unclear overall effect. Conrad, Bridges, Kalra, Pietsch, and Smith (2017) also examined extracorporeal resuscitation amongst patients with structurally normal hearts, concluding that the factors associated with an increase in mortality included “neurologic complications, pulmonary

hemorrhage, disseminated intravascular coagulation, CPR, pH less than 7.20, and hyperbilirubinemia after CPR cannulation" (p. 781). In a systematic review by Holmberg et al. (2018) that included 25 observational studies, the authors found no evidence for or against the use of an extracorporeal approach.

ACLS

As I alluded to above, ACLS refers to a group of approaches used to treat life-threatening cardiac conditions quickly and effectively (see Nambiar et al., 2016). ACLS involves the management of many vital systems of the body, including the cardiac system and the respiratory systems. Given that such management could easily be lethal if executed incorrectly, the usage of ACLS requires qualification and certification. Researchers have previously examined the effects of such certification measures on actual outcomes. For example, Lockey, Lin, and Cheng (2018) studied the effect of prior resuscitation team ACLS training on patient outcomes in resuscitation. These authors adopted a meta-analysis technique, including the data and results from eight prior observational studies and no randomized control trials (Lockey et al., 2018). Through their meta-analysis, they found that such training was significantly related to the return of spontaneous circulation, with an odds ratio of 1.64, but that there was no significant relative effect of the training on patient survival until discharge (Lockey et al., 2018). The findings of one of the eight studies included in the meta-analysis indicated a significant and strong effect (odds ratio of 7.15) of ACLS training on patients' 30-day survival (Lockey et al., 2018).

The study of Morgenstern, Heitz, and Milne (2018) produced fewer encouraging results, albeit ones partially in line with those of Lockey et al. (2018). Morgenstern et al. (2018) focused on comparing ACLS with basic cardiac life support in the case of patients who had suffered cardiac arrest outside the hospital setting, with the outcome being survival to hospital discharge. These scholars found no significant difference between emergency medical service crews trained in ACLS and those trained in only BLS (Morgenstern et al., 2018). In both cases, about 10% of the patients survived until release or discharge (Morgenstern et al., 2018). That overall rate, however, illustrates the overall severity of attempting to resuscitate patients who go into cardiac arrest outside of the hospital. It also does not encapsulate data regarding whether ACLS helps to immediately resuscitate a patient given that most patients under such conditions will die at some point in the process, The immediate and 30-day results that Lockey et al. documented suggest that ACLS may help patients better survive the immediate danger, but that it cannot forestall the long-term perils associated with cardiac arrest.

Furthermore, other researchers have argued that ACLS-trained nurses perform better than senior nurses without ACLS training in the hospital care context (Blaney, 2016), which is distinct from the use of ACLS examined by Morgenstern et al. (2018). Another factor complicating the use of ACLS is that the actual set of techniques used in the approach changes over time. For example, Panchal et al. (2018) published an update from the AHA advising clinicians on the state-of-knowledge regarding the efficacy of antiarrhythmic medications. These authors concluded with an updated recommendation

that “providers may consider either amiodarone or lidocaine to treat shock-refractory ventricular fibrillation/pulseless ventricular tachycardia cardiac arrest” (Panchal et al., 2018, p. 740). The use of such frequent updates is illustrative of the need for ongoing recertification training, which is not merely to retrain clinicians in existing techniques but also to ensure that their ACLS knowledge is up-to-date.

The degree of training necessary for procedures such as ACLS and the amount of key knowledge is significant enough that some have attempted to create technical support systems to assist clinicians in their use of ACLS. For example, Crabb et al. (2018) developed and reported on the testing of such a system, the Clinical Decision Display System, a web-based app designed to help with ACLS-related decision-making. To test this system, Crabb et al. followed multiple teams through ACLS simulations with and without the support app for 14 months. The results showed that the use of the app increased measures of effective ACLS application regarding the timing, accuracy, and precision of epinephrine administration (Crabb et al., 2018). Ninety-eight percent of the participants reported a willingness to use the app were it to be approved for clinical usage (Crabb et al., 2018). These results support the significant amount of information that goes into ACLS and the corresponding retention demands on clinicians.

Education and Skill Retention

The education of RNs and RTs is key to safe practice, given the many key roles that these professionals play in the hospital setting. Emphasizing the importance of this education, Maryniak, Markantes, and Murphy (2017) conducted a study of nurses

working for a 561-bed nonprofit hospital in Arizona, which had a turnover rate of 19% for nurses with 3 years of experience or less. The results indicated that not only do new nurses require support, but they need to be provided with the necessary education to perform highly in their positions. Serving as a template for outcomes in this regard are certain key leading programs. For example, Smithey (2019) provided information, as determined by the United States Department of Health and Human Services, about the development of a training program, known as the Nurse Education, Practice, Quality and Retention (NEPQR)-Registered Nurses in Primary Care (RNPC) program designed to train RNs to the full extent of their positions. The NEPQR-VNPC training program exists as an extension of NEPQR-RNPC designed for undergraduate nursing students who are both veterans and RNs. The standards set forth by the NEPQR-VNPC training program is relevant to the present study because the programs' three objectives include education, practice, and retention.

Other researchers have evidenced a need for greater effort to ensure knowledge and skill retention. For example, Rajeswaran et al. (2018) studied 85 nurses in three Botswana hospitals concerning their knowledge of cardiopulmonary resuscitation measures. The results indicated that 48% of nurses were unaware of the necessary life support (BLS) steps required following cardiac arrest. A posttest was conducted after the study and 6 months after the posttest, and the retest indicated that nurses' scores dropped by an additional 14.5%. As per their suggestion, there is a gap in the program, particularly concerning knowledge retention. Looking toward the source of education,

Cheng et al. (2018) conducted a study on current educational offerings in the form of standardized online and face-to-face courses. These researchers found that the learning outcomes from both of these are falling short, with providers demonstrating a decay of skills over time. This results in suboptimal clinical care and poor survival outcomes from cardiac arrest. A current synthesis of the evidence supporting best educational and knowledge translation strategies in resuscitation is lacking. In this AHA scientific statement, a review of the literature describing key elements of educational efficiency and local implementation, including mastery learning and deliberate practice, spaced practice, contextual learning, feedback and debriefing, assessment, innovative educational strategies, faculty development, and knowledge translation and implementation is provided.

One key to closing this gap may be tapping into stronger educational theory. For example, McLeod (2017) discussed how Kolb's experiential learning theory work on two levels: a four-stage cycle of learning and four separate learning styles. Much of Kolb's theory is concerned with the learner's internal cognitive processes. Drawing upon such theory may enable better retention. This was demonstrated by researchers such as Nishiyama et al. (2014), who studied the effectiveness of refreshing nurses' memories with 15-minute reviews of the BLS training to immediately follow a 45-minute chest compression training. A total of 140 participants was involved in this study, and the results indicated that the addition of a 15-minute review of BLS led to 1 year of retained skills. Further support for improved models of learning comes from Price and Reichert's

(2017) examination of the significance of providing nurses with ongoing opportunities for personal and professional development. The researchers did so by creating 18 focus groups consisting of 185 participants, which were held over 5 months. The researchers found that not only is continuous professional development a vocalized need of the nurses themselves, but it is anticipated of nurses throughout their career. Anderson, Sebaldt, Lin, and Cheng (2019) conducted a randomized control trial and found that the optimal approach may be short, monthly training sessions.

Further supporting the idea of using more experiential learning strategies to include retention was a study by Ross, Bruderle, and Meakim (2015). After identifying that nursing students may struggle to retain essential skills through the course of their 4-year education, these researchers sought to develop solutions and suggested a more hands-on approach to teaching. Terry, Terry, Moloney, and Bowtell (2018), on the other hand, recommended the integration of traditional face-to-face coursework with online materials to improve retention. Rutherford-Hemming et al. (2016) directly compared these two methods, finding that experiential simulation approaches to foster significantly greater retention than did online self-study modules. Other approaches have been suggested to make the transition from education to practice more seamless and thus improve the transfer of skills, such as nursing residencies (Van Camp & Chappy, 2017).

Simulation as Training

One approach to training in the medical field is simulation. Aebersold (2018) stated that simulation-based learning, including those that entail mannequins, are no

longer perceived as novelties in healthcare. These simulations are now mandatory, given their sufficiency and assist with the memorization of learning materials in this field (Aebersold, 2018); however, the evidence of their efficacy is somewhat mixed. For example, Aqel and Ahmad (2014) conducted a study about the gap in knowledge of high-fidelity simulators and the methods teachers use to teach this process. These researchers found that a notable loss of the understanding of cardiopulmonary resuscitation followed 3 months of participating in a program that entailed simulators. The suggestion was to enable nursing teachers to provide training sessions for cardiopulmonary resuscitation. Similarly, Abelsson, Lindwall, Suserud, and Rystedt (2017) examined the effect of repeated simulation on the quality of trauma care. The focus of this study was that the learning environment that can be constructed to meet the knowledge and experience need of the participants better.

In interpreting these results, it should be noted that simulation is not a unified, singular practice. Sørensen et al. (2017) conducted a study about situ simulation, which is a simulation training practice method in the healthcare industry that requires professionals to work together in teams to resolve real-life situations. These simulations are conducted in the professionals' workplace environment. The researchers stated that situ simulation was successful in helping to provide education-based gains for healthcare professionals. Others, such as Butt, Kardong-Edgren, and Ellertson (2018), have researched the use of virtual reality, video game-like simulators.

Everett-Thomas et al. (2016) suggested that another possible application of simulation is not as direct training, but as an assessment. This would be especially valuable for hospital personnel such as first responders or emergency room nurses, who may come face-to-face with life and death situations with some frequency. For prelicensure nurses, simulation may be especially valuable as well. Cant and Cooper (2017) found that simulation-based education not only improves nurses' knowledge and retention, but also their confidence and self-efficacy.

Researchers have also examined the relative strength of different feedback methods for simulation based ACLS training. For example, Kowlgi et al. (2016) compared traditional group feedback to video-assisted individual feedback. The study was a randomized controlled trial comparing two randomized groups of students who completed the same simulation exercises but were assigned different feedback strategies. Based on a follow-up survey, the students—who were all internal medicine residents—strongly favored group-based feedback. Ninety percent perceived that group-based feedback was most useful, and 81% thought it was most useful. Furthermore, 70% thought it was not more time-consuming, negating individual feedback's ostensible primary advantage. This illustrates the complexities inherent in different approaches to education, and the need to compare different approaches in their efficacy. The findings of Kowlgi et al. suggested the importance of collecting feedback from RNs and RTs in the current study and understand their preferences in ways that will allow the hospital to improve its ACLS recertification courses.

Implications

The findings in the body of existing literature align with the findings of the current study. If the findings of Anderson et al. (2019) are confirmed here, then more frequent recertification training may be a preferable approach. On the other hand, many RTs express a preference for a more involved, 2-day recertification training. Based on the specific findings and the reasons that the participants perceive for their struggles in retaining key medical knowledge from their recertification courses, the study findings will have implications for ways in which the hospital under study can improve, amend, and possibly restructure its ACLS recertification training so as to boost low retention rates, especially amongst RTs.

Summary

In the first section of this project study, I outlined the problem that the RTs and RNs who worked at a local hospital in the state of Maryland had expressed difficulty retaining the knowledge and skills required to renew their ACLS with the existing educational training and the importance of retention of cognitive skills in ACLS. This study was based on information processing theory and draws upon an existing body of literature to provide its background. The results have significant real-world significance and implications.

An extensive literature review on professional development for improvement, retention of cognitive skills, and importance of teams in professional development acknowledge the need for a program evaluation. I outlined the significance of the

problem for the local hospital and based on data collected, the importance of hand outs and quizzes, drills and mock quizzes, and more regular and comprehensive training was emphasized. In Section 2, I discuss the selected methodology of the study, including the data collection and analysis procedures.

Section 2: The Methodology

Qualitative Research Design and Approach

The research methodology chosen for the current study was qualitative. Qualitative research is an approach to exploring and understanding the meaning that individuals or groups ascribe to a social or human problem (Creswell, 2008). The qualitative methodology provides tools for researchers to study complex phenomena within their contexts. When this approach is applied correctly, it becomes a valuable method for health science research to develop a theory, evaluate programs, and develop interventions (Baxter & Jack, 2008). Observation and interview tools are used to gather data (Gall, Gall, & Borg, 2007). This qualitative study included interviews with participants. Qualitative analysis is a context-sensitive research methodology useful for exploring a phenomenon of interest. As a result, qualitative analysis is a natural fit for the complex nursing milieu (Elo & Kyngäs, 2008; Streubert & Carpenter, 2010). The purpose of this research was to describe the event under study more thoroughly and define what was occurring. By using a qualitative study, I was able to explore and understand the effectiveness of the training that RNs and RTs undergo to retain knowledge and skills needed to renew the ACLS recertification course. Qualitative research is also open-ended, making it ideal for exploring the full breadth of participants' experiences, rather than presupposing a certain set of closed-ended responses that participants might give.

The specific research design was a basic or generic qualitative design. A basic qualitative design allows researchers to examine the details of a phenomenon and its characteristics without locking the study into the specific characteristics of other qualitative designs, such as a case study or ethnography (Percy, Kostere, & Kostere, 2015). A generic qualitative approach is flexible in that it allows the researcher to draw aspects of the research from different designs without adopting such a design whole cloth (Percy et al., 2015). For example, in this study, I drew on the multiple data sources of a case study design (see Yin, 2017), but not the overall contextual focus of a case study. This flexibility was appropriate for the current study because none of the more specific designs were a strong match for the study's purpose. A case study focuses on the contextualization of a phenomenon (Yin, 2017), which was not the focus of this study. Ethnography seeks to compare outcomes within and across different groups (Comaroff & Comaroff, 2019), which was also not the focus of this study, nor was the focus on exploring in-depth lived experiences, as in phenomenological research (see Hegel & Inwood, 2018). Other specific qualitative designs would not have aligned well, but an overall qualitative design did; therefore, a generic qualitative approach was the best fit.

Participants

The setting for the study was a single local hospital in the state of Maryland. At this hospital—henceforth referred to as "the hospital"—both RNs and RTs had expressed difficulty retaining the knowledge required to renew their ACLS with the existing educational training, according to the project site administrators. Specifically, 60% to

70% of the RTs working at the hospital reported that they struggled or fail to remember the material needed for ACLS following the 1-day class. Furthermore, although the hospital uses 1-day ACLS recertification classes, 30% of RNs and 70% of RTs indicated that they prefer a 2-day renewal class because they cannot recall the information needed to renew their ACLS license. This made the study of ACLS retention at the hospital a priority, especially for RTs, but also to some extent for RNs.

From that standpoint, the population of interest consisted of RNs and RTs who had worked at the hospital long enough to go through at least one cycle of the hospital's 2-year ACLS recertification cycle. This inclusion criterion ensured that the experiences of all of the study's participants were relevant to the research questions. In qualitative research, sample sizes are not an issue of *a priori* statistical power analysis, but rather saturation (Mason, 2010). That is, a qualitative researcher does not target a specific number of participants but rather aims to achieve the point of saturation, at which adding more participants no longer contributes new ideas to the data. I chose an office room to conduct the semi structured interviews. The noise level was minimal. Aside from making the interviewee feel as comfortable as possible, the interview room facilitated clear communication, including nonverbal. The interviewees were aware that the interview was recorded, and the consent form was signed by the interviewees.

Protection of Participants' Rights

Ethical research practice was followed at all stages of the study. I obtained instructional review board (IRB) approval number 01-15-20-0609637 and site

authorization prior to collecting any data. Participation in the study was purely voluntary, and no information on participants was released to the hospital. All data remained confidential, and all participants were assigned code names for use in quotes and analysis. Any identifying information was also cleaned from the data. Participants were also given the opportunity to conduct a transcript review to ensure the accuracy of their data. Participants were told that they could withdraw from the study at any point up until publication. All collected data will be stored in a secure physical location or password-protected folder for 3 years following publication, at which point it will be destroyed or deleted.

Demographics

The participants of this study included five RTs and five RNs working at a local hospital in the state of Maryland. For participants being able to participate in the study, they had to (a) be employed by the hospital and (b) have undergone at least one ACLS recertification cycle. Provided that these criteria were met, participants who signed in the informed consent form were included in the study. Demographic characteristics of the participants are reported in Table 1. To protect the participants' identity, pseudonyms were given, and participants were referred to by these pseudonyms. Five participants were RTs and five were RNs. Three participants identified as male and seven identified as female. Participants' ages ranged between 25 years and 50 years old, and their work experience varied from 6 years to 30 years.

Table 1

Participant Demographics

Variable	Category	Number of participants
Age		
	20 to 29 years	2
	30 to 39 years	4
	40 to 49 years	3
	50 to 59 years	1
Gender		
	Male	3
	Female	7
Last time certified in ACLS		
	Within last 1 year	4
	Within last 2 years	6

Data Collection

Data were collected during in-depth interviews with five RNs and five RTs using qualitative, semistructured standardized interviews. The data collection process commenced once approval had been received from both IRB and the local institution. Once site authorization was obtained, an e-mail detailing the study, its purpose, the benefits it could possibly create in terms of improved ACLS recertification, and my contact information was sent to the hospital administrative office. The hospital then distributed this e-mail to all RTs and RNs employed at the time. To encourage participation, I emphasized the benefits that the study potentially could create for the hospital. Those participants who were interested in joining the study were asked to contact me directly via email. During this process, I provided more detailed information of the study to potential participants. Provided that participants were willing to participate

in the study, an informed consent form was presented to them, and participants were asked to sign the form before official enrollment in the study.

A semistructured interview protocol was applied, which represents a midpoint between structured and unstructured interviews and is the predominant form of qualitative data collection (see Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Semistructured interviews were evaluated as the most suitable data collection tool for this research study because semistructured interview protocols contain open-ended questions and follow a general format, although this approach leaves enough space for the participant to contribute insights.

I prepared in advance the general format of the interview protocol, which included a set of prepared questions as well as overall topics for the interview (see Kallio et al., 2016). Follow-up questions and further probing questions were added if needed on a case-by-case basis to encourage participants to say more. Once the participant had signed the consent form, a day and time with each respondent was scheduled for the interview to take place. All interviews were held in a private setting in a hospital conference room or unused office. Interviews lasted for approximately 30 minutes. Provided that participants gave their consent to do so, interviews were audio recorded to ensure all information was captured. Recorder audios were given code names ranging from Participant 1 to Participant 10 to protect participants' identities. Following the interview, once the data had been transcribed, I offered each participant the opportunity

to complete at transcript review by reviewing the transcript for completeness and accuracy.

Data Analysis

Once all data were collected and saturation had been achieved, the data analysis process commenced. Qualitative researchers do not target a specific number of participants, but rather aim to achieve the point of saturation, at which adding more participants no longer contributes new ideas to the data (Mason, 2010). For this study, I determined that data saturation was achieved after 10 in-depth interviews were conducted and no further new information was being presented by the participants.

The conceptual framework was referred to during the initial development of codes for use in the second step of the thematic analysis described below. Once all data were collected and saturation had been achieved, the data were analyzed through qualitative thematic analysis (Braun, Clarke, Hayfield, & Terry, 2018). Saturation was determined through a less in-depth review of the data than the final analysis, parsing the broad ideas that emerge and comparing them to the existing interviews to see if anything new has been added to the discussion. Thematic analysis is a six-step process that transforms a set of qualitative data into its essential themes. The data were then carefully reviewed several times (Braun et al., 2018). Second, coding referred to the identification of basic units of meaning—which may be expressed differently by different participants—and labeling them with a code. Once the codes were identified, the third step of the analysis was to

preliminarily identify themes (Braun et al., 2018). Themes represent larger ideas, which may involve the interaction of several coded units of meaning.

Once the preliminary theme list was compiled, the fourth step was to double-check the content of the themes against the original data to ensure that the themes accurately reflected the data (Braun et al., 2018). In the fifth step, the themes were compared against each other. This process ensured that the list was complete and well-defined, with every theme being unique. If new themes were added in this process, the fourth step was then repeated. The final stage of the analysis was to interpret the final list of themes and put them into context within both the local setting of the hospital and the larger setting of the research literature.

The specific analysis procedures followed the qualitative thematic analysis process as described by Braun et al. (2018) and referenced above. A report was then produced. The verbatim responses of the participants were incorporated to support the established themes and guarantee that the results were directly from the participants' shared lived experiences and not my personal perceptions or ideas.

Limitations of the Study

The only limitation noted in is research is the self-selection of participants. All of the RTs and RNs chose to participate and were not randomly selected. However, saturation was reached in the data collection that may indicate that the results were indicative of the hospital RT and RN population that met the criteria.

Data Analysis Results

In order to obtain an in-depth understanding of the problem under study and answer the research questions, I conducted 10 qualitative individual in-depth interviews with RTs and RNs to understand their experiences and perceptions regarding the phenomenon. This section is structured as follows. First, a short description of both the setting as well as the participants' demographics is provided. Then, information regarding how data were collected follows. Subsequently, the data analysis process is described, after which evidence of trustworthiness is discussed. Afterwards, attention will shift to the results, where themes resulting from the 10 individual in-depth interviews with RTs and RNs working at a local hospital in the state of Maryland are thoroughly discussed. To close this section, a summary of the findings is provided.

Data were collected from interviews with RNs and RTs using qualitative, semistructured, standardized interviews (Appendix B). Semistructured interviews represent the predominant form of qualitative data collection (Kallio et al., 2016) as they represent a midpoint between structured and unstructured interviews. The interviews were guided by an interview guide, which I prepared in advance. The interview guide consisted of a set of prepared questions as well as overall topics for the interview (Kallio et al., 2016). Follow-up questions or further probing questions were added on a case-by-case basis. The interviews were audio-recorded to ensure that all information was captured for later transcription.

According to Cho and Lee (2014), the primary strategies identified to enhance credibility in a qualitative content analysis methodology include observation, interviewing, document review, peer debriefing, presenting representative quotations, and triangulation. In the interests of contextualizing the content of the interviews using document collection, one of these key sources of secondary qualitative data (Yin, 2017). The conceptual framework guided the data collection process through the development of the interview guide, which was informed by the theories in the conceptual framework. The research questions that informed the data analysis results through themes were the following:

RQ1: What difficulties do the RNs and RTs describe in retaining the knowledge and skills from the ACLS recertification course?

RQ2: What strategies or learning environments do the RNs and RTs perceive would be most effective to help them retain in the knowledge and skills needed to pass the ACLS recertification exam?

Themes

The RTs and RNs who work at a local hospital in the state of Maryland have expressed difficulty retaining the knowledge required to renew their ACLS with the existing educational training. According to prior research, retention problems related to the ACLS recertification course are a national issue experienced by healthcare providers and institutions across the country (McEvoy et al., 2014). Performance and competency maintenance are identified as challenging in the context of a dynamic, complex acute care

hospital settings (Scott & Mensik, 2010). While this challenge is not new, it has received a great deal of attention in recent times, as third-party payers and healthcare reform are challenging the healthcare providers to improve patient outcomes and reduce the length of stay. With this in mind, I sought to understand the difficulties that RNs and RTs experience with retaining the knowledge and skills from the ACLS recertification course and the strategies or learning environments they perceive as most effective to help them retain the knowledge and skills needed to pass the ACLS recertification exam. The thematic analysis of individual semistructured interviews with five RNs and five RTs resulted in a number of themes that were attained in correspondence with Kolb and Kolb's (2005) experiential learning and Gurbin's (2015) information-processing theory, as well as the research questions. With reference to the first research question, participants' responses were categorized under three themes: (a) lack of practical application, (b) length of time between recertification, and (c) too many people in one group.

The first theme referred to the lack of practical application as a reason for experiencing difficulties with retaining the knowledge and skills from the ACLS recertification course. Participants explained that not using the knowledge they learned and not putting theory into practice indeed leads to knowledge and skills attrition.

The second theme related to how the length of time between recertifications was too long and would lead to participants forgetting information. In this regard, participants mutually agreed that a 2-year gap was too long and that recertifications should be

organized more frequently. Due to this long gap, participants said they often had to revise information themselves; however, the results suggested that not every RN or RT may be inclined to do this, which may be problematic.

The third and last theme in relation to Research Question 1 referred to how being given the ACLS training in a big group could inhibit the retention of information. Participants found that receiving the training in big groups would often lead to them not being able to practice different roles and tasks. As a result, they missed training on vital skills and tasks, which consequently resulted in attrition of knowledge and skills. Another participant added that having too many people in one group could also lead to chaos. According to this participant, working in smaller groups would make training sessions and the practical application thereof in real-life situations more efficient as everyone would know their role and specific expectations.

With reference to the second research question, participants' responses were categorized under six themes: (a) drills and mock codes, (b) self-practice, (c) handouts and quizzes, (d) more regular and comprehensive training, (e) support, and (f) equipment. The first theme referred to the application and inclusion of regular drills and mock codes so that nurses and therapists would be able to practice and put their knowledge into application. Participants explained that practicing mock codes on a fairly regular basis would keep staff up-to-date about procedures and contribute to their familiarity with procedures, drug dosages, and different scenarios that could possibly take place. The results suggested that actively practicing procedures, such as in the form of role play,

would be much more useful than sitting in a classroom and learning about the procedures because practical application would be more helpful with memorizing and remembering procedures.

The second theme referred to the responsibility of nurses and therapists to practice and retain knowledge themselves. The participants perceived that every caregiver is responsible for regularly revising information and practicing skills, including ACLS knowledge, by reading up on scientific literature, the guidelines, and course material available on the internet or distributed by the hospital. Closely related, a third theme referred to the perceived necessity of hospitals to provide learning material so staff can practice their skills and knowledge. Such material could be provided in the form of folders with a summary of the guidelines, snapshots of the algorithms and drug dosages pinned on information stations in the hospital, and computer quizzes available on hospital computers.

A fourth theme related to the idea of providing simulations, mock, codes, and opportunities on a regular basis. Although there was disagreement on how often such training should be provided, the current participants agreed that once a year was far from enough. In addition, participants also found that training should be provided for everyone and should cover both basic and advanced knowledge and skills.

The fifth theme referred to the ability to consult superiors or others with more experience in the field. Participants found that experienced nurses should indeed take the responsibility upon themselves to teach and guide younger nurses with reference to

ACLS and that superiors should debrief their staff so that they know what they did well and what they need to improve on. A sixth and last theme related to the equipment. In this regard, participants said that not having the proper equipment was annoying and that having the newest technologies at their disposal was crucial to effectively practice their ACLS skills. Some participants also mentioned to prefer high-fidelity mannequins over low-fidelity versions.

In qualitative thematic analysis, the codes and themes generated had a subjective element to them because every researcher will likely interpret the transcripts in a different way. This could not be avoided; however, confirmability was maximized by writing the results of the study in such a way that my reasoning during the data analysis process could be followed.

RQ1: What difficulties do the RNs and RTs describe in retaining the knowledge and skills from the ACLS recertification course? With reference to the first research question, participants' responses were categorized under three themes: (a) lack of practical application, (b) length of time between recertification, and (c) too many people in one group. All three themes are further elucidated in the following sections. Table 2 provides an overview of the themes and their respective relevance.

Table 2

Frequency Table of Themes Developed in Response to Research Question 1

Theme	Participant code	Percentage (N = 10)	Frequency
Lack of practical application	P1-P10	100%	15
Length of time between recertification	P1-P3, P5-P10	90%	14
Too many people in one group	P1, P3, P4, P7	40%	9

Theme 1: Lack of practical application. The first theme was mentioned by all 10 participants (100%). This theme referred to the lack of practical application as a reason for experiencing difficulties with retaining the knowledge and skills from the ACLS recertification course. Participant 5, for example, explained that "I've found that if not using that knowledge, that I lose the information that I learned." This participant also stated, "When I did transfer in the ICU, I was finding myself using that algorithm more. And so, I was able to retain that knowledge." This participant concluded, "Basically, if you don't use it, you lose it." Participant 4 agreed, "It's just the gap between the course and actually utilizing the skills that you use that you've learned at the ACLS class" and "that is a primary reason that we lose those skills." Participant 4 further explained,

> The primary problem is that the majority of respiratory therapists in this institution don't have enough practice in allocating the necessary skills that we have taken in ACLS training class, we're not directly involved in administering any drugs, reading any of the cases or intubating. We tend to forget that as with any skill, if you don't use it consistently, you will forget it.

Participant 4 continued, “Most of the therapists, including myself, after a week of taking the class, you forget it. Since we're not using it and we may not have a call for a month or 2 months.” Participant 1 agreed, adding that “someone who's doing it every day will remember that compared to somebody who's just doing it once in 6 months.”

According to Participant 4, what they learn during the course “goes into short term memory” and that because of this, “we tend to forget it quickly.” This participant stated, “We all study for the tests (…) And beyond that, everyone forgets.” In addition, he stated,

> I think we always just memorize for the tests. (…) everybody goes in panicking, just they just want to be able to get through it. Because the major issue (…) is that they know that if they do not pass the exam and they do not give recertify, they can get suspended. (…) you cannot work unless you are up-to-date. And so, there is that pressure thereof being able to pass.

Participant 4 further appended that due to this lack of practical application, many RNs cannot properly control the basic skills, which further impedes the retention of knowledge from ACLS class:

> What I find is that a lot of basic skills are lacking, especially within the nursing on the floors. When it comes, you're going into a patient's room and they can identify the oxygen flow from many of to have been able to have to use the equipment appropriately, especially the hand-bag attaching it to an oxygen flow meter, not an airflow meter, being able to grab the ample bag and understanding that they

> become the ventilators longer, sit there and be able to maintain an airway to the rest of the team gets there.

Similarly, Participant 1 noted, “You should know the basic in order to do advanced. So, everybody should know the basic of working and single.”

Theme 2: Length of time between recertification. A second theme that was stated by nine participants (90%) was that the length of time between recertifications was too long and would lead to participants forgetting information. In this regard, Participant 1 stated that “it definitely helps after each ACLS class. I am like, OK, I now know this”, but that “obviously in a few months I'm forgetting it.” Participant 1 explained, “I have to keep checking back to my algorithms every time to see what the algorithm is and what they want us to do” and that “then I have to go back to my notes and check it to make sure that I'm complying based on my certification.” Participant 1 continued, stating

> I feel like it is a long-time gap between renewals. I have noticed that I tend to forget certain protocols of the algorithms. I must keep going back and looking at my algorithms when we are dealing with different things. So, I feel like the time gap; 2 years is too long of a time.

Participant 2 similarly noted that “a 2-year gap is a too much” and stated that information will be often forgotten “within a month, almost.” Additionally, Participant 3 cited that “a 2-year gap is long” and further opinionated, “I think we had to need some repetition of the classes.” Lastly, Participant 5 considered that “perhaps 2 years is too long to retain that information,” suggesting

> Perhaps those classes could be closer together to help stack the knowledge and kind of help you remember more of. I just feel like people forget in a lot of a shorter period than 2 years. (…) I definitely do. I am human and I forget a lot of this stuff. If I am not using especially.

Theme 3: Too many people in one group. The third and last theme in relation to research question 1 refeed to how being given the ACLS training in a big group could inhibit the retention of information. The theme was mentioned by four participants (40%), who found that receiving the training in big groups would often lead to them not being able to practice different roles and tasks. Participant 1 explained in this regard that "I feel like the group is large too, that I'm not getting the opportunity to play different roles and see what different people do." Participant 1 continued, "If it's larger groups, it's really hard to do the different roles" and further said, "I wish it was a little bit more like rotations, different scenarios, smaller groups like that where you can get a lot more hands-on practice." Participant 1 perceived that "large groups definitely has problems retaining information" because "when in large groups it's difficult to get hands on." Participant 3 agreed, adding that "per five to seven people, the group is OK."

Participant 4 made an addition and said that having too many people around would also often lead to chaos. He explained that there are "too many people who don't need to be there and too many spectators especially." Participant 4 explained that this leads to chaos, which subsequently leads to inefficiency:

> The best people to look at is like a shock trauma or a trauma team when they go in. Everybody has a designated role and there isn't chaos. Everybody has a designated job, and that is what needs to be done at every code. So, there isn't any question, what is she doing? What is he doing? Okay. And you can rotate those jobs.

Participant 4 continued by providing an example of a situation where everyone knew what to do and did their jobs well:

> Immediately when the patient arrived, you had a nurse who was the I.V. nurse. You had the nurse who was, you know, assigned to a different responsibility. The P.A. came in, the doctor came in, respiratory came, and everybody knew exactly where they needed to go and what they needed to do. There was not this chaos. And we have a lot in our code that is chaos. You have too many people in a room doing nothing. If you are not part of the team, you need to leave.

RQ2: What strategies or learning environments do the RNs and RTs perceive would be most effective to help them retain the knowledge and skills needed to pass the ACLS recertification exam? With reference to the second research question, participants' responses were categorized under six themes: (a) drills and mock codes, (b) self-practice, (c) handouts and quizzes, (d) more regular and comprehensive training, (e) support, and (f) equipment. All six themes are further elucidated in the following sections. Table 3 provides an overview of the themes and their respective relevance.

Table 3

Frequency Table of Themes Developed in Response to Research Question 2

Theme	Participant code	Percentage (N = 10)	Frequency
Drills and mock codes	P1-P10	100%	29
Self-practice	P1-P10	100%	15
Handouts and quizzes	P1-P10	100%	14
More regular and comprehensive training	P1, P3-P10	90%	14
Support	P1- P4, P6-P9	80%	5
Equipment	P1, P2- P6	60%	5

Theme 1: Drills and mock codes. The first theme referred to the application and inclusion of the regular drills and mock codes so that nurses and therapists can practice and put their knowledge into application. All 10 participants (100%) mentioned this theme and found that this would be helpful in retaining information.

Participant 1 explained in this regard that "practicing mock codes and running mock codes in the hospital would be essential because that way you keep up-to-date about what's going on." Participant 2 agreed, adding,

> I think simulation is the best way because it is a hands-on and muscle memory. And when we practice because that is what is needed on the floor. And we do the real core. So, I think that is one strategy which I would suggest and like.

Participant 4 added,

> I think if we have more simulations within the department, it does not necessarily have to include nursing, but also respiratory. You know, have our clinical educator do things more often, maybe once a month with different scenarios,

> because you must look at what are the reasons a patient goes into cardiac arrest and look at each different scenario doing different scenarios. Problem is, it was a respiratory cardiac. Was it any other reason we must go to the if you go why this patient coded and then say, OK, we're going to look at each case separately on a monthly basis.

Participant 4 continued,

> When we get to the simulation lab, there is a patient that is on the computer and on the bed that's able to mimic different rhythm rhythms and tells us, OK, what are you going to do now? And this is the scenario and information about the patient. For example, 29-year-old female came in short of breath, suddenly coded…

Participant 4 similarly found that "being able to have more codes or drills, mock drills that will allow us to be able to get more experience and become familiar with the drugs and dosages" would be helpful. He explained,

> So, when we're adding code, if somebody is given something that's inappropriate, we can say, no, he should get this instead of being able to recognize the rhythms better, because sometimes the rhythms can be a little bit difficult to separate.

Participant 5 additionally said,

> I think practice makes perfect. And in this scenario, perhaps if there are not enough codes going on or use of the information to help retain perhaps mock

> codes or mock. Whatever you mean, the drill. Kind us mock drills just to allow for use of this information so that it can stick better on just about like.

Participant 1 further noted that regular mock codes also helped in building confidence, stating,

> I've noticed that when nurses are doing a lot of mock codes, they become a little more confident when you have a real-life situation, and they are able to retain the information more. Everybody wants to have hands-on learning rather than just sit in a classroom and learn. So, when you are like hands on teaching them, when they are actually touching the equipment, actually they're doing things. They tend to retain that information more than just sitting there and just telling them or lecturing them to do it.

Participant 1 further explained,

> When we do mock codes, we do everything. We do the basic life support as well as then we also try to empower nurses to like, let us do you know, let's put the different later on. Let us see if we need to shock the person. So those are different things that we work with nurses when we do the mock code. So, it always helps.

Four participants (40%) specifically mentioned role play as a learning technique and explained that during such simulations they would rotate roles so that they could practice different roles and tasks. Participant 5 stated that "roleplaying definitely would help" because "it's more hands-on training." Similarly, Participant 3 explained, "We use the simulation role to play the game" and that it learns them "to think of what the

diagnosis is" and the "primary sign in symptoms." Participant 4 explained in this regard that "everybody's designated a role to play." He further added,

> And you can rotate those jobs. So today I may be the recording notes, but tomorrow I am going to be doing something different to the team. Because if you do that and you rotate it, then the likelihood of maintaining the skills is high.

Participant 2 added,

> Our instructor will assign the role to us. We walk into the room and there is somebody who is telling us the scenario, what is wrong with the patient. And then basically we just start from there.

Participant 5 perceived that it would be useful to do the training separately for therapists and nurses so that nurses can learn how to cooperate and assist one another amongst each other. Participant 5 explained,

> I think it's important to have just nurses so the nurses can know how to do the arty stuff and also their responsibilities and then have them together so they can co-mingle and know that each other's responsibilities or interact with each other when the real thing happens.

Participant 5 continued,

> Sometimes there have been simulations where they would put us. It would be a mannequin set up and then the i-Pad would kind of pop all those scenarios and we would have meet us as a team. Like a couple other people on this team would try

to figure out according to the rhythm and the situation, would intervene to fly next.

To conclude, Participant 5 explained that “other times it's been very just cut dry. Question and answer” and that “I didn't really find that the question and answer very helpful compared to the active simulations where I had you thinking more involved in more teamwork.” Participant 5 explained that drills and mock codes “give you a hand on kind of feeling and kind of keep you on your feet, whereas doing test questions—although it is in its own way helpful—is not memorable. It doesn't help you remember.”

In addition to the previous, four participants (40%) further added the usefulness of real-life experiences. Participant 5 said in this regard, “I've always found the real life will teach you more than any practice.” Participant 5 further explained that “working in the ICU definitely helped me” because it helped “the information to stick around, because I'm using it on an everyday basis.” Participant 2 added to this that “Paying attention when there is a call going on about the medication, about the rhythm they are seeing. So that helped me a lot.” Participant 5 further stated, “I feel like floating nurses that don't use it on an everyday basis with it definitely have a hard time because of the lack of exposure.” The practice Megacode sheet helps in keeping the data for future improvement (Appendix C).

Theme 2: Self-practice. A second theme, which was mentioned by all participants (100%), referred to the responsibility of nurses and therapists to practice and retain knowledge themselves. The current participants all perceived that as caregivers, it

was their responsibility to make sure that they know what and how to do their jobs, including ACLS. Participant 5 explained in this regard,

> Always knowing stuff or just understanding, like understanding of what's going on just helps build a better environment when emergencies happen so that everybody's more informed.

Participant 1 similarly stated, “I think as an individual, I would have to go back and practice more on my end of things to make sure that I'm currently with the practice.”

Participant 2 found that “personal interest and personal initiation is needed to retain the knowledge” and added, “I was reading in and then kept my knowledge up-to-date by going over the literature” and “I made sure that every week, whenever I get the patient, every time when I was working, I go over on their EKG strips.” Participant 1 stated that it may be useful for hospitals to provide opportunities for their staff to practice their own skills. He explained,

> Loading on the computer or something uploading, or you're going to have like a central location like in the Internet saying these are the ACLS materials. And so, some people can like go and read them.

Theme 3: Handouts and quizzes. A third theme, which was mentioned by all 10 participants (100%), referred to the provision of material by the hospital so staff can practice their skills and knowledge. Participant 1 recommended, “If they provided more like handoff to hand out these things, that would help giving us handouts, more materials to review through.” Participant 1 explained that this should be “more like a quick review

or like a folder or file" that provides information such as "these are the basic things that you need to know in order to be current with your ACL has guidelines." Participant 1 also recommended that

> …such information should be spread throughout the hospital like, having like a snapshot of the algorithm in different places in the unit also helps sometimes to kind of like, oh, this is what I'm supposed to do after, you know, I've called a coder and things like that…. like posting it on nurses' the stations and stuff like that that helps, you know, kind of putting it out there.

Four participants also mentioned quizzes on computers in the hospital as a useful strategy to promote and secure information retention. In this respect, Participant 5 suggested "perhaps a little quiz or refreshers every couple of months just to help retain information." Participant 5 continued,

> If you forget you always must look it up. So that is a refresher on to refresh. Like. The ACL is algorithms from whichever you forget, like they can upload on one computer. Maybe two computers in here and then all the nurses can practice on that on their own time...Questions would definitely help in refreshing. You kind of put you back in that school's scenario where you must brush up on everything. And I feel like they do that once a year here and that definitely helps me remember. So, they do it once a year. They have some refreshers on like cardiac rhythms.

Participant 2 agreed, adding that this approach would be especially helpful with remembering medications: “definitely at least the medication part.”

Theme 4: More regular and comprehensive training. The fourth theme referred to how regular and comprehensive training should be. In this regard, participants had different opinions on how frequently these activities should take place and in what format. Participant 3, for example, found that such training should take place “two to three times a year” and recommended that they should come in the form of “2-day classes.” On the contrary, Participant 1 said,

> I would like to do some frequent training that we would be able to do, like a quick go back to like reviewing equipment or a review of things. Maybe if it is not like a two hour or a four-hour class again. More concretely, this participant found that such training should be given approximately once a month…I think once a month and we should do it for more than once a month for at least a day shift our nature so that everybody gets equal opportunities. It should be for both days and nights; it should be for all kinds of different shifts.

Participant 5 similarly suggested, “Let's say like every month or so, every 2 weeks, they have a mock code.” Participant 5 explained that

> “the main problem is that trainers often assume that everyone remembers the material and go over the session too quick: The very first thing they asked was “Who took the class?” And they always, they would generally say,” “ Well, since you guys are already here, we're going to make it shorter.” And since you guys

> already know the information, they were assuming that we retained the previous information that we held. And so, I think it's always, of course, good to be more thorough and never assume that everybody just because they've done it before, that they remember where humans are flawed.

Participant 5 continued,

> Teaching experience should be more like a learning experience. I mean, more and more intense, more in depth about just making sure that you're not missing anything because there's always updates. So, it is important to share those.

To conclude, Participant 1 noted the importance of giving training to everyone involved in respiratory therapy, explaining,

> I think that every RN and RT, whoever it is who works in this in this environment should practice barcodes. I am a strong believer of that, because the more you practice in these mock situations, the better you get. In real life situations. Because you never know when you are going to be in a situation that you need to use it.

Theme 5: Support. A fifth theme that was mentioned by four participants (40%) referred to the ability to consult superiors or others with more experience in the field. Participant 3 explained in this regard that “experienced nurses are helping the new nurses.” Participant 2 similarly said to consult others, stating, “If I don't get it, I ask the nurses to verify what I'm reading is right or not. That's how I tried to retain that knowledge.” Similarly, Participant 4 said to sometimes consult others and that they “go

over rhythms and drugs" with you. More specifically, Participant 1 explained that "doing a debrief" is useful because "it kind of helps us understand what do we do right? What did we do wrong? What are the things that we can improve?" Participant 1 continued,

> So when we're doing debriefing and if we have it somewhere where I can quickly pull out the algorithm and like I can quickly look at it or like when we're doing a debrief session to complete, like, look at that, that kind of helps.

Theme 6: Equipment. A sixth and last theme that was only briefly mentioned by six participants (60%) included ideas about equipment and the importance of having decent and up-to-date equipment. In this regard, Participant 5 explained that "not having the proper equipment around while training us" can be annoying, and that "people learn in different method, some prefer more hands on, while others are more verbal or visual. Accommodating to people's learning styles is really important in this scenario." Participant 5 explained that they often have to learn with "older versions' of simulations and such versions are often not accurate or

> not up-to-date… The mannequins are not ideal, and they can't always give you the best learning experience. Sometimes it often simulates real life, real patients. Doing compressions on a mannequin can be a lot easier than doing compressions on a 350-pound person, which you must push the chest two inches deep.

Participant 2 similarly found,

> The high fidelity is most preferred because it shows the rhythm and it will tell, you know, the patient is …. our patient has no pulse or something like that. So, I think a high fidelity, definitely!

Participant 1 added,

> I would love it if the mannequins were a little bit more high fidelity and like if there was a little bit more high-tech stuff, that's a very dingy small did your room where we used to have ours. And it is not enough technology in there.

Evidence of Quality

To ensure the evidence of trustworthiness in qualitative study, I sought to recommend the criteria of credibility (in preference to internal validity), dependability (in preference to reliability) and confirmability (in preference to objectivity).

Credibility. Credibility refers to the extent to which the data collected are believable from the point of view of the participant. In other words, credibility is concerned with whether or not the data, as collected and represented, is truly congruent with what the participant thinks. The only way to assure this in qualitative interview-based research is by asking the participants after data collection. This was done by means of member checking. Member checking is the process of taking ideas back to research participants for their confirmation, and/or to gather material to elaborate established categories; it has accurately interpreted what the participant meant, rather than specific words (Charmaz, 2006). The necessity for member checking lies in the fact that even recorded and verbatim-transcribed conversations can be misinterpreted.

To limit misinterpretation and maximize the credibility of the data and results, I offered each participant the opportunity to member check by reviewing his or her own answers for completeness and accuracy once the data had been transcribed. Interviewees were emailed their own transcripts and asked to check them for accuracy.

Dependability. Dependability refers to the extent to which findings are stable, consistent, and repeatable. In other words, it is the extent to which a study can be replicated, and another researcher would obtain similar results. One way to meet the requirement of dependability is by examining whether or not the researcher has been careless or made mistakes in conceptualizing the study, collecting the data, interpreting the findings and reporting results (Amin, Nørgaard, Cavaco, & Witry, 2020). One measurement was that I made sure that the interview and analysis protocol were valid. This was ensured by using a panel of experts as a test audience to ensure the data gleaned from interview responses could effectively answer the research questions. The same experts approved of the interview protocol and data analysis plan. Considering their expertise in the field of qualitative research, the approval of the panel ensured that the analysis process was in line with the accepted standards for the design of this study which was a basic of generic qualitative design.

A second measure that was taken in order to increase dependability was keeping an audit trail. According to Amin et al. (2020), “by examining the process by which the research has been carried out, the auditor can corroborate the study's dependability” (p. 7). Audit trails are an in-depth approach to illustrating that the findings are based on the

participants' narratives and involve describing how the researcher collected and analyzed the data in a transparent manner. Audit trails include detailed descriptions of the sources and techniques deployed to collect and analyze data, interpretations made, decisions taken, and influences on the researcher, with the aim of demonstrating truthfulness within the findings (Amin et al., 2020). The current study followed a thematic analysis approach as described by Braun et al. (2018). The specific analysis steps were described carefully and in detail so that future researchers will be able to follow in my footsteps. This exact process was described earlier in this section. The dependability of the study was also assured by a robust and complete description of the study's analytical methods. This included a detailed description of how I worked from individual codes to themes.

To further increase dependability, I made sure to remain self-aware of my own biases by keeping self-reflexive notes. In the interests of contextualizing the content of the interviews using document collection, one of these key sources of secondary qualitative data (Yin, 2017), I obtained the copies of ACLS recertification course material to see what strategies were used. These documents allowed me to evaluate the participants' interview responses within the context of the actual coursework that they must complete for recertification, as well as to clarify any references to specific parts of the training.

Confirmability. Confirmability refers to the degree to which the results of the study could be confirmed or corroborated by others. In qualitative research, it is assumed that each researcher brings a unique perspective; however, confirmability can be

enhanced by complete and thorough documentation of the research process. Furthermore, I remained aware of my own biases and existing prejudices, not so much to try to eliminate that bias (which is impossible), but to allow for it in the analysis.

Outcomes

The thematic analysis of 10 individual in-depth interviews with five RTs and five RNs who work at a local hospital in the state of Maryland resulted in several themes that were attained in alignment with experiential learning and information-processing theory, as well as the research questions. Kolb and Kolb's (2005) theory represent a four-stage cycle comprised of learning as a process by which knowledge is created through the transformation of experience. The first stage is concrete learning, where the RTs and RNs face with a new experience or reinterprets an existing experience. Each RN and RT is assigned a mannequin patient in the ACLS renewal class, takes history, performs a physical exam, develops a differential diagnosis and a plan to treat the patient. The concrete learning involves an openness and willingness to engage oneself in new experiences. This is followed by the next stage, reflective observation, where the RTs and RNs recall and interpret their experience. This stage is of importance because there are inconsistencies between experience and understanding. In the renewal class, the RNs and RTs discuss their observations and reflect on the clinical encounter. At this learner level, the feedback from the instructor is extremely important. The third stage is abstract conceptualization, in which the RNs and RTs forms new ideas, or reorganize existing abstract ideas, based on the reflective observation stage. Due to the reflective

observation, new ideas are accelerated and modifies an existing abstract concept that the RNs and RTs has learned from their experience in the ACLS renewal class. The RNs and RTs use the reflective observation in self-improving the knowledge, physical exam techniques and problem-solving skills. Self-directed learning (SDL) is of great value in learning to build on existing knowledge and getting engaged in active learning. For instance, the RNs and RTs may have previous experience with the same kind of patients' condition or illness, but the patient and the contextual background might add a new perspective to the present learning. Last learning stage is the active experimentation stage in which the RNs and RTs applies the new ideas to their surroundings to see if there are any modifications in the learning experience. As an outcome of feedback and SDL, the RNs and RTs practice their learning approach, such as problem-solving skill, physical exam technique with a new experience. The new experience generates a new reflection and approach in learning. Gurbin's (2015) information-processing theory includes the facets of sensory and memory response, focus, pattern acknowledgement, working memory, coding, recall, and long-term memory (Gurbin, 2015). Gurbin stated that the processes of learning, interpreting, remembering, and recalling information are similar. These two specific theories were already elucidated in the Literature Review. In the following section, these themes are discussed in detail. Direct participant quotes and tables are used to illustrate and support claims.

Through the current study, I sought to understand (a) the difficulties that RNs and RTs experience in retaining the knowledge and skills from the ACLS recertification

course and (b) the strategies or learning environments that RNs and RTs perceive would be most effective to help them retain the knowledge and skills needed to pass the ACLS recertification exam. Individual in-depth interviews with five RNs and five RTs guided the study.

The first research question asked: What difficulties do the RNs and RTs describe in retaining the knowledge and skills from the ACLS recertification course? I developed three themes to answer this question: (a) lack of practical application, (b) length of time between recertification, and (c) too many people in one group.

The first theme referred to the lack of practical application as a reason for experiencing difficulties with retaining the knowledge and skills from the ACLS recertification course. The participants explained that not using the knowledge they learned and not putting theory into practice led to knowledge and skills attrition. This finding aligns with experiential learning theory. Kolb and Kolb's (2005) theory represent a four-stage cycle comprised of learning as a process by which knowledge is created through the transformation of experience. These four stages of learning include: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation. The fourth stage, active experimentation, referred to developing solutions from the concepts learned and applying them. In line with the first theme discovered in this study, Kolb and Kolb posited that learning through practical application is a useful method to retain knowledge and skills.

A second theme related to how the length of time between recertifications was too long and would lead to participants forgetting information. In this regard, participants mutually agreed that a 2-year gap was too long and recommended that reviews should be organized more frequently. Due to this long gap, participants indicated that they often had to review information themselves. Not every RN or RT may be inclined to do this, however, which may be problematic. In line with Gurbin's (2015) theory, which posited that information is saved in the long-term memory through a constant process of coding and recall, these findings suggested that more frequent reviews could be helpful for knowledge retention.

A third and last theme in relation to Research Question 1 referred to how being given the ACLS training in a big group could inhibit the retention of information. The participants found that receiving the training in big groups would often lead to them not being able to practice different roles and tasks. As a result, they missed training on vital skills and tasks, which consequently resulted in attrition of knowledge and skills. Another participant added that having too many people in one group could also lead to chaos. According to this participant, working in smaller groups would make training sessions and the practical application thereof in real-life situations more efficient, as everyone would know their role and specific expectations. These findings were in line with the theory of Kolb and Kolb (2005) because they suggested that learning and practicing in smaller groups could give individuals the opportunity to physically practice different roles, whereas in bigger groups with a less hands-on approach with less opportunity for

practical application is more likely. As these scholars suggested that practical application is an important tool for knowledge and skills retention, working in smaller groups seemed to be more beneficial for the current participants.

The second research question asked: What strategies or learning environments do the RNs and RTs perceive would be most effective to help them retain knowledge and skills needed to pass the ACLS recertification exam? I developed six themes to answer this question: (a) drills and mock codes, (b) self-practice, (c) handouts and quizzes, (d) more regular and comprehensive training, (e) support, and (f) equipment. The first theme referred to the application and inclusion of regular drills and mock codes so that nurses and therapists would be able to practice and put their knowledge into application. Participants explained that practicing mock codes on a fairly regular basis would be helpful because it would keep staff up-to-date about procedures and contribute to their familiarity with procedures, drug dosages, and different scenarios that could possibly take place. More specifically, Anderson et al. (2019) found that the optimal approach may be short, monthly training sessions. In line with Gurbin's (2015) theory, these findings suggested that more regular training could positively contribute to the process of coding and recall, and in the long run could contribute to long-term knowledge and skills retention.

Furthermore, the current participants found that actively practicing procedures would be much more useful than sitting in a classroom and learning about the procedures. Indeed, participants evaluated practical application such as simulations as the most useful

method in retaining knowledge and skills from the ACLS recertification course because a hand-on approach was considered more effective than a hands-off approach such as passive learning. More specifically, participants believed that the practical application of knowledge was the most efficient way to memorize and remember procedures and suggested that a lack of practical application would lead to the opposite. Similar results were presented by Aebersold (2018), who stated that simulation-based learning, including those that entail mannequins, are no longer perceived as novelties in healthcare, but are now mandatory given their impact on memorization of learning materials in this field.

Further supporting the idea of using more experiential learning strategies to include retention was a study by Ross et al. (2015). After identifying that nursing students may struggle to retain essential skills through the course of their 4-year education, the researchers sought to develop solutions and suggested a more hands-on approach to teaching. Rutherford-Hemming et al. (2016) compared this method with traditional face-to-face coursework with online materials, concluding that experiential simulation approaches fostered significantly greater retention than did online self-study modules. These results were confirmed by participants of this study, who evaluated practical exercises as more useful in comparison to theoretical and more traditional coursework. The participants perceived the hands-on approach as helpful in retaining the information.

A specific recommendation from participants was the application of role play during mock codes. Role play referred to the idea of assigning different roles to different individuals and scheduling a rotation system so that every individual can get familiar

with different roles and tasks. The application of a role play was implied to strengthen team cooperation and—on a more individual level—rebuild the confidence on RNs and RTs. Further, it was also implied that role play would be very beneficial for RNs and RTs to retain the knowledge learned during the ACLS course. In the ACLS renewal class, the role-playing by actors, patients, or instructors is valuable in retaining the knowledge and skills in addition to providing feedback about the impact of learning. The value of learning through practical application has been similarly suggested by Kolb and Kolb (2005).

The second theme referred to the responsibility of nurses and therapists to practice and retain knowledge themselves. The current participants indicated that as caregivers, it was their responsibility to make sure that they know what and how to do their jobs, including ACLS. Participants explained that personal interest and determination played a vital role in retaining knowledge learned during the ACLS course. More specifically, they mentioned the use of reading the scientific literature, guidelines, and course material available on the Internet or distributed by the hospital. Although some researchers found online self-study to be useful, mock codes and simulations may be the most effective approach (Rutherford-Hemming et al., 2016).

The third theme refers to the material provided by the hospital so that the staff can practice their knowledge and skills frequently. Giving individuals the opportunity to regularly revise theory can be important as information is collected through the senses and reading material can contribute to the processes of coding and recalling information

(Gurbin, 2015). The provision of material that would allow staff members to quickly review information might be an effective strategy to help RNs and RTs to retain knowledge and skills learned during the ACLS course. Participants recommended that this material should be provided in the form of folders with a summary of the guidelines, snapshots of the algorithms and drug dosages pinned on information stations in the hospital, or computer quizzes available on hospital computers. With reference to computer quizzes, participants found that having the opportunity to self-quiz one's knowledge about ACLS would be helpful as this would give staff the ability to refresh their memory about algorithms, drug dosages, and other useful information.

The fourth theme related to the idea of providing simulations, mock, codes, and refresher opportunities on a regular basis. In this regard, participants had different opinions on how frequently these activities should take place and in what format. Some cited that training should take place two to three times a year and recommended that each training session should take 2 days. Others opinionated that training such as mock codes and simulations should take place as frequently as once a month but indicated that these should take only a few hours at most. In alignment with the latter, Anderson et al. (2019) conducted a randomized control trial and found that the optimal approach may be short, monthly training sessions.

In addition, the current participants also found that training should be provided for everyone, meaning that the training should not only be provided for RNs and RTs but also for other healthcare workers, such as pharmacy to strengthen cooperation between

different healthcare workers in real life situations. These training sessions should also be much more in-depth and focus on basic knowledge, as well as more specific knowledge and new developments in the field. Especially covering the basics was evaluated as important because some participants reported that too many trainers assume that their staff has all the knowledge and skills at their disposal. To overcome this issue, participants said that training should include a detailed revision of the basic knowledge and not only focus on the more advanced knowledge and skills. The participants feel that a 2-day class would be more beneficial as compare to a 1-day class in the renewal ACLS certificate. In alignment with these findings, Nishiyama et al. (2014), who studied the effectiveness of refreshing nurses' memories with 15-minute reviews of the basic life support training to immediately follow a 45-minute chest compression training, found that the addition of a 15-minute review of BLS led to 1 year of retained skills.

The final theme related to equipment and included ideas about equipment and the importance of having decent and up-to-date equipment, such as high-fidelity equipment. In this regard, participants said that not having the proper equipment was annoying and stated that having the newest technologies at their disposal was crucial to practice ACLS. In this respect, participants preferred high-fidelity mannequins over low-fidelity versions because high-fidelity versions more accurately resembled reality.

On being asked the preferred method of learning, the RTs and RNs preferred hands-on session, simulation training, and HealthStream. HealthStream is a learning

platform used by local hospital. Refer to Table 4 for the participants' preferred method of learning.

Table 4

Preferred Method of Learning

Learning method	Participant code
In-service on the unit	P1, P5, P6, P7, P8, P9
Hands-on session	P1 – P10
Simulation training	P1 – P10
Self-directed learning packets	P1, P3, P4, P5, P7, P8
HealthStream	P1 – P10

Summary

RTs and RNs who work at a local hospital in the state of Maryland have expressed difficulty retaining the knowledge required to renew their ACLS license with the existing educational training (project site administrator, personal communication, November 2018). Performance and competency maintenance are identified as challenging in the context of a dynamic, complex acute care hospital settings (Scott & Mensik, 2010). While this challenge is not new, it has recently received increased attention, as third-party payers and healthcare reformers have challenged the healthcare providers to improve patient outcomes and reduce the length of stay. Regular training and recertification in the knowledge and skills required to provide safe, effective care is essential. According to prior researchers, retention problems related to the ACLS recertification course are a national issue experienced by healthcare providers and institutions across the country (McEvoy et al., 2014).

To obtain an in-depth understanding of the phenomenon under study and answer the research questions, 10 qualitative individual in-depth interviews with RTs and RNs were conducted to understand their experiences and perceptions regarding the phenomenon. The specific analysis procedures followed the qualitative thematic analysis process as described by Braun et al. (2018). The thematic analysis of 10 individual in-depth interviews with five RTs and five RNs who work at a local hospital in the state of Maryland resulted in a number of themes that were attained in correspondence with Kolb and Kolb's (2005) experiential learning and Gurbin's (2015) information-processing theory, as well as the research questions.

The thematic data analysis resulted in several themes that were attained in correspondence with Kolb's experiential learning and Gurbin's information-processing theory as well as the research questions. With reference to the first research question, participants' responses were categorized under three themes: (a) lack of practical application, (b) length of time between recertification, and (c) too many people in one group. The first theme referred to the lack of practical application as a reason for experiencing difficulties with retaining the knowledge and skills from the ACLS recertification course. The second theme related to how the length of time between recertifications was too long, which led to participants forgetting information. The third and last theme in relation to Research Question 1 referred to how being given the ACLS training in a big group could inhibit the retention of information.

With reference to the second research question, participants' responses were categorized under six themes: (a) drills and mock codes, (b) self-practice, (c) handouts and quizzes, (d) more regular and comprehensive training, (e) support, and (f) equipment. The first theme referred to the application and inclusion of the regular drills and mock codes so that nurses and therapists can practice and put their knowledge into application. The second theme, which was mentioned by all participants (100%), referred to the responsibility of nurses and therapists to practice and retain knowledge themselves. Participants perceived that as caregivers, it was their responsibility to make sure that they know what and how to do their jobs, including ACLS. A fourth theme referred to how regular and comprehensive training should be. In this regard, participants had different opinions on how frequently these activities should take place and in what format. The fifth theme referred to the ability to consult superiors or others with more experience in the field. The final theme included ideas about equipment and the importance of having up-to-date tools, such as high-fidelity equipment.

Section 3: The Project

Introduction

In this qualitative research study, I explored the factors that affect RNs and RTs in learning and retaining knowledge and skills needed to renew the ACLS recertification, as well as the strategies that RTs and RNs perceive to help them retain the knowledge and skills. The local hospital staff identified that the completion of a 1-day renewal ACLS class may not ensure retention of long-term knowledge or proficiency. Based on the difficulty expressed by the RTS and RNs in retaining information, several themes were identified. With reference to the first research question, I categorized participants' responses under three themes: (a) lack of practical application, (b) length of time between recertification, and (c) too many people in one group. With reference to the second research question, participants' responses were categorized under six themes: (a) drills and mock codes, (b) self-practice, (c) handouts and quizzes, (d) more regular and comprehensive training, (e) support, and (f) equipment. The staff established that they want more practical time in the simulation lab, along with algorithms and scenarios on the computer. The project consists of a year-long program for professional development to educate the RNs and RTs to better prepare them for the ACLS recertification exam and continued safe practice.

The project was based on the recommendations of the participants that materials should be provided in the form of folders with a summary of the guidelines, snapshots of the algorithms and drug dosages pinned on information stations in the hospital, or

computer quizzes available on hospital computers. The training should take place 2 to 3 times a year, and each training session should take up to 2 hours. Additionally, some participants stated that training such as mock codes and simulations should take place as frequently as once a month, but that these should take only 15 to 20 minutes at most. The participants recommended variety of case scenarios that are pertinent to typical patient situations.

The professional development program will include self-study scenarios, along with RNs and RTs practicing in the simulation lab twice per year on their own (see Appendix A). There will be scenarios in the simulation lab with steps on what to do. In addition to this, I will post one ACLS question a month on the board in the staff room, which will challenge the RNs and RTs to think and discuss amongst themselves. The improvements include simulation-based scenarios and team training skills with mock codes (see Appendix C), and didactic presentations.

Rationale

The data collected from this study informed the design of a professional development program to assist RNs and RTs with the knowledge and skills to not only pass the recertification exam but also to practice what they have learned to safely care for patients. The participants in the current study perceived that in order to retain the ACLS knowledge and skills, there is a need of more mock codes, comprehensive education and training, practice in the simulation lab, and self-study modules on the computer. According to Nambiar et al. (2016), many healthcare professionals lack the necessary

knowledge of BLS/ACLS information, revealing a clear gap in current training methods that require immediate research attention. A revised curriculum that provides frequent exposure to ACLS via mock codes and practice in simulation lab should improve skills and knowledge retention. These strategies need to be implemented properly in order to provide the intended benefits to RNs and RTs (Nambiar et al., 2016). According to Dadiz and Baldwin (2016), adding continuing education to the programs may provide additional motivation to the staff attendance at the program.

It is difficult to cope with the ever-changing healthcare field (Brunt & Morris, 2019). Nursing professional development practitioners play a critical role in preparing practitioners for current and future roles and helping individuals cope with an ever-changing healthcare environment. Nursing professional development practitioners facilitate the professional role development of nurses and other healthcare professionals by encouraging interprofessional education and collaboration. By revising the curriculum based on the findings, it may be possible to increase RNs' and RTs' knowledge and skills retention. By changing the length of time between recertification, lack of practical application, and number of people in one group, it will be possible to address the flaws in the training format. Developing strategies and supplementing the practice simulation lab, drills and mock codes, and self-study will add to the practicality of the training. Role play is important aspect of learning, which emphasizes the importance of all the healthcare professionals.

Review of the Literature

I conducted the literature review to identify the current research and evidence-based practice on retention of cognitive skills in ACLS and professional development. The research was broadly done on CPR science, facilitating teaching, practicing on simulations and mannequins, curriculum development, and educational theories to provide the evidence-based professional development. I searched for materials using the Walden University library and Google Scholar, narrowing the search to include articles published between the years 2016 and 2020. The search terms that were used to find related research included *cognitive retention, ACLS, professional development, curricular development, emergency clinical skills,* and *teamwork in professional development.*

Professional Development for Improvement and Retention of Skills

RNs and RTs need professional development and opportunities to practice new skills. It is imperative for RNs and RTs to practice new skills to take care of patients in safe environment (Pool, Poell, Marjolein, & Ollete, 2016). According to Sadler (2018), in today's healthcare landscape, professional development is not an option but an imperative. A professional development practitioner has the ability to impact an organization's strategic goals to ensure that staff are providing safe and effective care, embracing evidence-based practices that impact clinical outcomes, and becoming adjusted to the needs of the organization (Sadler, 2018).

By engaging RNs and RTs in their personal and professional growth, it is possible to create a plan that includes the unique needs of the learner and is aligned to the needs of

the organizations. Such a plan could a positive impact on both patient outcomes and clinical workforce engagement. Furthermore, a revised program (see project description) is able to measure and track key performance metrics that include nurse satisfaction, retention, engagement, newly acquired knowledge/skills, patient/resident satisfaction, and clinical outcomes. Professional development plays a critical role in the retention of skills and knowledge, as well as the delivery of quality patient care. According to Halfer, Brewer, Ulrich, and Kramer (2019), the factors associated with high-quality patient care include working with competent peers, support for education, control over nursing practice, and patient care; such factors can be easily resolved through curriculum development.

It is vital to invest in the RNs' and RTs' professional development when seeking to improve the performance of a healthcare organization. Education plays an important role in achieving organizational goals through a combination of organizational and workforce interests (Chaghari, Saffari, Ebadi, & Ameryoun, 2017). Training is essential to promoting greater efficiency among staff, while professional development helps staff in critically thinking and team functioning necessary for cardiac arrest response in ACLS (Fevre, Garden, Waddington, & Weller, 2015).

Price and Reichert (2017) conducted a study on the significance of providing nurses with ongoing opportunities for personal and professional development. The researchers did so by creating 18 focus groups consisting of 185 participants, which were held over 5 months (Price & Reichert, 2017). Price and Reichert found that not only is

continuous professional development a vocalized need of the nurses themselves, but it is anticipated of nurses throughout their career.

According to American Heart Association (AHA) guidelines for CPR, repeated exposure helps RNs in retaining knowledge and skills, thus improving patient outcomes (Bhanji, 2015). According to Coleman and Desai (2019), RNs require professional development in order to stay abreast of regulatory mandates, practice changes, equipment updates, and other workplace expectations.

Cognitive Retention of Emergency Skills

One major use of professional development is the cognitive retention of emergency skills that a RT or RN may face on a daily basis. ACLS licensing involves complex knowledge and skills that require retention over time (Chang, Kao, Hwang, & Lin, 2020). The retention of emergency clinical skills such as ACLS is an important issue for medical practitioners because these skills deteriorate over time (Cheng et al., 2018). For instance, Rajeswaran et al. (2018) found that skills involving cardiopulmonary resuscitation knowledge and skills among nurses are deficient despite having training in their programs. Bhatnagar et al. (2017) also examined the knowledge of 41 young doctors 6 months after their completion of teaching program for cardiopulmonary resuscitation. The recruited doctors answered survey questionnaires to assess their knowledge of cardiopulmonary resuscitation. The results of the study indicated that exposure to the program led to increases in both knowledge regarding cardiopulmonary resuscitation (Bhatnagar et al., 2017). The retention of their knowledge however, significantly

deteriorated 6 months after their exposure to the learning program (Bhatnagar et al., 2017).

ACLS is particularly at risk of deterioration over time, given that the instruction of psychomotor skills has been unchanged and underdeveloped for several decades (Gonzalez & Kardong-Edgren, 2017). Moreover, nurses' cognitive retention of psychomotor skills has been found to be more difficult to retain compared to simple knowledge (Charlier, Van Der Stock, & Iserbyt, 2020; Merriel et al., 2016). According to Berry and Popp (2018), the reason for the decay of emergency skills among nurses is that these skills are irregularly applied because of the low frequency of medical emergencies.

Gonzalez and Kardong-Edgren (2017) found that deliberate practice, mastery learning, and reduction of cognitive load are strategies that can lead to the attainment of skills and more effective learning experiences. Charlier et al. (2020) found that hand-on-training is more effective when mastering psychomotor clinical skills as opposed to theoretical discussions. These findings underscore the complexity of ACLS skills in terms of cognitive retention because of the psychomotor skills involved in this particular emergency competency. The next section contains a discussion of the different strategies that can be used to enhance cognitive retention of ACLS skills through professional/curricular development.

Different strategies that can be adopted in professional/curriculum development. Existing programs intended to improve the ACLS skills of nurses remain insufficient (Ali, Misbahudeen, Mohtasham, & Fasil, 2019; Roel & Bjørk, 2020). For

instance, Roel and Bjørk (2020) found that despite adjustments to clinical programs intended to enhance ACLS skills, such as more focus on hands-on practice, did not lead to significant gains that meet the international standards of competence. Similarly, Ali et al. (2019) only found minimal improvements in knowledge and psychomotor skills among healthcare workers after being exposed to an intervention intended to improve those skills.

The learning contents and strategies of professional development can be informed by Kolb and Kolb's (2005) experiential learning theory and Gurbin's (2015) information-processing theory. In terms of experiential learning theory, the importance of having direct and hand-on experience is central to professional development intended to improve the skills of healthcare professionals (Liaw et al., 2018). Regarding the information processing theory, profession development is constructed based on the premise that simulation in order to activate various cognitive processes central to learning such as sensory and memory response, focus, pattern acknowledgement, working memory, coding, recall, and long-term memory (Topbas, Bingol, Gorgen, Terzi, & Yılmaz, 2017).

The content of professional development needs to be based on the learning needs of RNs and RTs. According to Jeffery, Longo, and Nienaber (2016), after identifying a knowledge gap, staff educators must be sure to incorporate the rationale behind the need for education into the learning activity itself. Professional development strategies can be targeted to streamline daily patient care, extra tasks, and other roles (Pool et al., 2016). Professional development focuses on self as continuing professional development, focus

of team as working with team, focus on patients by enhancing patient care and lastly focus on solutions by reducing barriers (Kimble, Shore, & Blackman, 2020). In this section, I will review the different strategies that can be incorporated in professional development, such as simulation, role-playing, self-directed learning, and learning the equipment.

Simulation. In addition to the development of clinical skills, simulation has also been used in order to develop healthcare professionals' mastery and retention of ACLS (Barsuk, Cohen, Wayne, Siddall, & McGaghie, 2016). Procedural simulation is particularly being used more extensively because of its effectiveness in enhancing learner's confidence and technical skills to perform a particular psychomotor skill (Rivière, Saucier, Lafleur, Lacasse, & Chiniara, 2018). For instance, Maxwell et al. (2016) found that exposure to a program involving the simulation of ACLS led to significant increases in learners' confidence and knowledge of ACLS. The mastery of ACLS skills is particularly important because this skill has been found to deteriorate over time if the training is not sufficient in terms of pacing, content, and implementation of evidence-based curriculum (Cheng et al., 2018).

One learning framework that has been used in order to develop simulation in curriculum/professional development is Kolb and Kolb's (2005) experiential learning theory (Pasquale, 2015). The RNs and RTs need to reflect on their experiences in order to create new experiences to be applied in new situation. According to Meakim, Fey, Chmil, Mariani, and Alinier (2015), simulation-based training is an educational mode for RNs

and RTs that allows them to have an active role in learning process. The RNs and RTs require continuing education and opportunities to implement new skills.

There is robust empirical evidence supporting the effectiveness of simulation in improving ACLS and other clinical skills. For instance, Abelsson et al. (2017) studied the effect of repeated simulation on the quality of trauma care. The focus of this study was the construction of a learning environment to meet the knowledge and experience need of the participants better. In another quasi-experimental study by Aljohani, Tubaishat, and Shaban (2019), the researchers found that a statistically significant difference in the mean scores in ACLS knowledge before and after exposure to a simulation program. Both sets of scholars highlighted the effectiveness of simulation as an important component of curriculum/professional development intended to enhance ACLS.

A variant of traditional simulation is *in situ* simulation. Sørensen et al. (2017) conducted a study about this simulation training practice method in the healthcare industry that requires professionals to work together in teams to resolve real-life situations. These simulations are conducted in the professionals' workplace environment. The researchers stated that in situ simulation was successful in helping to provide education-based gains for healthcare professionals.

The hands-on learning is important along with didactic learning. The participants' learning style should be taken into consideration when planning curriculum/professional development. The hands-on learning is equally important as role playing, simulation - based learning, and mock codes. The new RNs and RTs use reflective learning counteract

with hands-on learning. The new RNs often use a balanced learning style including both reflective learning and hands-on learning, similar to the teaching methods utilized in college nursing education, such as reflective journaling, case studies, simulation labs and clinical experiences (Shinnick & Woo, 2015). The hospital survey showed that a variety of learning styles are used to teach the RNs and RTs. Kolb's Learning Style Inventory assessment demonstrates that the nurses favored the concrete or accommodate learning style (Kolb & Kolb, 2005). The accommodators are intuitive, concrete learners who put ideas into action and adapt well to a changing situation.

Walker, Nuxoll, Niner, and Hagan (2020) examined the comparative effectiveness of online and instructor-led simulation programs involving resuscitation education. The results of the study revealed that instructor-led simulation was more effective compared to online-based stimulation. The implication of this research is that the implementation of simulation in curricular or professional development needs to remain centered on hands-on and instructor-led programs.

Despite the prevalence of simulation activities, Henriksen, Rodrick, Grace, and Brady (2018) noted that challenges such as patient safety and improvements in methods remain prominent issues. Another challenge with simulation is balancing the ethics and efficacy, such as the rationale for constructing simulation activities wherein patients die (DeMaria et al., 2016). These researchers highlighted the continued challenge of creating professional development curriculum that is not only effective, but also practical and ethical.

Role play. According to Fossen and Stoeckel (2016), healthcare professionals seem to experience important learning by putting themselves in the patient's position and discovering their own reactions to the situation. Role-playing activities allows nurses to have a deeper understanding of their patients and their experiences during medical emergencies (Stuhlmiller & Tolchard, 2019). Another benefit of role-playing is that this strategy has been found to enhance patient safety compared to traditional learning methods as a result of an enhanced understanding of the situations that patients experience (Sato, Okamoto, Kayaba, Nobuhara, & Soeda, 2017).

In the use of role play in professional/curriculum development, a group of RNs and RTs receive scenario for the patient a week ahead of the session. At designated times, the RNs and RTs each play the doctor, RN, RT, pharmacist, and the patient roles. A brief feedback follows the role play. The whole process should not take more than 30 minutes. Gleason (2015) evaluated a new role-play-based approach to teaching clinical knowledge and communication in mental health for medical students. The role-play-based learning method contained a batch of teaching modules that each included the narrative of a patient and guidelines for the facilitator. The advantage of role play is it adds reality to lesson, builds confidence by focusing on problem-solving, and is very effective with small groups.

Self-directed learning. The RNs and RTs are self-directed and self-learners. The RNs and RTs work in the complex and ever-changing healthcare settings and should be equipped with lifelong learning skills. One of the lifelong learning skills is self-directed

learning (Shirazi, Sharif, Moalzem, & Alborzi, 2017). Self-practice or self-directed learners need time and stress management skills. The RNs and RTs will be learning on their own time during down time at the hospital. According to Khiat (2017), self-directed learners require time management, stress management, assignment preparation, exam preparation, and note-taking skills.

Self-directed learning or self-practice is very important. As Kaulback (2020) emphasized, RNs and RTs should implement learning and teaching strategies to increase lifelong learning. Ralapanawa, Jayawickreme, Ekanayake, and Kumarasiri (2016) found that students who are in their internship assessed their experience as insufficient in developing their knowledge about advanced life support. Self-directed provides an opportunity to continue improving and enhancing the ACLS skills of healthcare practitioner such as RTs and RNs (Kaulback, 2020; Ralapanawa et al., 2016).

There is evidence supporting the effectiveness of self-directed learning in increasing the knowledge and skills of healthcare professionals ACLS (Bang & Kim, 2018; Barrie et al., 2018). For example, Bang and Kim found that self-directed learning presented through mobile-based interventions was effective in strengthening the cardiopulmonary resuscitation skills of nurses, especially when compared to traditional lectures. A major weakness of the studies reviewed in this section is that no researchers specifically focused on retention of ACLS skills over a longer time period in order to determine the long-term effects of self-directed learning.

Learning about equipment. Professional development incudes education on equipment used for ACLS recertification course. RNs and RTs must be given adequate training on new products and devices as the work they do becomes more integrated with patient care. According to Robeznieks (2015), doctors often rely on nurses when equipment malfunctions. A crash cart contains the equipment and medications required to treat a patient in the first 30 minutes of a medical emergency. The RNs and RTs should be familiar with the following equipment and drugs in the crash cart (Table 5).

Table 5

Crash Cart Equipment and Drugs

Equipment	Drug
Airway (oral and nasal) all sizes	Nitroglycerin spray or 0.4mg
McGill forceps, large and small	Dextrose 50%
King Airway set (3) eliminates the need for laryngoscope and endotracheal tubes	Narcan 1mg/ml (6)
Bag valve mask (adult and pediatric)	Epinephrine 1:10,000
Nasal cannula	Atropine Sulfate 1mg
Nonrebreather oxygen face masks	Amiodarone 150mg vial
IV start packs	EpiPen®
Normal saline solution (1000ml bags)	Solumedrol 125mg vial
IV tubing	Benadryl 50mg vial (2)
10ml normal saline flush syringes (3)	Adenosine 6mg (4)
Gauze	Lopressor 10mg (2)
Alcohol preps	
Monitor with defibrillator or AED	

Importance of Teams in Professional Development

Teamwork plays pivotal role in the professional development through role playing, simulations, hands on, and mock codes. The team is a group of individuals with specific roles and responsibilities who accomplish admissible tasks, often independently,

for a common goal within a larger organizational system (Pearce, Kozlowski, Grand, & Baard, 2015). The composition of a team includes the individual members that combine their skills and knowledge to fulfill the functions of the entire team. When a critical member is missing from a team training, the goal of all members learning to function efficiently may not occur. This gap in participation affected the performance of the code blue teams that trained without benefit of nursing presence. The curriculum revision must address the missing members' attendance at team-based trainings.

The professional development should include teamwork, autonomous decision-making, and engaging in practice based on evidence and research. Bindon (2017) emphasized that it is a professional responsibility for RNs and RTs to maintain competency. Individual RNs and RTs are accountable for their practice as healthcare professionals. RNs and RTs must employ a career development strategy in the dynamic and everchanging healthcare field. It is very important for RNs and RTs to identify goals in order to progress, and the RNs and RTs should remain vigilant for new opportunities to expand into careers. The RNs and RTs should be determined to fulfill their career planning for which the professional development is essential.

The professional development practitioner plays a pivotal role in designing, implementing, and evaluating a preceptor program. According to Harper and Maloney (2016), within this role, the practitioner supports the transition of nurses and other healthcare team members across learning and practice environments, roles, and professional stages. Role play is very important in learning and teaching. In professional

development, role-play experiences increase students' reflections on their own practice, and those reflections naturally affect how they approach others. During the mock code, different roles are played by different healthcare professionals. Boos, Castelao, Ringer, Eich, and Russo (2015) established that when the leaders of code blue are cross trained, the team's response time and patient outcomes improve.

Continuous education and practice are needed to maintain and improve the competency of healthcare workers to work effectively as a team. Teamwork is a skill that needs to be developed continuously (Kilpatrick et al., 2019). In a review conducted by Dirks (2019), the author identified that the strategies that can be used to enhance teamwork in the healthcare include clarification of team resources and goals, engaging in scenarios that would allow practicing teamwork, providing regular feedback, and ensuring that every member of the team remains informed about the goals of the team.

Project Description

The current project consists of a professional development program for RNs and RTs using handouts, simulation as training, mock codes, and drills. In this study, I identified the gaps that would address the concerns and addressed in a comprehensive curriculum. The professional development program will contain information about the implementation of the various components of the professional development such as intra-venous (IV) line insertion and the administration of medications. The program includes simulation-based training in the simulation lab, and more mock codes, where RNs and RTs play different role every time. In addition, the program will include more e-learning

HealthStream PowerPoints and a test. The simulation lab was made more accessible and user friendly. The RNs and RTs will be asked to sign onto the computer in the lab. For the simulation session to be effective, there will be a competency day for RNs and RTs. The new curriculum should start at the beginning of fiscal year. Table 6 provides an outline of the new curriculum plan.

Table 6

Revised Professional/Curriculum Development

Recertification class/session	Information	Cognitive activity
BLS	CPR, AED	Computer learning
ACLS	CPR review	E-learning, skills station
	Algorithms	Simulation lab
	IV-line insertion	Didactic lab
	Medication administration	
HealthStream learning	Review and test taking	E-learning, lecture

Most of the learning materials are easily accessible on the computer.

Project Evaluation Plan

The revised project/curriculum development encompasses numerous activities for the RNs and RTs. There was a formal evaluation documented to assess the learning activity. It is important to learn the techniques, barriers to learning and seek RNs and RTs feedback to improve the plan. The simulations, role play, mock codes, and hands-on learning will be evaluated on regular basis in order to assess training skills, learner satisfaction, and remaining program gaps. As Oocumma, Zigmont, Szyld, and Maestre (2015) noted, peer review and self-reflection are the best methods for evaluation.

The facilitator plans, guides, and manages a group event to ensure that the group's objectives are met effectively and considers the opinion of participants. The facilitator should reflect their own proficiency through recording, videotaping, peer-reviewing, and self-reflecting to address the gap on the new document that will be completed by the facilitator. The document will contain questions, learner assessments, performance barriers, and details of the simulation, role play, mock codes, and hands-on practice.

The simulation, role play, and mock codes sessions will continue every 3 months and will be compared to evaluate facilitator's role, training skills, and participants' satisfaction. These comparisons will help me in improving the evaluation plan. The role play is an outstanding means of evaluating decision-making and interpersonal communication skills. The patient care scenarios in role playing can start from simple and advance to complex decision-making to ensure an adequate level of competence. In simulation assessment, the RNs and RTs are exposed to active, experiential, reflective, and contextual learning approaches. The simulations are effective means of evaluating RNs' and RTs' competencies, professionalism, and knowledge in order to provide instant feedback. The simulations are significant in professional/curriculum development, as they promote self-efficacy in clinical decision-making, improvement in communication skills, and awareness of role play in the collaborative care setting.

The comprehensive goal of revised curriculum/professional development is to provide RNs and RTs with the retention of skills and knowledge to appropriately respond to code and improve patient care. The retention of skills and knowledge make sure that

the RNs and RTs are able to identify and assess the situation of the patient, respond to the patient in an appropriate time, use the required resources and equipment, and act within the scope of profession. The activities—such as simulation, role play, mock codes, and drills—should provide the RNs and RTs with the skills and knowledge necessary for their role in an emergency patient situation. Tools including participants' evaluation, observation checklist, and facilitator self-reflection will be used to meet these goals.

The hospital leadership stakeholders include senior executives and directors of nursing, respiratory, pharmacy, and medicine. These stakeholders will review the data and program goals and determine whether the quality of patient care has improved after the changes are implemented. The program developers are the stakeholders who will oversee the technical issues and provide with the data to assess the effectiveness of the curriculum development. The patients are also stakeholders, as patient surveys are an important tool in assessing hospital performance.

Project Implications

This project study of revised professional/curriculum development for the hospital in Maryland has implications for social change at the hospital at community level and hospital level. As a result of this project, the major social change that could occur is that the RNs and RTs would be better prepared, which would certainly improve patient care. The findings of this project will also impact the hospital as an institution. Reflective professional development allows participants to grow personally by increasing knowledge and improving clinical practice through behavioral changes (Oocumma et al.,

2015). The resulting reflective practice will support RNs' and RTs' lifelong learning based on Kolb and Kolb's (2005) learning theory. It is highly recommended that the participants who perceive value from simulation-based education, role play, and mock codes to continue to attend programs to further their knowledge and skills.

Concerning community impact, I anticipate that the patient outcomes will improve due to better prepared staff. Due to more effective retention of skills and knowledge, the staff's teamwork and communication skills should improve. The hospital's RNs and RTs should be able to assess and treat the emergent situations in a timely manner and thus reducing the adverse outcomes. According to Maxworthy and Waxman (2015), local collaborative groups allow institutions to work together to benefit the both the institution and the individual practitioner by improving knowledge, skills, and ultimately patient outcomes. The other institutions may benefit by sharing enhanced curriculum/professional development. There is a need to modify the educational programs at the local hospital in Maryland to include more evidence-based practice.

Section 4: Reflections and Conclusion

Introduction

In this section, I address the strengths and limitations of the current project. In addition, I present the implications for social change. I also discuss project development, scholarship, leadership, and directions for future research.

Project Strength and Limitations

RTs and RNs who work at a local hospital in the state of Maryland have expressed difficulty retaining the knowledge required to renew their ACLS with the existing educational training. The retention of skills in ACLS training is a national concern that requires specialized and effective training for RNs and RTs. The hospital needs to review the current state of education and implement curriculum to address the issues. According to Bhanji (2015), performance deteriorates when skills are not used frequently. Performance and competency should be maintained in challenging, dynamic, and complex acute care hospital setting. According to RNs and RTs, the perceived barriers include a lack of practical application, insufficient training, and too many people in the group. The current project consisted of professional/curriculum development that expands upon more regular and comprehensive training, drills and mock codes, handouts and quizzes, and self-practice.

Further, I discuss the limitation of the study, as well as the recommendations and implications, before closing the dissertation with a conclusion that recaptures the aim of the study, the findings, and the value of this study. The only limitation noted in is

research is the self-selection of participants. As a result, only RNs and RTs who were interested in the study and volunteered to participate were recruited. Anyhow. saturation was reached in the data collection that may stipulate that the results were indicative of the hospital RT and RN population that met the criteria.

Recommendations for Alternative Approaches

There are other educational approaches that can assist RNs and RTs in retaining skills in ACLS training for recertification class. Each RN and RT knows the best methodology that works best for them. The participating RNs and RTs identified simulations, education and training, case study, and electronic style as preferred learning style. According to Lopteiato et al. (2016), simulation is important to reinforce skills learned in practice environment. The hospital may be more successful by involving the senior leadership in mandatory training to RNs and RTs. Another approach is to alternate between ACLS one year and BLS the next year. The current participants indeed said that as caregivers, it was their responsibility to make sure that they know what and how to do their jobs, including ACLS. Participants explained that personal interest and determination played a vital role in retaining knowledge learned during the ACLS course. More specifically, they mentioned the use of reading the scientific literature, the guidelines, and course material available on the internet or distributed by the hospital. Although some researchers found online self-study to be useful, it seemed that mock codes and simulations may be the most effective approach (see Rutherford-Hemming et al., 2016).

Scholarship, Project Development, and Leadership and Change

The project study was a very lengthy, intense, and enjoyable learning experience. The study allowed me to apply my knowledge of adult learning theories into practice. As a clinical educator, I was familiar with some adult theories, and I was able to practically apply the learning and theories in the clinic education at the hospital. The utmost goal of an educator is to nurture learning in a caring environment. I recognized and included self-directed adults who are capable of critically evaluating themselves and peers and who are capable of thinking critically and reflecting on practice. The education enabled the RTs and RNs to learn professional dissemination skills to meet the ACLS competency. The RNs and RTs had the opportunity to practice skills that can be an asset in the future professional development and advancement (see Kelly, Blunt, Nestor, & Mondillo, 2020).

RNs and RTs need to update their practice based on evidence-based research. The execution of this qualitative study allowed me to study and support a rationale for the program. I was able to analyze the difficulties that RNs and RTs have in retaining the knowledge and skills from ACLS recertification course. In addition, I was able to develop strategies that RTs and RNs perceive in retaining knowledge and skills.

The findings of this study highlighted the importance of conceptual theoretical work in developing the study. The model developed by Botma, Van Rensberg, Coetzee, and Heyns (2015) promoted curriculum design based on the model. The model includes four steps: (a) activating existing knowledge, (b) engaging with new knowledge, (c)

demonstrating competence, and (d) applying knowledge. I gained confidence, knowledge, and skills over the course of this study. I learned to examine and study adult theory and practices in effective leadership and administration in diverse and equitable settings, both domestic and global. In addition, I learned about managerial activities, including program planning and development, leadership, organizational change, and evaluation. I feel competent enough to bring changes at the hospital in order to enable RNs and RTs to better retain the cognitive skills in ACLS recertification course.

Reflection on the Importance of the Work

The current study reflects the difficulties that RNs and RTs experience in retaining the knowledge and skills from the ACLS recertification course and the strategies or learning environments RNs and RTs perceive would be most effective to help them retain the knowledge and skills needed to pass the ACLS recertification exam. I learned that practicing mock codes on a fairly regular basis would indeed be helpful, as this practice would keep staff up-to-date about procedures and contribute to their familiarity with procedures, drug dosages, and different scenarios that could possibly take place.

A specific recommendation from participants was the application of role play during mock codes. Role play refers to the idea of assigning different roles to different individuals and scheduling a rotation system so that every individual can become familiar with different roles and tasks. The application of a role play was implied to strengthen team cooperation and—on a more individual level—rebuild the confidence on RNs and

RTs. Further, it was implied that role play would be very beneficial for RNs and RTs to retain the knowledge learned during the ACLS course. In the ACLS renewal class, the roleplaying by actors, patients, or instructors is valuable in retaining the knowledge and skills in addition to providing feedback about the impact of learning. The value of learning through practical application has been similarly suggested by Kolb and Kolb (2005).

Implications, Applications, and Directions for Future Research

The findings of this project have an impact on RNs and RTs healthcare education. According to Tsai (2016), healthcare professionals who are competent in their skills result in improved functioning in critical situations. Repetition in mock codes, simulation-based education, and handouts provides an opportunity to learn and transfer and apply skills and knowledge in the real-life situations.

In this qualitative study, I evaluated and assessed the perception of RNs and RTs to reinforce the professional development. The education and team training were established as critical in the retention of cognitive skills in the ACLS course. The effectiveness of the program depends upon the RNs' and RTs' willingness to incorporate their learning and apply clinical skills into practice.

In relation to the current study, a number of recommendations for future research can be made. A first recommendation pertains to addressing sampling issues. The current study only incorporated RNs and RTs from one hospital in the state of Maryland in the United States. As a result, the perceptions and ideas of RNs and RTs working in other

hospitals, states, and countries were left unexplored. To gain more knowledge on the subject and the experiences of the target populations with retaining the knowledge required to renew their ACLS, one recommendation is for future researchers to carry out similar studies in other geographical contexts. Such studies may also be interesting for the sake of identifying intra- and inter-national differences in experienced difficulties and perceived solutions. Additionally, it may be useful to increase the sample size and include other experts, whose perceptions may further contribute to a better understanding of the phenomenon.

A second recommendation is to incorporate triangulation methods such as the combination of individual interviews, focus groups, and/or quantitative surveys to increase the strength and trustworthiness of the results. In line with this, a third recommendation is to make this study quantifiable, referring to the use of quantitative methods such as surveys. Quantitative methods may make it possible to extend the results to wider populations. In addition, quantitative researchers could test the results for statistical significance, which is not possible in qualitative studies. Qualitative findings are indeed subject to interpretation; therefore, it is possible that if a different researcher replicated the current study, different themes may emerge, resulting in a different presentation of the results. By quantifying this study, more objective results may be obtained.

A final recommendation is to adjust the interview protocol and focus more on particular areas, for example the implementation of mock codes and simulations which

seemed to play a particularly relevant role in the retention of knowledge and skills with reference to ACLS training. Other themes that were only briefly mentioned such as the provision of relevant equipment and support are also worth further exploration. The study results also indicated that RNs and RTs are dissatisfied with the organizational structures and recommended that training should be given in smaller groups so that staff can practice different roles and obtain more personalized feedback. It may be useful for future researchers to pay more attention to such ideas. As a result, I advise replicating the current study with a focus on these aspects to obtain a more in-depth understanding of the phenomenon. More studies are required to further assess the possible positive impact of the previously mentioned strategies.

Conclusion

The findings of this study suggested that retention of knowledge and skills from the ACLS recertification course remains challenging for RTs and RNs. Further, the results indicated that the most effective strategies to overcome knowledge and skills attrition include implementing and organizing more mock codes and simulations on a fairly regular basis. In addition, encouraging the staff to self-practice by providing them relevant and up-to-date educational material, making sure that RTs and RNs get support from more experienced staff members and superiors, and providing up-to-date equipment and high-fidelity mannequins so that RTs and RNs can practice their skills and knowledge acquired during the ACLS training. This result of this study indicated the

need for program/curriculum development to address and evaluate the gaps, along with additional educational opportunities.

The AHA guidelines are reviewed every 5 years (Bhanji, 2015). According to AHA guidelines, there is a need to continue practice after the initial training to maintain the skills. Mock codes, simulation-based training, drills, hand out, and role play helps RNs and RTs in learning and implementing knowledge and skills in ACLS recertification. It also builds team work to practice their skills in a safe environment. The qualitative research method addressed the difficulties that RNs and RTs describe in retention of skills and knowledge from ACLS recertification course and the strategies or learning environments do RTs and RNs perceive that would be help them in retaining knowledge and skills.

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Appendix A: The Project Study – Revised Curriculum

Goal of the Curriculum

The goal of the revised curriculum is to provide the RNs and RTs with the knowledge and skills to appropriately respond to a cardiac arrest or code blue. The knowledge and skills include the ability to identify the patient situation, make assessment of the situation, administer the relevant interventions, use all resources including appropriate equipment, perform individual role in a team. The curriculum is a 3-day course.

Code Blue Team Training/Mock Code

Description of course. This is a mock code and simulation-based team training for RNs and RTs. The cases are based on care of the respiratory failure patient with a focus on assessment and interventions specific to the patient situation and application of code blue management skills. This course is offered twice a month.

Participants. In addition to the RNs and RTs other healthcare providers, such as doctors and interns and unit-based pharmacist were asked to join. There were 2 residents, 2 RNs, 2 RTs, 2 pharmacists, 1 resource nurse were included.

Facilitators. There should be two facilitators- a nurse educator and a respiratory therapist educator in facilitating the course.

Goal of the course. Participants will gain experience and understanding of assessment and care of the respiratory failure patient, in the context of a role play, learning about equipment, and importance of team approach utilizing the knowledge and skills.

Behavioral outcomes

1. Complete assessment will be performed by the participant and the cause of patient's change in condition will be identified.

2. The participant will efficaciously communicate with other healthcare providers throughout the situation in taking care of a patient.

3. The participant appropriately uses the available resources and equipment.

4. The participant will perform the assigned specific role in the team.

5. The participant will implement the appropriate interventions following the algorithms as appropriate.

6. The participant will be able to debrief and discuss performance within the scenario sharing feedback and identifying gaps in performance.

Educational Modality. The course consists of a combination of active and reflective learning. The debriefing session will include the usage of equipment, supplies, and space.

1. **Equipment**: High or low fidelity mannequin, bed/stretcher, IV pole and pump, code cart, defibrillator, monitor, computer station.

2. **Supplies**: Medications, oxygen equipment, handoff report, images, ECG, and Lab results.

3. **Space**: Inpatient room in the simulation center and classroom for debriefing with enough light and appropriate room temperature.

Format of the Course. The format of the course is as follows: 2-hour session

1. Staff and facilitator Introductions: 5 minutes

2. Prebriefed: Brief standardized introduction to simulation-based learning: 10 minutes the prebriefed will include the following:

a. Confidentiality (of case content, scenario performance, and debriefing discussion)

b. Video usage, simulation limitations

c. Participant responsibilities and expectations of performance

d. Introduction to the environment, equipment, mannequin, and space

3. Simulation scenario: 10-15 minutes (one of the following scenarios- cases will rotate). Each case will have identified behavioral outcomes specific for the patient presentation.

a. Respiratory failure

b. Change in neurological status

c. Respiratory distress related to COVID-19 infection

d. Myocardial Infarction

e. Sinus Ventricular Tachycardia (SVT) unresponsive to medical management and requiring cardioversion

f. Septic Shock

g. Pulseless Electrical Activity (PEA) arrest

4. Debriefing session: 30-40 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:

a. The emotional aspect of participating in the scenario.

b. Understanding what happened: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was communication effective.

c. Cognitive aspect as a result of this activity, personal goals for the future?

5. Repetition of the scenario: 10 minutes (usually the same general situation, although case presentation may be slightly changed). The participants will switch roles as leader, RN, RT, pharmacist, and doctor. 6. Debrief second scenario: 30-40 minutes, using the same approach as in first

debriefing, but also asking how performance in this scenario was different, including both positive actions and performance gaps self-identified.

7. Evaluations: 10 minutes

Evaluation

1.Participants will complete an evaluation form that includes the perspective of participation in

the activity and anticipated changes in practice.

2. An observational checklist will be completed by the facilitators for each scenario.

3. A new process will be implemented in which the facilitators will complete a post debriefing self- evaluation.

Code Blue Skills Review

The participants will demonstrate their role responsibilities, code management techniques and the use of equipment in the simulation lab with the emphasis on defibrillator station, overview of the skills, and code management.

Behavioral outcomes.

1. Defibrillator station: The participant will demonstrate correct usage of the defibrillator for:

a. Defibrillation

b. Cardioversion

c. External pacing

2. Overview of the Skills:

a. The participant will specify their role and responsibility in an emergency situation.

b. The participant will illustrate effective communication techniques.

c. The participant will list resources available for emergencies.

d. The participant will portray on how situational awareness improves patient outcomes.

3. Code Management:

The participant will describe roles and responsibilities of the code team using the "Position of healthcare professionals?" model. See Figure A1.

Educational modality.

These components utilize classroom style didactic in lecture format, case discussion, skills stations for equipment.

Equipment/Supplies/Space.

1. **Equipment:** Defibrillator, pads, manikin with different rhythms.
2. **Supplies:** Handouts on CRM skills and code management.
3. **Space:** Classroom with a projector for CRM lecture, task space for equipment station, inpatient space for "Position of Healthcare professionals during code blue exercise", and whiteboard for discussion.

Format of the course.

Orientation. This is a two-hour session with three individual sessions that are 40 minutes long. The participants are divided into three groups that rotate through the three stations. Each station begins with of a brief overview of the content. The defibrillator station will be in a task room with three defibrillators available for participants to practice the three uses after a demonstration of each by the facilitator. The session consists of an introduction, presentation, and discussion of the case study.

Evaluation.

Orientation. There will be feedback provided at each of the stations to the participants in real time. There is no formal evaluation of skills or knowledge at orientation. Participants will be encouraged by facilitators to continue to review the content and use the resources available on the internal website for defibrillator review.

Code blue skills. There will be critical element observation checklists for the

defibrillator station and real-time feedback given to the participants as they demonstrate each of the three uses. Real-time feedback will be provided in the CRM and code management session. Any participant having difficulty will be approached and coached individually and will be provided individual feedback.

Adult Procedural Skills.

Course description. This course is for healthcare professionals that includes a didactic session followed by a skills station on airway care.

Participants. RNs and RTs.

Facilitators. AHA Instructor and simulation medical director.

Goal of the course. To provide the participant with the knowledge and skills needed to perform procedures used in urgent and emergent patient situations.

Behavioral outcomes.

1. The participant will perform an intubation to protect the with proper technique.

2. The participant will use proper equipment, such as laryngoscope handle, blade, endotracheal tube (ETT), suction catheter, and an AMBU bag. 3. The participant will make sure that the patient is well sedated and then open the patient's mouth

4. The participant will insert the laryngoscope blade into the mouth of the patient.

5. The participant will lift the laryngoscope up toward the chest, but away from the nose to view the vocal cords.

6.The participant will then take the endotracheal tube, made of flexible plastic, in the

right hand and starts slipping it through the mouth opening.

7. The participant will insert the ETT precisely through the cords, and now the cuff rests below the cords. Then the cuff is inflated. The cuff ensures that there will be no air leak when the bag is squeezed.

8. The participant will auscultate through a stethoscope and checks breathing sounds to make sure that the tube is in proper position.

1. **Equipment/Supplies/Space Equipment:** Task trainers – airway model, laryngoscope blades, ETT,

   AMBU, 10 cc syringes, suction catheters, and stethoscope.

2. **Supplies:** gowns, sterile gloves, hats, drapes, computer station.

3. **Space:** Classroom with a projector for didactic, task rooms for each procedure.

Format of the course (includes evaluation method per session).

Airway protection: A one-hour didactic session on insertion of ETT to protect the airway in a sterile environment and documentation of the need to intubate the patient will be provided. It will be followed by a brief discussion on two basic styles of laryngoscope blades- the curved blade and the straight blade. The curved blade is Macintosh blade which is the most commonly used and the other is the Miller blade which is the straight blade. In addition, there will be a discussion on intubation, use of suction catheter, and how to effectively deliver a breath through AMBU bag.

Role of facilitators. They will provide feedback to participants during skill practice sessions and encourage reflection on performance. In addition, the facilitators will evaluate the participants and provide constructive feedback on performance gaps.

HealthStream

Description of the courses. This eLearning course provides knowledge for the healthcare professional on selected topics specific for code blue in the hospital setting.

Participants. RNs, RTs, and other health care professionals.

Facilitators. The course will be designed by clinical educators with the involvement from all relevant stakeholders for content.

Goal of the courses. To provide the healthcare professional with knowledge of critical information related to code blue.

Behavioral outcomes.

1. New code cart implementation: The participant will be comfortable in using the new code carts in their care environment (See Figure A1).

Educational modality. eLearning platform used by the medical center to provide staff with the relevant knowledge to perform their role. Individual assignments are tailored for professional roles and assigned to the participants.

Format of the course. Each course will have a module presenting content.

1. This course is for all healthcare professionals. The skills course will include specific case study examples with enclosed Q&A. There will be a posttest evaluation at the

end of the module that the learner will need to pass with a score of 90% or better. The participants will be given more than one chance to complete the module.

2. The new code cart implementation course is for RNs, RTs, pharmacy and the users of the code cart. The picture of each drawer of the code cart will be included in the module. A brief posttest concludes the module. (See Figure A1).

Nurse and Respiratory Therapists Competency Day:

Description of the course. Annual RNs and RTs competency day provides the nursing staff with the opportunity to demonstrate required skills necessary for the performance of their role. The RNs and RTs will complete the paper test before hand and then will show the skills. The RNs will have some common stations with RTs, such as airway care and suction. All the healthcare professionals will be required to take the lectures on infection prevention, skin care, hospital initiatives (active shooter, compliance), specialty specific mandatory skill and equipment usage demonstration, code response skills, and simulation sessions on specific patient situations. Code response skills and simulation sessions will be detailed here.

Participants. Inpatient staff.

Facilitators. Clinical nurse and respiratory educators and simulation staff.

Goal of the course. The participants will demonstrate skills necessary for their professional role within a code blue response.

Behavioral outcomes.

1. Defibrillator station: The participant will use the defibrillator correctly and appropriately for the patient situation.

2. Code Cart station: The participant will locate all necessary equipment within the code cart promptly.

3. Medication Administration: The participant will correctly prepare and administer emergency medications in a code blue setting.

4.Code Documentation station: The participant will accurately document within the medical record the events that occur during a code blue.

5. Deteriorating patient: The participant will assess the signs and symptoms of decompensating Patient, like, difficulty in breathing with physical activity (exertional dyspnea) or difficulty in breathing while lying flat (orthopnea) and implement appropriate interventions for the specific patient issue.

Educational modality. Skills stations for code cart, defibrillator with critical event observation checklists. Computer lab station with case scenarios to document in the medical record. Simulation for the deteriorating patient scenarios.

Equipment/Supplies/Space:

1. **Equipment**: Code carts, defibrillators, manikins, IV poles, IV pumps, computers.
2. **Supplies**: Emergency medications, IV fluids and IV administration supplies, oxygen administration supplies.

3.**Space**: Task rooms for skills stations, a computer lab for documentation, and inpatient room and debriefing room in the simulation center for decompensating patient scenarios.

Format of the course. Participants will be divided into three groups of 15 and further divided into groups of 5 to rotate through the Code cart station, defibrillator station, medication administration stations. Please refer to Table A1.

Table A1

RNs and RTs Annual Competency Day Schedule Template

Time	**Group A**	**Group B**	**Group C**
8:00-9:25	Mandatory for all the groups to attend in the classroom		
9:30- 9:50	Break and travel to the designated area		
9:50-11:20	Content A	Simulation	Content B
11:20-12:30	Lunch Break		
12:30-2:00	Simulation	Content B	Content A
2:00-2:15	Break		
2:15-3:45	Content B	Content A	Simulation
3:45-4:00	Discussion of any concerns		

Content A: Code cart and documentation

Content B: Mock code

1. **Defibrillator station:** Skills station lasting 20 minutes where staff nurses in groups of 4 will each demonstrate appropriate use of the defibrillator for defibrillation, cardioversion, and external pacing. There will be three defibrillators available at the skill station. Each nurse will be observed by a clinical nurse educator for performance, feedback provided as needed on performance gaps. Each nurse will have the Defibrillator Performance checklist completed by one of the educators. See Appendix G for the form.
2. **Code Cart station:** Skills station lasting 20 minutes where the RNs and RTs staff nurses in groups of 5 will complete a checklist documenting the location of the equipment. There will be three code carts available at the station. See the following Figure A 1 for the code cart drawer.

Figure A 1: Code Cart Drawers


2nd Drawer : Fluids, Syringes


3rd Drawer: Respiratory


4th Drawer: laboratory

3. **Medication administration:** Skills station is lasting 20 minutes where staff nurses in small groups of 4 where each nurse will demonstrate the preparation of emergency medications used in a code blue. Nurses will also describe the process of administration. There will be four code cart trays available for this station. Nurses will be observed in the medication administration process by a clinical nurse educator.

4. **Code Documentation station:** This 45-minute station in a computer lab will have a group of 12 nurses each at a computer terminal. The nurses will observe a video on a simulated code blue scenario and document the event in a simulated version of the code blue documentation system. Clinical nurse educators will be present in the room providing support and reviewing the performance of the nurse giving real-time feedback.

5. **Deteriorating patient:** This 1 hour and 45-minute session that occurs in the simulation center for a group of 12 participants with one clinical nurse educator and simulation staff. The participants will be divided into smaller groups of four. Each group of four will participate in one scenario as the providing team (bedside nurse, charge nurse, peers on the unit). The remaining eight students will observe the scenario via live streaming. All twelve students will participate in the debriefing. This process will be repeated two more times so all students will have an active role. The clinical educators for the area of practice will determine the three scenarios, based on staff needs but all will focus on caring for a decompensating patient and nursing care required. The format of this session will be:

Simulation session agenda

a. Brief: introduction to the agenda and outline the plan (5 minutes).

i. Confidentiality (of case content, scenario performance, and debriefing discussion)

ii. Video usage and simulation limitations

iii. Participant responsibilities and expectations of performance

iv. Introduction to the simulation environment-manikin, equipment, and space

b. Simulation scenario: 10 minutes. Each case will have identified behavioral outcomes specific for the patient presentation.

c. Debriefing session: 20 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:

i. The emotional aspect of participating in the scenario- how it felt, was it realistic.

ii. Understanding of the situation: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was effective communication.

iii. The cognitive aspect to practice as a result of this activity, personal goals for the future.

d. Repeat scenario two more times: 10 minutes with participants switching from active to an observer role.

e. Debrief each of two remaining scenarios: 20 minutes, using the same approach as in first debriefing, but asking how performance in this scenario was different in comparison, both positive actions and performance gaps self-identified. Evaluations: 5 minutes

ACLS.

Description of the course. This course is for adult healthcare providers caring for a patient needing advanced life support measures.

Participants. RNs and RTs

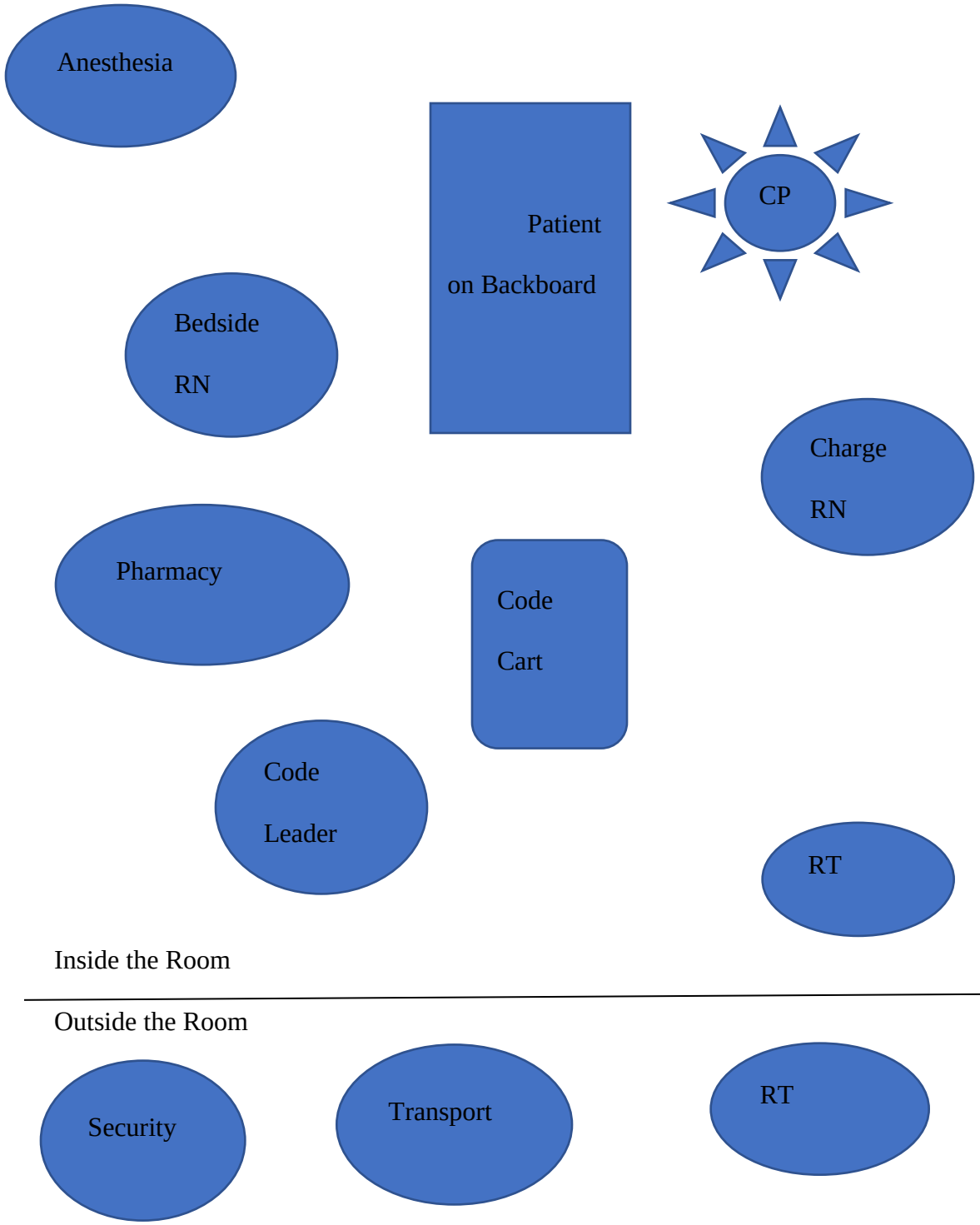
Facilitators. ACLS certified instructors.

Goal of the course. To provide the participant with the knowledge and skills needed to perform advanced life support.

Educational modality. Two-day course that includes didactic sessions followed by practice skills stations, and performance evaluation sessions on simulation manikins. A pretest is given on EKG to assess the cognitive skills on RNs and RTs. A posttest evaluation is given to assess knowledge.

Evaluation. Participants will pass the posttest evaluation and perform correctly at the skills stations completing critical skills on the observation checklist. Certification is good for two years.

Figure A 2: Position of Healthcare Professionals During Code Blue



Practice Megacode Skills

The following scenario highlight the key algorithms that RNs and RTs face at the hospital on inpatient situation

Key points to be stressed during this exercise include:

- Accurate rhythm identification
- Appropriate settings and timing for defibrillation
- Correct drug administration including knowledge of doses
- Initiation and/or Resumption of CPR (chest compressions) after shocking without delays for assessing rhythm
- Ability to generate the differential for PEA arrest (6 H's and 5 T's)
- Airway: Bag Valve Mask (BVM) done appropriately; timing of intubation request

RNs and RTs will be evaluated for their overall mastery of ACLS. Failure to achieve a minimum point for a practice mega code will necessitate remediation. For the purposes of this exercise the code team consists of a RT leading the code team, pharmacist as a scriber, RN managing the airway, another RN as IV therapist, and doctor performing chest compressions. While the team lead is primarily being evaluated, the other members

should be given feedback regarding the quality and speed of chest compressions and appropriate management of the airway.

Name _____ Evaluator: _____

Scenario: A 60-year-old female patient is complaining of palpitations and dizziness. She has a history of mitral valve prolapse and SVT. She is on 2L of Oxygen NC and she has a patent IV. She weighs 70 kg. You are the RN covering the cardiology inpatient service and have been asked to evaluate.

Scenario	/N	Comments (including point deductions)
Assessment: Monitor shows SVT. BP 110/70, HR 180, Pulse Ox 94% on 2L, RR 24, she is c/o feeling slightly SOB, denies CP. Lungs are clear. (1 POINT)		
Try vagal maneuvers for stable SVT.		
Vagal maneuvers (bearing down) have not helped, pt slightly SOB, BP 106/68		
Administer Adenosine 6 mg rapid IV push with saline flush (½ point medication, ½ point dose and style)		
No change in the monitor, SVT with rate of 180		

Administer 2nd dose of Adenosine 12 mg rapid IV push with saline flush		
Monitor shows SVT, rate 180		
Patient lethargic, Pulse weak, BP 80, O2 sat 88% RR shallow 28 (unstable tachycardia)		
Call for defibrillator and prepare for cardioversion		
Consider sedation with versed 2 mg		
Set defib on synch mode and charge to 50-100 joules (½ point knowledge, ½ point implementation)		
Clear, shock and check rhythm (SVT)		
Charge defib to higher energy level		
Clear, shock and check rhythm (V fib), no pulse (1 POINT)		
Turn off synch mode and charge defib to 120 j (1 POINT if shock within 30 seconds OR within 90 seconds with CPR started) Higher joules OK. Clear, shock at 120J.		
Clear, shock at 120 (Rhythm remains in V fib)		
Start CPR immediately (ideally within 5 seconds) after shock and continue for 2 minutes (1 POINT if started within 15 seconds)		
Check rhythm, V fib, charge defib to 150j		
Clear, shock at 150 j resume CPR		

5H’s

Hypoxia

Hypovolemia

Hyperthermia

Hypo /hyperkalemia

Hydrogen ion (acidosis)

5T’s

Tamponade

Tension pneumothorax

Toxins – poisons, drugs

Thrombosis – coronary

Thrombosis – pulmonary

Appendix B: Interview Questions

Q1. What difficulties do the RNs and RTs describe in retaining the knowledge and skills from the ACLS recertification course?

- Describe any difficulties you found in retaining knowledge and skills during and after ACLS re-certification course/
- Discuss what you perceive as the reason (s) for this difficulty?

Q2. What strategies or learning environments do the RNs and RTs perceive would be most effectiveness to help them retain knowledge and skills needed to pass the ACLS recertification exam?

- What strategies, experiences, or learning methods were used in the re-certification class?
- What strategies did you find helpful in retaining information and skills for practice?
- Did any of your class ever used simulation, role play, or other hands on experiences in re-certification class?

Appendix C: Mock Code Sheet

Date: _____ Unit/Bed: _____ Evaluator: _____

Checklist	Respond time	Observation
1. Determine Responsiveness		
2. Assess breathing		
3. Pulse checked by MD **RN RT Other**		
4. Begin CPR		
5. Crash cart to room		
6. O2/Ambu Bag started		
7. Ventilation good seal and head positioning		
8. Suction set up		
9. Respiratory rate		
10. Connect to monitor		
11. CPR backboard placed		
12. IV access obtained		
13. Initial rhythm accurately identified		
14. Time to first epinephrine (if appropriate)		
15. Time to first defibrillation (if appropriate)		

16. CPR uninterrupted during every 2-minute cycle		
17. CPR re-initiated <15 sec		
18. Current ACLS standards followed		
19. Documentation complete (start time noted)		
20. Copy of code sheet in chart		
21. Copy of code sheet in pharmacy box		
22. Code leader's vocal commands easily audible		
23. Code leader delegated tasks appropriately		
24. Code leader had a good understanding of the ACLS algorithm		
25. Code leader-maintained control		
26. Code leader was confident running the code		
TOTAL Points for Code Leader:		
Bonus Points: Excess people were removed from the room		

Suggestions:_____

_____