Critical Care Nurses’ Knowledge and Confidence in

Arrhythmia Interpretation

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A research thesis submitted in partial fulfilment of the requirements for

the degree

MASTER OF NURSING
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Declaration

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Signed:

Samira H. Kerbage

Date: 29/11/16
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List of Abbreviations

ACCCN: Australian College of Critical Care Nurses
ACSQHC: Australian Commission on Safety and Quality in Health Care
A. F: Atrial Fibrillation
A. FL: Atrial Flutter
AT: Atrial Tachycardia
AV: Atrioventricular
ALS: Advanced Life Support
ARC: Australian Resuscitation Council
CCRN: Critical Care Registered Nurse
CCU: Coronary Care Unit
CPR: Cardiopulmonary Resuscitation
ECG: Electrocardiography
HB: Heart Block
ICU: Intensive Care Unit
KART: Keller Assessment Rating Tool
LBBB: Left Bundle Branch Block
MET: Medical Emergency Team
MUHREC: Monash University Human Research Ethics Committee
NSR: Normal Sinus Rhythm
PAC: Premature Atrial Contraction
PACU: Post Anesthesia Care Unit
PJC: Premature Junctional Contraction
PVC: Premature Ventricular Contraction
RBBB: Right Bundle Branch Block
SVT: Supraventricular Tachycardia
VF: Ventricular Fibrillation
VT: Ventricular Tachycardia
WPW: Wolf Parkinson’s White
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Glossary

**Advanced Life Support:** “Basic life support with the addition of invasive techniques e.g. manual defibrillation, advanced airway management, intravenous access and drug therapy” (ARC, 2010, p.1).

**Arrhythmia:** Includes all the different kinds of abnormal cardiac rhythms made specific by naming the anatomical location of the pathology, it can be described as tachycardia where the heart rate is greater than 100 beats/minute or bradycardia where heart rate is less than 60 beats/min (Urden, Stacy, & Lough, 2014).

**Arrhythmia Competency:** The level of arrhythmia knowledge which enables the nurse to recognize and manage abnormal cardiac rhythms safely and precisely. (ARC, 2010).

**Basic Life Support:** “The preservation or restoration of life by establishment of and/or maintenance of airway, breathing and circulation and related emergency care which include the use of the Automated External Defibrillator” (ARC, 2010, p.1).

**Critical Care Nurse:** A registered nurse with postgraduate qualifications who delivers acute patient care in a monitored clinical environment. The nurse is responsible for identifying and implementing appropriate interventions and evaluating the care outcomes within the critical care setting such as intensive and coronary care units (ARC, 2010).

**Lead Specific Electrocardiographic Monitoring:** “the visual specific representation of the hearts ’electrical origin and direction of electrical flow” (Keller, 1997, p.6)

**Non-ST Segment Elevation Myocardial Infarction:** irreversible myocardial necrosis (heart muscle cell death) that results from an abrupt decrease or total cessation of coronary blood flow to a specific region in the heart and where the electrocardiography does not display an elevation in the ST segment because the infarction and subsequent lesion are not full
thickness which means that some of the muscle in that region can still be depolarized (Urden et al., 2014).

**QT Interval:** It is measured from the beginning of the QRS complex to the end of the T wave and indicates the total time interval from the beginning of depolarization of heart muscle to the end of repolarization. In normal patients, the QT interval is less than one half the R-R intervals; it lengthens with bradycardia and shortens with tachycardia (Urden et al., 2014).

**ST-Segment Elevation Myocardial Infarction:** A myocardial infarction involving sudden decrease in blood supply to the heart muscle resulting in irreversible myocardial death evidenced by electrocardiographic changes in the form of elevation in the ST-Segment (Urden et al., 2014).

**Ventricular Tachycardia:** is caused by a ventricular pacing site firing at a rate of 100 or more per minute usually maintained by a re-entry mechanism within the ventricular tissue: the QRS complexes on the ECG are wide and mainly regular. It is characterized by being pulseless which is life threatening and requires the use of the defibrillator or with a pulse which can be managed using drug therapy (Urden et al., 2014).

**Ventricular Fibrillation:** It is a result of the chaotic electrical activity from various foci in the ventricles characterized by an inability of the ventricles to pump blood effectively This is a lethal arrhythmia requiring defibrillation to restore the electric activity of the heart (Urden et al., 2014).

**Wolf- Parkinon’s- White Syndrome:** A condition in which the patient demonstrates supra-ventricular tachycardia with ante-grade conduction over an accessory pathway bypassing the AV node. This results in wide complex QRS complexes which resemble the ones in ventricular tachycardia (Urden et al., 2014)
Abstract

**Background:** Previous studies have revealed a knowledge gap in arrhythmia identification amongst critical care nurses. This deficit may affect their propensity to recognise early signs of patients’ deterioration and have adverse impact on survival. No Australian studies have described critical care nurses’ level of arrhythmia knowledge or how that knowledge affected their confidence.

**Aim:** To describe the level of arrhythmia knowledge and confidence demonstrated by critical care nurses.

**Design and Methods:** A descriptive quantitative study design was conducted using a two-part self-reporting survey. Part one collected participant demographic data and overall confidence while part two used the Keller Assessment Rating Tool to collect data on participant rhythm interpretation and confidence levels. Non-probability sampling resulted in 32 participants from a single site. Non-parametric statistics were used to analyse the data and Spearman’s rho was utilized to examine correlations between variables.

**Results:** The majority of participants were females (n=31, 96.9%) with median age of 42 years; (IQR=34-52) with six to ten years of experience (n=15, 46.9%). Poor scores were achieved in interpreting intermediate and advanced ECG strips. A positive monotonic relationship between the ranks of knowledge and confidence was detected. Median knowledge scores increased with years of experience and number of ECGs interpreted per month and decreased with level of ECG difficulty.

**Conclusion:** This study identified gaps in participants’ arrhythmia knowledge despite being generally confident in ECG interpretation. Participants identified shockable rhythms accurately but could not recognise other fatal arrhythmias. Further research is required to generalise findings.

**Keywords:** Critical care nurse; Knowledge; Confidence
Chapter One: Introduction

1.1: Background to the Study

The Australian Resuscitation Council (ARC) established guidelines on the value of recognising patients’ deteriorating signs and symptoms or what is known as the pre-arrest period. Failure to recognise the patients’ deterioration is often a problem leading to adverse effects and prolongation of in-hospital stay (Smith, 2010; Endacott et al., 2010). The mortality rate of the successfully resuscitated patients following an in-hospital cardiac arrest is poor and ranges between 25 to 67% within the first twenty-four hours after return of circulation (Sandroni, Nolan, Cavallaro, & Antonelli, 2007). The probability of maintaining blood flow to the brain and other vital organs post arrest increases if defibrillation via the automated electronic defibrillator is commenced as soon as a shockable rhythm is identified (Australian Resuscitation Council, [ARC], 2010). CCRNs have to demonstrate vigilance in cardiac monitoring, competence in arrhythmia recognition and an ability to combine Advanced Life Support (ALS) and invasive techniques when signs of deterioration are detected (ARC, 2010). In fact, arrhythmia interpretation knowledge, patient monitoring, early recognition of deterioration and call for help to initiate a response interlink to form a strong chain of prevention of cardiac arrests (Smith, 2010, ACSQHS, 2011).

Warning signs usually proceed unexpected deaths, cardiac arrests and admissions to intensive care units (ICU) hence early recognition and stabilisation to ensure prevention of arrest is key to promote survival (Sandroni et al., 2007). However, clinical decisions are sometimes made by inexperienced nurses who might fail to recognise early signs of deterioration, systematically assess the patient or link their knowledge of pathophysiology to the changes in observations. This could lead to adverse clinical outcomes (Endacott et al., 2010).
The ICU outreach or liaison is a service adopted in some Australian hospitals to recognise and manage the patients’ early signs of deterioration outside of the critical care units. The role was developed to support ward staff detect patients at risk before a medical emergency team (MET) call is triggered. The aim of the liaison was to initiate family and staff education and monitor patients’ status and care (Endacott & Chaboyer, 2006). While the role is crucial to improve patients’ outcomes and accelerate the rate of discharge from the hospital, it necessitates the presence of competent critical care nurses (CCRN) who can fit into the role. Competent CCRNs are perceived as well equipped to respond to clinical deterioration because they possess attributes of skills, knowledge and confidence hence presenting a solution to the hospital problem (Australian Commission on Safety and Quality in Healthcare [ACSQHC], 2011).

The ARC has identified the value of having an in-hospital system that maintains staff education about the signs of patients’ deterioration, and sets policies to guide staff how to react in the event of pre-arrest or actual arrest situations. The ARC concluded that educational efforts have a positive effect on cardiac arrhythmia knowledge, skills, and confidence in recognition (ARC, 2010). This will translate into safe practice and demonstrable competency in arrhythmia interpretation (ARC, 2010). Delayed response and poor management of clinical deterioration can be reduced by education and experience (Buykx et al., 2011).

In Australia, CCRNs must demonstrate an advanced level of arrhythmia knowledge including an ability to distinguish between shockable and non-shockable rhythms and proper electrocardiography lead placement. The Australian College of Critical Care Nursing (ACCCN) acknowledged that a mixture of critical care experience and a post graduate specialist qualification provides the nurses with an adequate preparation to address the needs
of patients in the critical care setting (Australian College of Critical Care Nurses, [ACCCN] 2003). However, poor electrode placement techniques; inability to differentiate heart blocks, aberrant conductions, tachyarrhythmia and failure to explain differences in ECG waveforms are still evident in the critical nursing practice (Keller & Raine, 2005; Adams-Hamoda, Caldwell, Stotts, & Drew, 2003).

It has been identified that symptomatic arrhythmias are related to the presence of multisystem disease leading to significant hemodynamic compromise (Reising, Kusu moto & Goldschlager, 2007). The electrocardiography (ECG) remains the gold standard for the evaluation of both narrow and wide QRS complex tachycardia despite the presence of some ECG’s that defy differentiation (Reising et al., 2007). However, there remains a high expectation from nurses and doctors to interpret the majority of the ECGs accurately (Reising et al., 2007). Furthermore, it had been reported previously that among the indications to record a 12 lead ECG were acute critical illnesses, peri and post cardiac arrest and acute coronary syndrome. However, any procedure involving sedation or anaesthesia, drug overdose leading to metabolic abnormalities and any acute critical illness should also prompt the CCRNs to investigate their effects on the cardiac function (Higgins, 2011).

CCRN are required to undertake refresher courses in ALS at least annually. This assessment is important to review the arrhythmia interpretation knowledge and resuscitation skills. However, the effectiveness of assessing ALS only once per year has been questioned because knowledge has been shown to decrease over time if not frequently updated (Broomfield, 1996; Taplin & McConigley, 2015). Furthermore, ALS competency does not deem CCRNs confident to manage arrhythmias (Whitaker, Carson, & Smolenski, 2000). Thus, different groups of CCRNs who have a varying degree of exposure to cardiac emergencies may have different levels of knowledge and confidence in arrhythmia
interpretation. Therefore, the ARC recommended that the emphasis should be in maintaining the arrhythmia knowledge and skills rather than completion of the ALS assessment (ARC, 2010).

It was previously shown that sound clinical knowledge is essential to secure optimum patient’s outcomes; a high degree of congruence is necessary between the requirements of patient care and the level of knowledge possessed by CCRNs (Fullbrook, Albarran, Baktoft, & Sidebottom, 2012). It is crucial that CCRNs are competent in cardiac rhythms recognition to initiate proper management as part of their duty of care (Fullbrook, 2007). CCRNs knowledge is affected by their level of experience (Vandijck, Labeau, & Blot, 2008), and complex arrhythmia recognition could be a deficit in their knowledge related to lack of experience and exposure (Fullbrook et al., 2012). Clinical experience with similar patient presentations improves the early detection of clinical deterioration (Endacott, et al., 2010).

The rationale underpinning decision making of CCRNs has been ascribed to their level of knowledge (Ramezani-Badr, Nasrabadi, Yekta, & Taleghani, 2009). Knowledge has been shown to help CCRNs recognise and prevent patients’ haemodynamic instability (Currey & Botti, 2006). Two decades ago, Lamb and Henderson (1993) demonstrated that in order to address cardiac arrhythmias, CCRNs had to be equipped with sound ability in advanced rhythm interpretation which included listing leads showing abnormal tracing, identifying the damage, the form of heart wall involvement and degree of injury. CCRNs are still expected to demonstrate this level of knowledge in arrhythmia interpretation (ARC, 2010).

Previous studies have revealed gaps in the CCRNs’ knowledge of cardiac arrhythmias (Keller, 1997; Keller & Raines, 2005, Pelter, Carey, Stephens, Anderson, &
Yang, 2010). This knowledge deficit affects nurses’ management of cardiac deterioration which may impact the quality of patient care (ARC, 2010). Studies have attributed the shortfalls in arrhythmia knowledge to several factors: Lack of exposure (Hui, Low, & Lee, 2011; McCarthy, Cornally, O’Mahoney, White, & Weathers, 2013; Arnold et.al, 2009), deficits in information (Fulbrook et al., 2012) infrequency of educational updates (Preston, Currey, & Eastwood, 2009; Kiyan et al., 2006) and unawareness of the active role played by critical care nurses during resuscitation (Hui et al., 2011)

1.2 Statement of the Problem

There is dearth of information regarding the level of cardiac arrhythmia knowledge possessed by Australian CCRNs and whether arrhythmia knowledge affects their confidence in recognising some versions of arrhythmia. Furthermore, it is not clear if arrhythmia knowledge is affected by frequency of exposure to ECG interpretation or the complexity of the arrhythmia.

1.3 Aim

The aim of this study was to describe the level of arrhythmia knowledge and perceived confidence demonstrated by CCRNs working on critical care wards.

1.4 Research Question and Operational Definitions

The research question was: Do CCRNs have the knowledge and confidence to interpret arrhythmias?

Operationalization of the variables was necessary to reveal the empirical referents and show how they were measured (Schneider & Whitehead, 2013). Thus arrhythmia knowledge was defined as the ability to accurately recognize and interpret normal and abnormal cardiac rhythms (Keller, 1997) operationalized as the score on a thirty-one strip
ECG and two electrode placement test. Confidence was operationalized as the CCRNs’ beliefs in their abilities to manage the patient needs safely (Arnold et al., 2009) measured as a score on a self-rating scale from zero to four with zero being the least and four being the most confident.

1.5 Theoretical Framework

Nursing knowledge is initially acquired in the classroom where a range of teaching methods are implemented. However, critical thinking skills that are necessary for safe practice are gained through experience (Lisko & O’Dell, 2010). The Experiential Learning Theory identifies the importance of experience to learning and defines learning as a process that involves acquisition of abstract concepts which can be applied in a variety of situations. Hence, the stimulus for the development of new concepts is provided by new experiences, and learning is created through the transformation of experience in the form of a learning cycle (Kolb, 1984). This is illustrated in Figure 1.

Figure 1. Kolb’s Experiential Learning Cycle

Kolb described a four stage cyclical process of adult learning. He proposed that learning is a cognitive process which requires active engagement with the environment. Adult learners create knowledge from experience rather than from delivered instructions. Learning is thus a holistic process involving acting, reflecting, feeling and thinking. In the concrete experience stage, learners engage openly and fully in the learning experience. In contrast to the reflective observation stage where learners take a step back and think about the experience. During abstract conceptualization, learners formulate logical theories based on the observations they made and then perform active experimentation to test theories and construct foundations for problem solving (Kolb, 1984; Kolb & Kolb, 2005; Bergsteiner & Avery, 2014). CCRNs have varying degrees of clinical experience ranging from novice to expert. It is not known in the Australian clinical setting if the varying level of experience affects how CCRNs respond to clinical deterioration and whether experience affects their problem solving skills. Kolb’s model informs how following the components of the learning cycle is crucial in the critical care environment to achieve optimum learning and retention of knowledge.

Furthermore, each learner has a habitual way of learning and a preferred learning style fitting perfectly with Kolb’s model. Hence CCRNs can either be divergers who learn through logical instruction and hands on exploration to constructively work up to the bigger picture, convergers who reflect on the experience, generate concepts and experiment what they learned, assimilators who prefer thinking about concepts than acting in situations or accommodators who actively intervene in concrete situations (Kolb, 1984; Bergsteiner & Avery, 2014).

Kolb’s learning stages and cycle could be used to evaluate the learning provision available to CCRNs and develop suitable activities that optimise their engagement in ECG
interpretation. The model was used to understand why critical care nurses have a varying degree of competence in arrhythmia knowledge. Expert CCRNs have transformed their experience following a cycle of application and reflection to create knowledge that could be applied in a variety of situations. In this research, Kolb’s experiential learning theory can explain what underpins the varying degree of knowledge and confidence in arrhythmia interpretation.

1.6 Thesis Structure

The thesis is presented in six chapters. Chapter One provides background information on the study, statement of the problem, aim of the research, research question operational definitions and theoretical framework. Chapter Two presents the literature review of the study, while Chapter Three explains the study methodology and ethical considerations. In Chapter Four the results of the study are presented. Finally, Chapter Five discusses the study findings, strengths, limitations, implications, recommendations and conclusions drawn from this research.
Chapter Two: Literature Review

A literature review was conducted to explore CCRNs knowledge of lethal cardiac arrhythmia; their ability to interpret ECG accurately and if that knowledge deemed them more confident in decision making. In this chapter, a search strategy is presented. Studies related to aspects of knowledge and measuring arrhythmia knowledge are evaluated.

2.1 Search Strategy

The search was conducted using the Monash University online library to identify existing published literature. Peer reviewed journals reporting primary research findings were favoured over secondary sources. Databases searched were CINAHL plus, OVID-MEDLINE, PROQUEST and WILEY INTERSCIENCE because they provided access to a wide range of articles relevant to the topic. Key words entered were ‘critical care’, ‘nurses’, ‘knowledge’, ‘arrhythmia’, ‘dysrhythmia’, “assessment”, “test” and “electrocardiography”. Boolean operators were replaced by Smart text search, and the word “test” was replaced by “tool” and “instrument” due to scarcity of articles retrieved. Limiters applied were full text, English language, human research and period of publication from 1990 to 2015 to ensure relevant literature was obtained. Articles that identified nurses’ perceptions of arrhythmia knowledge, confidence and level of knowledge were included. Reference lists of the identified papers were also manually reviewed for relevant articles. The literature retrieved was limited to articles published from the year 1990.

Grey literature was retrieved from Google Scholar. A Doctorate dissertation that had a validated assessment tool (KART) was crucial for the study and was formally requested through the Monash University librarian from the University of Miami because it was not
available through the Monash library catalogue. Websites like ACCN and ARC were also investigated to identify arrhythmia knowledge criteria.

2.2 Aspects of Knowledge

In this section, the evidence related to assessing CCRNs’ knowledge in arrhythmia identification is explored and critiqued in five sections. Knowledge for Practice, Knowledge Retention, Clinical Application of Knowledge, Knowledge and Confidence, Maintaining Knowledge and Measuring Arrhythmia Knowledge.

2.2.1 Knowledge for Practice

Nursing knowledge contributes to safe nursing practice (Sumner, Burke, Chang, McAdams, & Jones, 2012; Keller, 1997). Arrhythmia knowledge is crucial in the critical care setting because it affects CCRNs’ preparedness to detect and respond to clinical deterioration (Keller, 1997). CCRNs’ arrhythmia knowledge varies depending on the rate of exposure and level of experience (Keller, 1997; ARC, 2010). Hence, nurses with more experience and exposure are likely to recognize certain arrhythmias and initiate timely management in contrast to nurses with less experience who may fail to identify arrhythmias which result in patients’ deterioration and poor outcomes (Fullbrook, 2007). Despite undertaking annual ALS training, CCRNs show deficits in arrhythmia knowledge and electrode placement skills (Keller & Raines, 2005). A qualitative study aimed at identifying and describing the CCRNs’ perception of arrhythmia knowledge and levels of arrhythmia competency was undertaken (Keller & Raines, 2005). The participants worked in three Metropolitan hospitals and were required to interpret ECG strips and make treatment decisions accordingly as part of their role. Participants were required to determine their perception of arrhythmia knowledge and assign a rating score related to the level of knowledge needed to identify specific arrhythmias. Results showed the participants
perceived three categories of ECG: basic, intermediate and advanced. Deficits existed in nurses’ ability to identify specific arrhythmias like heart blocks, aberrant conduction, and tachy-arrhythmias and specific syndromes like Wolf Parkinson’s White (WPW). In this study, the nurses’ understanding of electrode placement varied among participants (Keller, 1997). However, this study needed further refinement of the arrhythmia subscales.

Similarly, another study identified the importance of nurses’ role in acquiring, analysing and communicating 12 lead ECG findings (Pelter et al., 2010). The study examined whether a group of CCRNs (n=75) could accurately interpret ECGs showing ST segment elevation myocardial infarction location (STEMI) and non ST segment elevation myocardial infarction (non STEMI). CCRNs from the emergency department, coronary and progressive care units were given six patients scenarios (three STEMI, three non-STEMI) and a corresponding 12 lead ECG. Results showed that the participants were unable to identify a non-STEMI presentation, correct lead positioning, anatomic location or amplitude of ST elevation. However, the study did not include staff from the ICU (Pelter et al., 2010).

Furthermore, Fulbrook et al., (2012) undertook a study in 20 European countries to assess intensive care nurses’ levels of knowledge. ICU nurses (n=1142) from 318 ICU units participated to answer a questionnaire designed in 16 languages addressing different areas of nursing. The survey showed that only 45.5% (n= 520) of the participants were competent in ECG/potential for ventricular arrhythmias identification. Results showed that experience was associated with a better performance in the ECG assessment. It emphasized that educational needs should be met to maintain competency (Fulbrook et.al ,2012).

Arrhythmia knowledge deficit is not exclusive to nurses. Doctors have also shown poor performances in ECG interpretation when they were tested (Sibbald, Davies, Dorian, & Yu, 2014). Twenty-nine cardiology registrars were examined using a set of ECG strips. They
interpreted half of the ECG’s using a standard analytic framework and half using their own approach. Overall, diagnostic accuracy for the entire 27 diagnoses was 58%. Of six life-threatening diagnosis, the residents missed 36% (n=123 of 348). The deficits in knowledge included identifying hyperkalaemia (n= 58, 81%) long QT (n=29, 51.7%), complete heart block (n=29, 34.5%) and ventricular tachycardia (VT) (n= 58, 19%). In this study, it was concluded that the registrars’ knowledge of ECG interpretation was suboptimal considering they were primary decision makers in their health care setting, (Sibbald et al., 2014).

These studies had shown that nurses and doctors had gaps in their arrhythmia knowledge. This deficit affects the quality of patient care and may prolong the in-hospital stay. However, the studies had shown that the level of arrhythmia knowledge improved with the years of experience. Correlations between level of experience and arrhythmia knowledge should be assessed to uncover the current status in Australian critical care settings. The studies also suggested that there should be a systematic method of addressing the gaps in arrhythmia knowledge to ensure optimal patient outcomes.

2.2.2 Knowledge Retention

Nurses’ arrhythmia knowledge retention and maintenance had been assessed previously. It was concluded that knowledge decays within a short period unless updated regularly (Broomfield,1996; Sumner et al., 2012). Simulation programs positively affect the ability to maintain arrhythmia knowledge (Sumner et al., 2012). There is a common agreement across several studies that medical and nursing staff tend to possess limited knowledge and skills of ECG interpretation related to infrequent training (MacInnes, 2014; Taplin & McConigley, 2015). To combat this, it was proposed that regular updates were necessary and rigorous assessment essential to avoid a mismatch between confidence and
competence in arrhythmia interpretation (Taplin & McConigley, 2015). ALS is an annual competency which includes assessing the level of lethal arrhythmia knowledge. Implementing ALS education and competency assessment can promote maintenance of knowledge necessary to avoid poor outcomes in the cardiac arrest situation. However, this approach covers lethal arrhythmias mainly and does not update the knowledge of other arrhythmias which if ignored by the CCRNS could lead to clinical deterioration. Also, the approach is limited by the high demand for ALS training and poor supply of trainers. This was the conclusion to a qualitative study which aimed to explore the methods of ALS education delivery, the issues related to maintaining the ALS competency skills and reasons why these skills decrease over time (Taplin & McConigely, 2015). Data were gathered from ALS nurse experts (n=11) in Western Australia using phone and face-to-face semi structured interviews involving a predetermined set of questions. The study findings suggested that using eLearning methods was important as an alternative to lecturing because it was economical and promoted regular updates of lethal arrhythmias recognition (Taplin & McConigely, 2015). The study however did not focus on the CCRNs’ point of view with respect to ALS education preferred method of delivery and the sample size may not have been a significant representative of the population of educators.

Two decades earlier, similar research was undertaken by Broomfield (1996) with the objective of testing registered nurses (n=19) retention of basic cardio pulmonary resuscitation (CPR) skills and knowledge. The study explored the need to keep updating CPR competency regularly. Study participants were students undertaking the national post registration ICU course. The instruments used were a 26-item CPR knowledge-questionnaire and an eight item skills testing observation tool. Results showed an initial improvement in CPR knowledge and skills post introducing the refresher course. They revealed a decrease in skills and knowledge retention ten weeks later which was statistically
significant (p=0.0000). The study maintained that regular updates of CPR knowledge and skills are vital through refresher courses to maintain competency (Broomfield, 1996). However, sample size (n=19) was small to represent the population. Furthermore, it did not reveal how often ALS competency needs to be updated or whether the same conclusion can be generalized on registered critical care nurses who have fulfilled the requirements of the course and are practicing within their scope. The knowledge test was limited to when and how to initiate CPR and did not test life threatening arrhythmias which may require initiating CPR or ALS.

Arrhythmia education improves acquisition and retention of knowledge. Arrhythmia education programs should be implemented and updated to provide the CCRNs with relevant information necessary for best practice. Basic arrhythmia knowledge retention over time and application of that knowledge in the clinical setting had been evaluated in a study. The objectives of the study were to examine if there was a difference in pre-test/post-test scores related to cardiac arrhythmia knowledge after introducing an arrhythmia education program and whether nurses’ preferred the traditional or simulation method to acquire arrhythmia knowledge (Sumner et al., 2012). A convenience sample of 138 newly hired full and part time registered nurses were recruited during their orientation. Following exposure to a program on basic arrhythmia, the participants (n=138) demonstrated knowledge retention at four weeks (p< 0.001) and at three months using simulation in the clinical setting. Limitations of the study included the possibility of nurses doing some studies prior to the test which resulted in higher scores (Sumner et al., 2012). The study did not focus on advanced arrhythmias knowledge and whether basic arrhythmia knowledge retention after three months deemed nurses competent in addressing the real life deteriorating cardiac patient. This was not clearly identified by the authors as a limitation.
Similarly, a Randomized Controlled Trial was conducted in a public university in Jordan by Tubaishat and Tawaalbeh (2015) to evaluate the effect of simulation based teaching on the acquisition and retention of arrhythmia knowledge among nursing students. A pre-test/post-test was used with nursing students randomly allocated to control (n=44) who received traditional lecture or experimental (n=47) who attended simulation scenarios. A paired t test showed that the mean knowledge score at the post-test was significantly higher (p<0.01) than at the pre-test for both groups. Results also concluded that participants in the experimental group demonstrated significantly increased knowledge of cardiac arrhythmias (mean=13.2, SD= +/-3.35) in the post-test after three months compared with those in the control group (mean=7.6, SD= +/-2.36).

2.2.3 Clinical Application of Knowledge

CCRNS are usually the first responders to the haemodynamic changes in hospital patients. When lethal arrhythmias such as Ventricular Fibrillation (VF) or Ventricular Tachycardia (VT) occur, time is the most important factor for survival. Hence, it is essential for CCRNs to have a sound level of knowledge in arrhythmia recognition in order to manage clinical deterioration in timely manner or what is known as clinical application of knowledge (Funk et.al, 2010; Whitaker et al., 2000). CCRNs’ decision-making or the ability to apply knowledge in the clinical setting improves with training and education. In fact, training CCRNs in arrhythmia interpretation empowers them to make the right clinical decisions and implement appropriate plans of care based on sound understanding of the patient condition. Hence the right decision would be made at the right time for the right patient (ARC, 2010). A prospective cohort study aimed to analyse emergency nurses’ ability to interpret VF and VT in a Hong Kong hospital and intervene by using electric shock to restore heart rhythm (Tai, Cattermole, Mak, Graham, & Rainer, 2012). A set of questions
was completed by nurses before and after a training session and the difference in mean scores was calculated between the pre and post teaching. Results revealed that 67% of the total participants (n=51) became more confident in defibrillation decision making and managing shockable arrhythmia post focused training (mean difference=0.42, p=0.014). The nurses’ performance in the knowledge test post training improved (mean difference=0.465, p=0.046). This research focused on the nurses’ ability to distinguish between shockable and non-shockable rhythm which is important to prevent delivering unnecessary shocks. Training was shown to improve their decision making abilities. The study however involved emergency nurses only hence further research was needed to uncover whether similar results can be deduced for nurses working in other specialty areas like Coronary Care Units (CCU) and ICU (Tai et al., 2012).

Similarly, the appropriate use of arrhythmia, ischemia and QT interval monitoring in the critical care setting was examined (Funk et al., 2010). Research nurses reviewed patients’ records (n= 1816) to check if proper monitoring had been utilized in the critical care wards in 17 American hospitals. Results showed evidence of inappropriate monitoring. 85% of patients with no indications for monitoring were being monitored. Only 21% of patients with QT and ischemic changes were monitored. This is an indicator of under monitoring and poor decision making which could lead to missing early signs of clinical deterioration (Funk et al., 2010).

2.2.4 Knowledge and Confidence

Knowledge affects the level of confidence in the clinical environment (Hui et al., 2011; McCarthy et al., 2013; Arnold et al., 2009). The level of knowledge that CCRNs possess strengthens their belief in their powers and capabilities to address the needs of the deteriorating cardiac patient safely and in timely manner. Furthermore, the rate of exposure
to cardiac deterioration and level of experience correlate with a higher level of confidence in the arrest situation (McCarthy, et al., 2013).

The ICU nurses’ potential constraints to perform defibrillation in the event of VT and VF were investigated by Hui et al., 2011. In a Hong Kong regional hospital, nurses were purposively chosen (n=12) with a range of years of clinical experiences. Interviews were conducted to explore cardiopulmonary resuscitation experience, existing defibrillation practices, and anticipated support. Newly qualified nurses expressed that they were reluctant to apply their theoretical knowledge in to practice due to lack of confidence and that their ability was hindered by doctors taking over resuscitation. Inexperience, insufficient knowledge in rhythm recognition and limited exposure to defibrillation were factors that participants perceived to affect performance. Participants stated that support from management and regular in hospital ‘real drill’ programs empowered them to apply nurse led defibrillation in ICU setting (Hui, et al., 2011). In this study however the selected ICU catered for patients with septic shock and multi organ failures more than patients with cardiac presentations which limited the nurses’ exposure to patients requiring defibrillation. Hence there might be discrepancy in the results if the study was carried in another hospital with a different patient mix.

Emergency nurses’ performance in 119 nursing procedures was scrutinized in a study undertaken across 11 different emergency departments in Ireland. ECG interpretation was among the hurdles assessed. Results conveyed a statistically significant positive correlation between emergency nurses’ (n= 214) level of perceived competence and frequency of practice (p<0.01). Results also showed that age and experience positively correlated with confidence (McCarthy et al., 2013). This study assessed the confidence level of only one
group of nurses that have critical care educational preparedness and hence the findings could not be generalised to ICU and CCU nurses.

Similarly, emergency nurses’ confidence and psychomotor performance were explored in another study. The Emergency Response Performance Tool (ERPT) and a confidence tool were developed and validated. The ERPT consisted of 11 items and six timed tasks. The confidence tool had 17 items and required participants to rate their confidence on a scale from 0% to 100%. Nurses who participated (n= 41) were assigned to three different groups depending on their experience. There were significant differences between the knowledge and confidence level between groups (p<0.001). It was concluded that years of experience and training affect the confidence level of emergency nurses. The study however needed to be undertaken with a different cohort of nurses to achieve generalizability (Arnold, et al., 2009).

CCRN's are not the only healthcare professionals whose confidence in clinical management is associated with the level of knowledge. In fact, it was maintained that doctors’ knowledge of ECG interpretation affects their confidence level. A descriptive study in Canada aimed to determine general paediatricians’ (n=124) practices and opinions regarding ECG use, accuracy of their interpretation and the relationship between accuracy and self-perceived confidence. The doctors completed a questionnaire, interpreted 18 paediatric ECG’s and were asked to classify the strips as normal or abnormal. The participants were asked to reveal their self- perceived confidence. Results showed a high ability to classify the ECG strip as normal or abnormal (mean = 80 +/- 12% SD) and an average ability to name the type of abnormality (mean 50+-20% SD). ECG interpretation was poor for abnormalities in axis deviation and cardiac hypertrophy. Overall confidence in
ECG interpretation correlated with and was the only significant predictor of interpretation accuracy (r=0.396, p<0.001) (Escudero, Sanatani, Wong, & Templeton, 2014).

2.2.5 Maintaining Knowledge

In order to maintain arrhythmia knowledge, it is widely accepted that CCRNs’ must be frequently assessed (Keller, 1997; Keller & Raine, 2005; Kiyan et.al 2006). Currently, CCRNs arrhythmia knowledge is mainly assessed through the annual ALS competency. Literature uncovered that while the ALS assessment is important to refresh the knowledge of shockable and non-shockable rhythms, it is limited by the frequency and methods of assessment. This was shown in a descriptive study done by Preston et al., (2009) to explore the methods used by educators to assess ICU nurses’ ALS skills and knowledge across the state of Victoria. Telephone interviews were used to collect data from 20 ICU educators working in the private (n=7) and public (n=13) health sector. Data were analysed using content analysis. Results showed that all educators used scenarios to assess ALS skills with 12 educators (60%) including a theoretical test. It was established that there was variability in the frequency and timing of ALS assessment in relation to initial education and assessor to participant ratio. All educators reported many CCRNs avoided undertaking ALS. It was proposed that other strategies should be implemented to secure adequate assessor to nurses’ ratio and arrhythmia knowledge updating (Preston et al., 2009).

In similar fashion, arrhythmia knowledge of medical registrars across the departments of Anaesthesiology, Emergency Medicine, Internal Medicine and Cardiology was assessed. 20 multiple choice questions were answered by residents (n= 101) involving fatal arrhythmias, pulseless electrical activity and asystole. The scores revealed a mean= 66.3, SD =17. Statistically significant differences existed in the knowledge level of residents working in different fields of medicine: Emergency Medicine (mean =86.2, 8.2 SD); Cardiology
(mean= 66.7, 12.9 SD); Anaesthesiology (mean=59.3, 16.2 SD) and Internal Medicine (mean= 56.1, 13.5 SD), p<0.0001. It was concluded that factors affecting arrhythmia knowledge included but were not limited to postgraduate ALS training. Awareness of the guidelines and frequency of exposure to critically ill cardiac patients positively contributed to arrhythmia knowledge maintenance. There was no mention how the ICU registrars performed which affected the study’s’ generalizability (Kiyan et al., 2009).

2.2.6 Measuring Arrhythmia Knowledge

The Keller Assessment Rating Tool (KART) was described in the literature as an instrument developed from the triangulation of qualitative and quantitative research methods to assess arrhythmia knowledge (Keller, 1997). CCRNs (n=25) were interviewed to explore their perception of arrhythmia knowledge by discussing and rating of ECG strips establishing the face and content validity of the tool. The KART was then administered to CCRNs (n=73) and the correlations and tests of differences between the means further contributed to construct and content validity and reliability. The Cronbach’s’ alpha of the KART was 0.82 which concluded that it is an effective tool in discriminating varying levels of arrhythmia expertise. The finalized KART was made of 29 items ranging in difficulty from beginner to advanced. Apart from showing a deficit in ECG interpretation of advanced arrhythmias and lead monitoring practice, this tool demonstrated a need to maintain arrhythmia competencies to achieve optimum patient outcomes (Keller,1997). The KART was the only valid and reliable instrument described in the literature to assess CCRNs arrhythmia knowledge.

2.2.7 Summary

Studies have consistently identified shortfalls in lethal arrhythmia knowledge. Whether attributed to lack of exposure, deficits in information, infrequency of educational updates or
unawareness of the active role critical care nurses play during resuscitation; the problem exists and is global. Frequent arrhythmia knowledge updates were described as important to retain the knowledge. While ALS is one approach to assess arrhythmia knowledge, it is limited by the mode of delivery and frequency of assessment. Knowledge, frequency of exposure and years of experience correlate with the level of confidence.
Chapter Three: Research Methods

In this section the steps that were undertaken by the researcher to conduct the study are described. The section includes and justifies the use of research design, instruments, ethical considerations, setting, sample, recruitment of study participants, data collection and analysis.

3.1 Design

In order to address the research aim, a quantitative study design was implemented. This design was chosen to objectively measure and describe variables. The design was used to determine the degree of correlation or association between the variables where present (Porritt, Gomersall & Lockwood 2014; Ingham-Broomfield, 2014). The design answered the research question by collecting and analysing data to formulate an idea about the current levels of confidence and knowledge in arrhythmia interpretation.

A non-experimental descriptive design was used to provide a knowledge base on topics about which little is known. The goal was to describe the current status of arrhythmia knowledge and confidence in arrhythmia interpretation as they naturally occurred in the private hospital setting without control or manipulation (Sousa, Dreissnack & Costa Mendes, 2007; Coates, 2011). The CCRNs’ were not assigned to experimental groups hence their knowledge and confidence were not controlled, manipulated or randomized. Descriptive data statistics were used to describe frequencies, proportions and percentages of knowledge and confidence without drawing definitive conclusions (Osborne & Schneider, 2013).

A survey was used to collect information about the participants’ inherent characteristics (Shields & Watson, 2013). Despite providing breadth rather than depth of
information (Shields & Watson, 2013), the survey was suitable to achieve the research aim. Data such as knowledge, confidence, experience and demographic characteristics were collected at one point of time hence the survey was cross-sectional (Shields & Watson, 2013). To address the issue of selection bias which results in having participants who are over or under represented in the study, another day was allocated for data collection to ensure the participants are better represented.

The instrument used was a two-part questionnaire as described in the following section. It was administered in person to provide results more quickly and present an opportunity to answer the participants’ questions (Shields & Watson, 2013).

3.2 Instruments

3.2.1 Questionnaire Advantages and Disadvantages

Questionnaires are commonly used instruments in quantitative research to elicit the views and characteristics of a large group of participants and enable the use of scales for the purpose of statistical analysis (Polit & Hungler, 2013; Timmins, 2015). Questionnaires are economical means of obtaining a large amount of information about attributes, attitudes and knowledge (Timmins, 2015; Osborne & Schneider, 2013). The questionnaire however had a limited ability to provide an in-depth view of the participants’ characteristics (Shields & Watson, 2013). The use of a questionnaire was appropriate in this study because it served as an evidence of the current situation (Coates, 2011; Osborne & Schneider, 2013. It was a form that was aimed at gathering information about the knowledge and confidence as well as demographic characteristics for the survey.
3.2.2 Parts of the Questionnaire.

The questionnaire consisted of two parts: the first included the participants’ demographics and Likert questions (APPENDIX B). This part of the questionnaire was a valid and reliable tool extracted from the literature (Escuedro et al., 2014) and consisted of 16 items modified to cater for the population of interest. Thus the word “doctor” was replaced by “critical care nurses”, and the place of practice was altered to reflect the participants’ actual setting.

The second part of the questionnaire contained the KART and rhythm specific confidence rating question (APPENDIX C). The updated version was used due to a stronger internal consistency and reliability after approval was sought from Dr Keller via electronic mail. The rhythm specific confidence rating question was added to the KART.

The questionnaires discussed previously were combined to create one tool. The combined questionnaire was written in plain English language and was appropriate for the participants’ level of understanding. The combined questionnaire was grammatically correct and asked one question at a time (Osborne & Schneider, 2013). The questionnaire presented a finite set of closed ended items that maintained the clarity and specificity intended by the researcher (Osborne & Schneider, 2013). Likert scales enabled the participants to provide their level of agreement or disagreement for a series of statements related to their confidence level and importance of ECG proficiency on a scale from zero to four (Fisher & Schneider, 2013).

3.2.3 The Pilot

Reliability and validity were established for the original tools. However, it was important to ensure that the questions had meaning and relevance in that particular hospital setting. It was crucial to demonstrate an acceptable level of face
and content validity in this quantitative study to maintain its rigour and quality because the developed instruments were used on a different cohort of study participants (Gillespie & Chaboyer, 2013). The researcher modified the questionnaires to cater for the population of interest: CCRNs. Modifying and combining the tools could have affected the consistency of the instruments (Osborne & Schneider, 2013). The researcher however was able to minimize this threat to internal validity by conducting the pilot which was a small study carried in advance of the actual study (Gillespie & Chaboyer, 2013) Hence face and content validity were achieved.

Two nurse unit managers, two associate nurse unit manager and a critical care educator were asked to assess the two-part questionnaire for clarity and content. It was important to check whether the instrument used could measure what it was meant to measure (confidence / knowledge). This pilot study was conducted served as a trial run to identify issues (Ingham-Broomfield, 2014). The researcher asked participants to complete the questionnaire and allow between one to one and a half minutes for each item to be answered. The pilot participants were to adhere to the sixty- minute time constraint especially while answering the ECG strips because it mirrors the time in which nurses are supposed to identify arrhythmias precisely and efficiently in the clinical setting (Sibbald et al., 2014). No changes to the combined tool were suggested by the pilot participants.

3.3 Ethical Considerations

Australian Nurses conducting human research have a moral responsibility towards the study participants which must be governed by ethical standards set by the National Health and Medical Research Council (NHMRC, 2007, updated 2015). The Minimal risk standard is the threshold that allows ethical review boards to evaluate how the researcher can maintain several important and potentially conflicting values including respect for
autonomy, beneficence, no harm, and justice (Kopleman, 2004). Such values help to shape the relationship between the researcher and participants as that of trust, mutual responsibility and ethical equality (NHMRC, 2015). The ethical principles governing this research were: respect for autonomy and informed consent, beneficence, no harm, anonymity and confidentiality, privacy, justice and consent (NHMRC, 2015). Ethical approval was granted from the Monash University Human Research Ethics Committee (MUHREC), (APPENDIX A).

3.3.1 Respect for Autonomy and Individual Responsibility (Informed Consent)

Autonomy refers to human beings right to determine what activities they will or will not participate in (Adams & Callahan, 2013). Autonomy entails giving a due scope to the participants’ choice based on a thorough understanding of what the research involves and its implications (NHMRC, 2015). This choice or consent to participate should be voluntary and based on adequate information explained by the researcher (Adams & Callahan, 2013; Bowrey & Thompson, 2014).

In this study, the explanatory statement was mailed to the all CCRNs one month prior to study date. It was presented in plain English language suitable to the study participants (APPENDIX D). It outlined alternatives to participation, research procedure, presence of services to participants adversely affected and how privacy and confidentiality were protected. A list of the researchers’ contact details as well as the Monash University Human Research Ethics Committee officer were provided. Furthermore; the explanatory statement clearly explained that withdrawal from the study will not be possible after the completed questionnaire was returned. All the participants were assumed of adequate mental capacity to consent to the study because they were current employees. Consent was implied when
the participants returned the completed questionnaire. No monetary inducements were paid to encourage participants to take part in the study. Furthermore, the participants were not directly approached by the researcher. This allowed them to exercise their right of voluntary participation. Participants were reassured that declining from participation will not affect their relationship with the employers or the researcher who is their work colleague. These steps demonstrated that the researcher was not abusing her position of power (Bradbury-Jones & Alcock, 2010) and maintained an emancipatory effect on the study participants because their intrinsic qualities were recognised (NHMRC, 2015).

3.3.2 Beneficence and No Harm

Refers to the obligation on the part of the researcher to maximize benefits for the study participants (Adams & Callahan, 2013). Beneficence involves maintaining their welfare and best interests (Woods & Schneider, 2013). The researcher had to demonstrate that the likely benefit of her research justified any risks of harm (NHMRC, 2015).

In this study, benefits included addressing the gaps in knowledge by dedicating a timeframe of ten minutes to teach participants on how to interpret and recognize the difficult to interpret ECG strips. Furthermore, study participants acquired continuing professional development (CPD) points as a compensation for their time and willingness to participate. A date to present the results was also scheduled. Results were used to outline nurses’ strengths and weaknesses in order to increase awareness of the nurses’ educational needs. a Results were presented in ten minutes during staff change over to minimise wasting their time. The study was able to contribute to the knowledge and understanding of critical care nurses and hence was justifiable by its potential benefit.

Clinical Educators, Director of Nursing and Nurse Unit Managers were regularly updated about study advancement and date of circulating results. An educational program was
suggested to cater for the nurses’ needs following survey completion. These steps were necessary to reflect a degree of sensitivity to the welfare and interests of research participants (NHMRC, 2015).

A risk is a potential harm, discomfort or inconvenience (NHMRC, 2015). The potential harms anticipated were psychological which included feelings of worthlessness and incompetence as well as fear from the outcomes of the study (Adams & Callahan, 2013). The study presented a possible social harm to the participants including damage to social networks within the hospital or relationships with the employers. It also imposed a degree of inconvenience because it involved giving up time in order to participate (NHMRC, 2015). In hospital counselling services were made available for nurses after permission was granted from the hospital administrators. Those services are present constantly at the hospital were the study was conducted to support staff facing threats that imperil their psychological wellbeing. Counsellors were contacted and informed about the research prior to conduction.

3.3.3 Anonymity and Confidentiality

Complete anonymity means that the researcher is blinded to the identity of the study participants, whereas confidentiality denotes that the identities of the research participants and the information they provide cannot be linked together (Woods & Schneider, 2013). It is a basic requirement to respect the anonymity and confidentiality while conducting research and that stems from recognizing the participants’ “intrinsic value” (NHMRC, 2015).

In this study, the design of data collection did not allow complete anonymity; however, steps were taken to prevent the identity of the participants being linked to the survey results. The participants were instructed to refrain from disclosing their names or employee numbers. The completed questionnaire was returned in a sealed envelope and placed in a
secure locked box accessed only by the researcher. Participants were informed that data collected will be stored on a password protected computer. The hard copies of the questionnaire were kept in locked drawer located at the researchers’ Monash University Office and would be shredded after the study was completed. Data collected was number coded to further secure anonymity prior to computer entry. Coded and cleaned data was stored on a networked drive that is managed by qualified IT staff (e solutions). This made the data readily available to use by the researcher and other authorised users and protected it from theft, loss or unauthorised use. Participants were advised that their coded data might be used for a publication.

Taking these measures prevented the disclosure of or unauthorized access to data that could be linked to the study participants or to the hospital where the study was conducted and hence was rendered free from any breach of confidentiality (Bradbury-Jones & Alcock, 2010).

3.3.4 Justice

The researcher was conscious of the ethical principal of justice and took active measures to achieve a study that was free from ignorance; indifference and bias (Kapp, 2006). The study was supervised by academics with experience, qualifications and competence appropriate for the research. All registered nurses who fitted the inclusion criteria were allowed to take part in the study regardless of their ethnic or cultural background (Woods & Schneider, 2013) because gender differences, educational backgrounds, levels of experiences and age informed the subjects’ sense of identity and shaped their values (NHMRC, 2015).

Furthermore, all participants were granted access to the benefits of the study. There was no exploitation of the participants and they were treated equally without favouritism or
discrimination. Research findings were made accessible in a clear and timely manner to all critical care nurses regardless of their participation (NHMRC, 2015). Furthermore, the study was carried with a sense of honesty without deceiving participants, falsifying or fabricating data (Woods & Schneider, 2013). Hence, the researcher demonstrated a degree of due regard to the individual differences and perceptions of those involved in research (NHMRC, 2015).

Complying with the above ethical principles ensured that the researcher demonstrated a degree of merit and integrity.

3.4 Setting

The study was conducted in a small private hospital. The Hospital was a comprehensive 166 bed acute surgical, medical, cardiac, and obstetric facility located in Melbourne’s south eastern suburbs.

Three critical care units from the hospital participated in the study: ICU, CCU and post anaesthesia PACU. The ICU is a seven-bed unit catering for patients post coronary artery graft surgery and other critical medical and surgical conditions. CCU is a 33-monitored bed unit serving patients with varying cardiac conditions, and PACU cares for patients post surgeries including coronary grafts and other cardiothoracic surgeries.

3.5 Sample

To address the key sampling principals of adequacy and appropriateness, purposive sampling was used (Endacott & Botti, 2005). This kind of non – probability sampling allowed for choosing participants with particular characteristics suitable for the study design (Schneider & Fisher, 2013). Although less rigorous and accurate than probability sampling which uses randomization to minimize bias, the researcher assumed that “errors of judgement in over and under representing elements of the population in the sample would
balance out” (Schneider, & Fisher, 2013, p. 191). This type of sampling was necessary for the collection of exploratory data from a highly specific population i.e. CCRNs.

After identifying the characteristics of the target population, the second step was to define the inclusion and exclusion criteria based on the research question to maintain the feasibility of the research (Botti & Endacott, 2005). Nurses who self-selected to participate had completed their post graduate studies in critical care, were employed on full time or part time basis and were working on the critical care units. Exclusion criteria were agency critical care nurses, Division1 nurses who did not hold critical care certificate and nurse unit managers or clinical educators.

3.6 Recruitment of Participants

The Critical Care Educator was requested to assist in mailing the explanatory statement and invitation to participate in the study. It was not appropriate for the research team to have contact details of potential participants, hence the educator agreed to do so on behalf of the research team. Approval was granted from the Director of Nursing Services who also provided an overview of the current hospital policy regarding ECG monitoring.

The researcher posted flyers on each of the selected critical care wards to recruit participants. The hospital’s phone texting service was also utilized to remind CCRNs about the date of the study.

3.7 Data Collection

After having their questions answered and the criteria for participation explained, the participants were instructed to individually answer the questions to the best of their knowledge. All the nurses who took part returned the completed questionnaire in a sealed
envelope. The envelopes were placed in a dedicated box in the centre of the conference room.

3.8 Data Analysis

The researcher used descriptive data statistics to describe, organise and summarize the raw data obtained by measurement (Botti & Endacott, 2005). Descriptive statistics were used to present the data coherently to allow the main characteristics to be identified and to pinpoint patterns and trends (Moxham, 2012). Data forms were checked for quality and completeness prior to computer entry. Statistical Software Program for Social Scientist package (SPSS 21) was used for analysis, management and documentation. The goal was to preserve details at data entry stage with manipulations performed later if necessary. The researcher kept record of changes.

Preparation of data was the preliminary step for quantitative data analysis. The data was translated into a form that allowed for computer entry by using numbers or scores (Borbasi & Jackson, 2012). Each item in the questionnaire was considered a variable and was represented by a single numerical value for quantification (Hoare & Hoe, 2013). Numerical values were either directly transcribed for example actual age, or assigned a numerical value if they were non-numerical such as gender or level of experience. Variables in Likert type questions were given a code from zero to four to facilitate analysis (Fisher & Schneider, 2013). The actual grade from the KART was also entered. Hence, data coding was accurate, allowed for desired management, and was reproducible and representative of the responses (Fisher & Schneider, 2013). Frequency distributions were used to describe data because they presented the number of occurrences of each event in the study and detected errors at the data entry stage (Hallet, 1997; Fisher & Schneider, 2013).
When raw data was entered and coded two descriptive statistics measures were used to condense and summarise discrete (nominal, ordinal) or continuous (interval, ratio) data. The measures were central tendency and dispersion (Fisher & Schneider, 2013). The Kolmogorov-Smirnov statistic was utilized to assess the normality of the distribution of scores. Tests of normality revealed that $p=0.000$ which indicated the sample was not normally distributed. Hence a certain degree of skewness which refers to the asymmetry of distribution of scores existed. Thus non parametric data statistics were used (Fisher & Schneider, 2013).

The median was used as a measures of central tendency. Measures of dispersion employed were counts ($n$) and percentages ($\%$). The number of participants within each category was accounted for along with the corresponding percentages of the total number of participants. Summary tables were used to display the frequency of responses to individual variables (Botti & Endacott, 2005). The columns in the tables displayed the frequency of responses and the rows showcased the variables.

Spearman’s rank correlation coefficient was used as a non-parametric measure of rank correlation. The aim was not to establish if $X$ (knowledge) caused $Y$ (confidence) but if there was a positive or negative monotonic relationship between the two, whether the increased level of knowledge is associated with an increased or decreased level of confidence. Spearman’s rho was employed to summarise the strength and direction of a relationship between the ranks of the two variables (Fisher & Schneider, 2013). Hence, coded data for the KART were reversed such that a higher value was given to the correct answer. The sum of the coded data was entered for analysis. Coded data for the confidence level of each KART question were added and the score was also entered.
3.9 Summary

This chapter described how the study was executed and what variables it aimed to examine. The study utilised a quantitative descriptive design to collect data about arrhythmia knowledge and confidence. Data collection was conducted using a two-part questionnaire extracted from the literature and modified to cater for the CCRNs working in a small private hospital. Ethical guidelines were followed during participant recruitment, data collection and storage. Purposive sampling was used for data collection after permission was gained from the hospital administration and MUHREC. Descriptive data statistics were used for analysis. The next chapter will show the results of the study.
Chapter Four: Results

In this chapter the results of the study are presented. The results are reported in three sections. In the first section an overview of the demographic details including age, gender, primary area of practice, number of ECG’s interpreted per month and reasons for recording ECG’s is presented. The participants’ general perceived confidence in ECG interpretation is also reported. In section two the scores of the KART and the degree of confidence attributed to each ECG strip is accounted for. The focus of section three is the results by category of ECG: basic, intermediate and advanced and associations between demographic characteristics and questionnaire results. There were no differences in the data according to type of critical care unit hence the results are presented below for the whole sample. Finally, this section presents the ECG test scores in relation to the degree of confidence that participants attributed to each ECG strip.

4.1 Demographic Characteristics

Thirty- two participants (n=32) working in ICU, CCU and PACU units in fulltime/part time capacity completed the study. The nurses have a post graduate qualifications in critical care nursing or equivalent and the majority have been working on critical care units between six to ten years (n=15, 46.9%) while few had less than five years of experience (n=5, 15.6%). The participants had a median age of 42 years (IQR= 34-52). Other demographic characteristics are presented in Table 4.1
TABLE 4.1 Demographic Characteristics

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>ICU</th>
<th>CCU</th>
<th>PACU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>18 (56.3)</td>
<td>10 (31.25)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>Male</td>
<td>1 (3.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of beds/unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10</td>
<td>18 (56.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td></td>
<td></td>
<td>3 (9.4)</td>
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<tr>
<td>&gt;31</td>
<td></td>
<td>11 (34.4)</td>
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<td>Primary Area of Practice</td>
<td>18 (56.3)</td>
<td>11 (34.4)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>Other Areas of Practice</td>
<td>6 (18.8)</td>
<td>7 (21.9%)</td>
<td>3 (9.4)</td>
</tr>
</tbody>
</table>

4.2 Recording and Interpreting ECG

The participants from different critical care units (n=18, 56.3%) reported that most of the ECGs were not reviewed by a cardiologist, while others (n=8, 25%) confirmed that all ECGs were reviewed by the cardiologist. Further, a number of participants (n=6, 18.8%) reported that only a portion of the ECGs were reviewed. This might be an indicator that the expectation in that hospital is for CCRNs to efficiently interpret ECGs.
While most participants revealed that the most common reason for ordering an ECG in their setting was chest pain (n=29, 90.6%), the majority excluded eating disorders (n=1, 3.1%), positive cardiac family history (n=8, 25%) or drug ingestions (n=2, 6.3%) as common reasons to record an ECG. Less than half of the nurses reported recording an ECG to a patient presenting with syncope (n=13, 40.6%) and palpitations (n=14, 43.8%). Participants who primarily work in PACU (n=3, 9.4%) excluded chest pain as a common reason for ordering an ECG. Routine post-operative nursing management and patient’s admission to cardiac care unit were stated as other factors prompting nurses for ordering an ECG in their setting.

Participants were required to interpret ECGs as part of their clinical responsibilities with most participants reporting they interpret more than five per month (Figure 4.1). Participants reported relying primarily on their clinical judgement rather than the diagnosis provided by the ECG machine despite perceiving the ECG machine as a useful tool (n=26, 81.3%). The majority of participants (n=20, 66.7%) reported not relying on the ECG machine for interpretation while only one nurse (3.3%) reported depending on the machine for interpretation.
Furthermore, the majority of participants (n=24, 75%) acknowledged that being proficient in ECG interpretation was very important while the remainder (n=8, 25%) perceived it as somewhat important. Results indicated that no nurses in the sample denied the value of being proficient in ECG interpretation.

Participants’ general perceived level of confidence in ECG interpretation is presented in Figure 4.2. As the result show, participants mostly rated themselves as generally confident in ECG interpretation. Participants who rated themselves as somewhat unconfident worked in PACU (n=3, 9.3%).
FIGURE 4.2 General Confidence in ECG Interpretation

General Confidence in ECG interpretation

- very confident
- somewhat confident
- neutral
- somewhat unconfident

0 5 10 15 20 25 30
4.3 Results of the KART

In this section, the results of the KART are presented along with the level of confidence ascribed to each ECG strip. Median scores by years of experience, number of ECG interpreted per month and category of ECG are also displayed. Finally, this section presents the median scores by confidence category.

4.3.1 Rhythm Strips Results

The results of the KART are presented in Table 4.2. Most participants attempted to answer all the questions and only question 16 had some participants refraining from answering it (n=6, 18.8%). Results showed that most participants failed to answer basic arrhythmia questions like Question five and Question eight correctly despite being attempted by the majority (n=30, 93.7%) and (n=29, 90.6%) respectively. Participants were unable to adequately interpret third degree heart blocks or distinguish whether the block was at the ventricular or junctional level Table 4.2. Other types of heart blocks such as Mobitz II and Right Bundle Branch Block (RBBB) with supraventricular tachycardia (SVT) were also misinterpreted by the participants as presented. Premature atrial and junctional contractions (PAC & PJC) which were rated as intermediate and advanced also were not properly recognised by the participants as revealed by the scores. Another finding is the participants’ inability to interpret rhythms involving atrial fibrillations (AF) where the electric conduction is through an accessory pathway such as WPW. In fact, none of the participants was able to correctly interpret the WPW strip. Other strips that scored poorly were advanced arrhythmias such as ventricular couplets and 2:1 atrial flutter (A FL). Further, the lowest median scores belonged to participants who work in PACU (median=33, IQR= 27-42). The participants who worked in CCU scored the highest (median=58, IQR= 42-76). ICU participants scores came second (median=55, IQR=48.75-64.75).
## TABLE 4.2 The KART Results

<table>
<thead>
<tr>
<th>KART QUESTION</th>
<th>Rhythm</th>
<th>*Attempted n (%)</th>
<th>Answered Correctly n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>VT</td>
<td>31 (96.9)</td>
<td>31 (96.9)</td>
</tr>
<tr>
<td>Question 2</td>
<td>SB</td>
<td>32 (100)</td>
<td>32 (100)</td>
</tr>
<tr>
<td>Question 3</td>
<td>NSR</td>
<td>32 (100)</td>
<td>32 (100)</td>
</tr>
<tr>
<td>Question 4</td>
<td>AV Paced</td>
<td>31 (96.9)</td>
<td>28 (87.5)</td>
</tr>
<tr>
<td>Question 5</td>
<td>Unifocal PVC</td>
<td>32 (100)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>Question 6</td>
<td>4:1 Atrial flutter</td>
<td>32 (100)</td>
<td>31 (96.9)</td>
</tr>
<tr>
<td>Question 7</td>
<td>VT</td>
<td>31 (96.9)</td>
<td>31 (96.9)</td>
</tr>
<tr>
<td>Question 8</td>
<td>Multifocal PVC</td>
<td>29 (90.7)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>Question 9</td>
<td>PAC</td>
<td>29 (90.7)</td>
<td>4 (12.5)</td>
</tr>
<tr>
<td>Question 10</td>
<td>ST</td>
<td>32 (100)</td>
<td>24 (75)</td>
</tr>
<tr>
<td>Question 11</td>
<td>3rd HB at junction</td>
<td>29 (90.7)</td>
<td>12 (37.5)</td>
</tr>
<tr>
<td>Question 12</td>
<td>Asystole</td>
<td>32 (100)</td>
<td>32 (100)</td>
</tr>
<tr>
<td>Question 13</td>
<td>Mobitz I</td>
<td>32 (100)</td>
<td>18 (56.3)</td>
</tr>
<tr>
<td>Question 14</td>
<td>Idioventricular</td>
<td>31 (96.9)</td>
<td>22 (68.8)</td>
</tr>
<tr>
<td>Question 15</td>
<td>Ventricular Bigemny</td>
<td>30 (93.8)</td>
<td>18 (56.3)</td>
</tr>
<tr>
<td>Question 16</td>
<td>Ventricular Couplets</td>
<td>25 (78.1)</td>
<td>8 (25)</td>
</tr>
<tr>
<td>Question 17</td>
<td>1st AV Block</td>
<td>31 (96.9)</td>
<td>28 (87.5)</td>
</tr>
<tr>
<td>Question 18</td>
<td>Torsades de pointe</td>
<td>31 (96.9)</td>
<td>28 (87.5)</td>
</tr>
<tr>
<td>Question 19</td>
<td>Junctional</td>
<td>31 (96.9)</td>
<td>24 (75)</td>
</tr>
<tr>
<td>Question 20</td>
<td>Atrial fibrillation</td>
<td>32 (100)</td>
<td>31 (96.9)</td>
</tr>
<tr>
<td>Question 21</td>
<td>3rd HB at Ventricle</td>
<td>32 (100)</td>
<td>12 (37.5)</td>
</tr>
<tr>
<td>Question 22</td>
<td>AT</td>
<td>32 (100)</td>
<td>26 (81.3)</td>
</tr>
<tr>
<td>Question 23</td>
<td>SVT + RBBB</td>
<td>30 (93.8)</td>
<td>9 (28.1)</td>
</tr>
<tr>
<td>Question 24</td>
<td>AT + HB</td>
<td>30 (93.8)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>Question 25</td>
<td>Atrial Fibrillation + Ablereency</td>
<td>29 (90.7)</td>
<td>1 (3.1)</td>
</tr>
<tr>
<td>Question 26</td>
<td>WPW</td>
<td>31 (96.9)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Question 27</td>
<td>NSR + RBBB</td>
<td>30 (93.8)</td>
<td>18 (56.3)</td>
</tr>
<tr>
<td>Question 28</td>
<td>2nd AV Block Mobitz II</td>
<td>29 (90.7)</td>
<td>4 (12.5)</td>
</tr>
<tr>
<td>Question 29</td>
<td>2:1 Atrial Flutter</td>
<td>32 (100)</td>
<td>9 (28.1)</td>
</tr>
<tr>
<td>Question 30</td>
<td>NSR+ LBBB</td>
<td>30 (93.8)</td>
<td>19 (59.4)</td>
</tr>
<tr>
<td>Question 31</td>
<td>PJC</td>
<td>32 (100)</td>
<td>2 (6.3)</td>
</tr>
</tbody>
</table>

*The percentages are calculated based on the number of participants who attempted to answer the KART question out of the total number of participants (n=32)
The majority of participants attempted to answer the two questions presented at the end of the KART which require them to indicate with a cross the proper position of electrode V1 and Lead II. Despite a high participation rate, most of the answers were incorrect as evidenced by results presented in Table 4.3.

**TABLE 4.3 Electrode Placement V1 and Lead II**

<table>
<thead>
<tr>
<th>KART QUESTION</th>
<th>LEAD</th>
<th>ATTEMPTED</th>
<th>ANSWERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 32</td>
<td>V1</td>
<td>31 (96.9%)</td>
<td>12 (37.5%)</td>
</tr>
<tr>
<td>Question 33</td>
<td>II</td>
<td>29 (90.7%)</td>
<td>11 (34.4%)</td>
</tr>
</tbody>
</table>

4.3.2 Confidence Level in KART ECG Strip Interpretation

The degree of confidence attributed by the participants to each KART question is presented in Table 4.4. Participants expressed a high confidence level in responding to basic KART questions five and eight despite providing a wrong answer. The confidence decreased when the participants answered more advanced KART questions. Hence, the confidence level decreased while answering question 16, or maintained a level of neutrality such as in answering Questions 24 and 25. Results also showed that the participants expressed a high confidence level in responding to KART Question 26 despite not answering it correctly.
## TABLE 4.4 Confidence in KART ECG Strips Interpretation

<table>
<thead>
<tr>
<th>KART Rhythm</th>
<th>Question/ Rhythm</th>
<th>Not Confident n (%)</th>
<th>Somewhat Unconfident n (%)</th>
<th>Neither n (%)</th>
<th>Somewhat Confident n (%)</th>
<th>Very Confident n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. VT</td>
<td>VT</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
<td>14 (43.8)</td>
<td>15 (46.9)</td>
</tr>
<tr>
<td>2. SB</td>
<td>SB</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>10 (31.3)</td>
<td>21 (65.6)</td>
</tr>
<tr>
<td>3. NSR</td>
<td>NSR</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>7 (21.9)</td>
<td>24 (75.0)</td>
</tr>
<tr>
<td>4. AV Paced</td>
<td>AV Paced</td>
<td>2 (6.3)</td>
<td>1 (3.1)</td>
<td>2 (6.3)</td>
<td>10 (31.3)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>5. Unifocal PVC</td>
<td>Unifocal PVC</td>
<td>2 (6.3)</td>
<td>1 (3.1)</td>
<td>2 (6.3)</td>
<td>10 (31.3)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>6. 4:1 A. FL</td>
<td>4:1 A. FL</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>7 (21.9)</td>
<td>25 (78.1)</td>
</tr>
<tr>
<td>7. VF</td>
<td>VF</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
<td>8 (25.0)</td>
<td>22 (68.8)</td>
<td></td>
</tr>
<tr>
<td>8. Multifocal PVC</td>
<td>Multifocal PVC</td>
<td>4 (12.5)</td>
<td>1 (3.1)</td>
<td>5 (15.6)</td>
<td>12 (37.5)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>9. PAC</td>
<td>PAC</td>
<td>5 (15.6)</td>
<td>4 (12.5)</td>
<td>4 (12.5)</td>
<td>14 (43.8)</td>
<td>5 (15.6)</td>
</tr>
<tr>
<td>10. ST</td>
<td>ST</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
<td>4 (12.5)</td>
<td>9 (28.1)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>11. 3rd HB at junction</td>
<td>3rd HB at junction</td>
<td>5 (15.6)</td>
<td>2 (6.3)</td>
<td>3 (9.4)</td>
<td>12 (37.5)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>12. Asystole</td>
<td>Asystole</td>
<td>0 (0)</td>
<td>4 (12.5)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>28 (87.5)</td>
</tr>
<tr>
<td>13. Mobitz I</td>
<td>Mobitz I</td>
<td>2 (6.3)</td>
<td>1 (3.1)</td>
<td>5 (15.6)</td>
<td>14 (43.8)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>14. Idioventricular Bigemny</td>
<td>Idioventricular Bigemny</td>
<td>5 (15.6)</td>
<td>2 (6.3)</td>
<td>3 (9.4)</td>
<td>13 (40.6)</td>
<td>9 (28.1)</td>
</tr>
<tr>
<td>15. Ventricular Bigemny</td>
<td>Ventricular Bigemny</td>
<td>5 (15.6)</td>
<td>4 (12.5)</td>
<td>6 (18.8)</td>
<td>16 (48.6)</td>
<td>11 (34.4)</td>
</tr>
<tr>
<td>16. Ventricular Couplets</td>
<td>Ventricular Couplets</td>
<td>14 (43.8)</td>
<td>4 (12.5)</td>
<td>6 (18.8)</td>
<td>6 (18.8)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td>17. 1st AV Block</td>
<td>1st AV Block</td>
<td>2 (6.3)</td>
<td>3 (9.4)</td>
<td>3 (9.4)</td>
<td>7 (21.9)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>18. Torsades de pointe</td>
<td>Torsades de pointe</td>
<td>1 (3.1)</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>17 (53.1)</td>
<td>13 (40.6)</td>
</tr>
<tr>
<td>19. Junctional</td>
<td>Junctional</td>
<td>3 (9.4)</td>
<td>3 (9.4)</td>
<td>3 (9.4)</td>
<td>12 (37.5)</td>
<td>11 (34.4)</td>
</tr>
<tr>
<td>20. A. F</td>
<td>A. F</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>9 (28.1)</td>
<td>23 (71.9)</td>
</tr>
<tr>
<td>21. 3rd HB at ventricles</td>
<td>3rd HB at ventricles</td>
<td>2 (6.3)</td>
<td>4 (12.5)</td>
<td>4 (12.5)</td>
<td>12 (37.5)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>22. AT</td>
<td>AT</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
<td>6 (18.8)</td>
<td>17 (53.1)</td>
<td>7 (21.9)</td>
</tr>
<tr>
<td>23. SVT+RBBB</td>
<td>SVT+RBBB</td>
<td>6 (18.8)</td>
<td>4 (12.5)</td>
<td>8 (25.0)</td>
<td>9 (28.1)</td>
<td>5 (15.6)</td>
</tr>
<tr>
<td>24. AT + Block</td>
<td>AT + Block</td>
<td>7 (21.9)</td>
<td>6 (18.8)</td>
<td>12 (37.5)</td>
<td>5 (15.6)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td>25. A.F+Aberrency</td>
<td>A.F+Aberrency</td>
<td>6 (18.8)</td>
<td>5 (15.6)</td>
<td>10 (31.3)</td>
<td>10 (31.3)</td>
<td>1 (3.1)</td>
</tr>
<tr>
<td>26. WPW</td>
<td>WPW</td>
<td>2 (6.3)</td>
<td>0 (0)</td>
<td>9 (28.1)</td>
<td>11 (34.4)</td>
<td>10 (31.3)</td>
</tr>
<tr>
<td>27. NSR+aRBBB</td>
<td>NSR+aRBBB</td>
<td>6 (18.8)</td>
<td>0 (0)</td>
<td>8 (25.0)</td>
<td>15 (46.9)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>28. 2nd AV block</td>
<td>2nd AV block</td>
<td>4 (12.5)</td>
<td>6 (18.8)</td>
<td>8 (25.0)</td>
<td>11 (34.4)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>29. 2:1 A. Flutter</td>
<td>2:1 A. Flutter</td>
<td>1 (3.1)</td>
<td>3 (9.4)</td>
<td>4 (12.5)</td>
<td>13 (40.6)</td>
<td>11 (34.4)</td>
</tr>
<tr>
<td>30. NSR+ LBBB</td>
<td>NSR+ LBBB</td>
<td>5 (15.6)</td>
<td>2 (6.3)</td>
<td>5 (15.6)</td>
<td>15 (46.9)</td>
<td>5 (15.6)</td>
</tr>
<tr>
<td>31. PJC</td>
<td>PJC</td>
<td>4 (12.5)</td>
<td>3 (9.4)</td>
<td>6 (18.8)</td>
<td>15 (46.9)</td>
<td>4 (12.5)</td>
</tr>
</tbody>
</table>
4.3.3 KART Scores by Categories of ECG

(Basic/Intermediate/Advanced/Total)

The knowledge scores were examined by category of ECG: Basic, Intermediate and Advanced. Results in Table 4.5 show that the median scores and inter quartile ranges are highest in the Basic category followed by Intermediate and Advanced.

**TABLE 4.5 Median KART Scores by Category of ECG.**

<table>
<thead>
<tr>
<th>Category of ECG</th>
<th>Number of Questions in Category (n=33)</th>
<th>Correct Response (n=32)</th>
<th>Median KART(IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>12</td>
<td>10 (9-11)</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>9</td>
<td>5 (3.25-7)</td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td>12</td>
<td>2 (1-3)</td>
<td></td>
</tr>
</tbody>
</table>

4.3.4 KART Scores by Number of ECG’s per Month

In Table 4.6, the total median scores of the KART by the number of ECGs interpreted per month is presented. Results showed that the median scores of knowledge increase with the number of ECGs interpreted per month. Another finding is that median knowledge scores of participants who interpret between six to 10 ECGs per month are higher than those in any other category.
### TABLE 4.6 Median KART Scores by Number of ECGs/Month

<table>
<thead>
<tr>
<th>Number of ECGs per Month</th>
<th>Number of Participants</th>
<th>Median KART (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>5</td>
<td>13 (10-20)</td>
</tr>
<tr>
<td>6-10</td>
<td>10</td>
<td>20 (16-22)</td>
</tr>
<tr>
<td>11-15</td>
<td>5</td>
<td>15 (11-16.5)</td>
</tr>
<tr>
<td>16-20</td>
<td>5</td>
<td>17 (12-18)</td>
</tr>
<tr>
<td>&gt;20</td>
<td>7</td>
<td>19 (17-24)</td>
</tr>
</tbody>
</table>

### 4.3.5 KART Scores by Years of Experience

The knowledge scores by years of experience are presented in Table 4.7. Results showed that participants who worked more than twenty years scored the highest medians. The lowest knowledge scores belonged to the participants who had 11 to 15 years of experience.

### TABLE 4.7 Median KART Scores by Years of Experience

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>Number of Participants</th>
<th>Median KART (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>5</td>
<td>17 (10.5-21)</td>
</tr>
<tr>
<td>6-10</td>
<td>15</td>
<td>17 (16-20)</td>
</tr>
<tr>
<td>11-15</td>
<td>4</td>
<td>14.5 (10.25-18.75)</td>
</tr>
<tr>
<td>16-20</td>
<td>3</td>
<td>15 (13-19)</td>
</tr>
<tr>
<td>&gt;20</td>
<td>5</td>
<td>20 (15-23)</td>
</tr>
</tbody>
</table>
4.3.6 KART Scores by Confidence Category

Figure 4.3 shows that participants who expressed a higher perceived level of confidence in arrhythmia interpretation have higher median scores compared to participants who revealed a lower level of confidence.

**FIGURE 4.3 Total Median Scores by Confidence Category**

![Median Scores and IQR by Confidence Category](image)

4.3.7 Correlations between Confidence and KART Scores

The relationship between each participants’ perceived level of confidence in answering the KART questions and the KART scores were investigated using Spearman’s rho correlation coefficient. Data analysis indicated that there was a weak positive monotonic correlation between the ranking of the two variables: KART scores and confidence (p=0.096, R=0.4703, n=32). The confidence level increased with the increase in the KART score as presented in Figure 4.4.
4.4 Summary of the Results

Results of the study indicated that most of the participants were females who were experienced in recognizing cardiac arrhythmia and were frequently required to interpret ECG. Proficiency in ECG interpretation was reported by the majority of participants who rated it as very important while the remainder regarded it as somewhat important.

The general confidence level of the participants in recognizing cardiac arrhythmias was high. However, the results showed that the confidence level specific to each arrhythmia strip decreased with each advanced KART question. The median KART scores increased with the years of experience, category of difficulty and number of ECGs interpreted per month. Finally, the participants with higher KART scores expressed a higher level of confidence in arrhythmia interpretation and there was a positive correlation between the two variables: confidence and knowledge.
Chapter Five: Discussion

In this chapter the results are discussed and the implications of the findings are considered. The chapter is presented in four sections. Section one serves as a comparison between the study findings and results from the literature. The study strengths and limitations which threatened the internal and external validity are presented in section two and three. Section four discusses the contribution of this research to the body of nursing knowledge while section five presents the recommendations for future research. Finally, section six is the conclusion and introduces some final comments about this research.

5.1 Interpretation of Results

5.1.1 Proficiency in ECG Interpretation

The notion of proficiency in ECG interpretation was acknowledged by the participants of this study. This indicated that the participants were aware of the standards from the Australian national framework for recognizing and responding to cardiac clinical deterioration. The framework stressed the importance of successful arrhythmia recognition and the presence of efficient response system to clinical deterioration in the hospital (ACSQHC, 2011). However, it is acknowledged that the participants’ understanding of the importance of ECG interpretation may have been gleaned from post-graduate training and years of role experience. In addition, these findings are similar to the results from another qualitative study which showed that CCRNs should be competent in cardiac arrhythmia recognition to initiate safe nursing management. CCRNs need to be equipped with sound ability to identify the ECG leads showing abnormal tracing, pinpoint the cardiac damage, differentiate between heart blocks, aberrant conductions and tachyarrhythmia (Keller & Raine, 2005).
5.1.2 Interpreting ECGs

The results of this study indicated that most of the participants were required to interpret ECG on regular basis. This reflects the expectation that CCRNs interpret ECGs frequently (Reising et al., 2007).

Furthermore, the majority of CCRNs reported not relying on the ECG machine for interpretation. This could be attributed to the participant’s level of experience which underpins clinical judgement. For, it was reported that critical thinking skills necessary for safe practice are gained through experience (Lisko & O’Dell, 2010; Buykx et al., 2011). Therefore, the participants’ level of experience may explain their lack of reliance on the machine for interpretation. As life- long learners in the clinical setting, the participants use their experience as the foundation for problem solving when clinical deterioration arise (Kolb,1984). Their knowledge is created from the transformation of experience as it transcends from the concrete (doing) to the reflective (cognitive) to the conceptual (conclusion and learning) levels (Kolb,1984). CCRNs may have acquired the ability to independently interpret ECGs because their experience enabled them to formulate concepts and schemas necessary to face the patients’ clinical deteriorations when they occur and experiment what they have learned.

In addition, the research participants with greater than twenty years of experience scored the highest median in the KART. Despite the lack of statistical significance related to small sample size the findings are supported by previous studies. CCRNs’ knowledge is reflective of the learning experiences they were subjected to (Vandijck et al., 2008; Endacott et al., 2010), and hence arrhythmia recognition could be a deficit in their knowledge due to lack of experience and exposure (Fulbrook et.al, 2012).
In this study, participants who interpreted the lowest number of ECGs per month performed the worst in the KART. This study finding was expected because the frequency of exposure to ECG interpretation affects the level of arrhythmia knowledge (Keller, 1997; ARC, 2010).

5.1.3 Knowledge of Arrhythmia Strips

Results of this study revealed that the median scores and interquartile ranges were highest in the Basic category which included VF, VT and asystole followed by Intermediate and Advanced. Similar findings from another study identified that CCRNs arrhythmia knowledge followed an ascending trend from basic to complex (Keller, 1997). Furthermore, the participants of this study scored poorly in life threatening cardiac arrhythmias such as complete heart block and electrode placement questions. Such findings were supported by studies which indicated that CCRNs demonstrated poor knowledge related to complex arrhythmia recognition and correct lead positioning (Keller, 1997; Pelter et al., 2010).

In this study, some participants scored poorly in basic arrhythmias such as Unifocal and Multifocal PVC’s (Keller, 1997), which was unexpected and reveals a degree of poor arrhythmia knowledge. The participants were unable to adequately interpret third degree heart blocks or distinguish whether the block was at the ventricular or junctional level. This is expected because these rhythm strips are considered intermediate level of difficulty and require a higher degree of competence in arrhythmia interpretation (Keller, 1997). Other types of heart blocks such as Mobitz II, RBBB with SVT were also misinterpreted by the participants. RBBB was misinterpreted despite the presence of a hint: at the V1 level. This result is similar to what was found in a previous study whereby deficits in ECG interpretation were identified with hyperkalemia,
prolonged Qt intervals, heart blocks and ventricular tachycardia (Sibbald et al., 2014). Premature atrial and junctional contractions which were rated as intermediate and advanced were not accurately recognised by the study participants as revealed by the KART scores which is similar to a previous study (Keller, 1997). Also, the participants were unable to interpret rhythms involving atrial fibrillations where the electric conduction is through an accessory pathway such as Wolf Parkinson’s White (WPW). Other strips that scored poorly were ventricular couplets and 2:1 atrial flutter which are advanced arrhythmias. Such findings overlap with the conclusions from a previous study (Keller, 1997). The findings identify a knowledge gap in interpreting intermediate and complex arrhythmias which usually are associated with clinical deterioration and unintended consequences.

5.1.4 Differences Between the Scores of the Groups

In this study, the lowest median scores belonged to participants who worked in PACU. In addition, PACU participants excluded chest pain as a common reason for ordering a 12 lead ECG which was expected because patients in their setting are still under the effects of anaesthesia and unable to accurately self-report the intensity of their pain (Guo, Li, Liu, & Herr, 2015). Participants who worked in CCU and usually interpret ECGs more frequently had the highest median KART scores. Such findings question whether there is a varying level of knowledge among the three critical care groups related to frequency of exposure. It was previously identified that nurses with more experience and exposure are likely to recognize arrhythmias and initiate timely management to prevent’ deterioration contributing to poor outcomes (Fullbrook, 2007). However, the small number of participants in each group rendered the finding statistically insignificant. No previous studies were done to compare how different groups of CCRNs differ with respect to their knowledge and confidence in arrhythmia knowledge.
5.1.5 Confidence in interpreting ECGs

In this research, it was revealed that participants who possessed a higher level of arrhythmia interpretation knowledge expressed a higher level of confidence. The results provided some insight to the role of knowledge in affecting the level of confidence. This finding is supported by previous studies which have identified a relationship between confidence and knowledge and concluded that an increased level of knowledge affects confidence in clinical decision-making (Hui et al., 2011; McCarthy et al., 2013; Arnold et al., 2009). A significant correlation between knowledge and confidence had been revealed in this study. There was a positive monotonic relationship between knowledge and confidence. There was statistical dependence between the ranking of the two variables. As the knowledge increased, so did the value of the confidence.

In addition, the study participants rated themselves as generally confident in ECG interpretation. This level of confidence decreased as per the level of difficulty of each KART question. High confidence scores with poor KART performances suggest a mismatch between confidence in ECG interpretation and level of actual knowledge which is an element of competence in interpreting arrhythmias (Taplin & McConigley, 2015)

5.1.6 ECG Knowledge Maintenance

It was identified in this study that the majority of participants excluded drug ingestion, eating disorders and positive family cardiac history as common reasons for ordering a 12 lead ECG in their setting. Less than half of the participants identified syncope and palpitations as common reasons for recording an ECG. This was unexpected among CCU participants and suggested insufficient knowledge of the reasons for ordering an ECG and unawareness of the hospitals’ policies in that setting. Similarly, denying drug ingestion, palpitations and syncope by some ICU participants as common reasons was also
unexpected in that setting because the policy of that hospital required all patients admitted to ICU and irrespective of presentation have an ECG recorded for them. It had been reported previously that apart from common indications to record a 12 lead ECG such as acute critical illnesses or arrest, any procedure involving sedation or anaesthesia, could lead to metabolic abnormalities and should prompt further investigation to determine the effects on the cardiac function, including patients’ in PACU (Higgins, 2011). The findings of this study suggested a degree of unawareness from the participants about the common reasons for ordering an ECG in their setting. Since the ECG is the gold standard for evaluation of cardiac activity (Reising et al., 2007), the CCRNs knowledge about ECG indications should be updated (Keller, 1997; Keller & Raine, 2005; Kiyan et.al 2006), as previously discussed knowledge decays within a short period unless updated regularly (Broomfield, 1996; Sumner et al., 2012).

5.2 Strengths of the Study

This study was of robust design. Previously tested questionnaires that had a high degree of reliability and validity and an interpretable scoring system were used for data collection. The observed frequencies and trends have been compared to those established in different contexts and published in previous literature. The careful documentation of the study procedures allowed for a level of transparency and maintained a study that could be replicated in the future.

5.3 Limitations

Some issues affected the study’s credibility, dependability, generalizability and reliability (Kelley, Clark, Brown, & Sitzia, 2003). The aim of the researcher was to attain results that could be applied to the population in general and hence the selection of a sample representative of the population was key (Kelley et al., 2003). In this study the researcher
purposefully recruited participants known to possess certain inherent characteristics i.e. CCRNs. This type of non-probability sampling can limit the generalization of finding (Kelley et al., 2003; Carman, Clark, Wolf, & Moon, 2015). In this instance generalizability was affected because the participants were not randomly selected, so their representativeness was questionable (Endacott & Botti, 2005). In addition, the participants were drawn from a single private hospital and as a consequence the level of knowledge and confidence in ECG interpretation is limited to that hospital setting. In similar fashion the number of participation in each group was too small to conduct a between groups statistical comparison. This limited the ability to establish conclusions about each group of participants since not all of them were equally represented. Hence, one of the issues encountered was selection bias which is a systematic error that could have affected the results because a representative sample of the population of CCRNs or of each group could not be achieved (Osborne & Schneider, 2013).

Further, identifying when the participants have had the ALS competency assessment could have provided some additional insights.

All participants self-selected to take part. This may have affected the study outcome because nurses who self-selected to participate could have differed from other nurses in their inherent characteristics (Osborne & Schneider, 2013) including their knowledge and confidence in ECG interpretation.

Another issue that threatened the internal validity was instrumentation. The two-part questionnaire was adapted from the literature but modified to cater for the population of interest. Changes in measurement technique in which the questionnaire was altered to reflect CCRNs demographics instead of doctors threatened the consistency for multiple observers or inter-rater reliability (Osborne & Schneider, 2013). The instrument however was piloted
to check for face and content validity which decreased this threat. In addition, most of the items in the questionnaire were closed ended using a fixed number of alternative responses (Osborne & Schneider, 2013). While fixed response items required the participants to choose the answer that was closest to their preferred answer, there was little flexibility for respondents to present their own perspectives (Osborne & Schneider, 2013).

In addition, the Likert type questions threatened the study through acquiescence bias. The participants might have agreed with the statements irrespective of their contents. Hence, the participants might have responded in a manner that would be viewed favourably by others. The social desirability bias might have taken the form of over or underrating their confidence level or the importance of being proficient in ECG interpretation (Carman et al., 2015).

The KART challenged the participants’ knowledge which might have affected their inner feeling of self-worth (Keller, 1997). The questionnaire however was relevant to explore the current level of knowledge and confidence. The questions were sequenced to increase the response rate (Keller, 1997). A set of instructions regarding the questions was provided to ensure the questions were explicit and easy to follow (Escudero et al., 2014).

5.4 Implications for Nursing Practice

This study served to describe the current level of arrhythmia knowledge and confidence of CCRNs working in a small private hospital. Although the results could not be generalised on the larger population of CCRNs, the study gave a snapshot about a topic of interest about which little was known before. The low median scores achieved in the KART are an indicator of the knowledge level of CCRNs in that hospital. Despite achieving a passing grade in the KART, the scores were expected to be higher if the levels of exposure and experience were taken in to account. This is important because low levels of arrhythmia
knowledge affect the critical care nurses’ preparedness to recognise patients’ clinical deterioration or what is known as the pre-arrest period (ARC, 2010). The results suggest initiating measures to improve the level of arrhythmia knowledge.

A mixture of critical care experience and a post graduate specialist qualification provides the nurses with an adequate preparation to address the needs of patients in the acute clinical setting (ACCCN, 2003). However, the level of cardiac arrhythmia knowledge that is necessary to prevent hemodynamic instability and recognise clinical deterioration requires the presence of an in-hospital educational system that updates the CCRNs’ arrhythmia knowledge frequently not just annually because knowledge decreases over time (Taplin & McConigely, 2015).

CCRN’s education should be inclusive but not limited to lethal arrhythmia recognition. The current ALS competency assessment is limited to distinguishing between shockable and non-shockable arrhythmias. This enables the CCRNs to manage the patients via drug therapy or the defibrillator. Other arrhythmias which do not fall in to this category such as WPW presents as a wide complex tachyarrhythmia and might be mistaken for VT (Urden et al., 2014). This implies that CCRNs should have a comprehensive understanding of the different types of arrhythmias and the appropriate treatment plan for each. Therefore, the in-hospital education system has to incorporate different types of arrhythmias and how to manage each kind. CCRNs should be able to accurately assess patients and interpret signs and symptoms of deterioration, be confident in analysing the urgency of the situation, communicate and escalate care while providing life preservation measures. Failure to do so might lead to adverse patients’ outcomes and prolong the in hospital stay (ACSQHC, 2011).

Generally, hospital in-service sessions utilise didactic teaching approaches which involves a traditional teacher and student role. The clinical educators must consider
implementing active learning strategies when addressing ECG competency to enhance retention of information related to ECG interpretation. Learning by doing rather than seeing could be the answer to acquiring arrhythmia knowledge and should be adopted by the clinical educators. Such approach ascertains that the CCRNs are active agents in the learning process. Hence, the learners’ readiness to learn, learning needs and style of learning should be considered prior to executing the in-service sessions (Bastable & Doody, 2011; Kolb, 1984). The learners should be recognised for their ability of constructing knowledge based on previously held beliefs and experiences because there is an ongoing interaction between the learner and the experience at the meta-cognitive level as Kolb proposed (Graffam, 2007; Kolb, 1984). In healthcare, educators should acknowledge that CCRNs can utilize the acquired knowledge to promote a positive health outcome (Hoke & Robbins, 2005) and to make crucial decisions about what they understand or what they should do (Tanner, 2012). Therefore, clinical scenarios and simulation can be utilized to update and maintain arrhythmia knowledge. Acknowledging different learning styles and needs provide the CCRNs with the opportunity to be actively involved in the experience, to reflect on it, to use analytical skills in order to conceptualize the experience and to utilize the new ideas gained for appropriate critical decision making (Kolb, 1984).

In similar fashion, the CCRNs should be accountable and reflect on their own learning needs and styles of learning. They should actively seek to fill the knowledge gaps by choosing what how and why they need to know information (Kuiper & Pesut, 2004; Kolb, 1984). This may contribute to alleviate the feelings of anxiety associated with incompetence which is a barrier to adult learning (Spiers et al., 2014). The CCRNs and the clinical educators should direct, manage and organise the learning needs within a supportive and clearly defined learning pathway (Michael, 2006). This will enhance the
learners’ motivation to seek knowledge and promote life-long learning (Stevenson & Gordon, 2014).

5.5 Recommendations

This study sought to assess the levels of CCRNs’ arrhythmia knowledge and confidence in arrhythmia recognition. Since no similar studies have been done in Australia before, this study was important to uncover the existing levels of both variables. Further research is required on a larger scale to identify what factors are associated with nurses’ knowledge of cardiac arrhythmias.

While Kolb’s experiential learning theory served the purpose of informing this research by explaining how knowledge is gained from experience, other theories such as Benner’s stages of clinical competence or the situated learning theory could have informed how the professional skills such as ECG interpretation could be developed and acquired. Further studies are required to understand how knowledge and skills are gained in the clinical setting. Whether clinical learning is unintentional and situated within authentic activity, context and culture needs to be investigated in the hospital setting.

It will be interesting to have in between group comparisons and involve another group of nurses that have similar post graduate educational preparation such as emergency nurses. CCRNs working on different critical care wards might have different rates of exposure to cardiac deterioration. Literature has stressed on the value of frequency of exposure to maintain knowledge and hence future studies are important to determine this aspect.

In addition, the study utilized an existing tool with a high level of reliability and validity. The tool has been developed in the United States of America and is reflective of
the educational curriculums of the country. It will be important to develop a knowledge assessment tool reflective of the critical nursing curriculum in Australia because there could be a difference in the educational preparedness. A practical and objective assessment tool is necessary to evaluate this area of nursing proficiency.

Since one of the dimensions of ALS assessment is distinguishing between shockable and non-shockable rhythms, further research is needed to explore if ALS assessment alone is sufficient to maintain arrhythmia knowledge. Other arrhythmias might lead to clinical deterioration but are not assessed via ALS hence it would be worthwhile to introduce another comprehensive approach for assessing arrhythmia knowledge and explore if that approach deems CCRNs more competent in ECG interpretation.

Meanwhile, since ALS competency is the current method of assessing CCRNS arrhythmia knowledge, its frequency and mode of delivery should be questioned to discover what the gold standard is to maintain arrhythmia knowledge. Future studies are needed to compare groups of CCRNs who undertake annual ALS assessment to those who get assessed on more frequent intervals.

In addition, it will be interesting to explore the CCRNs perceptions regarding ECG interpretation skills and knowledge. Hence qualitative studies involving focused interviews regarding knowledge maintenance, ECG proficiency, skills acquisition and preservation as well as preferred methods for ALS assessment serve to have an emancipatory effect on this group of nurses. CCRNs will feel that they are empowered because their opinions are taken in to account.
5.6 Conclusion

While ECG monitoring is of paramount importance in the critical care setting, it should be accompanied by sound arrhythmia knowledge. Prompt recognition of the ECG changes associated with disturbances in cardiac function can guide decisions regarding the urgency and modality of treatment. It could mean the difference between life and death to the patient. This study established that CCRNs working in a small private hospital had suboptimal level of arrhythmia knowledge despite being experienced. The general level of confidence in ECG interpretation was high which indicated a mismatch between competence and confidence. The rhythm specific confidence increased with the level of difficulty of the ECG strips. The study however was limited by its sample size and by the participant selection.

The need for educational strategies to bridge the gaps between learning and practice is crucial. However, in order to achieve this nursing administrators and educators should reflect on the existing standards of practice and hold individuals accountable for their own learning. While nurse educators are encouraged to actively address learning needs, critical care nurses should strive towards maintaining their knowledge and should collaborate with the educators to achieve an optimum level of arrhythmia knowledge. The CCRNs’ learning could thrive in an environment where the CCRNs are given the opportunity to express their learning needs and be encouraged to pursue their learning goals and achieve ECG interpretation proficiency.

Previous studies have concluded that arrhythmia knowledge is an important element within critical care nursing (Keller, 1997; Keller & Raine, 2005; Fulbrook et al., 2012). Developing arrhythmia knowledge requires an ongoing evaluation by nursing educators, administrators, researchers and clinical practitioners. This study implies that regular updates
in ECG monitoring and arrhythmia competency are necessary to achieve quality patient care and high nursing standards.

While the ALS competency is widely recognised in Australia as an approach to assess some aspects of arrhythmia knowledge, it does not incorporate many arrhythmias that could lead to clinical deterioration. It is important for the CCRNs to maintain their knowledge via other approaches. The aim of arrhythmia interpretation programs should be knowledge for early detection of deterioration rather than for completing the ALS mandatory assessment. Once the CCRNs are aware of this subtle but crucial difference they will become better prepared to actively engage in the learning process.

Thorough assessment of clinical deterioration including ECG changes should be regarded as an ongoing process and not as a time consuming task (Endacott et al, 2010). Clinical educators have to incorporate this notion while facilitating and coaching the CCRNs learning.

The KART was utilized to assess knowledge in a small Australian private hospital. Further research is needed to maintain the validity, reliability and feasibility of the KART as an instrument to assess Australian CCRNs arrhythmia knowledge on a larger scale.
References


Park, B. Parker, K. Reid-Searl & D. Stanley(Eds.), *Koziar and Erbs’ Fundamentals of Nursing* (2nd ed.). Sydney: Pearson Australia.


APPENDIX A

Human Ethics Certificate of Approval

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the National Statement on Ethical Conduct in Human Research and has granted approval.

Project Number: CF15/4723 - 2015002031

Project Title: Critical Care Nurses' Knowledge and Confidence in Recognizing Cardiac Arrhythmias

Chief Investigator: Miss Kelli Innes

Approved: From: 12 January 2016 To: 12 January 2021

Terms of approval - Failure to comply with the terms below is in breach of your approval and the Australian Code for the Responsible Conduct of Research.

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must include your project number.
6. Amendments to the approved project (including changes in personnel): Require the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.
7. Future correspondence: Please quote the project number and project title above in any further correspondence.
8. Annual reports: Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. Final report: A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.
10. Monitoring: Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. Retention and storage of data: The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.
Professor Nip Thomson
Chair, MUHREC
cc: Prof Ruth Endacott, Mrs Samira H. Kerbage
Monash University, Room 111, Chancellery Building E
APPENDIX B

The Demographics and Overall Confidence Questionnaire
Adapted from Escudero, Shubhayan, Wong and Templeton (2015)

Please circle Yes or No to the following questions:

a) Are you a registered critical care nurse working at PPH in full time/part time basis? Yes/No
b) Have you been involved in monitoring cardiac patients in the past 12 months? Yes/No
c) Have you got a post graduate qualification in critical care nursing? Yes/No

If you answered Yes to the above questions please continue with the survey, if you answered No to any of the above questions thank you for choosing to participate, however you do not meet the criteria for our study and should not continue answering the survey.

Please answer the following questions

1. AGE ...........................................
2. Gender Male/Female (Please circle)
3. What is the number of beds in which you clinically practice? (Please circle)
   < 10       10-20       20-30       >30
4. How long have you been in practice as a critical care nurse? (Please circle)
   1-5 yrs.   6-10 yrs.   11-15 yrs.   16-20 yrs.   >20 yrs.

5. What is your primary type of practice? (Please circle)
   Intensive Care
   Coronary Care
   Post Anaesthesia Care

6. What other aspects of critical care do you participate in (Please tick all that apply)
7. How many ECG’s do you interpret within a month? (Please tick)
    .... 0-5       .... 5 to 10       .... 11 to 15       .... 16 to 20       .... > 20

8. Are all the ECG’s that you interpret reviewed by a cardiologist? (Please tick)
    .... YES
    .... NO
    .... Some (please explain)

9. What are the most common reasons for ordering an ECG in your setting? (Please tick)
    .... Eating Disorders
    .... Family history of cardiac disease
    .... Chest Pain
    .... Drug ingestion
    .... Palpitations
    .... Syncope
    .... Others (Please Specify)

10. Does your ECG machine provide an interpretation of the ECG? (Please tick)
    .... YES
    .... NO

11. If you have answered YES to the above question, how often do you rely on this interpretation? (Please circle)

    Never  < 25%  25-50%  51-75%  > 75%

12. How important do you feel it is for a CCRN to be proficient in ECG interpretation? (Please circle)
0. Not important
1. Somewhat unimportant
2. Neutral
3. Somewhat important
4. Very important

13. How useful do you find electrocardiography in evaluating potential cardiovascular presentation? (Please circle)
   0. Not useful
   1. Somewhat not useful
   2. Neutral
   3. Somewhat useful
   4. Very useful

14. How confident are you in your overall ability to interpret ECG? (Please circle)
   0. Not Confident
   1. Somewhat Unconfident
   2. Neutral
   3. Somewhat Confident
   4. Very Confident.
APPENDIX C

The Keller Assessment Rating Tool

KART (Keller, 1997) modified in 2015

Directions:

Please insert the name of the arrhythmia in the space provided under each rhythm strip

- All strips are six second strips.
- All strips are Lead II unless otherwise noted.
- Some underlying rhythms may appear more than once.
- If rhythm is a bundle branch block, indicate whether it is a right or left block.
- If rhythm is 3rd degree heart block, indicate whether the block is at the ventricular or junctional level.
- Please circle the number to indicate how confident you are in your assessment with zero being not confident in my assessment and four being most confident.

1. [Image of a rhythm strip]

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident
2.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat confident
   4. Very Confident

3.

A) Rhythm Interpretation:

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
4.

A) Rhythm interpretation_______________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

5.

A) Rhythm interpretation_______________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
6. A) Rhythm interpretation _____________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

7. A) Rhythm interpretation _____________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
8.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

9.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident
A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident
0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

15.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

16.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident


2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

17.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Confident
   2. Neither Confident nor Unconfident
   3. Somewhat Unconfident
   4. Very Confident

18.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
4. Very Confident

19.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

20.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?
   
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
21.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

22.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident
23.

A) Rhythm interpretation (V-1 lead)

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

24.

A) Rhythm interpretation

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
25.

A) Rhythm interpretation (V-1 lead) _________________________________

B) How confident you are in your assessment?

   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident

26.

A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
A) Rhythm interpretation (V-1 lead) _________________________________

B) How confident you are in your assessment?
   0. Not Confident
   1. Somewhat Unconfident
   2. Neither Confident nor Unconfident
   3. Somewhat Confident
   4. Very Confident
29. A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

30. A) Rhythm interpretation (V-1 lead) _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident

31.
A) Rhythm interpretation _________________________________

B) How confident you are in your assessment?

0. Not Confident
1. Somewhat Unconfident
2. Neither Confident nor Unconfident
3. Somewhat Confident
4. Very Confident
Answer the Following Questions using the Codes

W = white electrode

B = black electrode

R = red electrode

G = green electrode

BR = brown electrode

32. Please mark a cross where you would place the electrode in the proper position to obtain a MCL-1 or V-1 view or rhythm strip tracing, using the letter code above.

33. Please mark with a cross where you would place the electrode to obtain a Lead II view or rhythm strip tracing, using the letter code above. Indicate which electrode is the positive electrode in this configuration by placing a plus sign next to the letter.
APPENDIX D:  

Explanatory Statement

Project Title:
Critical Care Nurses Knowledge and Confidence in Cardiac Arrhythmias Interpretation

Project Number:

Primary Researchers  
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You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed above.

What does the research involve?
The aim of the study is to identify critical care nurses’ knowledge of cardiac arrhythmias in a range of hospital settings and whether their knowledge affects their confidence. This explanatory statement has been mailed to you to explain what this study involves which will help you to decide whether you wish to participate in a study day that will be held in the hospital’s conference room. If you decide to participate you will be kindly asked to complete a two-part questionnaire: The first part asks some information about you and how you generally rate your confidence in arrhythmia interpretation, the second is an arrhythmia assessment test consisting of 31 arrhythmia strips and a ‘confidence’ rating question for each strip. Both parts of the questionnaire are expected to be completed within an hour and individually to maintain privacy. Following completion of the questionnaire you will be encouraged to ask questions about the content. A ten-minute presentation will follow, this will focus on the difficult strips and how to accurately analyse them.

Why were you chosen for this research?
You were purposefully invited to participate in this search because you are Division 1 Registered Nurses with post graduate qualifications working in acute settings where you
have to recognize and interpret cardiac arrhythmias. Ramsay Health approval was sought prior to conducting this study as well as Monash Human University Research Ethics Committee.

**Source of funding**

There is no conflict of interest between the researchers involved in this research. The research is self-funded by the student conducting the study.

**Consenting to participate in the project and withdrawing from the research**

This study is descriptive, exploratory and categorized a low risk research. A written consent is not required because the questionnaire is an anonymous survey of your knowledge and confidence levels. Completing the questionnaire is recognized as an implied consent to participate. Prior to submitting the questionnaire, you have the full right to choose not to take part in this study. However, once you return the questionnaire in a sealed envelope and place it in a designated secure, locked box you will not be able to withdraw from the study. It will not be possible to withdraw data once the responses have been submitted. Should you identify any source of discomfort and lack of willingness to participate you are still welcomed to attend the presentation involving arrhythmia interpretation?

**Possible benefits and risks to participants**

The anonymised results of this study will be of benefit to Ramsay Health as they will inform future provision of education regarding cardiac arrhythmias. The potential benefit to you personally lies in the opportunity to ask questions following completion of the questionnaire and to give feedback. You will also be provided with a certificate on the day identifying that you have earned a CPD point from participating. This study will not jeopardise your relationship or employment status with Ramsay Health. The only inconvenience is to be willing to dedicate some of your own free time in order to participate in a study session scheduled for the purpose of determining your knowledge and confidence in arrhythmia interpretation.

**Services on offer if adversely affected**

Should you feel any source of discomfort, you are welcome to seek emotional support and counselling via Ramsay Health Counselling Services as approved by the Director of Human Services?

**Payment**

No monetary payment is offered to study participants.

**Confidentiality**

The completed questionnaire is to be placed in a sealed envelope and put in a locked box accessed by researchers only. Your responses to the questionnaire are anonymous which
means that the researchers cannot link the answers to the participant. The demographic details requested will not allow the research team to identify you. This study is part of the requirements of a Masters of Nursing (Critical Care) and thus the results will be presented in the thesis dissertation.

**Storage of data**

The hard copies will be stored in a locked drawer in the primary researcher’s office at Monash University, Peninsula. Coded and cleaned data will be stored on a pass- word protected networked drive managed by qualified IT staff to protect it from loss or theft or unauthorised use. The Data collected will be retained for five years after publication of results and then destroyed after review. The hard copies will be shredded in secure waste and the documents containing archived data will be deleted from the networked storage facilities. Apart from the researchers involved in this study, no one can access the stored data.

**Use of data for other purposes**

Aggregate de- identified data will not be used for other projects other than this study.

**Results**

Results will be made available in 2016 and a 10-minute presentation will be held on each of the critical care wards that took part in the study to explain results and pinpoint areas of improvement. Results will be also presented via posters in the clinical handover rooms. The Director of Health Services will be emailed the anonymised results.

**Complaints**

Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Executive Officer, Monash University Human Research Ethics (MUHREC)

Executive Officer
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Thank you
Samira H. Kerbage        Miss Kelli Innes        Professor Ruth Endacott