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THE KNOWLEDGE LEVEL OF CRITICAL CARE NURSES ABOUT CARDIOPULMONARY RESUSCITATION GUIDELINES AT A UNIVERSITY AFFILIATED PUBLIC SECTOR HOSPITAL IN JOHANNESBURG

Mpho Moepeng

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree

of

Master of Science in Nursing

Johannesburg, 2017

DECLARATION

I, Mpho Moepeng, declare this research report is my own work. It is being submitted for the degree of Master of Science at The University of the Witwatersrand in Johannesburg. It has not previously been submitted for any degree or examination.

Signed .....
on .....day of 2017

Protocol Number **M160831**

DEDICATION

All challenging work needs self-effort as well as love, support and encouragement from people who are very close to our hearts. I dedicate my humble effort to my sweet and loving husband, Bokang, and my beautiful daughters Sadi, Tumi and Botlhe.

Special thanks to Sadi for playing the motherly role to your siblings during my absence from home while studying. You are my rock.

ACKNOWLEDGEMENTS

First and above all, I praise God, the all mighty, for providing me this opportunity and granting me the capability to proceed successfully.

This research report appears in its current form due to assistance and guidance from people and institutions, therefore I would like to offer my sincere gratitude to them.

Dr Shelley Schmollgruber, I thank and appreciate your perseverance, sage advice, insightful criticism, patience and encouragement as my study supervisor throughout the process of conceptualising, actual research, organising and submitting this research. You helped me in more ways than anyone else. Thank you for sharing your research expertise with me.

To Leeane, the Biostatistian, I am thankful for your assistance with statistical analysis and interpretation of the data.

To the hospital management, thank you for granting me permission to conduct the study in your institution, with special thanks to all the nurses who agreed to be my study participants.
To my classmates and friends, Tebogo, Lorato, Tlamelo and Chinwe for the support during the research and writing efforts. Keep up the spirit.

Thank you all for making this study possible. May the Lord bless you, make his face shine upon you, be gracious to you, lift up his countenance upon you and give you peace.

ABSTRACT

Background: Cardiac arrest remains a leading cause of sudden death worldwide. Provision of high quality CPR, in case of cardiac arrest, increases chances of patient survival, therefore, nurses as front-line patient caregivers are expected to be knowledgeable and skilful in providing CPR to cardiac arrest victims.

Objective: The goal of this study was to investigate critical care nurses' knowledge of evidence based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, and to establish if there is an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation.

Methodology: A descriptive cross-sectional survey design was utilised in this study to elicit the knowledge of critical care nurses on the current cardiopulmonary resuscitation guidelines. The **setting** for this study was the two adult emergency departments (Trauma and Medical) and five (n=5) adult Intensive Care Units of a 1,200 bed capacity public sector hospital in Johannesburg. The ICUs included Trauma, Cardiothoracic, Coronary care, Neurosurgery and multidisciplinary or general units. The **population** of the study involved all critical care registered nurses currently working in the adult Emergency Departments and Intensive Care Units, and all nurses with specialty education and training in Trauma and Emergency Nursing and Intensive Care Nursing were eligible for participation in this study. The total **sample** of registered critical care nurses (N=96) was used. In this study, a non-probability purposive sampling method was used to select participants.

The **data collection tool** was a self-administered questionnaire with two parts. The first section collected demographic data of the participants, while the second section employed 20 multiple choice questions based on the latest AHA guidelines for adult CPR. The knowledge level of critical care nurses was classified as sufficient for participants who answered correctly at least 17 of 20 questions (>85%) and insufficient for less than 17 out of 20 questions (total score <85%), according to the AHA accreditation criteria. **Reliability** was determined by means of a pilot study, and validity through a panel of experts.

Results: Nurses had insufficient knowledge of the current AHA guidelines for cardiopulmonary resuscitation as none could attain the minimum score of 85% .There was no association between post-basic specialisation, years of nursing experience and scoring in the CPR knowledge test.

In **conclusion,** all critical care nurses had insufficient knowledge of the current AHA guidelines for CPR.

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ABBREVIATIONS

The following list of abbreviations are used in the study.

AACN	American Association of Critical Care Nurses
AED	Automated External Defibrillator
ACLS	Advanced Cardiac Life Support
AHA	American Heart Association
ATLS	Advanced Trauma Life Support
BLS	Basic Life Support
CPR	Cardiopulmonary Resuscitation
PALS	Paediatric Advanced Life Support
SANC	South African Nursing Council
WHO	World Health Organization

CHAPTER ONE

OVERVIEW OF THE STUDY

1.0 INTRODUCTION

Cardiac arrest is amongst the major causes of sudden deaths globally. It is estimated that 6 million people worldwide die annually due to cardiac arrest, 60-70% of all sudden deaths are attributed to coronary artery diseases, 10% is due to other types of heart diseases, while non cardiac causes of cardiac arrest such as trauma, respiratory arrest, chocking, electrocution and drowning are responsible for 25% of the deaths (Podrid & Cheng, 2016). Cardiac arrest occurs most frequently in adults, and affects men more than women and is very rare in children. Survival of cardiac arrest depends on several factors, amongst which is the presence of individuals who are competent in performing cardiopulmonary resuscitation (CPR). The American Heart Association has developed guidelines that are evidence based to guide practitioners in decisions during resuscitation. These guidelines also help practitioners to remain competent in their roles and reduce variation in practice. In an in-hospital setting, nurses are often the ones who witness and respond to cardiac arrest, because they are near patients most of the time, hence it is vital they are knowledgeable of the guidelines.

1.1 BACKGROUND OF THE STUDY

As cardiac arrest can occur in or outside the hospital setting, CPR guidelines have been developed for both lay rescuers and healthcare professionals. The American Heart Association (AHA) guidelines for CPR have recommended separate chains of survival that guide rescuers' decisions in managing individuals who suffer cardiac arrest depending on whether they are within or without the hospital premises.

The main purpose of clinical practice guidelines is to describe to users, the appropriate standard of care in which the expected clinical benefits outweigh the negative effects, basing the description on the latest official scientific research findings. If adopted globally, clinical practice guidelines can help minimise differences in management of patients regardless of their geographic locations. Other benefits of clinical practice guidelines

include helping users use resources in the most efficient way possible, act as focus for quality control and providing a focus for continuing education.

The first CPR and emergency cardiovascular care guidelines were published in 1966 by an Ad Hoc Committee on cardiopulmonary resuscitation established by the National Academy of Sciences of the National Research Council (Neumar *et al*., 2015). Since then periodic revisions to the guidelines were published every five years, with the latest guidelines being published in 2010 and updated in 2015. It is empirical that healthcare professionals keep abreast with new developments in guidelines for them to provide high quality care that is evidence based, thus remain competent in their roles, maintain and improve standards of practice and ultimately improve patient outcomes.

The quality of cardiopulmonary resuscitation is associated with outcome. Delays in initiating cardiopulmonary resuscitation, in-adequate compression depth and prolonged interruptions of chest compressions have been identified by most studies as factors contributing to poor quality CPR and are associated with worse outcomes such as poor neurologic outcomes or even death. Cardiac arrest survival rates remain low despite advancements in resuscitation science and technology. Regular CPR training and education helps with the acquisition of new theoretical knowledge and skills. It is therefore important for healthcare professionals, including nurses, to keep updated with resuscitation science in order for survival rates with good neurologic outcome to increase.

1.2 PROBLEM STATEMENT

Studies on CPR knowledge and skill-retention report decline in level over time with poor performance, three to six months post training. In a systematic review of studies on retention of adult ACLS knowledge and skills by Yang *et al.,* (2012), all studies reported variable rate of knowledge or skills deterioration over time, from 6 weeks to 2 years after training. Meaney *et al.,* (2012) also reported in their study, a decrease in cognitive and skill retention among healthcare providers at 3 and 6 months post training in CPR.

This problem occurs across all healthcare professional disciplines, including nurses and doctors, in developed countries where they have all the resources for training, and in developing countries with limited resources. Most studies on CPR knowledge and skill

level have been conducted in developed countries. With few studies on CPR knowledge and skills conducted in the South African context, the results of poor CPR knowledge and skills were consistent with those studies conducted in other countries. Knowledge deficit can lead to non-adherence to the guidelines, ultimately negatively influencing patient outcomes, safety and quality of life after cardiac arrest.

This study seeks to find an answer for the question "Do nurses have knowledge of evidence-based guidelines for cardiopulmonary resuscitation and does qualification and years of experience in critical care units influence knowledge levels of critical care nurses?"

1.3 PURPOSE OF THE STUDY

The purpose of this study is to investigate critical care nurses knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, with the intention of making recommendations for clinical practice and education of critical care nurses.

1.4 RESEARCH OBJECTIVES

The objectives of the study are:

- To determine and describe critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care units of the public sector hospital in Johannesburg.
- To establish if there is an association between qualification (trauma and emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation.

1.5 SIGNIFICANCE OF THE STUDY

Critical care areas provide care for the most critically ill or patients with life threatening conditions. These patients can go into cardiac arrest at any moment in time and because of the nature and complexity of these patients, caring for them requires specialised knowledge

and skills in life support to be able to save lives. It is therefore important that nurses as frontline caregivers, are knowledgeable and competent in CPR in order to optimise the patient's chances of survival and quality of life after cardiac arrest.

Additional training in life support courses such as Basic and Advanced Cardiac Life Support (BLS and ACLS) equip health professionals with the most current knowledge and skills that are evidence-based and necessary for the management of life threatening conditions, such as cardiac arrest. It is therefore vital that critical care nurses keep abreast with new developments in resuscitation science and technology. This study aims at evaluating critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg. The results of this study will create awareness of critical care nurses' current knowledge of CPR, and make recommendations for nursing education and training, and further research in CPR.

1.6 RESEARCHER'S ASSUMPTIONS

Assumptions are statements that are taken for granted or considered to be true, even though they have not been scientifically tested (Burns & Grove 2009). Following is the discussion of this study's meta-theoretical, theoretical and methodological assumptions.

1.6.1 Meta-theoretical Assumptions

The four basic paradigms of nursing, person/client, environment, health and nursing, are the conceptual frameworks of this study with the following assumptions:

1.6.1.1 Person/client

The researcher's perception is that a person/client is the receiver of care. This also includes family members and other groups of people important to the patient. A person is a multidimensional being with biological, psychological, social and spiritual components. A person's health outcome is attributed to how they interact with the components of the multidimensional being.

1.6.1.2 Environment

The environment aspect of the meta-paradigms of nursing focuses on the surroundings, whether internal or external, that affect the patient. The researcher believes the environment plays a significant role in maintaining health and promoting recovery from illness, and a person can modify his/her environmental factors to improve their health status.

1.6.1.3 Health

One's health constantly changes due to environmental, physical and psychological factors. To maintain homeostasis, the body adjusts to adapt to the stresses. Individuals and communities should strive towards attaining high levels of wellness by taking good care of their physical, psychological, spiritual and social wellbeing.

1.6.1.4 Nursing

Nursing is a profession within the healthcare sector. It deals with provision of care to individuals, families groups, communities and populations, whether sick or well. Provision of nursing care, autonomously or in collaboration with other health team members, aims at preventing illness and injury, facilitation of healing, alleviation of suffering and optimisation of health through promotion of safe environment, diagnosis and treatment, advocacy and research. Apart from proving care to clients, nurses have roles that include nursing education, health systems management, active participation in development and review of health policies, amongst others.

1.6.2 Theoretical Assumptions

The theoretical assumption, upon which this study is based, is the AACN Synergy Model for patient care. The model describes nursing practice based on the characteristics and needs of a patient and their families, and nurses' competencies. The model is centred on the belief that nurses' competencies are driven by the needs of patients and their families, and synergy results when there is a match between the patient's needs and that of a nurse, together with skill capacities. The model provides means of identifying and discussing

patients' needs in an organised and structured way, addressing their uniqueness and providing for care continuity throughout the health-illness continuum (Kaplow & Reed, 2008).

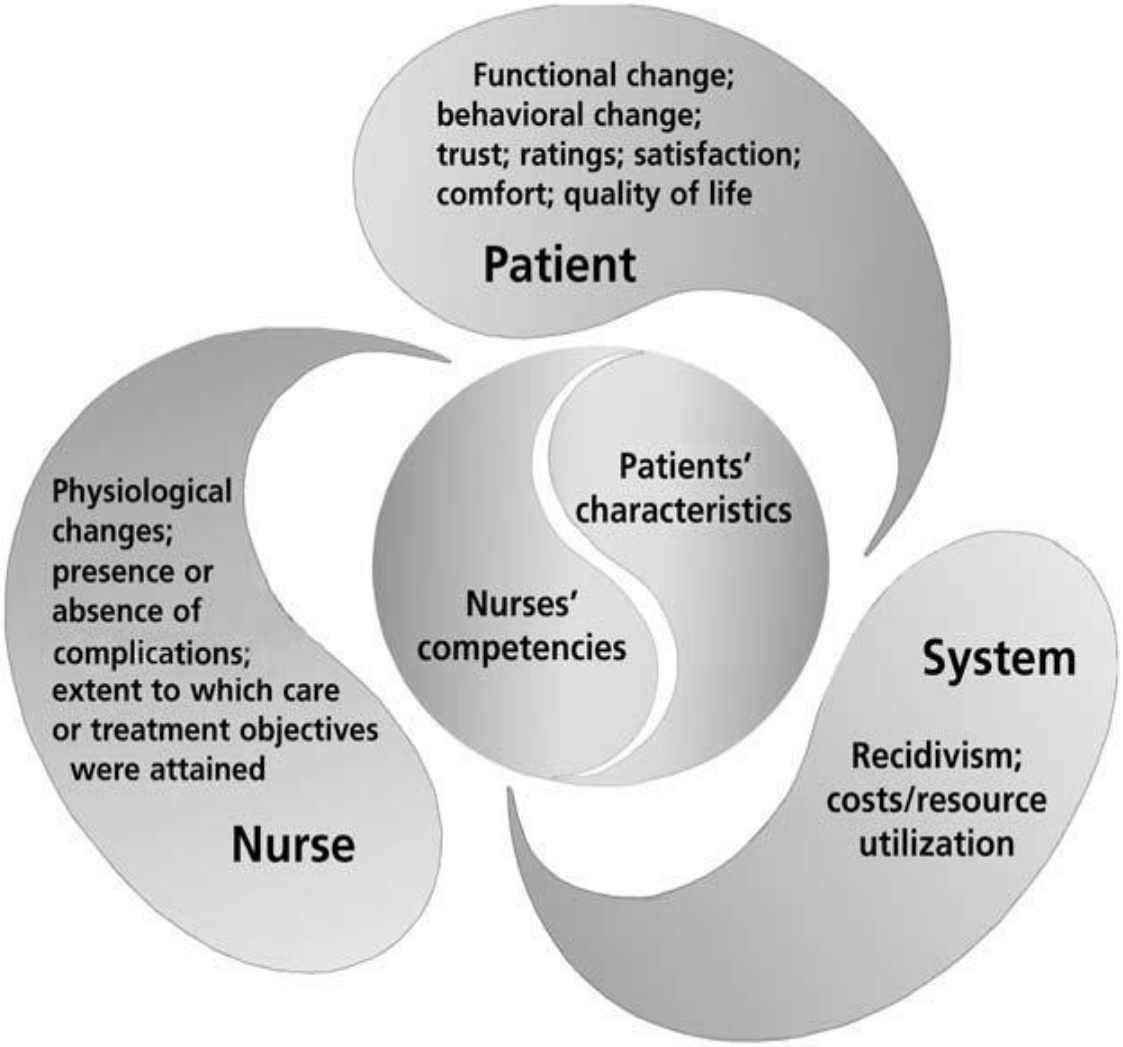


FIGURE 1.1: The AACN Synergy Model for Patient Care

Source: "Implementation of the Synergy Model in Critical Care" by Reed, K., Cline, M., & Kerfoot, K. Available on www.jblearning.com

The assumptions guiding the model are;

- Patients are biological, psychological, social and spiritual entities who present at a particular developmental stage. The whole patient (body, mind and spirit) must be considered.

- The patient, family and community all participate to providing a context for the nurse patient relationship.
- Patients can be described on a number of dimensions. The interrelated dimensions paint a profile of the nurse.
- A goal of nursing is to restore a patient to optimal level of wellness as defined by the patient. Death can be an acceptable outcome, in which the goal of nursing care is to move a patient to a peaceful death (AACN Synergy model).

The following are the model's three components that interact to form a professional hyper-dynamically model of practice.

1.6.2.1 The patient characteristics

Patient characteristics are believed to reflect the universal needs of patients. The model has embedded eight (8) patient characteristics; resiliency, complexity, resource availability, participation in care, participation in decision making, and predictability.

1.6.2.2 The nurse characteristics/competencies

Since nursing care reflects an integration of knowledge, skills, experience and attitudes needed to meet the needs of patients and families, the model describes eight (8) nurse competencies that provide a comprehensive and contemporary view of the work of nurses. These are clinical judgement, advocacy & moral agency, caring practices, collaboration, systems thinking, response to diversity, facilitation of learning, and clinical enquiry. These are believed to be attributes necessary among nurses to ensure optimal outcome for patients. In addition to articulating the work of nurses, the model acknowledges the varying levels of expertise amongst nurses, being level 1 (advanced beginner), level 3 (competent), and level 5 (expert) for each characteristic.

1.6.2.3 The system/environment

This component of the model addresses the context in which the patient needs and nurse competencies merge. Without an environment that supports the patient and nurse

characteristics, the synergy will be less than optimal and the realization of the best outcomes will not occur (Kaplow & Reed, 2008).

1.6.2.4 Application of synergy model during CPR

With post basic training in Trauma & Emergency Nursing and/or Critical Care Nursing, nurses working in critical care areas are expected to uphold competencies and provide care at competent or expert level in order to ensure optimal outcome for their patients.

In a critical care setting, patients exhibit some high levels of complexity, vulnerability and instability and inability to participate in care and decision-making; these patient characteristics should be of concern to the nurse. Since nursing care is a reflection of an integration of knowledge, skills, experience and attitudes needed to meet the needs of a patient and families, nurses caring for such patients should exhibit high levels of clinical judgement and caring practices, high levels of clinical enquiry, advocacy, moral agency and collaboration with other members of the multi-disciplinary team caring for the patient. The conditions of critically ill patients admitted to ICUs are mostly complex and unstable, with patients often presenting with more than one condition. In this regard, nurses caring for them should exhibit high levels of clinical judgement, such as the ability to diagnose a patient in cardiac arrest and act accordingly.

The experience of being critically ill or severely injured makes the patient vulnerable to physical and emotional dependency. These patients are at high risk for exploitation as they have deficits in self-care and decision-making, hence depend on healthcare professionals or significant others for their care. Critical care nurses should advocate for these patients' rights to safeguard them against harm and exploitation. Again, performing CPR requires more than one person, therefore resuscitation team members should collaborate with other team members to optimise patient outcome.

1.6.3 Methodological Assumptions

1.6.3.1 Approach

The primary factor that determines the study approach is the nature of the phenomenon under study, which in this study is nurses' knowledge level of the current CPR guidelines. The research question for this study is, "Do nurses have knowledge of evidence-based guidelines for cardiopulmonary resuscitation and does qualification and years of experience in critical care units influence knowledge levels of critical care nurses?" Answering this question requires numerical data that requires statistical analysis to explain the phenomenon. Knowledge can be operationally defined and measured. For this study, a multiple choice test method will be used to quantify nurses' knowledge of CPR guidelines, therefore, a quantitative approach was adopted.

1.6.3.2 Study design

This study is a descriptive cross-sectional survey. The purpose of the study was to evaluate and describe nurses' knowledge of CPR guidelines therefore, a descriptive design was found suitable for meeting the plans and procedures for the study. Data collection will be carried out at a one point in time using a questionnaire hence a cross-sectional survey design was appropriate for describing the status of nurses knowledge level of CPR guidelines at a fixed point in time.

1.7 OVERVIEW OF METHODOLOGY

The research design, methods, data analysis and ethical considerations of this study are briefly discussed below.

1.7.1 Research Design

The study, a descriptive cross sectional survey, follows a quantitative approach, which was chosen because the findings can later be generalised to the entire population.

A descriptive cross-sectional survey design will be utilised in this study to elicit the knowledge of critical care nurses on the cardiopulmonary resuscitation guidelines. Both trauma and emergency, and Intensive Care nurses will be included in this study population as the sample is limited to critical care registered nurses who are working in one public sector hospital in Johannesburg.

1.7.2 Research Methods

1.7.2.1 Setting

The setting for this study is the two adult emergency departments (Trauma and Medical) and five (n=5) adult Intensive Care Units of a 1,200 bed capacity public sector hospital in Johannesburg. The trauma and emergency department is considered a Level I public sector trauma unit that accepts direct cases in need of highly specialised care. The ICUs include trauma, cardiothoracic, coronary care, neurosurgery and multidisciplinary or general ICU. They represent highly specialised public sector critical care settings, which accept critically ill patients from both medical and surgical disciplines. The General ICU, Cardiothoracic and Trauma units are considered Level III ICUs, as they provide highly specialised care for multi-organ failure, whilst the Coronary care and Neurosurgery are considered Level II as they provide care for single organ failure. The number of official beds range from seven to 12 Intensive Care beds per Unit.

1.7.2.2 Population

The population of the study involved all critical care registered nurses currently working in the adult Emergency Departments and Intensive Care Units in one university affiliated public sector hospital in Johannesburg.

A preliminary record review undertaken in February 2016 indicated, according to the allocation lists, that there were 96 (N=96) registered critical care nurses working in adult Emergency Departments and Intensive Care Units.

1.7.2.3 Sample and sampling method

All nurses with specialty education and training in Trauma and Emergency Nursing and Intensive Care Nursing will be eligible for participation in this study. The total sample of registered critical care nurses (N=96) will be used in this study. A non-probability purposive sampling method will be used to select participants, as only those who meet the inclusion criteria will be selected for participation in the study. Inclusion criteria for prospective participants are:

- Critical care nurses currently registered with the South African Nursing Council in the categories of either Trauma and Emergency Nursing or Intensive Care Nursing.
- Currently in full-time employment at the study selected institution.
- Working in one of the study selected sites.

This advanced level of knowledge and skill is acquired through post basic training and formal education leading to registration as a critical care nurse and maintained through continuous professional development and clinical experience.

1.7.2.4 Data collection

- The Instrument

One instrument, identified in literature and previously published studies, was used to achieve the study objectives. The "*Evaluation Questionnaire on CPR Knowledge for Health Personnel from Emergency Services*," derived from the recommendations of the 2010 American Heart Association (AHA) Guidelines and Updates for CPR (AHA, 2010) and adapted for use in Spain by Garcia, Belen, Luis, Nuria, Hernandez, Valverde, Rosillo and Castro (2015), was chosen as the most suitable instrument.

The self-administered questionnaire contained two parts. The first section collected demographic data of the participants. Section two employed 20 questions on CPR with four possible responses, with one correct possibility, where the knowledge of the clinicians was explored regarding BLS (six questions) and ALS (14 questions). Among the questions,

seven referred specifically to aspects updated in the 2010 clinical practice guideline on CPR, both for BLS and ALS.

Twenty questions were used in the questionnaire and each correct answer will have a score of one point. The knowledge level of critical care nurses was classified as sufficient for participants who answered correctly at least 17 out of 20 questions (>85%) and insufficient for less than 17 out of 20 questions (total score <85%), according to the 2010 AHA accreditation criteria.

With this study, the researcher intended to investigate the critical care nurses knowledge regarding the adult BLS for healthcare professionals and their adequacy to the current CPR guidelines.

- Data Collection Procedures

Permission to conduct the study was sought from the institution's management where the study was conducted. Once permission was granted, the unit managers of the units of interest to the study were consulted for permission to conduct the study in their respective units. The purpose and objectives of the study were explained to all nurses in respective units. Nurses were assured of confidentiality and anonymity with regard to information they give to the researcher. It was explained that participation in the study is voluntary, hence they may refuse to take part, decline to answer any particular question or discontinue participation, at any given time, without incurring penalties. Prospective participants were encouraged to ask questions they may have regarding the study following the distribution of an information letter to those who have agreed to participate in the study. Completed questionnaires were placed into sealed envelopes and collected from each unit by the researcher daily.

1.7.2.5 Data analysis

Descriptive and comparative statistics were used to evaluate critical care nurses knowledge of evidence based cardiopulmonary resuscitation guidelines. Percentage, mean and standard deviation are statistical tests that were used to describe respondents' demographic data and nurses' theoretical knowledge. A t-test was used to determine critical care nurses

knowledge (<85% and >85%) and adequacy to the current guidelines. A Chi-square test was used to determine the associations between critical care nurses knowledge and qualification (Trauma and Emergency qualified and Intensive Care qualified), and years of experience (<10 years and >10 years).

1.8 ETHICAL CONSIDERATIONS

The following ethical requirements were taken into consideration prior to and during the study:

- Submission of research proposal and protocols to the University Postgraduate Committee for permission to conduct the study.
- Application for clearance to conduct research was made to the Committee for Research on Human Subjects (Medical) of the University of Witwatersrand.
- Permission to use the instrument was obtained from the developers of the instrument (refer Appendix E).
- Application for permission to conduct the study to the Hospital Management (refer Appendix D).
- To ensure confidentiality and anonymity of the participants, no names were used during data collection and reporting.
- There was explanation to participants that participation in the study is voluntary and participants may decline to answer any particular question as well as discontinue participation in the study at any time within incurring any penalty (refer Appendix B).

1.9 VALIDITY AND RELIABILITY OF THE STUDY

There was pre-testing of the data collection tool. This gave the researcher an opportunity to check, among other things, if the questions are well understood and whether participants found the questionnaire too long, therefore determine which ones needed to be excluded and what needed to be added.

A panel of experts in critical care nursing reviewed the data collection instrument to validate its contents. To maintain reliability, data was gathered solely by the researcher and

in the same manner/pattern throughout, with an exact and accurate capturing of information. To portray a true picture of the population under the study, a statistician was consulted to help calculate an appropriate sample size, bearing in mind the possibility of some participants refusing to take part in the study. The researcher stuck to the study's inclusion and exclusion criteria when selecting the sample.

1.10 OUTLAY OF THE STUDY

The study will be presented in the following order:

Chapter One : Introduction and overview of the study
Chapter Two : Literature review
Chapter Three : Research methodology
Chapter Four : Data analysis and discussion
Chapter Five : Research conclusions, limitations and recommendations

1.11 SUMMARY

This chapter provided an overview of the research problem and the researcher's planned approach to investigating the problem. The chapter also included a brief discussion of the meta-theoretical, theoretical and methodological assumptions used to guide the study, as well as an outlay of the organisation of the chapters. Following is detailed discussion of literature review, research methodology, data analysis and discussion, research conclusions, limitations and recommendations.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 INTRODUCTION

This chapter deals with review of literature related to the objectives of this study. This chapter discusses guidelines in general, clinical practice guidelines, their uses and users, how clinical practice guidelines benefit patients, healthcare professionals and the healthcare system and potential limitations and problems of guidelines. Following will be the focus on guidelines for cardiopulmonary resuscitation, how they are developed and by whom, and a comparison of the 2010 and 2015 AHA guidelines for adult CPR and emergency cardiovascular care, followed by elaboration of the 2015 sequence for CPR, chains of survival for management of both in and out of hospital cardiac arrests. The procedure of performing CPR is then discussed with focus on when and how the procedure is performed, the drugs and equipment used during the procedure. The physiology and techniques of resuscitation manoeuvres will be discussed with emphasis on chest compressions, ventilation and airway support, and defibrillation. Lastly, the chapter will discuss CPR education and training, roles of nurses during CPR, nurses' knowledge of CPR and association between knowledge and demographic data of nurses, and summary of the chapter.

2.2 GUIDELINES

There are many different types of guidelines and the definition varies across disciplines. In healthcare, there are clinical practice guidelines, public healthcare guidelines and others. This discussion will focus only on clinical practice guidelines.

2.3 OVERVIEW OF CLINICAL PRACTICE GUIDELINES

Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances (Shekelle, 2016). The process of development of clinical practice guidelines is rigorous and evidence-based. This means the experts take the latest evidence from research and use

it to guide patient care that yields the best possible patient outcomes. Evidence-based clinical practice guidelines have differing uses and users, potential benefits, limitations and problems/harms.

2.3.1 Uses and Users of Clinical Practice Guidelines

Healthcare professionals, insurance companies, healthcare administrators and lawyers are common users of clinical practice guidelines. Healthcare professionals use guidelines to help them take better care of patients. Insurers and administrators may use clinical practice guidelines for policymaking, e.g. policies on quality and payment of care, and lawyers may use guidelines in malpractice litigations, e.g. in case of negligence.

2.3.2 Potential Benefits of Clinical Practice Guidelines

2.3.2.1 Benefits to patients

The use of evidence-based guidelines in clinical practice results in improved quality of care to patients, hence improved health outcomes of patients. This is because evidence-based guidelines promote interventions of proved benefit to the patient, hence have the potential to reduce morbidity and mortality, and improve the consistency of care given to patients. Patients with identical clinical problems may differ in their geographic location, hospitals and clinicians, but through use of guidelines, patients will be cared for in the same manner regardless of where or by whom they are treated.

2.3.2.2 Benefits to healthcare professionals

Guidelines offer explicit recommendations for practitioners therefore improve the consistency of care, clarify interventions of proved benefit to patients, and ultimately improving the quality and outcome of patient care. Since clinical practice guidelines are developed following a systematic review of evidence, they can point out where knowledge gaps exist, hence help practitioners identify areas of research.

2.3.2.3 Benefits to the healthcare institution and system

Clinical practice guidelines can be used as reference for quality assurance projects and initiatives, where clinicians or hospital practices can be compared to a common standard of care to demonstrate where improvements can be made (Lim et al., 2008).

2.3.3 Potential Limitations and Problems of Clinical Practice Guidelines

The following were identified by Shekelle, (2016) as potential problems of clinical practice guidelines:
The challenge of keeping guidelines updated, potential for inappropriate use of guidelines as tools for legal or restrictive administrative purposes, difficulty in accessing guidelines at the point of care as many are lengthy, or specific components relevant to a patient are not readily searchable or retrievable. There is lack of coordination between guidelines development groups, generating differing recommendations. There may be potential for conflict of interest.

Most guidelines focus on the diagnosis and treatment of single diseases, therefore application of guidelines developed to address a specific condition to patients with multiple morbidities may adversely affect patient safety if recommended treatments for one condition conflict with those of another condition.

2.4 GUIDELINES FOR CARDIOPULMONARY RESUSCITATION

2.4.1 Background of CPR

The history of cardiopulmonary resuscitation dates back to 1767, when a few wealthy citizens in Amsterdam gathered to form the Society for Recovery of Drowned Persons in an effort to respond to sudden death. Following the success of this first society, rescue societies sprang up in many European capitals with a goal of finding a way to successfully resuscitate victims of sudden death, thereby making societies of the 18th century precursors of today's emergency medical services (Marzooq & Lyneham, 2009).

Since the inception of the first CPR guidelines, periodic revisions were published every five years up until 2010. In 2015, no new guidelines were published as updates were made to the 2010 guidelines rather than complete revision of the guidelines.

2.4.2 Development of the AHA Cardiopulmonary Resuscitation Guidelines

Globally, healthcare providers and consumers of today understand that healthcare must be based on scientific research, practitioner's knowledge accumulated from clinical experience, patient values and preferences. For healthcare practitioners to deliver high quality CPR that is evidence-based, evidence must be compiled, discussed and recommendations made by respective resuscitation councils.

The International Liaison Committee on Resuscitation (ILCOR) is the mother body that provides a forum for liaison between principal resuscitation organisations worldwide. The committee was formed in 1992 with the mandate of gathering information on resuscitation, after which the information was discussed and debated by representatives of the resuscitation organisations in order to come up with recommendations that are science-based and have been agreed upon by the member organisations

Member organisations of the ILCOR are expected to have accepted a task for creating resuscitation guidelines for more than one country and the councils' membership constitution must be multi-disciplinary. The ILCOR comprises representatives of the American Heart Association, European Resuscitation Council, Heart and Stroke Foundation of Canada, Australia & New Zealand Committee on Resuscitation, Resuscitation Council of Southern Africa, Inter American Heart Foundation and the Resuscitation Council of Asia.

2.4.2.1 The process of evidence evaluation of the 2015 guidelines

The ILCOR produced the first International CPR guidelines in 2000. Since then, the member councils frequently evaluate new resuscitation science and knowledge. For the 2015 guidelines, the AHA collaborated with the ILCOR in the review process. As the mother body, the ILCOR came up with high priority topics that needed to be reviewed.

Selection of the topics was based on clinical importance and availability of new research findings.

Task forces comprising international experts were formed, one for Basic Life Support, Advanced Life Support, Acute Coronary Syndromes, Paediatric Life Support, Neonatal Life Support and one for Education, Implementation and teams. Each team then selected a topic from the priority topics presented by the ILCOR. The topic was then expressed as a question in PICO (Population, Intervention, Comparator and Outcome) format. The PICO question was then addressed by a systematic review of all scientific literature available and pertinent to each question. When all relevant publications had been collected, a GRADE system was used to rate the quality of the findings of each study. The research is then summarised into a draft of topic specific consensus and treatment recommendations, followed by drafting of official guidelines.

2.5 COMPARISON OF THE 2010 AND 2015 AHA GUIDELINES FOR ADULT CPR AND EMERGENCY CARDIOVASCULAR CARE FOR HEALTHCARE PROFESSIONALS.

The 2015 AHA guidelines for adult CPR and emergency cardiovascular care expand on many of the recommendations made in those of 2010, with focus on high quality chest compressions, as the intervention is most likely to improve resuscitation outcomes. The guidelines also take note of opioid overdose as one of the possible causes of cardiopulmonary arrest. In the latest guidelines, the chain of survival has been separated into out of hospital and in-hospital settings compared to the previous guidelines where there was only one chain for both settings. The table below shows a summary of key changes made to the 2010 guidelines. The comprehensive guidelines are available in the Resuscitation Journal.

Table 2.1: Comparison table of key changes made to the 2010 AHA guidelines for adult CPR and emergency cardiovascular care.

Issue	2010 recommendation	2015 recommendation
Chains of survival	There was only one chain for both in and out of hospital care of patients who experienced cardiac arrest.	Separate chains of survival have been recommended that identify the different pathways of care for patients who experience cardiac arrest in the hospital as distinct from out of hospital settings.
Recognition of a patient in cardiac arrest and signalling for help.	The healthcare professional should check for response while looking at the patient to determine if breathing is absent or normal.	Healthcare professionals must call for help upon finding the victim unresponsive, but it would be practical for a healthcare professional to continue to assess the breathing and pulse simultaneously before fully activating the emergency response system/ calling for backup.
Chest compressions and rescue breaths.	It is reasonable for both emergency medical service and in-hospital professional rescuers to provide chest compressions and rescue breaths for cardiac arrest victims.	It is reasonable for healthcare professionals to provide compressions and ventilations for all adult patients in cardiac arrest, whether from cardiac or non-cardiac cause. Moreover, it is realistic for healthcare professionals to tailor the sequence of rescue

		actions to the most likely cause of arrest.
Chest compressions rate.	It is reasonable for lay rescuers and healthcare professionals to perform chest compressions at a rate at least 100/minute.	In adult victims of cardiac arrest, it is reasonable to perform chest compressions at a rate of 100-120/minute.
Chest compression depth.	The adult sternum should be depressed at least 2inches (5cm).	During manual CPR, rescuers should perform chest compressions to a depth of at least 2 inches (5 cm) for an average adult while avoiding depths greater than 2.4 inches (6 cm).
Ventilations with advanced airway.	When an advanced airway (i.e. endotracheal tube, Combitube or laryngeal mask airway) is in place during 2-person CPR, give 1 breathe every 6-8 seconds without attempting to synchronise breaths between compressions. This will result in 8-10 breaths/minute.	It may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths/minute while continuous chest compressions are being performed during CPR with advanced airway.

2.6 CHAINS OF SURVIVAL

Cardiac arrest can occur in or outside a hospital setting, therefore both qualified and laypersons should be able to perform CPR depending on their level of training. Management of patients who suffer cardiac arrest within the hospital premises differs to that of patients outside of the hospital, therefore the AHA has found separate chains of survival to be suitable for care for patients experiencing cardiac arrest in and outside the hospital settings, since the elements of structures and processes are different for the two.

The chain of survival describes very crucial inter-dependent steps, which when followed one after the other, can maximise chances of surviving cardiac arrest. The rings or

connecting structure in the AHA version of chains of survival are: immediate recognition of cardiac arrest and activation of the emergency response team, early CPR with emphasis on chest compressions, rapid defibrillation, effective basic and advanced life support and integrated post cardiac arrest care.

2.6.1 Out of Hospital Cardiac Arrest

- The first link: Immediate recognition of cardiac arrest and activation of the emergency response team

The link includes all actions taken following the collapse of a patient up to the time when the emergency medical team (EMS) arrives. Community response to cardiac arrest is critical to saving lives. Timely recognition of a patient collapsing, activation of the emergency response team, fast response and dispatch of EMS with all necessary equipment, and detection of cardiac arrest are actions that have to occur rapidly ahead of defibrillation or advanced care, therefore patients, relatives or anyone else should activate EMS response system if they experience or recognise early warning signs of cardiac arrest, such as chest pains or breathlessness.

According to the 2015 guidelines, to help bystanders recognise possible victims of cardiac arrest, dispatchers should be able to identify agonal or gasp breaths by asking straightforward questions regarding the victim's responsiveness and patterns of breathing.

- The second link: Early CPR with emphasis on chest compressions

The 2015 updated guidelines recommend that untrained lay rescuers should provide compression-only (hands only) CPR, with or without dispatcher guidance, for adult victims of cardiac arrest. The rescuer should continue compression until arrival of an AED or rescuers with additional training. All lay rescuers should, at minimum, provide chest compressions and additionally, if the trained lay rescuer is able to perform rescue breathe, he/she should add rescue breaths in a ratio of 30 compressions to two breaths. The rescuer should continue CPR until an AED arrives and is ready to use, EMS providers take over the victim, or the victim starts to move.

- Third link: Rapid defibrillation

The AHA 2015 CPR guidelines recommend that public automated defibrillators programmes, aimed at assisting people who experience cardiac arrest outside the hospital setting, be employed in open or unrestricted areas where chances of witnessing someone experience cardiac arrest are high, such as in airports, casinos and sports facilities. There is clear and consistent evidence of improved survival from cardiac arrest when bystanders perform CPR and rapidly use an AED, and defibrillation is only effective when administered within the first 3 minutes of the time of collapse (Kronick et al., 2015).

- Fourth link: Basic and advanced emergency medical services

The Emergency Medical Services (EMS) provide initial management of the patient in cardiac arrest. After stabilisation, the victim should be transported to an appropriate health facility capable of providing advanced comprehensive care.

- Fifth link: Effective advanced life support

This includes advanced airway management, drug therapies, intravenous or intraosseous access, and haemodynamic monitoring of the cardiac arrest victim.

2.6.2 In-Hospital Cardiac Arrest (IHCA)

- Link 1: Surveillance and prevention

In a hospital setting, patients often demonstrate deterioration prior to cardiac arrest. This link helps hospitals in structuring their care process to prevent and detect patient deterioration and cardiac arrest, e.g. through continuous patient assessment, observation, measuring and recording vital signs.

- Link 2: Recognition and activation of emergency response team

Healthcare professionals should be able to recognise patient deterioration leading to cardiac arrest and activate the emergency response team. It is important that hospitals have knowledge of and understand mandated, un-ambiguous activation protocol for summoning response to a deteriorating patient.

- Link 3: Immediate high quality CPR

Same as in out of hospital setting, healthcare professionals should give high quality CPR with emphasis on chest compressions of the 2015 recommended depth and rate, and allow complete chest recoil by avoiding leaning on the victim's chest.

- Link 4: Rapid defibrillation

With defibrillators within reach in hospitals, healthcare professionals should be able to identify and deliver shock to victims experiencing ventricular fibrillation or pulseless ventricular tachycardia immediately.

- Link 5: Advanced life support and post arrest care

Hospitals have multi-disciplinary response teams comprising personnel trained to perform invasive procedures such as endotracheal intubation and administration of intravenous drugs.

2.7 THE CPR PROCEDURE

CPR is a lifesaving procedure in case of cardiac arrest. The procedure consists of chest compressions, artificial ventilation, defibrillation and medications to maintain blood flow to vital body organs during cardiac arrest. It can be performed by one person (single rescuer) or by two or more persons (team rescue) in or outside the hospital settings.

2.7.1 Indications and Contraindications

CPR should be executed on anyone who has lost consciousness and has no pulse. A Do-Not-Resuscitate order is the only definite contraindication. Others include instances where the person made it clear, well in time, they do not wish to be resuscitated, or if the doctor reasonably believes the procedure will not be successful.

2.7.2 Equipment and Drugs

Essential equipment for resuscitation includes items from drugs and consumables to access to electrical power. Emergency equipment is kept in crush/emergency charts. The charts should be well stocked and organised to facilitate rapid access. There is no standardisation of resuscitation equipment therefore healthcare institutions should provide lists of minimum equipment and drugs to be maintained in the arrest trolleys.

2.7.3 The 2015 Algorithm for Adult Basic Life Support for Healthcare Professionals

The sequence presents actions that rescuers should perform for life support. In the algorithm, emphasis is placed upon immediate recognition of cardiac arrest, rapid defibrillation and high quality chest compressions.

On arrival at the scene, the healthcare provider should first ensure the scene is safe by checking for anything unsafe, such as fire, traffic or exposed electric wires. If safe, the victim should not be moved.

2.7.3.1 Recognition of cardiac arrest and activation of emergency team

In an in-hospital setting, healthcare providers should be able to recognise early signs and symptoms of a patient deteriorating or already in cardiac arrest. The guidelines recommend that hospitals should have a set of criteria that signify a patient's condition is deteriorating, which the healthcare provider will use to mobilise the rapid response team.

The rescuer should then assess if the patient is unresponsive and call for help, mobilise the resuscitation team, bring an AED to the victims' side, feel for the presence of pulse and

breathing, while at the same time activating the response team. If a pulse is present and breathing is normal, the provider should continue close monitoring of the patient.

When a pulse is present and breathing is abnormal, the rescuer should provide rescue breathing at a rate of one breath every 5 to 6 seconds or about 10 to12 breaths/minute, activate the emergency response system (if not already done), and continue with rescue breathing while checking for pulse every 2 minutes.

If there is no pulse, chest compressions should be started at 30 compressions and two breaths. An AED should be used the moment it comes on site and is ready, check for the possibility of opioids overdose and administer naxolone per protocol if suspected.

2.7.3.2 Chest compressions and shock delivery

Before beginning compressions, emergency response system or back up should have been activated and an AED and emergency equipment retrieved. When the AED arrives, the rescuer checks if the rhythm is shockable or not. If shockable, then a shock should be given and CPR be resumed immediately for about 2 minutes. Compressions, rhythm checks and shock delivery should be continued until an advanced life support provider takes over or the victim moves.

In the event that the rhythm is unshockable, the rescuer should resume CPR for about 2 minutes (until prompted by AED to allow rhythm check). This should be continued until advanced life support providers take over the victim or the victim starts to move.

2.8 THE PHYSIOLOGY AND TECHNIQUES OF RESUSCITATION MANOEUVRES

During CPR, special techniques, such as chest compressions, ventilation and defibrillation, have to be performed as recommended and proved by scientific research in order to provide high quality CPR.

2.8.1 Chest Compressions

Chest compressions are essential elements of CPR. The goal is to provide the heart and brain with oxygenated blood and direct cardiac massage as well as thoracic pump mechanisms help achieve this. All patients in cardiac arrest are eligible for chest compressions. Healthcare professionals can initiate compressions without a physician's order as long as they find a patient unresponsive without definite pulse or normal breathing. A valid DNR order is the only contra indication for compressions.

2.8.1.1 The physiology of chest compressions

The external cardiac massage and the thoracic pump models are the two main hypotheses that describe how chest compressions keep blood flowing to the vital organs.

- The cardiac massage model

This model theorises that when the heart is squeezed between the pushed down sternum and the thoracic spine, blood will be forced out of the heart into the circulation circuit and ultimately perfuse the vital organs.

- In the thoracic pump model

In this model, it is theorised that the pressure inside the thoracic cavity is increased intermittently when the chest is compressed; the vena cava, the heart and the aorta will experience the same amount of pressure exerted on the chest. This subsequently increases pressures in the arterial and venous vasculature, resulting in blood flow to the vital organs.

2.8.1.2 The technique of chest compressions

- Patient and hand positioning

The patient must lie on their back, on a hard plane when possible; in cases where the victim is in bed, hard boards should be used as, beds are generally soft. This will cause diversion of some of the force that is supposed to depress the sternum and end up wasted in displacing the mattress rather than depressing the sternum.

Depending on whether the patient is on the bed or floor, the rescuer stands or kneels beside the patient's chest, places the heel of one hand on the lower half of the sternum and the other on top of the first. Both hands must be overlapped and perpendicular to the victim's chest for optimal transfer of force. To minimise compression force transferred to the victim's chest, rescuer's fingers must be held upright from the victim's chest.

- Compression depth, rate and chest recoil

With arms straight, elbows fully locked, and shoulders vertically above the victim's sternum, the rescuer compresses the chest to a depth of 5 to 6 cm (2-2.4 inches) at a rate of 100 to120 compressions per minute (Kleinman *et al.,* 2015). The 2015 ILCOR systemic review addressed whether compression rates different from 100/min influenced physiologic or clinical outcomes, such as return of spontaneous circulation, end-tidal CO2, survival to hospital discharge, etc. and it was found there might be an optimal zone for the rate between 100/min and 120/min.

After each compression, the rescuer must allow complete return of the chest to its normal position. The latest guidelines recommend that rescuers should desist from leaning on the victim's chest between compressions. Doing so results in insufficient recoiling of the chest, which is linked with decline in coronary perfusion pressure.

- Interruptions during chest compressions

Interruptions of chest compressions must be kept minimal. There may be interruptions during rhythm analysis, ventilations, or switching of rescuers delivering compressions. Studies have reported that manual chest compressions were slower and shallower than those recommended by the AHA guidelines hence some counties introduced mechanical CPR devices to help reduce strain and ease the burden of physical labour required to conduct CPR, as rescuer fatigue is associated with poor quality compressions.

- Calling off chest compressions

Chest compressions are only discontinued after the return of spontaneous blood flow. If not restored, then the physician leading the resuscitation team can make the decision to call off compressions based on clinical judgement. Some aspects that may be considered are time

elapsed since the start of chest compressions, type of rhythm that lead to arrest, existing illnesses, and any other causes that lead to arrest and are treatable, such as drug overdose.

2.8.2 Ventilation and Airway Support

Ventilation of the lungs enables oxygenation of the blood and removal of carbon dioxide. Effective ventilation needs an airway that is not obstructed, and must be able to safeguard the lungs against aspiration. If the airway is injured, threatened, or there is potential for obstruction, airway patency and protection can be achieved by intubation. Intubation also enables ventilation without interrupting compressions.

Airway adjuncts can be placed through the oropharyngeal or nasopharyngeal routes. The oropharyngeal airways are used mostly for patients with no cough reflex, when the nasopharyngeal airways are better tolerated by patients who are not unconscious, but contraindicated for those with known or suspected basal skull fractures.

Ventilations can be given via the rescuer's mouth (mouth-to-mouth technique) or a bag-valve-mask (BVM). If ventilations are given through the rescuer's mouth and if at rescuer's disposal, a barrier device such as pocket mask or face shield must be worn. The rescuer then pinches the patient's nostrils closed to create an airtight seal and gives two breaths after every 30 chest compressions. Each breath should be given over a period of approximately 1 second and cause the victim's chest to expand. Inadequate or no expansion at all is indicative of insufficient airtight seal or an obstructed airway.

When using the bag valve mask, the rescuer must make sure an effective airtight seal is achieved through proper head placement (if neck injury is not suspected) and fitting of the mask to the victim's mouth and nose, then squeeze the bag with one hand for approximately 1 second. This delivers about 500ml of air into the patient's lungs.

2.8.3 Defibrillation

The purpose of defibrillation is to treat ventricular fibrillation (VF) and pulseless ventricular tachycardia (PVT), which are fatal cardiac dysrhythmias.

2.8.3.1 Types of defibrillators

Depending on the type of defibrillator, shocks may be performed using the Manual External Defibrillator (MED) or the Automated External Defibrillator (AED).

- The Manual External Defibrillators

These are used by appropriately trained doctors, nurses and paramedical staff as they rely on human interpretation of the electrocardiograph and decision about energy selection before shock delivery. Instructions for operating the defibrillator differ, depending on the type/manufacturer, and need following for safe use. Ward defibrillation procedures/protocols should also be available to guide staff on steps of defibrillation from patient preparation, positioning of electrodes to operation of the defibrillator in order to give electric shocks.

- The Automatic External Defibrillator (AED)

An AED is a portable defibrillator that can be used by both medical and non-medical people, provided they have been properly trained on its use. It has an in-built computer that analyses the patient's rhythm and determines if defibrillation is or is not needed. It gives instructions to the user through voice prompts on what to or what not to do, until a shock is delivered when necessary.

2.8.3.2 Safety precautions during defibrillation

There are general safety precautions to be followed when performing defibrillation regardless of the type of defibrillator used:

- Ensure a non-conductive environment

Conductive items should be removed from the victim's surroundings and the defibrillator. Fluids such as water, blood, vomitus, or sweat must be wiped off the chest.

- Ensure a non- explosive environment

Rescuers should not defibrillate where inflammable materials such as petrol are within range.

- Ensure non-contact

No one should be in touch with patient at a time when shock is being delivered. The clinician responsible for defibrillation should check for no contact with the patient by shouting loudly "ALL CLEAR" before delivering the shock.

2.9 CPR EDUCATION AND TRAINING

The knowledge and skills regarding the performance of CPR are essential to critical care nurses, nurses in general and other healthcare professionals, with the goal of recognising and responding to patients at risk of experiencing cardiac arrest and delivering high quality CPR when required. CPR is a component of most life support courses, such as Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), Paediatric Advanced Life Support (PALS), and Advanced Trauma Life Support.

Basic Life Support course training for healthcare professionals provides understanding of basic techniques in resuscitation, such as basic steps in performing CPR and using AED. Upon completion of training, course participants undertake a cognitive knowledge examination and a skill proficiency test for which 85% is the minimum required mark to be BLS certified and the certification expires in two years. A valid BLS certification is a pre-requisite for entry into advanced life support courses and is mandatory for all healthcare professionals in most countries.

2.9.1 Approaches to CPR Training

Instructional approaches to training differ and remain the choice of the instructor/institution looking at the effectiveness of the method, availability of resources, costs, time consumption and other aspects. Common CPR teaching approaches include the traditional lecture led mode, the high fidelity simulation and a self-directed video based mode.

2.9.1.1The traditional classroom

The method involves transmission of information to students as discrete topics in lectures or seminars. The teaching is teacher-centred and the teacher serves as the source of knowledge while learners are passive receivers. It puts the responsibility of teaching and learning mainly on the teacher and is believed that students listen to the teacher's explanations and they be able to use the knowledge (Bradley 2011).

There are mixed feelings about the effectiveness of this teaching mode. Those in support of it argue that classroom teaching enables the instructor to present factual material in a logical manner to stimulate critical thinking amongst students. They also believe it is good for the novice learner, explaining that the instructor will always be available to clarify issues of concern when necessary.

2.9.1.2 The high fidelity simulation

The method or style entails a 'life–like' dummy that make true to life biological reaction to actions in a 'real-time' 'real-life' situation. After simulation, learners engage in a debriefing session to discuss rationale and concepts in support of the activities or behaviour, and to reflect on performance. Learners can repeat simulation and debriefing, as many times as they wish as the environment is controlled and safe, hence there is no danger to the patient. For this reason, simulation in CPR education has become an important teaching method for teaching learners necessary knowledge and skills.

In a study by Aqel & Ahmed, (2014), which aimed at examining the effect of using high fidelity simulation on knowledge and skill acquisition and retention with university students, where students were divided into two groups (control and intervention), the results showed that prior to exposure to the traditional lecture method (4 hour teaching + demonstration on a low fidelity manikin) and the high fidelity simulation teaching methods, there was no difference in baseline CPR knowledge. Post intervention tests revealed that the intervention group (group exposed to high fidelity simulation) scored higher than the control group, and continued to score higher than the control group three months later. These findings were consistent with those of other studies.

2.9.1.3 Self-directed learning

In this method, learners take the responsibility for their own learning rather than responding to an instruction. They work out their learning goals, establish learning means and material selection, and employ learning plans and assess learning outcomes.

The efficacy of these distinctive learning methods continues to be unclear and more or additional research is needed, not only to connect the immediate results to the teaching method but also to eventually ascertain the effect on real life cardiac arrest circumstances. This statement is supported by findings of a study by Meany *et al*. (2012) in which one of the objectives was to find out if selected teaching methods (traditional instruction, limited instruction with feedback manikin or self-directed learning) were associated with performing excellent CPR. The results reported that none of the teaching methods was associated with significant odds ratio of performing excellent CPR.

2.9.2 Levels of CPR Training

Courses on cardiopulmonary resuscitation provide skills needed to recognise and respond to cardiopulmonary emergencies; training can be at basic or advanced level. BLS is the foundation and pre-requisite to advanced level training in resuscitation and can be tailored for both lay and healthcare professional rescuers, while advanced level courses are mostly aimed at healthcare professionals. Rhythm recognition, defibrillation, cardioversion, airway management are some of the skills learnt in advanced life support courses.

There are insufficient scientific findings in support of using ALS over BLS during resuscitation efforts. The few studies conducted in out-of-hospital medical emergencies are in support of BLS rather than ALS use. Sanghavi *et al.* (2014) compared the effects of BLS and ALS on outcome following incidences of out-of-hospital cardiac arrest, and found greater survival with BLS to hospital discharge (13%), compared to 9.2% of those who received ALS. Sanghavi *et al.* (2015) again in another study compared survival rates and neurologic functioning on four conditions (major trauma, stroke, acute myocardial infarction and respiratory failure) over a period of five years; the results again reported higher survival rates among patients receiving BLS than those receiving ALS.

As medical emergencies such as cardiac arrest necessitate early optimisation of care, and ALS providers are trained to provide advanced and sophisticated on site care, one would expect advantage of ALS over BLS, but studies report the opposite.

2.9.3 Training Intervals

After initial training and certification in life support courses, certification is valid only for two years, after which trainees are expected to renew their certification be it BLS, ACLS or ATLS. However, with evolving trends in support of regular up keeping of proficiency and ongoing education and training of health professionals, there is a need to change certification of trainees from the two-year period standard to an approach that focuses on CPR competency, as there is extensive proof that CPR knowledge and skills deteriorate fast after training.

Cardiopulmonary resuscitation education and training is a complex issue and literature puts forward many suggestions to improve learning and performance of skills, however, the best approach appears to lie in using a combination of teaching methods, and resuscitation training be carried out frequently to prevent deterioration of skills and knowledge.

2.10 ROLES OF NURSES DURING CARDIOPULMONARY RESUSCITATION

One of nurses' primary roles regarding CPR is prevention of arrest occurring using assessment skills and sound clinical judgement. This implies that nurses should be able to recognise changes that signal deterioration and intervene appropriately, e.g. moving the patient to a high-risk unit increases the chance of witnessing an arrest if one happens. In an in-hospital setting, nurses often are often the first on the scene of arrest, initiating CPR as well as summoning assistance from the code team.

2.11 NURSES' KNOWLEDGE OF CPR

Knowledge is considered the blueprint of intellectual growth. We acquire it through many ways such as, practice, experimentation, observation, asking, desire to learn and reading critically. In most institutions, the CPR procedure is taught using different teaching strategies, but if learners, in this case nurses, don't practice or do the procedure repeatedly,

or do not have the desire to learn it, or are afraid or ashamed to ask to get information about it, then they wouldn't be knowledgeable, which will be evidenced by low performance marks if tested on the procedure.

Patients' survival from cardiac arrest partly depends on nurses' ability to perform CPR, but research results from different countries across the globe report that nurses lack knowledge and competence in performing CPR. In a study by Passali et-al, (2011), which evaluated nurses' and doctors' knowledge of basic and advanced life support resuscitation guidelines, the knowledge score was sub-optimal for both groups. A similar study was conducted in Bahrain (Asia) by Marzooq et al., (2009), where the average score of nurses on knowledge of CPR was 49%. In Nepal, the mean score was 55% (Parajulee & Selvaraj, 2011), 11% in South Africa (Keenan et al., 2009), and in an interventional study by Rajeswaran, (2014) conducted in Botswana, nurses knowledge increased from 55% before training to 80.6% post training. All these studies indicate nurses' poor knowledge of CPR.

Knowledge of guidelines is associated with performance of CPR. Burkhardt et al., (2014) conducted a study to quantify the effect of knowledge on performance of all aspects of chest compressions being rate, depth, recoil and hand positioning. The results showed that participants who identified effective compression rate to be greater than or equal to 100/minute, performed chest compressions at a higher rate than those who identified the compression rate as less than 100/minute. On hand placement, participants who knew proper hand placement performed a greater number of compressions than those who did not know. The findings suggest that knowledge of guidelines had significant impact on CPR performance for at least some components of CPR.

As guidelines are updated and revised from time to time, nurses have a responsibility to equip themselves with new developments in resuscitation science, health technologies and approaches.

2.12 ASSOCIATION BETWEEN CPR KNOWLEDGE, PERFORMANCE AND DEMOGRAPHIC DATA OF NURSES

Several factors have been found to impact on nurses' knowledge and performance of CPR either in a positive or negative way.

2.12.1 Training in CPR

Studies have found training to influence knowledge and performance of CPR. According to Kallestedt et al., (2010), theoretical knowledge on how to perform CPR is essential for the ability to perform it in practice, and nurses with good theoretical knowledge achieve better CPR performance. In a study by Roshana et al., (2012), participants who received some CPR training within five years obtained the highest mean score and those who were involved in resuscitation frequently scored higher than those who were seldom or not involved.

2.12.2 Work area/ unit

Working in certain units of a hospital influences nurses' knowledge of CPR. In a study conducted by Bukiran & Buzkurt, (2014) where the objective was to determine basic theoretical BLS and ACLS knowledge level (pre-test) and nurses knowledge level of short term (1day) and long term (6-12 months) after training (post-test), pre-test scores were significantly higher in nurses working in Accident and Emergency (mean score of 14.2/25), followed by those working in critical care areas with mean score of 13.8/25, then medical and surgical units with13.5/25 and 11.3/25 respectively. These results are consistent with those of Garcia et al., (2015), where one of the objectives was to find out if work experience and experience in emergency services influenced knowledge of CPR, as they found working in Accident and Emergencies influenced knowledge of CPR (Kruskal-Wallis $H = 19.5$, $gl = 5$ and $p<0.01$).

2.12.3 Experience

In the same study by Bukiran & Buzkurt, (2014), pre-test scores were higher in nurses who had 10 or more years of work experience with mean score of 13.9/25, followed by those with 5 to 9 years with 12.3/25 and lastly the 0 to 4 years with 11.0/25.

2.12.4 Qualification

On analysis of association between demographic data and knowledge of CPR in a study conducted by Al-Janabi & Al-Ani, (2014), there was significant association between

nurses' knowledge and their academic qualification (p=0.016). Nurses with a Bachelor's Degree in nursing performed better than those who had a Diploma.

2.13 ATTITUDES TOWARDS CPR

An individual's feelings, beliefs/opinions influence one's tendency to respond positively or negatively towards knowledge and performance of CPR. Most studies report healthcare professionals, including nurses, to have positive attitudes towards CPR. In a study by Makinen et al., (2009), where they analysed attitudes towards CPR with defibrillation and implementation of the Finnish National Resuscitation Guidelines, 98% of nurses reported positive attitudes. Similarly, the study by Tsegaye et al., (2015), with the aim of evaluating knowledge, attitudes, and practice and associated factors among medical students in Ethiopia, found 93.8% of respondents had positive attitudes towards CPR. Positive attitudes included confidence in performing CPR and belief that CPR guidelines improve patient care and provide good source of advice.

Some of the negative attitudes include lack of motivation, lack of training, lack of frequent practice, lack of confidence and hesitation to start CPR due to fear of legal suits by relatives if the procedure does not go well.

2.14 SUMMARY

This chapter discussed most issues surrounding CPR, from how CPR guidelines are developed, to how the actual CPR procedure is performed. It also dealt with CPR training, and most importantly nurses' knowledge of CPR and association between knowledge and some demographic data of nurses.

CHAPTER THREE

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

This chapter outlines the research design, research methods, ethical considerations, validity and reliability of the study. The research design discussion includes a description of the quantitative, non-experimental, descriptive design used in this study. The study setting is also discussed. Under research methods, the study population, sample and sampling methods, data collection and data analysis are elaborated. Discussion of ethical considerations encompasses informed consent, permission to conduct the study, anonymity and confidentiality of study participants. Validity and reliability of the study are explained, and lastly the chapter is summarised.

3.2 OBJECTIVES

The objectives of the study are:

- To assess and describe critical care nurses knowledge of the 2010, with 2015 updates of AHA, adult cardiopulmonary resuscitation guidelines
- To establish if there is an association between qualification, experience, work area (unit), life support courses undertaken and their validity, and knowledge of the guidelines.

3.3 RESEARCH DESIGN

A quantitative, non-experimental, descriptive cross-sectional approach was adopted for this study to investigate the knowledge level of critical care nurses regarding the current American Heart Association guidelines for adult cardiopulmonary resuscitation and emergency cardiovascular care for healthcare professionals, and determine factors associated with knowledge of the guidelines.

3.3.1 Quantitative Research

This study was quantitative as the researcher was interested in collecting numbers or scores that nurses achieved after completing the survey questionnaire, which evaluates nurses' knowledge of CPR guidelines, after which the numbers were analysed statistically to explain the phenomena under investigation.

In this study, the phenomenon under investigation was nurses' knowledge of CPR guidelines. Describing if nurses have adequate or inadequate knowledge of the guidelines demands a quantitative answer. The study also sought to investigate if qualification and years of work experience influence knowledge of the guidelines. This part can also be answered successfully by a quantitative method as there are statistical techniques/software developed that allow researchers to predict scores on one factor/variable (in this case knowledge level) from scores on one/more factors such as work experience, qualification, and gender. A quantitative approach best suits the purpose of this study, hence was employed to answer the research questions appropriately.

3.3.2 Non-experimental study

In a non-experimental research design, there is no manipulation of the independent variable therefore, no intervention, nor is the setting controlled (Brink et al., 2012). The study is carried out in a natural setting and phenomena are observed as they occur with the purpose of describing and explaining relationships between variables.

In this study, nurses' knowledge level of the guidelines was the dependent variable. This means the knowledge level could vary depending on several factors. Age, gender, work experience, educational level, the type and validity of life support training undergone by participants were independent variables and could not be manipulated because they were naturally existing attributes. Since the phenomena under investigation in this study was observed as it occurred in a natural setting, without manipulation, a non-experimental research design was found suitable.

3.3.2 Descriptive Study

There are three main types of descriptive methods, observational, case study and survey method. A descriptive, cross-sectional survey design was found suitable for this study as the researcher would observe and describe phenomena as they occurred in their natural environment, at one point in time, without manipulating anything.

3.4 SETTING

The setting of a study is the location where the study will be conducted. Study setting can be natural, partially controlled or highly controlled. This study was to be conducted at an academic hospital in Johannesburg. No modifications would be made to the hospital or departments of interest to the study during the study, hence the phenomena under investigation will be observed in a natural setting.

The hospital is located in Johannesburg and is the main teaching hospital for the University of the Witwatersrand, Faculty of Health Sciences. The hospital is 1088 bedded and offers a full range of tertiary and highly specialised services to the population of Gauteng Province and neighbouring provinces. It is a referral hospital for a number of hospitals in its chain. In units of interest to the study, there are about 95 specialist nurses, of which 29 are trauma trained and 66 are ICU trained.

3.5 RESEARCH METHODS

3.5.1 Population

In this study, the population comprised all nurses working in critical care areas of an academic hospital in Johannesburg, South Africa. The researcher used the following inclusion criteria as the basis for the decision of whether an individual would or would not be classified as a member of the population.

Eligible respondents had to be registered with the South African Nursing Council as a professional nurse, and be trained in either trauma or ICU nursing. They also had to be working in adult Trauma casualty, adult Medical casualty, Trauma ICU, Coronary care

unit, Cardiothoracic ICU, Neurology ICU, or General ICU. A preliminary record review undertaken by the researcher in February 2016 indicated, according to the allocation lists, that there were 96 (N=96) registered critical care nurses working in adult Emergency Departments and Intensive Care Units.

3.5.2 Sample and Sampling

A sample is a subset of population elements (Polit & Beck, 2008). Sampling refers to the researcher's process of selecting the sample from a population order to obtain information regarding a phenomenon in a way that represents the population of interest (Brink et al., 2012). In this study, every person who met the inclusion criteria were asked to participate, thus a census sample was used because the study population was small and a complete enumeration and greater than or equal to 80% response rate were feasible. (a total of 96 trauma & ICU trained nurses).

3.5.3 Data Collection

3.5.3.1 What data will be collected? How, by who, where and when?

In this study, information on participants' knowledge level of the current AHA guidelines for adult CPR and emergency cardiovascular care was collected using a structured questionnaire. The first section of the questionnaire gathered information on participants' demographic data. The second section gathered information on nurses' knowledge of the current guidelines for adult CPR. The questions were structured multiple-choice questions with only one possible answer. After collecting the questionnaire, the researcher marked and calculated scores obtained by participants, which were then be analysed statistically.

Data was collected in adult trauma casualty, adult medical casualty, neurology ICU, trauma ICU, cardiothoracic ICU, Coronary Care Unit (CCU) and general ICU of an academic hospital in Johannesburg, South Africa. Data was collected from the 1st of December 2016, solely by the researcher. Before gathering of data, permission to conduct the study was sought from the hospital management. Once permission was granted, managers of individual units were asked for permission to conduct the study in their individual units.

Information about the study objectives, rights of participants, privacy and confidentiality were given to potential respondents. The data collection tool was given only to nurses who agreed to participate in the study. Participants answered the questions in their allocated cubicles under supervision of the researcher. Searching for answers via cellphones and other means was not allowed. Completed questionnaires were collected immediately by the researcher.

A self-report technique using a questionnaire was found fit as a data collection tool for the study. Questionnaires can be hand delivered, mailed, self/individually administered or electronically administered depending on the choice of the researcher. For this study, the questionnaire was self-administered. Questionnaires were handed to respondents to complete on their own, in the presence of the researcher, and then collected by the researcher for analysis.

3.5.3.2 The data collection instrument

A structured questionnaire was used to collect data. The questionnaire was divided into two sections. Section 1 collected information on respondents' demographic data, which included age, gender, educational qualifications, work experience, life support courses undertaken. Section 2 was the knowledge assessment of respondents based on the current American Heart Association guidelines update for adult CPR and emergency cardiovascular care for healthcare professionals. The multiple-choice questions were based on the content of the American Heart Association Basic Life Support course for healthcare professionals. The pass mark was set at 85%, as set by the American Heart Association cognitive knowledge test score. Knowledge levels were categorised as adequate (85% and above) or inadequate (< 85%).

This study followed a quantitative approach. It derived data through the measurement of variables using a questionnaire as a measurement instrument. Validity and reliability are important concepts in the context of measurement, therefore in order to obtain information that is valid and reliable, the researcher must ensure the measurement procedures and instruments to be used have acceptable levels of validity and reliability.

3.5.3.3 Validity of the instrument

Validity is the degree to which an instrument measures what it is supposed to measure (Polit & Beck, 2008). Instrument validity can be assessed/measured through face, content, criterion or construct validity. In this study, face and content validity were executed as measures of ensuring validity of the questionnaire.

- Face validity

This is a casual review of measurement instrument by lay/untrained persons. It measures or assesses whether the planned measurement procedure to be used in a study appears to be a valid and relevant measure of a given variable. For this study, nurses who were not experts in CPR were given the study questionnaire and commented on its relevance to as to whether it appeared to do what it claimed to do.

- Content validity

This is a measure of the suitability of the items in the measurement instrument to expert reviewers. For this research, an organised review of the instrument's contents was undertaken to ensure it contained everything it should, and nothing it should not. Since the tool was used to measure knowledge of the 2010 AHA guidelines for CPR and cardiovascular care, some contents of the questionnaire were modified to include the 2015 updates.

3.5.3.4 Reliability of the instrument

An instrument's reliability is the consistency with which it measures the target attribute (Polit & Beck, 2008). This means that other researchers must be able to conduct the same study, under same conditions and generate same results. Test-retest, alternate-form and internal consistency are ways of assessing reliability of the instrument.

3.5 DATA ANALYSIS

3.5.1 Data Processing

The data collected for the study were entered and stored on an Excel spreadsheet. The data processing procedure entailed cleaning the data by checking for missing data, errors in recording and duplicates within the data. This process entailed checking the questionnaires to verify if the data was recorded correctly.

To prepare for data analysis the study variables were grouped and coded to meet the study objectives. The age of respondents were categorised into five categories, i.e. <30 years, 31to 40 years, 41to 50 years, 51to 60 years and >61 years. The gender of the participants was coded as a binary variable (female/male). The academic qualification and post-basic specialisation and years of experience in nursing of the participants were coded as binary variables (diploma/degree), (Trauma and Emergency/Intensive Care nursing) (<10 years/>10 years) respectively. The life support courses attended were coded as nominal categorical variables (BLS/ACLS/ATLS/PALS/other).

From the answers given by the participants for the 20 questions in the CPR knowledge section of the questionnaire, a final score was generated using the data collection instrument-marking key. This score was recorded as the 'CPR knowledge score,' a continuous variable recorded as a percentage.

3.6.2 Approach to Data Analysis

Statistical software was used to compute the analysis of the data, and a statistician consulted. To fulfil the first objective of determining and describing critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care units of a public sector hospital in Johannesburg, descriptive analysis of the mean score of the different demographic characteristic categories were computed.

To explore the distribution of the data, the Shapiro Wilk test was employed to check the normality of the outcome variable (CPR knowledge score percentage).

To compare the differences in the mean scores between each group, the parametric t-test for comparison of means was used in instances where a comparison between two groups had to be conducted. A one-way ANOVA test of comparison of means was computed in instances where a comparison between more than two groups had to be conducted.

A multi-linear regression model was computed to fulfil the second objective of establishing if there was an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation.

Since the outcome variable 'CPR knowledge score' was recorded as a continuous variable, linear regression analysis was used. The outcome variable was recorded as a continuous variable in percentages. The results of the data analysis are presented in Chapter Four of the research report.

3.7 ETHICAL CONSIDERATIONS

When humans are used as study participants in a research enquiry, as is the case in most healthcare research, care must be exercised to ensure that participants' rights are not violated, which when not exercised undermines the scientific process and may have negative consequences. Brink et al., (2012) state that in order to conduct a research ethically, the researcher must carry out the research competently, rigorously and methodologically sound, manage resources with respect and integrity, acknowledge fairly those who contribute guidance or assistance, communicate results accurately and consider the consequences of the research in the field of study in particular and for the society in general. Throughout all the stages of the research, the researcher observed the three basic principles that direct researchers when conducting studies being beneficence, respect for human dignity, and justice.

3.7.1 Ethical Principles

3.7.1.1 The principle of beneficence

Researchers have the duty to minimise harm and maximise benefits for the study participants, society or community as a whole. In order to adhere to the principle of beneficence, researchers have to protect the following participants' rights during the research process:

- The right to freedom from harm and discomfort.

Researchers have the responsibility to avoid, prevent or minimise harm to study participants, be it physical, psychological, emotional, spiritual, economic, social or legal.
In this study, there was minimal risk of temporary discomfort to participants when completing the questionnaire, e.g., participants might have felt anxious or embarrassed responding to the questions, but there was no risk of other forms of harm resulting from participating in the study.

3.7.1.2 The principle of respect for human dignity

This principle includes the right to self-determination and the right to full disclosure.

- The right to self determination

This principle holds that because humans are capable of self-determination, or controlling their own destiny, they should be treated as autonomous agents who have the freedom to conduct their lives as they choose without external controls (Burns & Grove, 2009). This means that eligible study respondents have the right to choose whether to take part in a study or not, without fear of penalty or prejudicial treatment.

This right was respected by informing prospective participants that participation in the study was voluntary, and that they had the right to refuse to participate. Should they decide to participate and later feel they no longer wish to, participants would be allowed to withdraw at any point without penalty. No rewards would be given to participants for agreeing to participate in the study, as they may feel obliged to participate, which violates their right to self-determination.

- The right to full disclosure

In order to address participants' right to full disclosure, the researcher fully described the nature of the study, the right to refuse to participate in the study, researcher's responsibilities and potential risks and benefits to potential respondents.

3.6.1.3 The principle of justice

The principle of justice encompasses participants' right to fair treatment and the right to privacy.

- The right to fair treatment

In this study, participants were selected for the sole purpose of the study without discrimination, be it social, cultural, sexual, religious or political affiliation. Pertaining to fair treatment of participants for this study, the researcher respected participants' culture, beliefs and lifestyle. For example, most people value time and during data collection the researcher was always punctual and ended sessions on the agreed time.

- The right to privacy

Most studies in which humans are subjects intrude into participants' personal lives as participants share information on their attitudes, behaviours, opinions, etc., therefore researchers have the obligation to protect and maintain participants' privacy throughout a study.

To protect participants' right to privacy in this study, participants completed the data collection questionnaire wherever they felt comfortable. The completed questionnaire was kept locked and accessible only to the researcher, supervisor and the statistician. The collected data would only be used for the purpose of the study and the completed questionnaires would be destroyed as soon as the research report had been accepted. The research report did not reveal any information on participants' or institution names nor shall the information be shared with any other person or institution.

3.6.2 Informed Consent

Obtaining an informed consent is a procedure a researcher can use during the process of the research to ensure that the above mentioned participants' rights are protected. Informed consent means that participants have adequate information regarding the research, are capable of comprehending the information, and have the power of free choice, enabling them to consent to or decline participation voluntarily (Polit & Beck, 2008).

The researcher communicated/disclosed information to prospective respondents in the information letter in order to obtain consent that was informed (Appendix B). Prospective participants were informed that the information they provided would only be used for research purposes, and they were assured of their right to privacy. The main goals of the research were communicated, with a brief discussion of the description of the data collection tool. Information on estimated time commitment at time of contact with participants was stipulated. The source of funds for the study were disclosed. An explanation on how research participants were selected and recruited was briefly given. Potential risks and benefit to prospective candidates and others were stated.

Voluntary consent and right to withdrawal were discussed. Researcher's contact information was provided in case respondents had questions, comments or complaints.
In addition to respecting the participants' rights, the researcher protected the integrity of the scientific knowledge by avoiding, fabrication/falsification/forgery, manipulation of design methods or data, plagiarism and irresponsible collaboration in order to demonstrate respect for the scientific community.

The researcher signed a plagiarism form, which was handed to the ethics committee of the university as a pledge against plagiarism. Resources, be they financial, human or material, were managed in an effective, efficient and economic manner. Furthermore, the researcher asked for permission to conduct the study from relevant authorities, as elaborated below.

3.7.3 Permission to Conduct the Study

Permission to conduct the study was sought, in writing, from the University of the Witwatersrand Postgraduate Committee (Appendix C), the management of the hospital

(Appendix D) and individual study participants through verbal agreement. The researcher also applied to the Committee for Research on Human Subjects (Appendix E) for clearance.

3.7.4 Anonymity and Confidentiality

Anonymity exists if nothing links the respondents' and the information they gave as study respondents. In this study, participants were assigned code numbers from 001 to 100 as a way of maintaining anonymity. Completed questionnaires were identified using codes not participants names. There was a master list of participants' names and their code numbers, which was locked in a secure place.

Confidentiality is the researcher's management of private information that must not be shared with others without authorisation of the subject. The researcher tried to ensure confidentiality of the information given by the study respondents by not sharing information and removing all identifying information when writing the research report.

3.8 VALIDITY AND RELIABILITY OF THE STUDY

3.8.1 Validity of the Study

In the context of a research study, validity is concerned with the truth of the research, or the accuracy of the research results, thus it is the standard criterion by which researchers judge the quality of research (Grevetter & Forzano, 2003). The following are the two aspects of validity.

3.8.1.1 Internal validity

Internal validity is concerned with factors within the research study that raise doubts or questions about the results or interpretation (Grevetter & Forzano, 2003). For a study to be considered to have internal validity there should be one, and only one, possible explanation for the results; any alternative explanation for the results is a threat to internal validity.

To maximise internal validity of this study, the conditions under which the study was conducted was the same for all the respondents. These included use of a standardised

instrument to collect data, the researcher was the only person collecting data, data collection was done in the morning for all the respondents, and respondents were not be allowed to search for answers or discuss the questions.

3.8.1.2 External validity

External validity is the degree to which a broad statement can be concluded with regard to the study results, to other people, settings, times and characteristics apart from those used in the study. Every study is conducted at specific time and place, with specific study subjects, measurement techniques and procedures. If the results of a study can be generalised to other times, settings, populations and other measurements outside the limited scope of that study then the study is said to have external validity. Conversely, if the results are true only within the limited constraints of the study, then the study lacks external validity (Grevette & Forzano, 2003).

In an effort to curb threats to external validity of this study, pre-testing of the instrument was conducted in another public sector academic hospital in order to reduce the influence that pre-testing could have on the results. The study was conducted within the shortest timeframe possible to avoid maturation and mortality of the study population. The researcher followed respondents to ensure they returned the questionnaires to maximise response rate and keep drops outs low.

3.8.2 Reliability of the Study

Reliability is the extent to which the data collection tool generates invariable results. A pre-testing process was conducted, which helped ensure feasibility of the study and detected possible flaws in the instrument used. Content validity was achieved by having the data collection instrument reviewed by an expert panel of specialists in critical care nursing.

Reliability was maintained by ensuring consistency and precise capturing of information. Data collection was done by the principle researcher. An appropriate sample size was discussed with a statistician to ensure representation of the population under study, taking

into account possible refusal rates. Sample inclusions and exclusion criteria were adhered to.

3.9 SUMMARY

This chapter gave details of how the researcher planned to conduct the study. The methods were found suitable for meeting the purpose and objectives of the study. These included the study design, setting, sample and sampling technique, plans for data collection and analysis, the data instrument, validity and reliability, and ethical considerations.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

4.1 INTRODUCTION

This chapter presents how the collected data was presented and analysed, with description of the results. Both descriptive and inferential statistics were used to analyse the study findings.

4.2 APPROACH TO DATA ANALYSIS

To compute the analysis of the data, the statistical package STATA version 13.1 was used. To fulfil the first objective of determining and describing critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care unit of a public sector hospital in Johannesburg, descriptive analysis of the mean score of the different demographic characteristic categories was computed.

To explore the distribution of the data, the Shapiro Wilk test was employed to check the normality of the outcome variable (CPR knowledge score percentage). It was found that the data was normally distributed (p=0.6461) hence the mean CPR percentage scores and standard deviations were , as shown in Chapter Four of the report (see Table 4.1).

To compare the differences in the mean scores between each group, the parametric t-test for comparison of means was used in instances where a comparison between two groups had to be conducted. A one-way ANOVA test of comparison of means was computed in instances where a comparison between more than two groups had to be conducted.

To fulfil the second objective, establishing if there is an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation, a multi-linear regression model was computed. Linear regression analysis was used since the outcome variable 'CPR knowledge score' was recorded as a continuous variable. The outcome variable was to be recorded as binary variable showing scores

below and above 85%, as stipulated by the AHA accreditation criteria. This however, was not possible as it was found that all participants scored below 85%, hence the outcome variable 'CPR knowledge score' was recorded as a continuous variable showing the percentage score of each participant.

Initially a univariate linear regression model was computed to determine the individual association between each of the variables of interest (between post-basic qualification and years of experience) and CPR knowledge score. This association was then explored considering covariates that could influence this relationship hence a multilinear regression model was computed adjusting for all the demographic characteristics collected for the study. The results of the data analysis are presented in Chapter Four of the research report

4.3 RESULTS

4.3.1 Demographic Data of Respondents

This section on demographic information of participants comprised eight items and included, age, gender, qualification, post-basic specialisation, years of experience as a specialist nurse, life support courses attended and last training in those courses. The following are results of the above-mentioned parameters as obtained from 94 (n=94) participants.

Table 4.1 Demographic characteristics of the study respondents

Characteristic	Frequency	Percentage (%)
Age group		
<30 years	12	12.77
31-40 years	20	21.28
41-50 years	44	46.81
51-60 years	17	18.09
>61 years	1	1.06
Gender		
Female	78	82.98
Male	16	17.02
Qualification		
Diploma	74	78.72
Degree	20	21.28
Post-basic specialisation		
Trauma and Emergency nursing	18	19.15
Intensive Care nursing	76	80.85
Year of experience		
< 5 years	30	31.91
>5 - 10 years	33	35.11
>10 years	31	32.98
Attended life support courses		
Basic life support (BLS)	90	95.74
Advance cardiac life support (ACLS)	20	21.28
Advanced trauma life support (ATLS)	12	12.77
Paediatric Advanced life support (PALS)	6	6.38
Other	2	2.13
Last training in BLS		
within past 12 months	21	22.34
13-24 months back	25	26.6
more than 24 months back	44	46.81
Last training in ACLS		

within past 12 months	2	2.13
13-24 months back	3	3.19
more than 24 months back	15	15.96
Last training in ATLS		
within past 12 months	1	1.06
13-24 months back	4	4.26
more than 24 months back	7	7.45
Last training in PALS		
within past 12 months	0	0
13-24 months back	0	0
more than 24 months back	6	6.38

- Age

In this study, the age of participants was categorised into five sub-categories, being age less than 30, 31to 40, 41 to 50, 51 to 60 and greater than 60 years. The results of age distribution amongst respondents are presented in the figure below.

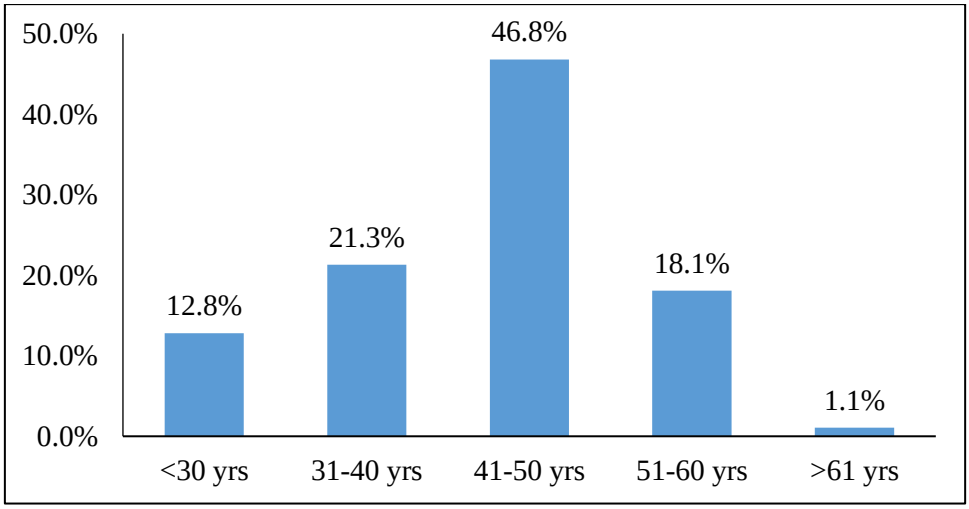


Figure 4.1 Age distribution of respondents (in years)

Of the total sample (n=94), the largest portion the respondents of nurses were aged between 41 to 50 years of age, followed by 21.3% and 18.1% in the 31 to 40 and 51 to 60 categories respectively, and only 12 (n=12; 12.8%) respondents were less than 30 years of

age. When considering the difference between age categories, these results suggest more than three-quarters (80.9%: n = 76) of the respondents were aged less than 50 years. It can be extrapolated from the results that this is younger group of nurses.

- **Gender**

There were only two categories of gender: male and female. The figure below shows the gender distribution of the study respondents.

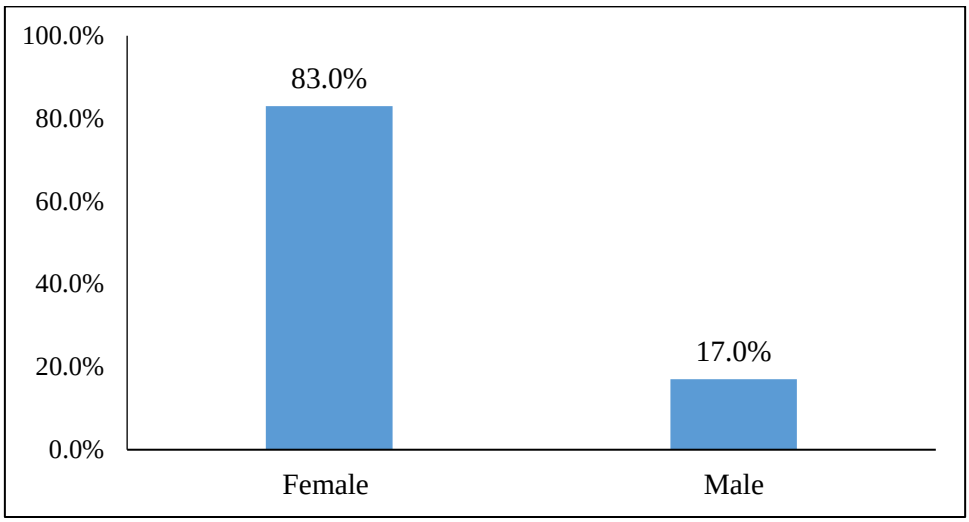


Figure 4.2 Gender distributions of respondents

Females accounted for 83.0% (n=78), whilst males accounted for only 17.0% (n=16). These findings suggest females dominated the study sample.

- **Qualification**

Participant's academic qualification was categorised into two categories: Diploma or Degree. The following figure shows the educational qualification of the participants.

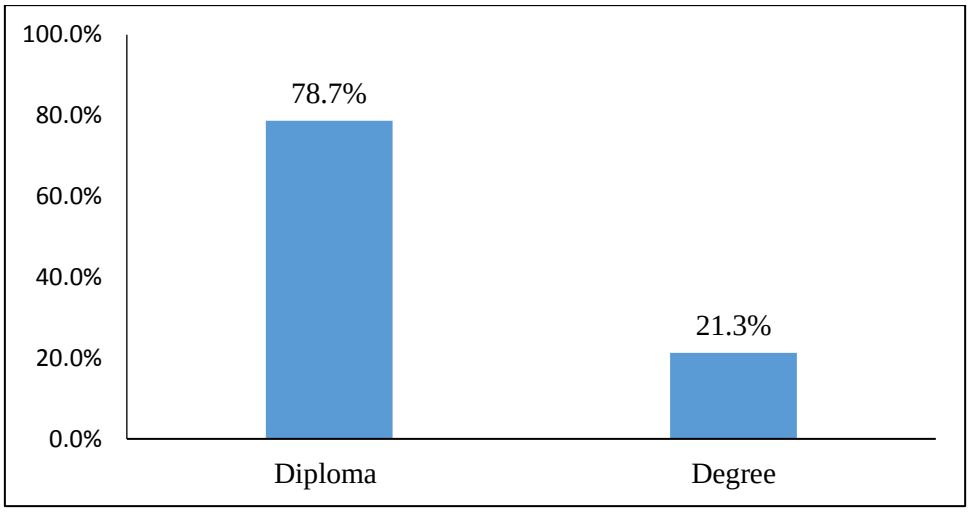


Figure 4.3: The distribution of the study respondents' qualification

In terms of academic qualifications, more than three-quarters (78.7%; n=74) of the respondents had a diploma level qualification in nursing and only 20 (n=20; 21.3%) were degree qualified.

- **Post-basic training nursing specialisation**

This study focused on nurses who were Trauma or ICU trained. The figure below shows the distribution of post-basic training amongst participants of this study.

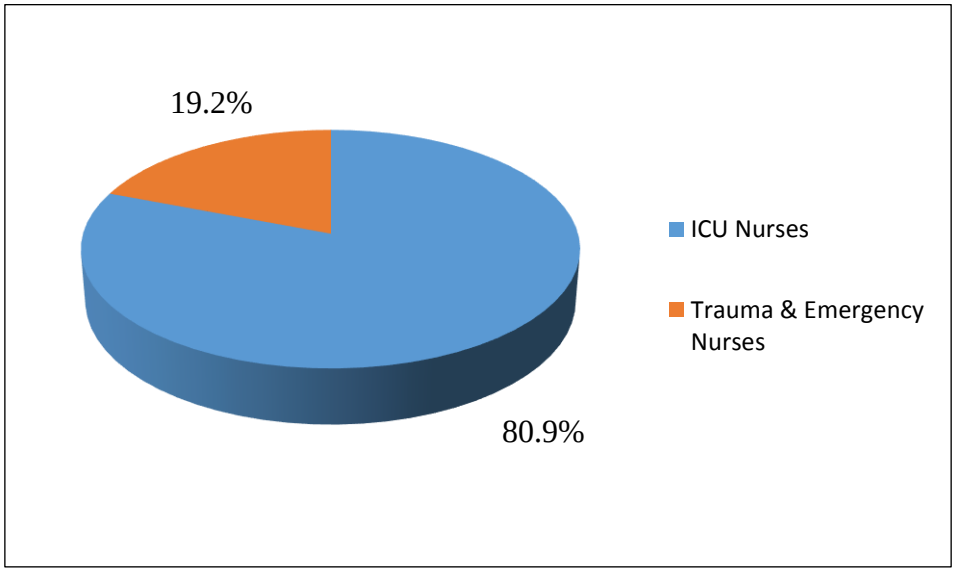


Figure 4.4 Distribution of post basic nursing specialisation among respondents

In terms of postgraduate qualifications, more than three quarters of the respondents were ICU trained nurses, and only 18 (n=18: 19.2%) were Trauma and Emergency nurses.

- **Years of experience**

In this study, participants' years of experience as Trauma or ICU trained specialist nurses was categorised into three categories: less than 5 (<5) years, greater than 5 up to 10 (>5-10) years and greater than 10 years (>10). The figure below shows the years of experience accumulated by the study participants.

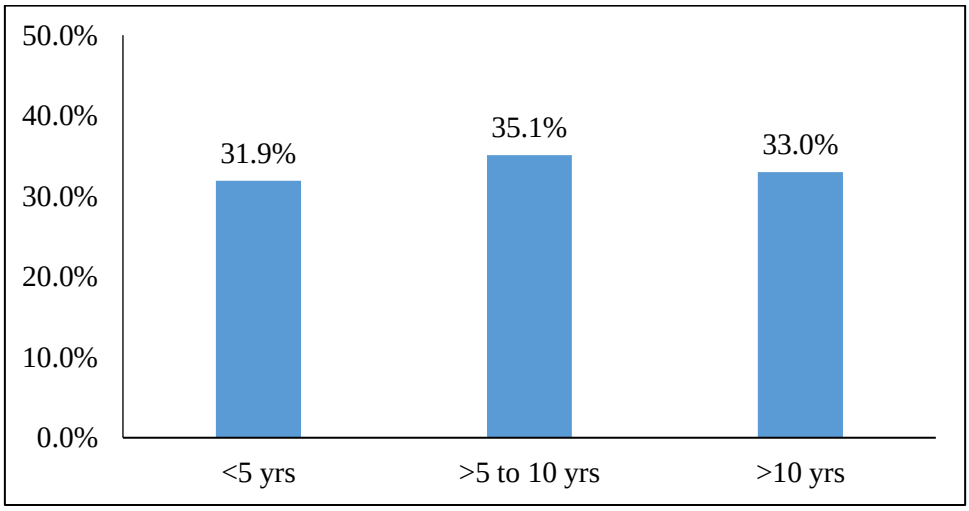


Figure 4.5 Work experiences of respondents

Of the total sample (n=94), the largest (35.1%: n=33) group of nurses had more than five years to 10 years work experience, the next group of nurses had more than 10 years of work experience (33.0%: n=31), and 30 (n=30: 31.9%) nurses had less than five years of work experience. These findings indicate a close two thirds (67.0%: n=63) of nurses have less than 10 years of work experience.

- **Training in life support courses**

This study evaluated participants training in basic, advanced, trauma, paediatric, and other life support courses.

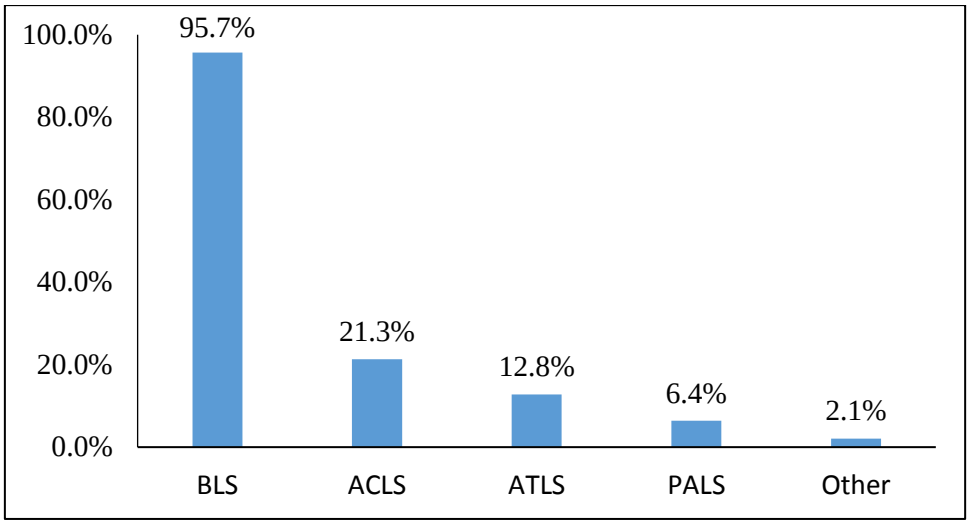


Figure 4.6: Distribution of life support courses attended by study respondents

Of the total sample (n=94), an overwhelming majority of respondents were trained in basic life support (BLS), followed by only 21.3% (n= 20) and 12.8% (n= 12) in the categories of advanced Cardiac life support (ACLS) and advanced Trauma life support (ATLS), respectively. A marginal number of 2.1% (n=2) of respondents were trained in paediatric advanced life support (PALS).

- **Last training in life support courses**

This study evaluated participants' last training in the life support courses attended. For each life support course, there were three categories of last training: 'Within past 12 months,' '13 to 24 months,' and 'more than 24 months.' The following figures present respondents' last training for each life support course.

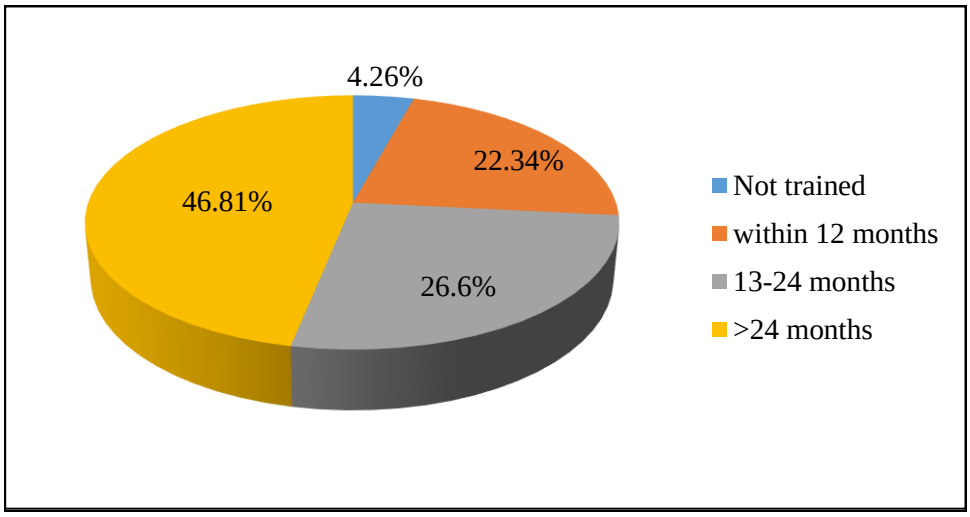


Figure 4.7 Respondents' last training in BLS

As seen in Figure 4.7, the results show that for all participants trained in BLS (95.74%), 22.34% were trained within the past 12 months, 26.60% within the 13 to 24 months category, and 46.81% were trained more than 24 months ago.

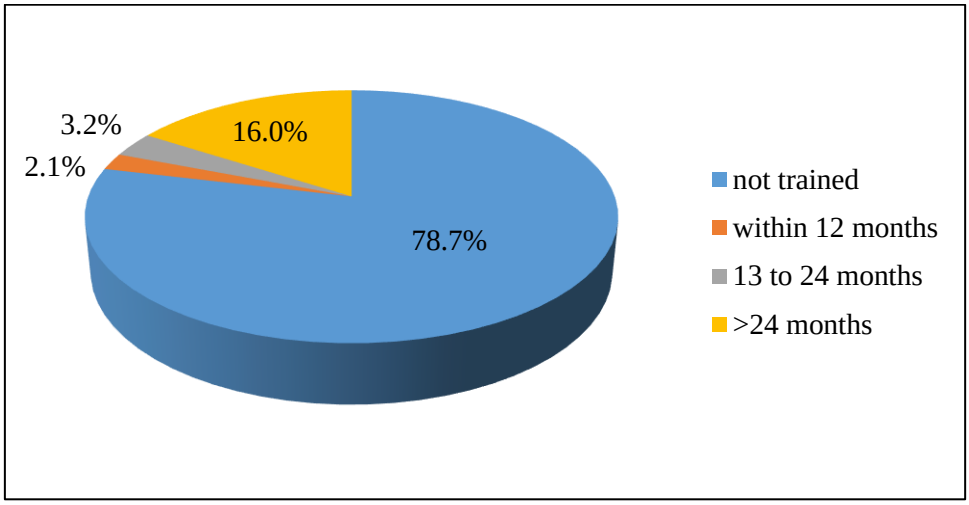


Figure 4.8 Respondents' last training in ACLS

In this study, 21.28% of the study respondents were trained in ACLS; 2.13% were trained within the past 12 months, 3.19% within the 13 to 24 months category, and 15.95% were trained more than 24 months ago.

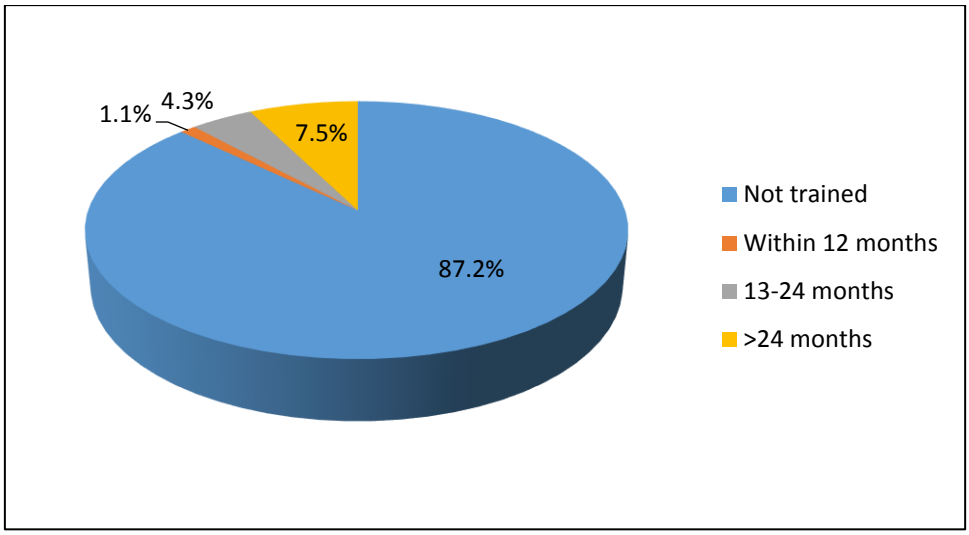


Figure 4.9 Respondents' last training in ATLS

In this study, 12.77% of the study respondents were trained in ATLS; 1.06% were trained within the past 12 months, 4.26% within the 13 to 24 months category, and 7.45% were trained more than 24 months ago.

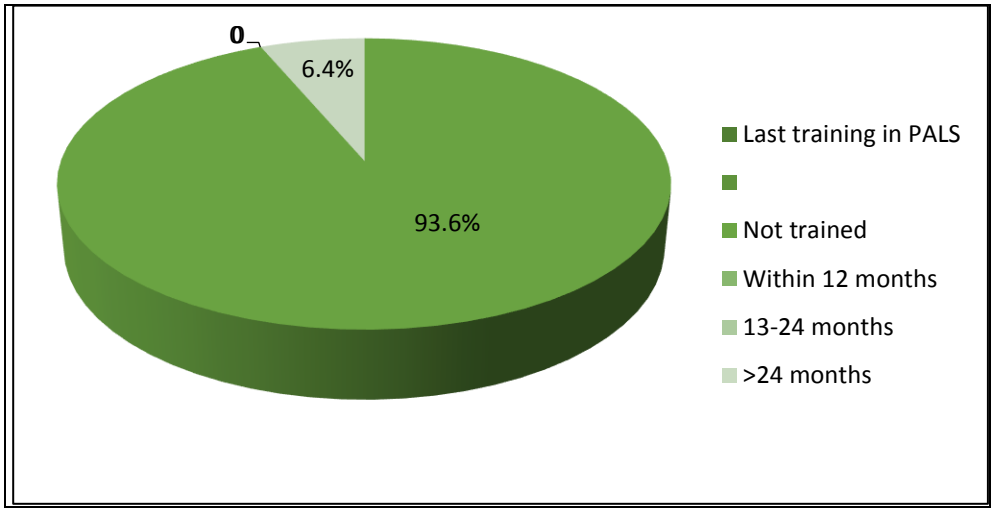


Figure 4.10 Respondents' last training in PALS

Of the study participants, 6.38% were trained in PALS, and all of them were trained more than 24 months ago.

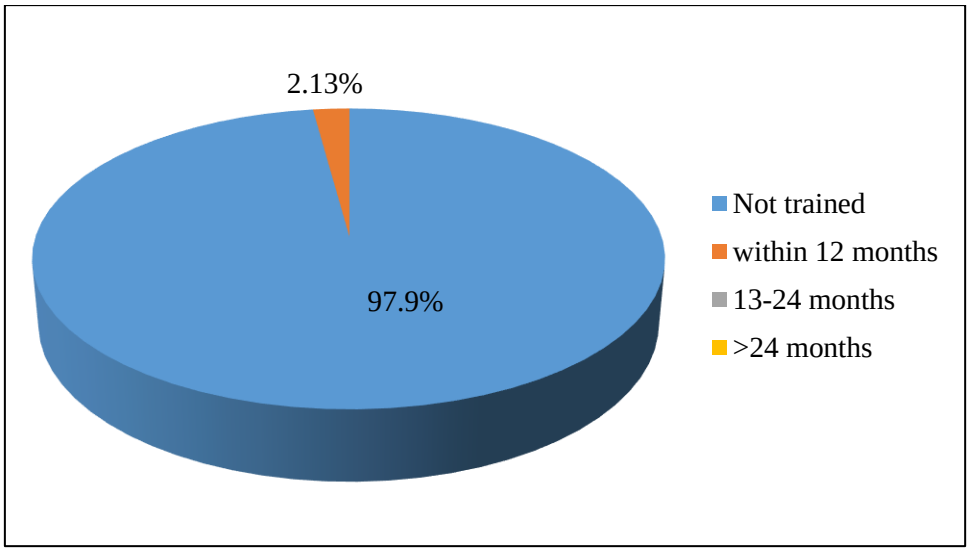


Figure 4.11 Respondents' last training in other life support courses

Of the study participants, 2.13% were trained in other life support courses; all were trained within the past 12 months.

These results show that, of all those who were trained in BLS, almost half had valid training, while the remainder's training was invalid. For the ACLS course, only about 6% had valid training while the rest was invalid, which is same for ATLS course. All participants who were trained in PALS were trained more than 24 months ago hence none had valid training. All the people who reported having training in other life support courses stated neonatal resuscitation as their other course; all had training in that course within the 12 months period, hence all had valid training.

4.3.2 Evaluation of Nurses' Knowledge of CPR Guidelines

This section consisted of 20 multiple-choice questions with four possible answers. Each correct response was given a score of one, while the incorrect was given a zero. A final score of each participant was calculated as a percentage.

Table 4.2 Distribution of study respondents who gave a correct response to each questionnaire item

Item	n	Frequency (%)
Q1	10	10.64
Q2	64	68.09
Q3	60	63.83
Q4	42	44.68
Q5	28	29.79
Q6	34	36.17
Q7	13	13.83
Q8	74	78.72
Q9	78	82.98
Q10	54	57.45
Q12	33	35.11
Q14	32	34.04
Q15	39	41.49
Q16	67	71.28
Q17	59	43.62
Q18	12	12.77
Q19	47	50
Q20	59	62.77

The table above illustrates the number of respondents who answered each questionnaire item correctly (refer to questionnaire in appendix for description of questionnaire items).

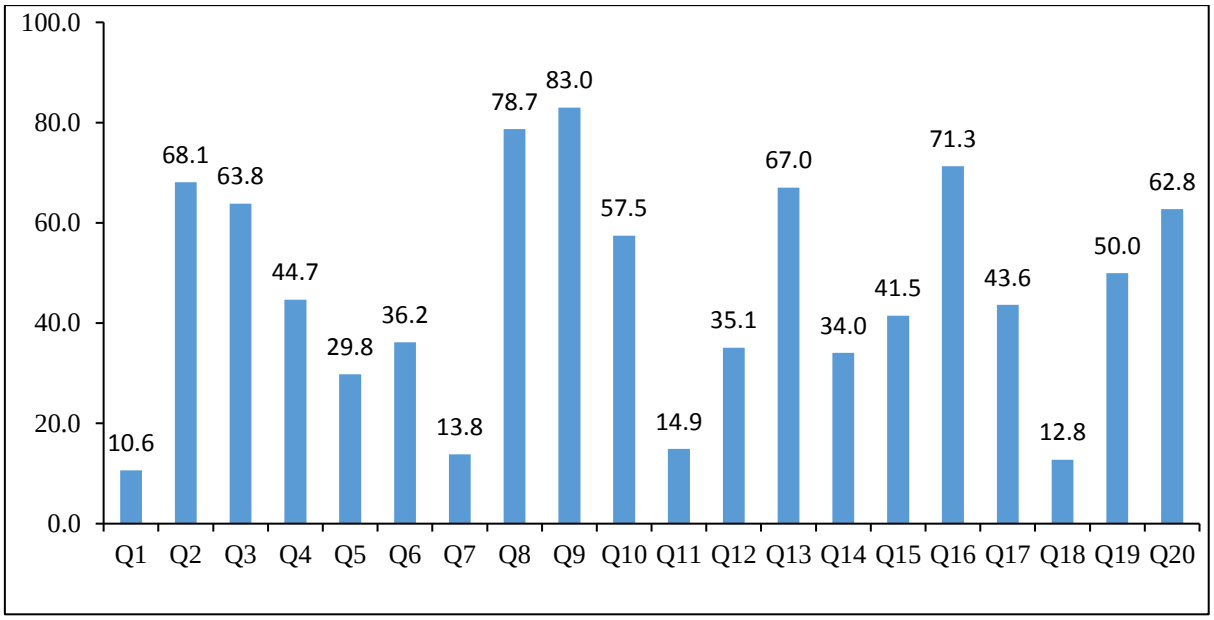


Figure 4.12 Percentage of correct responses for each question

From the figure above, it can be seen that the majority of respondents (83.0%: n=78) gave the correct response to Q9, followed by Q8 with 78.7% (n=74) and Q16 with 71.3% (n=67). Other items in which more respondents (50% or more) gave correct responses were items Q2, 3, 10,16 and 20 with 68,1% (n=64), 63.8% (n=60), 71.3% (n=67) and 62.8% (n=59) respectively.

Item Q1 had the least number of respondents (10.6%: n=10) who gave the correct response followed by Q18 with 12.8% (n=12), Q7 at 13.8% (n=13) and Q11 at 14.9% (n=14). Other items with least correct responses were Q4, 5, 6, 12, 14, 15, 17 and 19.

4.3.3 Comparative Testing

In this section, a comparison of the CPR knowledge scores of the nurses by demographic characteristics as well as the association between the nurse's demographic characteristics and their CPR knowledge score is presented.

4.3.3.1 .Nurses knowledge score by demographic characteristics

Table 4.3 below outlines the mean knowledge scores of nurses by demographic characteristics. The mean scores are presented in percentages for each demographic

category and a comparison of the means to obtain the p-values was computed using a one-way analysis of variance (for comparison of more than two groups) and an unpaired t-test (for comparison of two groups).

Table 4.3 Mean Cardiopulmonary Resuscitation (CPR) knowledge score by demographic characteristics

Characteristic	Mean	SD
Age (one-way Anova p-value=0.1535)		
<30 years	48.75	12.45
31- 40 years	49	13.04
41-50 years	43.86	13.07
51-60 years	44.71	10.23
>61 years	70	.
Gender (t-test p-value=0.6866)		
Female	45.77	12.54
Male	47.19	13.9
Academic qualification (t-test p-value=0.9967)		
Diploma	46.01	12.66
Degree	46	13.24
Area of post-basic specialisation (t-test p-value=0.4508)		
Trauma and Emergency nursing	48.06	13.74
Intensive Care nursing	45.53	12.51
Years of experience (one-way Anova p-value=0.5204)		
<5 years	46	13.98
>5-10 years	44.24	10.98
>10 years	47.9	13.28
Life support courses attended (one-way Anova p-value=0.8122)		
basic life support	45.94	12.61
advanced cardiac life support	49.5	13.56
advanced trauma life support	48.75	11.89
paediatric advanced life support	43.33	6.06
Other	45	14.14

The mean CPR knowledge score of the 94 participants recruited for the study was 46% (SD=12.71). The results indicated that none of the participants could pass the CPR knowledge test, i.e. score above 85%.

The data shows that nurses within the age group >61 years had the highest mean CPR score (70%), however there was only one participant in this age group. The second highest score was 49± (13.04%) which was amongst the participants aged between 31 and 40 years. There was little variation in the mean CPR knowledge scores between the different age groups.

The one-way analysis of variance test of comparison showed there was no significant difference between mean CPR knowledge scores among the different participant age groups ($p=0.1535$). The male participants in the study had a slightly higher mean CPR knowledge score (45.77±1023) compared to the female participants of the study, however the variation in theses scores was not significant ($p=0.6866$).

There was no variation in mean scores between nurses with a Diploma (46± 12.54%) and nurses with a Degree (46± 13.9%), however there was a slight variation in the measure of dispersion (the standard deviation).

As seen in the table, there were slight variations in the mean CPR knowledge scores among the different categories of the following demographic characteristics: post-basic specialisation, years of experience, life support courses attended as well as duration within which life support courses were taken. Despite the variation in the scores for the different demographic characteristics, the statistical tests of comparison indicated that the difference in the mean scores, based on the different demographic characteristics, was not significant ($p<0.05$). In instances where the standard deviation was not indicated (*), such as in the characteristic ‘advanced trauma life support training within 12 the past months,’ it illustrates there was only one participant in that category.

The overall data on Mean Cardiopulmonary Resuscitation knowledge score in nurses shows that while there may have been differences in the mean scores among the different demographic characteristic categories, the variation in the scores was not significant ($p<0.05$).

4.3.3.2 Nurses knowledge score by post basic nursing speciality

The mean knowledge score of nurses with post basic speciality training in Trauma and Emergency Nursing, and Critical Care Nursing were compared. The figure below shows comparison of the mean CPR knowledge score of nurses by their post-basic speciality qualification.

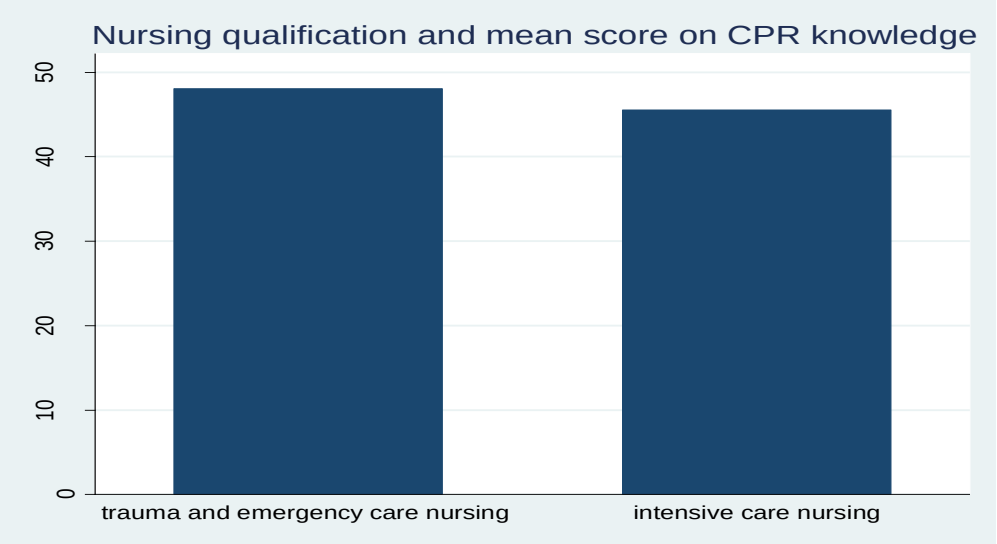


Figure 4.13 Comparison of mean CPR knowledge score by post-basic nursing speciality

The graph shows there is little variation in the mean scores of the two groups, although Trauma and Emergency nurses seem to have a slightly higher mean score (48 %) compared to the Intensive Care nurses (45%).

4.3.3.3 Nurses knowledge score by years of experience

The figure below illustrates the difference in the mean CPR knowledge scores of nurses with less than 10 years' experience as specialist nurses compared to nurses with more than 10 years of experience as Trauma or ICU specialist nurses.

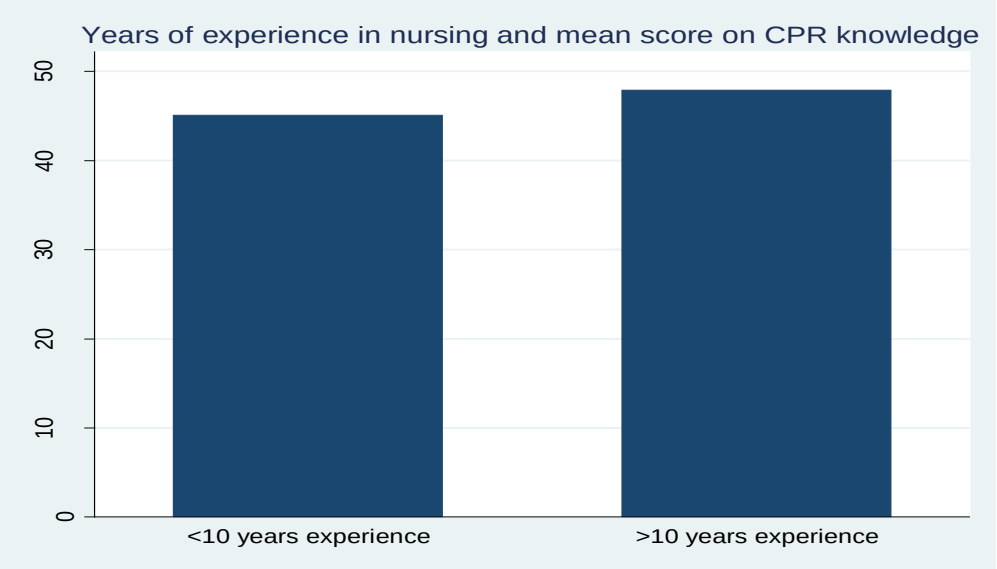


Figure 4.14 Comparison of mean CPR knowledge score by years of experience

As in the post-basic specialisation mean scores, the same trend of little variation in the mean scores of the two groups was observed here. However, nurses with more than 10 years of nursing experience scored slightly higher (58%) than nurses with less than 10 years' nursing experience (55%).

4.3.4 Association between Post-basic Nursing Specialisation, Years of Nursing Experience and Scoring in the CPR Knowledge test

To fulfil the study objective of determining the relationship between nurses post-basic specialisation and scoring in the CPR knowledge test, as well as years of nursing experience and scoring in the CPR knowledge test, univariate and multivariate linear regression models were computed and the results are presented in the table below.

Table 4.4 Univariate and Multivariate linear regression model illustrating the association between post-basic nursing specialisations, years of experience and scoring in the CPR knowledge test

	Univariate analysis			**Multivariate analysis**		
Characteristic	**coef**	**p-value**	**95 % CI**	**coef**	**p-value**	**95% CI**
Area of post-basic specialisation (base= Trauma and Emergency nursing)						
Intensive Care nursing	-2.53	0.451	-9.16- 4.10	-0.95	0.828	-9.57 – 7.68
years of experience (base=<10 years)						
> 10 years	2.82	0.314	-2.71 – 8.36	omitted due to colinearity		

The results show that for the univariate analysis, Intensive Care nurses were likely to score 2.53% less than did Trauma and Emergency nurses in the CPR Knowledge test. However these results are not statistically significant (p=0.451), hence there is likely to be no difference in scoring between the two. The univariate analysis results also show there is likely to be no difference in scoring between nurses with <10 years and nurses with >10 years' experience (p=0.314) as specialist nurses.

For the multivariate analysis, the association between post-basic specialisation, years of nursing experience and scoring in the CPR knowledge test was explored adjusting for the following demographic factors: age, gender, academic qualification, post-basic specialisation, years of experience, life support courses attended and time elapsed since the courses were last attended. The results of the multivariate analysis illustrate that when adjusting for the demographic factors listed, Intensive Care nurses were likely to score -0.95% less than Trauma and Emergency nurses in the CPR Knowledge test, however these results are not statistically significant (p=0.828). The multivariate analysis results also illustrates that when adjusting for the listed demographic factors, collinearity exists in the association between years of experience and CPR knowledge test scoring.

The overall findings of the multilinear regression model illustrated there was no association between post-basic specialisation, years of nursing experience and scoring in the CPR knowledge test.

4.4 DISCUSSION OF THE RESULTS

The purpose of this study was to investigate critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg.

The first section of the survey questionnaire gathered information on the nurse's demographic details. The distribution revealed that 48.8% (n=44) were aged between 41 and 50 years. These results are consistent with the South African Nursing Council (SANC) Statistics of 2016, which reported that more than half (57%) of registered nurses in South Africa were aged between 40 and 59 years (SANC. 2016). This suggests that South African nurses are aging and young people are not joining the profession. These results are

inconsistent to those reported in Nepal by Parajulee, (2011), where 84.3% of nurses were aged between 20 and 25 years, and Rajeswaran, (2014) in Botswana, where almost half of the nurses were aged between 26 and 30 years, suggesting a young nursing population.

The study participants were female dominated with 83% (n=78), and 17% (n=16) were males. These results are consistent with reports of gender distribution of nursing staff in research reports and hospitals worldwide. At the John Hopkins Hospital in the USA, men comprise 10% of the nursing staff (Wilson. 2009), and approximately 3.1% of nurses in Canada and the US are males, while 8.77% are male in the UK (UK Essays. 2013). According to SANC (2015) statistics, only 10% of nurses in South Africa are male. Rajeswaran, (2014) reported 86.3% female participants in their study in Botswana, while in the study of Parajulee, (2011) all nurses participants were female. This may be because for some time the nursing profession was largely female dominated.

On the educational qualification of participants, the majority (78.7%: n=74) of respondents were trained at Diploma level as opposed to 21.3% (n=20) who were Degree qualified. These findings are consistent with those of other studies. Rajeswaran, (2014) found in Botswana that 69.6% of nurses who participated in their study were Diploma holders, while only 19% had Degree qualification. Similar findings were observed in Bahrain by Marzooq & Lyneham, (2009), where 74.4% of study participants were Diploma holders while the remaining 18.3% had a Bachelor's Degree in Nursing.

Most of the study participants 80.9% (n=76) had post-basic training in Intensive Care Nursing, while those with Trauma and Emergency Nursing accounted for 19.2% (n=18). There was an almost equal number of nurses in the three categories of years of experience, with 32.0% (n=30), 35.1% (n=33) and 33.0% (n=32) for the less than 5years, 5 to 10 years and more than 10 years respectively.

Almost all the study participants (95.7%: n=90) were trained in BLS, but about half (46.8%: n=44) of those trained, were trained more than 24 months ago, hence their training or certification had expired. A much smaller percentage of participants were trained in other life support courses, ACLS 21.3% (n=20), ATLS 12.8% (n=12), PALS 6.4% (n=6) and 2.1% (n=2) in other life support courses. Most respondents' training in life support courses was invalid. This illustrates that nurses are not updating, or renewing their

certification of life support courses. The problem of invalid life support certification among healthcare professionals has been documented in studies. Xanthos et al., (2012) found, in their study in Greece, that only 1.3% (n=1) received BLS training within 6 months, and the mean time elapsed since last BLS course training was 15 years.

Section two of the questionnaire evaluated participants' knowledge of the current CPR guidelines. The mean CPR knowledge score of the 94 participants recruited for the study was 46% (SD=12.71). The results indicated that none of the participants could pass the CPR knowledge test, i.e. score above 85%. The results of poor theoretical knowledge of CPR, indicated by the majority of healthcare professionals scoring below the expected 85% pass mark set by the AHA, are consistent with findings of other studies. In a study by Keenan et al., (2009) in South Africa, 11% of nurses attained the pass mark while the remaining failed to achieve it. In Greece, 15.8% of nurses achieved the pass mark and failure rate was 74.2% (Xanthos et al., 2012).

The mean knowledge score (in percentage) of nurses in this study is 46% +/-12.71%. Similar results of low mean scores on CPR theoretical knowledge tests based on statistical mean scores were reported by other studies. Meaney et al., (2012) reported 63% +/-18% in Botswana, Marzooq & Lyneham, (2009) in Bahrain reported 42%, Pantazopoulos et al., (2011) reported 49.5% in Greece, while Parajulee & Selvaraj, (2011) reported 54.52% in Nepal, and Bukiran & Bozkurt, (2014) in Turkey reported 50.4%. These results show that nurses have inadequate or poor theoretical knowledge of CPR. Bukiran & Bozkurt, (2014) attribute the low score to ineffective initial or refresher training. Instructor competence, teaching methods, poor recalling of knowledge and frequency of updates are other reasons that influence poor CPR knowledge amongst nurses. Marzooq & Lyneham, (2009), in Bahrain, attributed nurses' poor CPR knowledge to lack of motivation to update, as reported by 1.7% of the respondents, while 14% blamed lack of institutional guidance.

Looking at the distribution of number of correct responses for each question, item Q9 had the highest number of respondents (82.3%: n=78) who answered correctly. This shows that nurses have good knowledge of drug of choice (Amiodarone 300mg) recommended for treatment of persistent ventricular fibrillation. A good number of nurses (78.7%: n=74) also had good knowledge regarding safety precaution during defibrillation, where the person delivering a shock has to announce "CLEAR" before administering the shock.

Other areas where a good number of respondents (50 or more) demonstrated good knowledge of the guidelines by giving correct answers were, the sequence of BLS steps (Q2) and safety precaution during shock delivery (Q8). Most nurses also knew that prolonged interruptions of chest compressions were common but deadly during CPR (Q3), the appropriate interval to interrupt chest compressions (Q10), drug of choice for treatment of bradycardia(Q13) and that resuscitation of a pregnant woman should be performed as if she were not pregnant(Q20).

Items Q1, Q18, Q7 and Q11 had the least number of correct respondent answers. These results are indicative of lack of knowledge regarding guidelines based on those questions. When comparing the **mean scores by demographic characteristics**, the results of this study revealed**:**

With regard to age, nurses within the age group >61 years had the highest mean CPR score of 70%, however there was only one participant in this age group. The second highest score was 49± (13.04%) which was among the participants aged between 31 and 40 years, however there was little variation in the mean CPR knowledge scores between the different age groups. These findings are inconsistent with findings of other studies. In a study by Parajulee & Selvaraj, (2011), in Nepal, respondents in the 26 to 30 years age group had the highest mean score of 12.25/21 (+/- 3.28) compared to other age groups. Similar findings of young nurses outperforming the older ones were reported by Bukiran & Buzkurt, (2014).

With regard to gender, the male participants in the study had a slightly higher mean CPR knowledge score (45.77± 1023%) in comparison to the female participants of the study, however the variation in these scores was not statistically significant (p=0.6866). AL-Janabi & AL-Ani, (2014) also found in their study that males outperformed females in CPR knowledge test, as they obtained 61.8% compared to females with 46.7%. The results of this study are inconsistent with the findings of Bukiran & Buzkurt, (2014), where females outperformed their male counterparts with mean of 12.7/21 marks compared to 11.4/21 obtained by males.

In this study**, for qualification**, there was no variation in mean scores between nurses with a Diploma (46± 12.54%) and nurses with a Degree (46± 13.9%), however there was a slight variation in the measure of dispersion (the standard deviation). In Bagdad, Al-Janabi

& Al-Ani, (2014) found that 74.3% of nurses with Degree qualification scored above the cut-off point as opposed to 22.9% of those with Diploma

For post-basic training nursing specialisation, there was little variation in the mean scores of the Trauma and Emergency and Intensive Care trained nurses, although the former appear to have a slightly higher mean score (48 %) compared to the latter (45%).

For work experience as a specialist nurse, as in the post-basic specialisation mean scores, the same trend of little variation in the mean scores of the two groups was observed. However, nurses with more than 10 years of nursing experience scored slightly higher (58%) than nurses with less than 10 years (55%).

To fulfil the study objective of determining the relationship between nurses post-basic specialisation and scoring in the CPR knowledge test, as well as years of nursing experience and scoring in the CPR knowledge test, the univariate and multivariate linear regression models were run. The overall findings of the multivariate linear regression model illustrated there was no association between post-basic specialisation, years of nursing experience and scoring in the CPR knowledge test. These results are in agreement with those of Parajulee & Selvaraj (2011), who reported no association between CPR knowledge and work experience.

In other studies, knowledge of the guidelines was associated with academic qualification (Elazazay et al., 2012, p value=0.008), Marzooq & Lyneham, 2009, p value=0.001), years of experience, work area at p value of 0.013 (Parajulee & Selvaraj, 2011), and previous and valid training in one or more CPR courses. Bukiran & Buzkurt, (2014), in Turkey, found that having already undertaken a similar course, the number of courses undertaken and working in ICU and Emergency Department significantly affected nurses' CPR knowledge levels.

4.5 SUMMARY

This chapter presented a report of the findings of the study. The findings were then discussed in relation to those of other studies from the literature.

The next chapter discusses the limitations of the study, conclusions and recommendations for further research.

CHAPTER FIVE

SUMMARY OF THE STUDY, MAIN RESULTS, LIMITATIONS AND CONCLUSIONS

5.1 INTRODUCTION

This is the concluding chapter of the research report where the study summary, findings, strengths and limitations are discussed. To conclude the chapter, recommendations for clinical practice and education of critical care nurses as well as recommendations for future studies concerning critical care nurses and cardiopulmonary resuscitation knowledge will be given.

5.2 SUMMARY OF THE STUDY

5.2.1 Purpose of the Study

The purpose of this study was to investigate critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, with the intention of making recommendations for clinical practice and education of critical care nurses.

5.2.2 Objectives of the Study

The study objectives were:

- To determine and describe critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care units of the public sector hospital in Johannesburg.
- To establish if there is an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation.

5.2.3 Study Methodology

The research methodology for this study included an approved questionnaire for data collection, validation of the questionnaire for the South African context by a group of experts, as well as statistical analysis of the data collected

The instrument used to achieve the study objectives was the "*Evaluation Questionnaire on CPR Knowledge for Health Personnel from Emergency Services,*" derived from the recommendations of the 2010American Heart Association (AHA) Guidelines and Updates for CPR (AHA, 2010) and adapted for use in Spain by Garcia, Belen, Luis, Nuria, Hernandez, Valverde, Rosillo and Castro (2015). The questionnaire comprised two sections, i.e. a section for demographic data collection and a section on CPR knowledge, which comprised 20 questions. Permission to conduct the study was requested and granted from the institutions management where the study was conducted using a letter of reference for research conduction at the institution. As per the AHA guidelines that came with the CPR questionnaire, the knowledge level of critical care nurses was considered sufficient/optimal if the participants scored >85% in the CPR knowledge section.

To validate the study to be suitable for use in the South African public sector hospital settings, a pilot study was conducted in which five participants (critical care nurses), who voluntarily agreed to participate, were employed to answer the study questionnaire and comment on the suitability of the questionnaire based on their level of comprehension of the questions. All the participants of the pilot study deemed the questionnaire easy to comprehend and answer.

To meet the study objectives statistical analysis using STATA version 13.1 was conducted by a statistician. To fulfil the first objective of determining and describing critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care units of a public-sector hospital in Johannesburg, descriptive statistics on mean scores for each demographic category were conducted and statistical tests for mean comparison, such as the one-way analysis of variance (ANOVA) and t-test, were computed. To fulfil the second objective of establishing if there was an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of

cardiopulmonary resuscitation, uni-variate and multivariate linear regression models were fitted to establish the association between these factors individually and the overall score (univariate model), as well as the factors adjusted for all demographic factors and the overall score (multivariate model),

5.3 SUMMARY OF MAIN FINDINGS

The purpose of this study was to investigate critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, with the intention of making recommendations for clinical practice and education of critical care nurses. The general finding across the globe is that nurses have suboptimal knowledge of evidence-based guidelines for cardiopulmonary resuscitation

In the current study, of the 96 critical care nurses recruited for the study, almost half were aged between 41 and 50years and more than 75% of the participants were trained at Diploma level as opposed to a Degree. Approximately 80% of the participants were ICU nurses as opposed to Trauma and Emergency nurses.

There was an equal distribution between the number of nurses with 5 to 10 years' experience (35%), nurses with <5 years' experience (32%) and nurses with >10 years' experience (33%). Of the participants training on life support courses, it was found almost all participants had undergone the Basic Life Support course (95%), while only a few underwent the advanced Cardiac Life Support (21%), advanced Trauma Life support (12%) and advanced Paediatric Life Support courses (6%).

Upon assessing the mean CPR knowledge score, it was found that the mean CPR knowledge score for all the participants in the study was 46% ±12.71%. The results indicated that the nurses had suboptimal knowledge on CPR, as found in other studies globally (Passali et al., 2011, Roshana et al., 2012, Bukiran & Bozkurt, 2012, Meaney et al, 2012, Ehlers & Rajeswaran, 2014, Parajulee & Selvaraj, 2011).

The one-way analysis of variance test of comparison showed there was no statistically significant difference between mean CPR knowledge scores among the different

participant age groups (p=0.1535). This is a statistically relevant finding, as in the demographic results there was an unequal distribution of participants in the different age groups. There was no variation in mean scores between nurses with a Diploma (46± 12.54%) and nurses with a Degree (46± 13.9%) because there were more nurses with a Diploma than with a Degree. There were similar findings of no significant difference in CPR knowledge mean scores between the different life support course groups due to the variation in distribution of participants in each group.

The regression analysis results to find the association between nurse's specialisation and CPR knowledge score illustrated there was likely to be no difference in scoring between the Trauma and Emergency nurses and the Intensive Care nurses. The regression analysis results also illustrated there was likely to be no difference in scoring between nurses with <10 years nurses and nurses with >10 years' experience (p=0.314) as specialist nurses. Although this finding is different from the finding by Bukiran & Buzkurt, (2014), that nurses with more years of experience were likely to score higher than nurses with fewer years of experience, it is important to note some of the confounding factors that may have led to the findings in the current study such as the fact that there was an overall suboptimal performance in the CPR knowledge questionnaire among all participants, which may have been due to the participants having gone through life support courses more than two years ago. It is shown in a study by Roshana et al., (2012) that participants who undergo life support courses frequently are likely to have a higher CPR knowledge score and in the present study, it seems most of the participants underwent life support courses in what would be considered a length of time that would contribute to poor CPR performance (Roshana et al., 2012).

Another finding in this study that contradicts other findings in literature is that there was no difference in CPR knowledge scoring between nurses with a Diploma and nurses with a Degree. A study that contradicts this finding is by Al-Janabi & Al-Ani, (2014), where it was found that nurses with a Degree were likely to score higher than nurses with a Diploma, however it is important to note that in the current study most participants had a Diploma as opposed to a Degree, hence there was no statistical significance in the variation of the mean CPR knowledge scores.

5.4 LIMITATIONS OF THE STUDY

The study had the following limitations:

5.4.1 Generalisability of the findings

The sample size used for this study was small (94 participants), which makes it difficult to generalise the findings to studies of a similar healthcare setting, however the results showed similar trends on suboptimal CPR knowledge of nurses as found in other studies of similar settings (Passali et al., (2011), Roshana et al., (2012), Passali et al., (2011), Bukiran & Bozkurt, (2012), Meaney et al, (2012), Ehlers & Rajeswaran, (2014), Parajulee & Selvaraj, (2011)).

5.4.2 Study Setting

Since the study was conducted at a busy public sector academic hospital, which is understaffed, it is possible the participants could have answered the questionnaire under duress from working long hours, which may have led to poor performance in the CPR knowledge test.

5.5 RECOMMENDATIONS OF THE STUDY

Based on the study findings, the following recommendations for clinical practice and education of critical care nurses are made.

5.5.1 Clinical Practice of Critical Care Nurses

Studies on CPR knowledge and skill retention report decline in knowledge level over time, with poor performance three to six months' post training, hence it is important for nurses to undergo frequent training on CPR knowledge to keep up to date with all the updates from the American Heart Association.

Frequent compulsory training sessions need to be conducted at public health care hospitals to ensure critical care nurses are up to date with changes in trends in cardiopulmonary resuscitation.

Governments should avail resources such as textbooks, articles and video lectures aimed at life frequent life support courses for critical care nurses

New critical care nurses with less experience should undergo more frequent life support training and testing to ensure they have optimal knowledge of evidence-based guidelines for cardiopulmonary resuscitation.

Nursing staff should be encouraged to advance their careers by specialising, to acquaint themselves with research skills and a culture of seeking new knowledge.

5.5.2 Critical Care Nursing Education

The following recommendations are made for critical care nursing education.

The curriculum for nurses should place more emphasis on frequent life support courses and encourage a culture of keeping up to date with research trends among nurses through journal clubs or monthly journal review seminars.

Practical examinations should include a component of cardiopulmonary resuscitation to ensure nurses have optimal knowledge.

5.5.3 Research Recommendations

The following recommendations for future studies are made.

Future studies on knowledge of evidence-based guidelines for cardiopulmonary resuscitation should include a larger population, with sampling that ensures equal distribution of participants in the different demographic groups.

A study should be conducted to compare knowledge of evidence-based guidelines for cardiopulmonary resuscitation prior to and post-basic life support training to evaluate the effect of life support training courses on knowledge of such.

Studies on knowledge of evidence-based guidelines for cardiopulmonary resuscitation should be conducted in different healthcare settings across the country to evaluate the impact of the health-care setting on knowledge.

The purpose of this study was to investigate critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, with the intention of making recommendations for clinical practice and education of critical care nurses. The study results indicate that critical care nurses have suboptimal knowledge of evidence-based guidelines for cardiopulmonary resuscitation. It is recommended that frequent compulsory training sessions be conducted at public healthcare hospitals to ensure that critical care nurses are up to date with change trends in cardiopulmonary resuscitation.

5.5 CONCLUSION

The first objective of the study was to determine and describe critical care nurses' knowledge of evidence-based guidelines for cardiopulmonary resuscitation in the critical care units of a public-sector hospital in Johannesburg. In the study, it was found that there was no statistically significant difference in the mean CPR knowledge scores among the different demographic factors ($p>0.05$) Although this finding contradicts findings in literature that report a correlation between demographic factors, such as level of education and level of nursing experience with overall CPR knowledge scoring, the findings in the present study are justified as there was a small sample size and unequal distribution of participants in the different demographic groups.

The second objective of the study was to establish if there was an association between qualification (Trauma and Emergency nurses and Intensive Care nurses) and years of experience (<10 years and >10 years) on knowledge of evidence-based guidelines of cardiopulmonary resuscitation. From the regression analysis, it was found there was no statistically significant association between qualification and years of experience with knowledge of evidence-based guidelines of cardiopulmonary resuscitation ($p>0.05$). This finding may have been because the overall performance of all participants was poor (46%± 12.71%) and more than three quarters of the participants were Intensive Care nurses as

opposed to Trauma and Emergency nurses. The comparison of association between the two groups and CPR knowledge core could not have shown a significant association as both groups performed poorly despite the variation in numbers in each group. The overall performance of the nurses at the Johannesburg public sector hospital was suboptimal (none of the participants scored the recommended 85%), as seen in other studies of similar setting by Passali et al., (2011) and Roshana et al., (2012).

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APPENDIX A

THE KNOWLEDGE LEVEL OF CRITICAL CARE NURSES ABOUT CARDIOPULMONARY RESUSCITATION GUIDELINES AT A UNIVERSITY AFFILIATED PUBLIC SECTOR HOSPITAL IN JOHANNESBURG

DATA COLLECTION INSTRUMENT

SECTION 1: DEMOGRAPHIC DATA

1.0 Research Code Number

PLEASE MAKE A CROSS (X) ON THE APPROPRIATE BOX

2.0 What is your age?

<30 years	31 to 40 years	41 to 50 years	51 to 60 years	>61 years

3.0 What is your gender?

Female	Male

4.0 What is your current academic qualification?

Diploma	Degree

5.0 What is your area of post-basic specialisation

Trauma and Emergency Nursing	
Intensive Care Nursing	

6.0 Years experienced as a registered Trauma and Emergency/Intensive Care nurse

< 5 years	>5 to 10 years	>10 years

7.0 Have you attended any of the following life support courses?

Basic Life Support (BLS)	Advanced Cardiac Life Support (ACLS)	Advanced Trauma Life Support (ATLS)	Paediatric Advanced Life support (PALS)	Other(please specify)

8.0 When did you last train in the life support course(s)?

Within past 12 months	13 – 24 months back	More than 24 months back

PART 2: EVALUATION QUESTIONNAIRE OF CPR KNOWLEDGE

The questions below are based on basic and advanced life support course for healthcare providers. The guidelines were developed by the American Heart Association (AHA) in 2010 and updated in 2015 using current recommendations from scientific evidence.

1. To apply basic high quality CPR, according to the new recommendations, we should (**indicate the correct choice by a cross X**)

Item	Statement	Response
a	Chest compressions rate should be 100/minute	
b	The depth of the compressions must be at least 5cm in adults	
c	Reduce to a minimum interruptions of chest compressions	
d	Ventilation takes the leading role with respect to chest compressions	

2. What is the correct sequence of the BLS steps, according to the current AHA guidelines?

Item	Statement	Response
a	A-B-C (airway, breathing, compressions)	
b	C-A-B (chest compressions, airway, breathing)	
c	C-B-A (chest compression, breathing, airway	
d	B-C-A (breathing, chest compressions, airway)	

3. What mistake is common and sometimes deadly during the treatment of cardiac arrest?

Item	Statement	Response
a	Not obtaining vascular access	
b	Prolonged periods without ventilation	
c	Not performing endotracheal intubation	
d	Prolonged interruptions of the chest compressions	

4. What action is part of high-quality chest compressions?

Item	Statement	Response
a	Allow full chest wall recoil after every compression by avoiding leaning on the victim's chest	
b	Administer chest compressions without ventilation	
c	Administer between 60 and 100 compressions per minute with a ratio of 30:2	
d	Administer continuous compressions with a depth of 5 cm	

5. When giving rescues breaths during CPR, 1 breath should be given over:

Item	Statement	Response
a	1 second	
b	5 seconds	
c	10 seconds	

d	15 seconds	

6. Which is the best strategy to perform high-quality CPR on a patient with an advanced device for the airway?

Item	Statement	Response
a	Administer compressions and ventilations with a ratio of 30:2	
b	Administer compressions and ventilations with a ratio of 2:30	
c	Administer one ventilation every six seconds during the time of interruption of compressions	
d	Administer continuous chest compressions and give 1 breath every 6 second (10 ventilations/minute)	

7. Using capnography in intubated patients …

Item	Statement	Response
a	Permits supervising the CPR quality	
b	Measures the oxygen levels in the alveoli	
c	Determines the level of inspired carbon dioxide in relation to the cardiac output	
d	Electrolyte abnormalities are detected early using code management	

8. Which practice is safe during defibrillation?

Item	Statement	Response
a	Only the rescuer giving compressions should be in contact with the patient	
b	Make sure no oxygen is circulating in patient's chest during discharge	
c	Determine the presence of pulse immediately after	

	discharge	
d	Announce imperatively “clear” before administering the charge with the defibrillator	

9. What medication and in what dosage is it recommended to treat a patient with persistent ventricular fibrillation?

Item	Statement	Response
a	2 mg atropine	
b	300 mg Amiodarone	
c	1mg/kg vasopressin	
d	2 mg.kg per minute of dopamine	

10. What is the appropriate interval to interrupt chest compressions?

Item	Statement	Response
a	5 seconds or less	
b	From 10 to 15 seconds	
c	From 15 to 20 seconds	
d	Interruptions are not acceptable under any circumstance	

11. What action improves the quality of chest compressions administered during a resuscitation attempt?

Item	Statement	Response
a	Observe the ECG rhythm to determine compression depth	
b	Prevent full chest compression with each compression	
c	Perform compressions on the upper half of the sternum with a frequency of 150 compressions per minute	
d	When feasible, alternate rescuers giving compressions every 2 minutes regardless of whether they are fatigued or not	

12. Which is the adequate ventilation strategy for an adult with respiratory arrest and pulse of 80 beats/min?

Item	Statement	Response
a	One ventilation every 3 or 4 seconds	
b	One ventilation every 5 or 6 seconds	
c	Two ventilations every 5 or 6 seconds	
d	Two ventilations every 6 or 8 seconds	

13. A patient with respiratory insufficiency is apnoeic, but continues having a strong pulse. Cardiac frequency drops suddenly to 30 beats/min. Which intervention has the highest priority?

Item	Statement	Response
a	IV bolus atropine	
b	IV infusion of adrenalin	
c	Application of transcutaneous pacemaker	
d	Simple manoeuvers of airway and assisted ventilation	

14. What rhythm requires synchronised cardioversion?

Item	Statement	Response
a	Unstable supra-ventricular tachycardia	
b	Ventricular fibrillation	
c	Sinus tachycardia	
d	Normal sinus rhythm on monitor, but with lack of pulse	

15. What is the range of PETCO2 target values after cardiac arrest when ventilating a patient in whom we achieve return of spontaneous circulation?

Item	Statement	Response
a	From 30 to 35 mmHg	
b	From 35 to 40 mmHg	

c	From 40 to 45 mmHg	
d	From 45 to 50 mmHg	

16. What is the most reliable method to confirm and monitor the correct location of an endotracheal tube?

Item	Statement	Response
a	Five-point auscultation	
b	Waveform capnography	
c	Calorimetric ETCO2 detectors	
d	Use of oesophageal detectors	

17. If we had a manual defibrillator monitor, the initial monitoring of cardiac activity in a patient who has just had a cardiac respiratory arrest witnessed must be performed in the following manner:

Item	Statement	Response
a	Turn on defibrillator monitor, select derivation II and monitor with paddles	
b	Turn on defibrillator monitor, select derivation II and monitor with adhesive electrodes placed on chest	
c	Turn on defibrillator monitor, select derivation II and monitoring with adhesive electrodes placed on limbs	
d	Perform 12- derivation ECG	

18. Regarding CPR manoeuvres, **indicate the incorrect response**:

Item	Statement	Response
a	The compression-ventilation ratio in an adult is 30:2	
b	If there is no breathing and no pulse, start by administering two ventilations	
c	The chest compression rate should be between 100 and 120 per minute	

D	If there is no breathing or agonal breathing, no pulse start chest compressions	

19. During monitoring of a patient, upon observing the rhythm on the monitor you doubt between VF and supra-ventricular tachycardia. **Indicate the correct action.**

Item	Statement	Response
A	Upon doubt act as VF	
B	Upon doubt act as asystole	
C	Upon doubt act as asystole and re-evaluate the rhythm at the minute	
D	Upon doubt adrenalin helps the differential diagnosis	

20. What actions would you take during resuscitation of an 8-month pregnant woman?

Item	Statement	Response
A	Only perform basic CPR, given that administering medications and defibrillation are contraindicated during pregnancy	
B	Perform advanced CPR without defibrillation, it is contraindicated during pregnancy	
C	Perform basic CPR instrumented with SAED, we cannot administer medications to a pregnant women	
D	Perform advanced CPR, as if she were not pregnant	

Should you wish to add anything more to the topic under consideration, please use the space provided below:

THANK YOU for taking the time to complete the questionnaire

APPENDIX B

THE KNOWLEDGE LEVEL OF CRITICAL CARE NURSES ABOUT CARDIOPULMONARY RESUSCITATION GUIDELINES AT A UNIVERSITY AFFILIATED PUBLIC SECTOR HOSPITAL IN JOHANNESBURG

PARTICIPANT'S INFORMATION LETTER

My name is Mpho Moepeng. I am a Master's Degree student specialising in Trauma and Emergency Nursing at the University of the Witwatersrand in the Department of Nursing Education. I hope to conduct a research project and invite you to consent to being included in my sample of critical care nurses.

The purpose of this study is to investigate critical care nurses knowledge of evidence-based guidelines for cardiopulmonary resuscitation in a university affiliated public sector hospital in Johannesburg, with the intention of making recommendations for clinical practice and education of critical care nurses.

I hereby invite you to take part in the research study.

The study will be conducted in adult Trauma and Emergency department, adult Medical Casualty, Trauma ICU, Coronary care unit, Neurology ICU, General Medical ICU and Cardiothoracic ICU of an academic hospital in Johannesburg. A questionnaire will be used to collect data. Your involvement will entail the completion of the attached questionnaire, which will take you about 25 to 30 minutes to complete.

There are no benefits or risks to you by participating in the study. However, I hope the results of this study will provide valuable information regarding critical care nurses knowledge on current evidence-based guidelines and help direct nursing education and training as well as continuing development of critical care nurses.

Your rights

Your participation is entirely voluntary and you are free to decline the invitation altogether, or to withdraw at any time without having to give any explanation. By completing the questionnaire, you signify you consent to participating in this study.

The researcher will try her level best to maintain confidentiality. To ensure anonymity, research codes will be used instead of your names. All information you volunteer will be treated with utmost confidence. Publication of results will only show grouped information, no personal or institution names or any identifying information will be published. If you are interested, results will be made available after the study is completed.

The research committees of the University of the Witwatersrand and relevant health institution have approved the study and its procedures.

Thank you for taking the time to read this information letter. Should you require any further information regarding the study, or your rights as a study participant, please feel free to contact me in the Department of Nursing Education, or on the following telephone numbers: 079 912 8982, or by email at tibisomphodudu@yahoo.com.

Yours faithfully
Mpho Moepeng (MSc Nursing Student)

APPENDIX C

R14/49 Ms Mpho Moepeng

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160831

NAME: (Principal Investigator)	Ms Mpho Moepeng
DEPARTMENT:	Nursing Education Charlotte Maxeke Johannesburg Academic Hospital
PROJECT TITLE:	The Knowledge Level of Critical Care Nurses about Cardiopulmonary Resuscitation Guidelines at a University Affiliated Public Sector Hospital in Johanneburg
DATE CONSIDERED:	26/08/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Shelley Schmollgruber
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	18/11/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in August and will therefore be due in the month of August each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX D

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Ms. G. Ngwenya
Office of the Nursing Director
Tell: (011): 488-4558
Fax: (011): 488-3786
23 November 2016

Ms. Mpho Moepeng
Department of Nursing Education
Faculty of Health Sciences
University of Witwatersrand

Dear. Mpho Moepeng

RE: "The Knowledge Level of Critical Care Nurses about Cardiopulmonary Resuscitation Guidelines at a University Affiliated Public Sector Hospital in Johannesburg"

Permission is granted for you to conduct the above recruitment activities as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.
5.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Supported / ~~not supported~~

Ms. M.M Pule
Nursing Director
Date: 2016/11/23

Approved / not approved

Ms. G. Bogoshi
Chief Executive Officer
23.11.2016

APPENDIX E

PERMISSION TO USE RESEARCH QUESTIONNAIRE

Dear Shelley Schmollgruber,

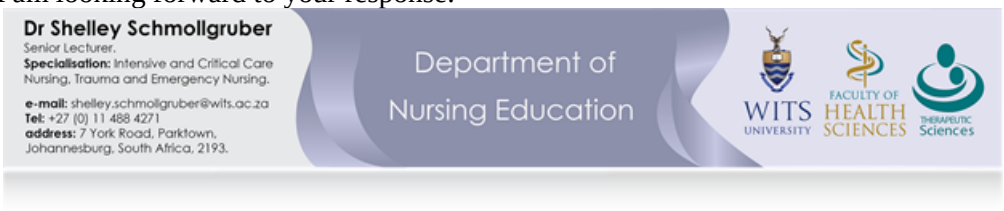
I attach in this email the survey that my research team used in the study. I agree for you to use it in your study. I am a nurse in an emergency hospital in Murcia and also I work as an associated teacher in the University of Murcia. If you are interested in a future we will work in publish articles to improve our curriculum. Some days ago, we prepared another similar survey but this is better, with new recommendation AHA 2015. I attach also this survey.

Yours faithfully,
Ana Belén Sánchez

2016-05-27 21:33 GMT+02:00 Shelley Schmollgruber <schmoll@iafrica.com>:
Dear Ana Sanchez Garcia,
My name is Shelley Schmollgruber. I am the postgraduate coordinator in the Department of Nursing Education of the University of the Witwatersrand in Johannesburg, South Africa. I am currently supervising a research study and my MSc student has expressed particular interest in your work entitled "Assessment of knowledge of the hospital emergency medical system of the autonomous community of the region of Murcia". Enfermeria Global, 39: 246-260.

On behalf of my student I would like to request your permission to use the instrument as we are conducting a similar study in our South African context. Would it be possible to send us a copy of the instrument along with your permission to use the instrument. If you are in agreement we can forward a copy of the proposal to you once our ethics committee has approved the study. We anticipate that the study will be completed by early 2017.

I am looking forward to your response.



APPENDIX F

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

06 February 2017
Person No: 1170485
PAG

Mrs MD Moepeng
P O Box 3584
Molepolole
00267
Botswana

Dear Mrs Moepeng

Master of Science in Nursing: Approval of Title

We have pleasure in advising that your proposal entitled *The knowledge level of critical care nurses about cardiopulmonary resuscitation guidelines at a University Affiliated Public Sector Hospital in Johannesburg* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX G

Gill Smithies

Proofreading & Language Editing Services

59, Lewis Drive, Amanzimtoti, 4126, Kwazulu Natal

Cell: 071 352 5410 Email: moramist@vodamail.co.za

Work Certificate

To	Dr Shelley Schmollgruber
Address	Wits Dept of Nursing Education
Date	24/05/2017
Subject	Thesis: THE KNOWLEDGE LEVEL OF CRITICAL CARE NURSES ABOUT CARDIOPULMONARY RESUSCITATION GUIDELINES AT A UNIVERSITY AFFILIATED PUBLIC SECTOR HOSPITAL IN JOHANNESBURG, by Mpho Moepeng
Ref	SS/GS/20

I, Gill Smithies, certify that I have proofed the following thesis, Forward, Chapters 1 to 5, Appendices and References: The knowledge level of Critical Care nurses about cardiopulmonary resuscitation guidelines at a university affiliated public sector hospital in Johannesburg, by Mpho Moepeng, to the standard as required by Wits Dept. of Nursing Education.

Gill Smithies

24/05/2107