

CHAPTER ONE

1.0 INTRODUCTION

Critical Care Nursing is the care given to patients with deteriorating clinical condition that require continuous monitoring and artificial sustenance of the vital functions (Lakanmaa, 2013). Competence is an ability to perform successfully and efficiently, while incorporating the understanding of clinical situation and solve the problem using clinical judgment (Schroeter, 2008). The quality of care provided to critically-ill patients and their subsequent survival greatly depends on nurses' critical care nursing competence levels. Therefore, staff caring for patients in acute hospital settings should have competencies in critical care nursing (Armitage, 2007). Critical care nursing competencies have emerged to be useful in early recognising and responding to deteriorating clinical conditions among the acutely and critically-ill patients (Thomson, et al. 2007; Armitage, 2007; Fletcher, et al. 2007).

Lakanmaa, (2013) showed that critical care nurses' competence levels were low and stood at 25%, predicting unsafe practice. Up to 75% of nurses working in critical care areas have poor competence levels (Scribante and Bhagwangee, 2007). Botha, (2012) reported poor competence levels, standing at 48% among qualified nurses and 17% among non-qualified ones. This situation presented a high risk of delaying in starting resuscitation measures, when patient's condition deteriorates. Failure to care for critically ill patient during the initial and critical 60 minutes of an illness, 'The Golden Hour' (McCormick, et al. 2012), risks patients' safety and contributes to mortality. "Golden Hour" is the time frame between deterioration of patients' condition and beginning of resuscitation (Thomson, et al. 2007 and McCormick, et al. 2012). Management during this time is aimed at not to produce harm to the patient, but determine the patient's survival and quality of life. This is because outcomes from critical illness are time dependent and it is therefore vital to avoid lengthy delay in initiating treatment.

1.1. BACKGROUND

Frost and Wise, (2007) stated that checking of physiological clinical observations on critically-ill patients emerged to be the 'gold standard' for patient care, given its strong guidance in directing nurses' knowledge and skills of describing patient's physiological status. Luettel, et al. (2007) and McHugh and Lake, (2010), suggested that nurses working in critical care areas need special expertise in caring for acutely ill patients who usually presents with problems of airway and lung ventilation, cardiovascular and neurologic systems. Frost and Wise, (2007) indicated that poor recordings and poor interpretation of clinical observations by non-trained staff put patient at risk of death. In addition, Thomson, et al. (2007) reported that failure of nurses to recognize clinical deterioration condition, delay to take action or delay in giving patients medical attention when they have a cardiac arrest was attributed to poor levels of critical care nursing competencies. Fletcher, et al. (2007) indicated that failures of nurses to recognize and respond early to critically ill patients' deteriorating clinical condition, endangered patients' safety. Fletcher, et al. (2007) also reported that nurses with poor critical care nursing competence levels failed to convey information in a manner that would convince doctors and other multidisciplinary team, of the urgency of the situation. Gawande, (2009) highly recommends that patient safety in critical care areas can only be assured when nurses working from these units have the required expertise.

In Zambia, the prevalence of critical care nursing competence among nurses working in critical care environments was not known. Poor levels of critical care nursing competence and high levels of mortality in critical care settings were a global concern (Perrie, 2009; Msidi, 2010). But, little or probably nothing was documented on critical care nursing competence level and patient resuscitation in Zambia. Compared with critical care nursing competence level in Europe, Africans (Zambians inclusive) mostly used untrained or junior staff with poor levels of competence to document clinical observations of acutely ill patients. This led to the failure or delay in recognizing clinical deterioration, delay to respond, ultimately contribute to mortality.

In some studies, death reports were associated with resuscitation problems in acute or general hospitals, medical specialties, accident and emergency department and in surgical specialties (Thomson, et al. 2007; Darran, 2010; Trimble, 2013).

Therefore, evaluating critical care nursing competence levels among Zambian nurses provided valuable insights into the circumstances for nurses' failures to recognise deteriorating clinical conditions in acutely-ill patients and their delay to act, leading to patient's death. Further, research result on critical care nursing competence level suggested strategies to address high mortality rate in the critical care areas. In addition, suggestions that would help Ministry of Health and General Nursing Council develop strategies and policies on how best to improve critical care nursing health service delivery in Zambia were drawn. The lack of research in this topic prompted the need to carry out the study.

1.2. STATEMENT OF THE PROBLEM

In Zambia, there were neither known previous studies on critical care nursing competence level nor established reference standards for nurses working in critical care areas. Previous studies done elsewhere indicated that high levels of incompetence among nurses in critical care areas showed a positive correlation between nurses' knowledge, skill and prevalence of patient mortality cases. Though there could be many other factors causing deaths among critically ill patients, low levels of critical care nursing competence was one of the main factors contributing to high levels of mortality (McCormick, et al. 2012; Fletcher, et al. 2007; Gawande, 2009). At University Teaching Hospital (UTH), in 2013, mortality stood at; 98% in Main Intensive Care Unit (MICU), 87% in Adult Medical Emergence Unit (AMEU), 54% in Paediatric Intensive Care Unit (PICU), 5% in Paediatric Out-patient Department (P-Op-D) and 41% in Neonatal Intensive Care Unit (NICU) (Health Management Information System (HMIS, 2013). UTH is the tertiary hospital where all complicated cases from all lower level institutions in the country are referred to for specialized management.

University Teaching Hospital and Ministry of Health while working with partners started the training of critical care nurses locally to improve nurses' competence levels in critical care nursing practice. But the numbers of trained nurses in this special field of nursing are inadequate to be assigned to critical care units. Hence UTH management addresses inadequacy of having specialized nurses in critical care nursing by assigning non-trained nurses to manage critically-ill patients.

Armitage, (2007) and Perrie, (2009) state that assigning competent critical care nurses to critical care units make nurses be quick in identifying clinical deteriorating critically-ill patient and practice safely. However, critical care nursing competence levels among nurses at UTH was unknown. This prompted the investigator to undertake the study to evaluate critical care nursing competencies among nurses.

1.3 JUSTIFICATION

An evaluation of critical care nursing competence level among nurses provided valuable data which described competence levels among nurses working in critical care units which influenced nurses' failures to recognise early deteriorating clinical conditions in acutely-ill patients and delayed to respond, leading to patients' death. On the other hand, there was no study found that evaluated the critical care nursing competence levels in Zambia. Therefore, this study established competence levels among nurses in critical care areas and suggested strategies for improving critical care nursing practice to improve the quality of care to patients, and to reduce mortality in critical care units. The study identified research limitations for future studies.

1.4 RESEARCH QUESTION

What are the critical care nursing competence levels among nurses working from critical care areas at the University Teaching Hospital, Lusaka?

1.5.0 RESEARCH OBJECTIVES

1.5.1 General Objective

To evaluate critical care nursing knowledge and skill levels; and establish demographic factors influencing competence levels among nurses working from critical care units at the University Teaching Hospital, Lusaka, Zambia.

1.5.2 Specific Objectives

1. To determine competence levels of nurses in relation to caring for critically-ill patients
2. To establish the factors influencing competence levels among nurses caring for critically ill patients

1.6 SIGNIFICANCE OF THE STUDY

The findings of the study will consequently lead to:

- i) Identifying factors which make nurses competence levels poor, fail to recognize deteriorating condition and delay to act upon patient's deteriorating condition, contributing to mortality.
- ii) Lobbying and advocating for the need to ensure that all general nursing graduates undergo orientation before they are posted to critical care units.
- iii) Facilitation of feedback on gaps in knowledge and skills necessary for optimizing performance among nurses working in critical care areas.

1.7 THEORETICAL FRAMEWORK

THE SYNERGY MODEL FOR PATIENT CARE

This section reviewed the Synergy Model for Patient Care developed by the American Association of Critical Care Nursing Certification Corporation in 1999 (AACN Certifying Corporation, 2014). The Synergy Theoretical Model for Patient Care was a suitable guide for this research project, as it assists in appraising the nurses' abilities in providing care directed to patients' needs.

Critical care nursing competencies are a set of cognitive and physical activities that are transformed and linked. In critical care nursing context, nursing competencies are considered as a mechanism by which nurses' ideas are transformed into interventions on a patient (McCormick, et al. 2012). The Synergy Model for Patient Care, which assumes nursing levels of competence as performing, competencies in nursing are an active process involving recognizing and responding to deteriorating patients' clinical condition (AACN Certifying Corporation, 2014, 2012; Fletcher, et al. 2007).

AACN Certifying Corporation, (2014); Gentile, (2012) indicates that critical care nursing is done by integrating the eight patient characteristics and eight nurse competencies. Using the eight patient characteristics, the nurse recognizes unique patient characteristics, which helps her or him to detect the patients' unique health varying vulnerability. The nurse uses cognitive rules of applying intended nursing interventions transforming them into performance of the basic critical care nursing procedures. Most of the nursing competencies, especially, critical thinking, clinical inquiry, clinical judgments and nursing practice are employed during initial stage of patient care. The nurses use the physical process of reflecting and reviewing critical care nursing actions employed, such as taking and recording observation, interpreting the numerical observed values, detecting clinical deviations from normal range, recognising clinical condition deterioration and responding promptly. This implies that the nursing actions are expressed in the interventions or observable behaviours of performing expected tasks.

Furthermore, AACN Certifying Corporation, (2014); Gentile, (2012) propose that each of the nurse's competencies in the Synergy Model for Patient Care has 5 dimensions derived from patient needs but driving nurses' competencies. Therefore, having proficient in the 5 dimensions of nurse characteristics, assures patients with severe or complex needs be offered safe nursing interventions. This model is relevant to this research project because it shows the process of critical care nursing competencies and ends in observable safety measures implemented on a critically ill patient.

AACN Certifying Corporation, (2014) recommends that nurses must look at the patient as individual entities with special needs through the span of health-illness continuum. An integration of nurses' interrelated dimensions to patients' needs at particular time, paint a 'profile of the nurse'. The critical care nursing practice's goal is directed by the Synergy Model. This goal is to generate thought processes in light of patients' clinical deteriorating condition during the "Golden Hour" and make succinct judgments of responding appropriately to stabilize the patients' condition. "Golden Hour" is the periods during which a patient is more vulnerable, such as at the time onset of illness, during surgical or medical interventions and during recovery from critical illness (Thomson, et al. 2007; McCormick, et al. 2012; Armitage, 2007). The Synergy Model urges nurses to use strategies, such as the "Scoring System" and "Track and Trigger System" during the "Golden Hour" (Frost and Wise, 2007; Armitage, 2007) to detect early unstable patient condition and prevent harm to patient's life.

In the Synergy Model for Patient Care, the act of scrutinizing patient characteristics using the scoring system or tract and trigger system is a protocol that enables nurses put their ideas into visible actions. The "scoring system" or "tract and trigger system", sufficiently and rapidly permit nurses to appreciate and interpret deteriorating patient condition. Through these activities, nurses transform information about patients' clinical status from linear or hierarchic plan into systematic course of actions.

The Synergy Model for Patient Care in AACN Certifying Corporation, (2014); Armitage, (2007), further, assumes that upon implementing her or his action, the staff caring for acutely or critically ill patient reviews the patients' status. This involves checking patients' simple and basic clinical observations. Reviewing patients' condition is a conscious process in which the nurse decides to check and compare basic observation with current ones, recognize or not, deviations and continue to assist the patient or not by employing interventions.

Monitoring and managing a critically ill patient safely is the ability of the nurses to think about "thinking" and continuously examining and coordinating the actions based on patients' physiological observations. The nurse ensures the offered nursing care is safe and of quality. This whole process of "thinking about" and integrating knowledge, skill, experience and environment to patients' needs is referred to as "continuum of nurse characteristics" or acceptable levels of competence (AACN Certifying Corporation, 2014).

In response to the Synergy Model for Patient Care's contention on nurses' competency levels, Armitage, (2007); Lakanmaa, (2013); Gawande, (2009); Fletcher, et al. (2007) highly recommends that staff caring for patients in acute hospital settings must have competencies in monitoring, measurement, interpretation and prompt response to the acutely and critically ill patient appropriate to the level of care they are providing. For those untrained, the institution ought to build their capacity to allow them have in depth knowledge and skill required for optimal patient care. Furthermore, the Model stress that staff working from critical care units require to be assessed, regularly, to ensure that they demonstrate the critical care nursing competencies.

However, Msidi, (2010); Fletcher, et al. (2008); Thomson, et al. (2007) reported that lack of competencies in critical care nursing made staff in acute hospital take too long to recognise patients who are clinically or physiologically deteriorating. The staff does not always do what is needed to address the deterioration once it is identified and the right people to do the right things when patients have deteriorated clinical conditions are

usually not there. This problem needed to be addressed by evaluating critical care nursing competence levels while using the nurses' competencies from the Synergy Model.

1.7.1.1 Theories Guiding Competency Development

To elaborating further the factors influencing nurses' levels of competence, ideas from two theories were used. These theories, Benner's Theory of Novice-to-Expert and taxonomy of learning from Bloom's Taxonomy Theory (Polinsky and Hillery, 2013), elaborate the effects of professionalism on achieving excellent competence levels of critical thinking and clinical judgment. The Benner's and Bloom's Theories stress the importance of the Synergy Model in this study.

1.7.1.1.1 Benner's Theory

Benner's Theory suggests that competence levels can only be achieved through learning which occurs as learners participate in simulations attuned to specialised nursing practice. In this theory, learning does not occur just by performing procedural tasks in a step-by-step manner, but it occurs as learners engage into simulations of actions (Polinsky and Hillery, 2013). As learners move through these stages, at each level of learning process, competencies develop, that enables them to think, respond to and perform certain specific task on patients nursed (Berragan, 2013). This theory supports the Synergy Theoretical Model, American Association of Critical Care Nurses and Critical Care Nurses' Association of Philippines who suggest that critical care nursing competence level acquisition can only occur through specialised training.

1.7.1.1.2 Bloom's Theory

Bloom's Theory argues that learning occurs after exposure to specific stimuli. It elicits competence development, observed by changes in behaviour in the learners (Draper, 2013). Change in behaviour (performing of a skill), entails that planned education had occurred and competency has developed. This theory suggests that lack of training in specialised field of nursing limits nurses' practice.

This theory is useful in determining the extent to which nurses would agree with the statements asked regarding critical care nursing skills and described functions in specialised procedures. Bloom's Theory was also important to reflect on nurses' levels of critical thinking and clinical judgment during patient care, as proposed by the Synergy Model.

1.8 PRINCIPLES OF CRITICAL CARE NURSING

Critical thinking and clinical judgment in critical care nursing is highly recommended in the principles of critical care nursing spelt out by Elliot, et al. (2007). The Nurses and Midwife's Act of 1997, part iv (2) outlines the activities that nurses are allowed to perform. Particularly, part (d) which allows nurses to resuscitate and intubate patients with deteriorating condition. American Association of Critical care Nursing Certification Corporation, (2014); Association of Philippians Critical Care Nursing Inc. (2012); American Association of Critical-Care Nurses, (2008); the Nurses and Midwife's Act of 1997 of the Laws of Zambia, (2000) recommend highly that nurses working in high dependent units must undergo a post graduate training in critical care nursing to prepare them for highly specialised care. This contention is supported by the Synergy Model for Patient Care and the two theories Benner and Bloom.

In view of the unveiled information on the development of critical care nursing competence levels, standards of critical care nursing practice must be evaluated using set indicators. These indicators are drawn from of principles of critical care nursing, used to guide nurses' practice. Elliot, et al. (2007)'s guiding principles for critical care nursing emphasizes on;

- Critically-ill patients and their families to have the right to receive individualized care from qualified professional nurses.
- Critical care nurses must possess appropriate knowledge, attributes and skills to effectively respond to the needs of critically-ill patients, and to the challenges of advancing technology.

- Where a basic nurse education program does not include the required specialized knowledge, attributes and skills, access to such education must be provided to nurses, responsible for the care of critically-ill patients.
- The preparation of critical care nurses must be based on the most current available information and research.

As observed from the Synergy Model for Patient Care, the two theories and Elliot's guiding principles to critical care nursing education and practice, nurses in high dependent units require specialised knowledge and skills. Allocating general nursing graduates to highly specialised units pose a healthcare danger to the society. This could be one of the factors that contributed to high mortality cases observed in 2013 at UTH (HIMS, 2013).

Literature reviews suggested that new personnel to critical care units must undertake an orientation prior to their posting. At UTH, nurses not trained in critical care nursing work alone in critical care units without prior orientation, but with high patient turnover, a situation which does not match with patient needs. The situation defeats the ideal nurse: patient ratio in critical care units of 1:1 or 1:4 in poor resource settings (Waters, 2014; Critical Care Networks-National Nurse Lead, 2012; Thomson, et al. 2007; Critical Care Nurses Association of The Philippines Inc. 2012; McCormick, et al. 2012). The situation at the University Teaching Hospital contradicts these standards, as nurses whether trained in critical care nursing or not, nurse on average 17 critically ill patients, at a ratio of 1:17, a situation that is catastrophic to meeting patients' needs.

1.9.0 DEFINITION OF CONCEPTUAL AND OPERATIONAL TERMS

The following are definitions of conceptual and operational terms used in the study:

1.9.1 Competence

Conceptual: Competence is 'an ability to do something successfully or efficiently', incorporating the understanding of clinical scenario, technical, and communication skills, and the ability to solve problems through the use of clinical judgment (Schroeter, 2008).

Operational: Nurses' ability to identify clinical deterioration of patients' physiological key systems' observations and start nursing interventions immediately. It was categorized into two levels being competent or incompetent for easier description.

1.9.2 Knowledge

Conceptual: knowledge is the "awareness, consciousness or familiarity gained by experience or learning and is a combination of both practical and theoretical knowledge" (Perrie, 2009).

Operational: Nurse's application and understanding of critical care nursing, clinical scenario situations of critically ill patient, to be reflected from the scores to be attained from the three clinical vignettes with competence indicator put at 75 percent. Clinical vignette were useful in assessing nurses' ability to understand specific patient situation and act appropriately.

1.9.3 Skill

Conceptual: Skill means an understanding of specific learned capacities in performing specific activity or dexterity which involve methods, procedures or techniques (Learnardi, 2013).

Operational: Ability to employ and perform critical care nursing technical procedures with competence indicator set at 75 percent. It was measured using the Likert scale for self reported responses.

1.9.4 Qualifications

Conceptual: Specialist qualified nurse attained after undertaking a Post Basic Diploma or Master's Degree (Briggs, Brown, Keston, et al. 2006 and Williams and Schmollgruber 2006; cited in Botha, 2012).

Operational: Level of education means a nurse's post-graduate qualification and highest level of formal education attained. It was either in critical care nursing or not.

1.9.5 Work experience

Conceptual: Experience is the exposure to nursing practice; one must have which is more of an impact than the actual time spent during training in nursing (Polinsky and Hiller, 2013).

Operational: Experience meant the chronological period of time (in years) that a nurse had spent working in the critical care areas. It was categorized into two groups; below 5 years and 5 years and above. The longer the experience, the more competent the nurse was expected to be.

1.9.6 Intensive and Critical Care Nursing

Operational: Critical Care Nursing refers to the care given to medically complex and critically-ill patients, requiring continuous monitoring and artificial sustaining of the vital functions (Lakanmaa, 2013). It involves stabilization of patient's critical illness with focus on and initiating cardiopulmonary resuscitation if cardiac arrest is observed, maintaining patent airway and adequate lung ventilation, managing failing cardiovascular system using cardiac monitor and defibrillator safely and effectively. It also involves managing and monitoring patient's neurological functioning (Merriam-Webster, 2013).

1.9.7 Critical Care trained Nurse

Operational: The critical care trained nurse refers to a person registered by the General Nursing Council of Zambia as having a recognized post-graduate registration in Critical Care Nursing Science (Perrie, 2009).

1.9.8 Non-Critical Care trained nurse

Operational: The non-critical care trained nurse means a person registered by the General Nursing Council of Zambia as a Registered Nurse or Enrolled Nurse with no post-graduate qualification in Critical Care Nursing Science but with practical critical care nursing experience and currently practicing in critical care areas (Msidi, 2010).

1.9.9 Critical care Area /Highly Dependent Unit (HDU).

Operational: These are high dependent units, staffed with personnel and specialised equipment, dedicated to monitor and manage patients with unstable and life-threatening illnesses (McCormick, et al. 2012).The units have advanced technological machines like cardiac monitors, blood gas analysis apparatus, ventilators and other life support equipment. The critical care areas included MICU, NICU, Adult Medical Emergency Unit (AMEU), Casualty, Paediatric Intensive Care Unit, Renal Unit, Special Observation Unit (Labour Ward) and Paediatric Out-Patient Department (A01).

1.10 VARIABLES OF INTEREST

Table 1 gives types and scale of measurement for the variables in the study.

Table 1: Variables and their Cut-off Points

Variable	Type	Scale of measurement	
		Indicator	Cut-off point
Dependent			
Competence	Dichotomous	Competent	>50%
		Incompetent	<50%
Independent			
Knowledge	Categorical	Knowledgeable	≥ 6 scores (37%)
		Low Knowledge	≤ 5 scores (36%)
Skill	Categorical	Skilled	≥ 41 scores (57%)
		Unskilled	≤ 40 scores (56%)
Education level	Ordinal	Specialty qualification	Trained
		No specialty qualification	Not trained
Experience	Ordinal	Experienced	≥5 years
		Inexperienced	<5years

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1. INTRODUCTION

In order to appreciate the advantages and shortcomings of levels of competence needed during the care of patients with deteriorating clinical condition and their credible clinical application. It is important to understanding the main physiological clinical observations and life-threatening problems for the critically-ill patients. Physiological observations are simple clinical readings such as level of consciousness, respiratory rate, heart rate, temperature, blood pressure, oxygen saturations and urinary output; measured to assess the general functioning of the body systems and to detect deviations from the normal range (Karthika, 2011; Frost and Wise, 2007). A deviation of these physiological observations is expressed as life-threatening health problem. The deviations are detected by focusing observations on the key body system; respiratory, cardiovascular and neurological (Frost and Wise, 2007). The accuracy and technique of checking on these vital body systems depends on the critical care nursing competence levels expert in the nurse assigned with the task.

2.2. AN OVERVIEW OF CRITICAL CARE NURSING

Critical care nursing is concerned with human responses to life-threatening major surgery or complications of illness (Sole, et al. 2009). It is vital to understand, clearly, the main physiological human response clinical observations which critical care nursing is concerned with. The physiological observations, whose deviations from the normal range call for urgent critical care nursing interventions include:

- Patent airway and lung ventilation management
- Cardiovascular monitoring and management
- Neurological monitoring and management

2.2.1 Patent Airway and Lung Ventilation Management

A partially-obstructed airway is associated with a diminished level of consciousness. In these circumstances simple airway-opening manoeuvres such as a chin lift or jaw thrust should be applied by the nurse to allow for adequate lung ventilation and adequate oxygenation. If non-surgical and simple manoeuvres fail, the nurse should be equipped with knowledge and skill to use airway adjuncts and endotracheal intubation safely, avoiding inflicting harm on the patient. The competent nurse in critical care nursing is expected to lookout for abnormal respiratory pattern since respiratory rates are essential indicators of critical illness (Frost and Wise, 2007). This is because fast and shallow respirations lead to hypoxia, which is potentially deadly. It must be relieved urgently, by applying high concentrations of oxygen to maximize the fraction of inspired oxygen (FiO₂). The nurse lacking knowledge on the most reliable way to achieve a higher FiO₂ using a mask with a reservoir bag (non-rebreathing bag) or intubation risks patient's survival. This is because the nurse will not take note of the FiO₂ and check for oxygen saturation. He or she will not know that high FiO₂ may reduce respiratory drive, leading to hypercapnic, respiratory coma. The nurse will not know that he or she is required to commence oxygen therapy of 40 percent and titrate it upwards if saturations fall below 90 percent and downwards, if the patient becomes drowsy or if the saturation exceeds 94 percent.

Increasingly, checking for patient's airway patency, respiratory rate and oxygen saturation to detect clinical deterioration are a challenge. This is because observations' deviations from normal ranges need to be interpreted and acted upon rapidly and efficiently without delays. However, nurses' ability to act upon recognized airway and ventilation problems according to patient's lung pathology are compromised due to different types of training and experience (PENN, 2013). As such, most nurses (not trained and inexperienced) in critical care nursing, fail to implement respiratory system support techniques like pulse-oximetry, analyze and interpret blood gases; know their normal ranges and take corrective actions rapidly to stabilize patient's condition (PROMED, 2013).

They also fail to suction patient's nasal airway, tracheostomy tube and provide emergency oxygen therapy. These nurses, further, fail to choose the appropriate ventilator mode which allows for the patient to interact with the set ventilator breaths, in relation to lung pathology. In addition, nurses lack knowledge on the uses of Ambu bag and portable oxygen tank on the unit. Furthermore, the nurse's lack of knowledge on medications commonly used in respiratory problems makes them fail to make autonomous decisions needed for managing patients with airway and breathing problems.

2.2.2 Cardiovascular Monitoring and Management

The nurse caring for a critically-ill patient must have specialized knowledge and skill in restoring patient's cardiac functioning and maintaining effective circulation. This is because cardiovascular function and altered mental status are related and, denote deteriorating patient's clinical condition (Thomson, et al. 2007). But, nurses with poor levels of competence do not document patient's vital signs appropriately and fail to interpret them to recognize patient's cardiovascular status. This makes nurses not succeed in providing timely and quality care to patients during "Golden Time" (McCormick, et al. 2012; Armitage, 2008; GULLO, 2006). Furthermore, the nurses' lack of knowledge on how to start 12 lead electrocardiogram (ECG) monitor, identify cardiac rhythm and interpret it, prevent them from recognizing patients going into cardiac arrest. In addition, lack of knowledge on sequence of handling cardiac arrest increases patient mortality. For example, it is challenging for non-critical care trained nurses to define the observed rhythm on the cardiac monitor. This is because non-trained nurses lack technical know-how on the patterns and types of shockable rhythms, (ventricular tachycardia and ventricular fibrillations), and use the defibrillator safely.

In cardiovascular problems, nurse's interventions are aimed at maintaining an average mean arterial pressure (MAP) for the maintenance of tissue perfusion and survival of vital organs. Though nurses come into contact first with the patient (McCormick, et al. 2012) their lack of knowledge and skill on measures used to maintain average tissue perfusion is grave for patient survival.

As such, all interventions and decisions the nurse makes must be decisive in stabilizing critically-ill patient's clinical condition, which does not apply to poorly competent nurses.

2.2.3 Neurological Monitoring

The nurses' understanding of patient's neurological function and performing neurological procedures depends on their level of education and experience. This makes them determine level of consciousness immediately the patient gets into care by recognizing deteriorating condition. The nurse needs to know that unresponsiveness in a patient results from disturbances in the flow of blood to the cerebral cortex, which is proportional to the *cerebral perfusion pressure (CPP)*. Cerebral perfusion pressure allows for all parts of the brain tissues to be viable and it is obtained by subtracting intracranial pressure (ICP) from mean arterial pressure (MAP), thus: $CPP = MAP - ICP$. Resuscitation Guidelines, UK, (2008) states that poor knowledge and skill in a nurse will stop them from employing intervention for maintaining normal cerebral perfusion pressure of between 70–100 mmHg, leading to brain death. Nurses' inability to perform neurological examination leads to unsafe practice. Neurological examination involves assessing: patient's level of consciousness using a Glasgow coma scale (G.C.S.), focusing on pupil size and reaction to light and asymmetry of limb response.

The Glasgow coma scale is a 15-point scale, graded from best score for eye opening, verbal response and motor response (Sprigings and Chambers, 2008; Karthika, 2011). These parameters form the principle basis of estimating the patient's level of conscious and brain status. Glasgow coma scale graded between 13-15 score implies that patient has mild brain damage, from 9-12 implies that patient has moderate brain injury and scores from 3-8 implies that patient has severe brain trauma. The nurse with low level of competence will not know that Glasgow coma scale score of 8 and below require urgent interventions like intubation to ensure adequate oxygen supply to the brain tissue and stabilize the patient. Pupil reaction assessment provides important information to depict specific brain pathology. An incompetent nurse will not distinguish and interpret pupil's reaction to light to identify brain pathology in line with patient's clinical picture.

Nurses without specialised skill will miss out patient clinical features, chief to their recovery. Knowledge on causes of patient's eye movement and relate them to specific brain trauma is vital as it helps the nurse to detect specific area of brain damage. Low competence levels among nurses prevent them from identifying brain pathology and relate it to eye movements. Unknowledgeable and unskilled nurse fails to take note of patient's different limb movement patterns in relation to specific lesions in the cerebral cortex. Failure to define accurately the site of the lesion in the brain, relating it to limb weakness, increases the transient time for making diagnosis and stabilizing patient's deteriorating condition.

Deviations noted during respiratory, cardiovascular and neurological assessment helps to triage critical illness. Inability of the nurse to use these parameters to weigh and link patient situation to a 'scoring system' or 'track and trigger system' is serious (Frost and Wise, 2007; Armitage, 2007). This is because the nurse's failure to connect deviated parameters from set cut-off points will delay in starting patient care and calling for help. The cut-off scores signifying clinical deteriorating condition (Thomson, et al. 2007) to trigger the healthcare team's response and call the Emergency Care Team are any UNRESPONSIVE patient with Glasgow coma scale less than or equal to 8 and with:

- Heart rate >150
- Heart rate <40
- Respiratory rate >40
- Respiratory rate <8
- Systolic blood pressure <80mmhg
- Oxygen saturation < 90 percent

The nurse is also required to monitor the following additional parameters in specific clinical circumstances; hourly urine output and biochemical analysis, such as blood glucose, base deficit and arterial PH.

2.3. CRITICAL CARE NURSING COMPETENCE LEVELS

The aforementioned explanations are indicative of the competence levels the nurse must acquire in critical care nursing in order to safely manage patient's clinical deterioration. The nurse cannot make big decisions and take critical actions without a specialised body of knowledge and skill regarding critical care practice. Thus a poor level of competence in the nurse with regard to critical care can lead to "failure to stabilize" a deteriorating patient condition, leading to rapid decline that could have been avoided had the nurse intervened early and appropriately. This can be attributed to the experience of the nurse, who are said to be at an advantage of recognizing clinical deteriorating patient symptoms and are able to respond accordingly, assuring optimal outcomes for the critically-ill patient.

Thomson, et al. (2007); Gawande, (2009); Armitage, (2008) in United Kingdom recommended that physiological observation be recorded and acted upon by staff trained to understand their clinical relevance, prevents patient deaths resulting from unsafe critical care practice. This is in line with Waters, (2014)'s report in Spain which stated that critical care nursing practice is to be provided by highly competent nurses. However, Lakanmaa, (2013), in Finland reported that challenges in critical care nursing results from lack of appropriate training in emergency response, poor practice by the nurses to record accurately physiological observations of critically-ill patients and failure to respond appropriately to patients' unstable condition requiring artificial support to the failing vital organs. Other reviewed literature in Sweden,(Kylmänen, and Spasic, 2010), suggests that training in emergency response improves nurses' practice in stabilizing patient's condition, ultimately reduces mortality. This is because trained nurses have good competence levels which enable them to establish and initiate resuscitation procedures to patients with clinical deteriorating conditions. Deteriorating conditions in a patient can only be detected by monitoring patient's vital signs, cardiac rhythm and oxygen saturation. Furthermore, Frost and Wise, (2007) recommended that nurses with excellent competent levels know that death may occur if patient's patent airway and adequate lung ventilation are not established. Suserud and Haljamäe (2014) in Sweden

suggested that personnel involved in the care of critically-ill patient should have a higher competence level. This is in line with most researchers worldwide including Africa (Sprigings and Chambers, 2008; Critical Care Nurses Association of The Philippines Inc., 2012; PENN, 2013; Darran, 2010; Trimble, 2013; Perrie, 2009), who suggests that nurses in critical care areas need to have extraordinary expertise and competence in caring for the acutely ill patients. In South Africa (SA), Botha, (2012) reported that critical care nursing competence level was poor with 48% among qualified ICU and 17% among enrolled nurses, lower than 75% set competency indicator. Furthermore, Scribante and Bhagwangee, (2007) in SA stated that 75% of nurses were incompetent to nurse the ventilated patient. However, no literature was found on evaluation of critical care nursing competence levels in Zambia.

2.3.1 Knowledge Levels

Critical care nursing competence levels are required to be above set competence indicator to ensure safe practice. The prevalence of knowledge levels among critical care nurses in a study done in Finland by Lakanmaa, (2013) was as low as 25%. In other studies conducted in India and Sweden (Kylmänen and Spasic, 2010; Nilsson, 2008) levels of competence among two groups of nurses, theatre nurse and nurse anaesthetist respectively were at different levels, affecting patient's safety. The differences in the levels of competence resulted from poor knowledge levels in nursing science and medicine (Nilsson, 2008). One Indian study (Chase, 2010) conducted among nurse managers with same attributes to critical care nurses; found that high knowledge levels among nurses contributed positively to their high competence levels in patient care.

Various factors to mortality among critically-ill patients have been reported in the literature. However, there are very few data concerning nurses' knowledge on care of critically-ill patients, as well as factors that may influence nurse's application of knowledge at the bedside. Hence, lack of knowledge may be a barrier to effective practice. From two studies conducted one in South Africa (Perrie, 2009) and the other in Tanzania (Saidi, 2012) on nurses' knowledge levels in specific critical care areas for

critically ill patients on mechanical ventilation, reported low knowledge levels, lower than the 70 percent competency indicator. This affected nurses' levels of competence in critical care nursing practice. A study conducted in Zambia (Mwewa, 2010); on Knowledge and Utilization of ICU Admission Criteria and Guidelines reported high level of knowledge (94 percent), but the nurses' practice was poor.

2.3.2 Skill Levels

Waters, (2014) in Spain reported that there is demand for high levels of skill among personnel involved in caring for critically-ill patient. In Korea, Sun, et al. (2012) reported that ward nurses with training in CPR had a reduction in cardiopulmonary arrests cases indicating that training empower nurses with specialised skills to practice safely. In France, Chellel, et al. (2002) reported that unskilled staff provides suboptimal care to critical ill patients. PROMED Agency, (2013) and Resuscitation Council (UK), (2008) suggests that it is required that a professional proficiency assessment prior to posting to critical care units must be done. In France, Chellel, et al. (2002) and in South Africa, McCormick, et al. (2012) suggests that interventions employed by skilled and competent nurses in critical care nursing minimize deterioration of patient's condition. Said, (2012) revealed that nurses' practical skills never reflected their observed and desired practice during the "Golden Hour" of patient treatment. Mismanagement of the patient during the "Golden Hour" of their illness (Mallett, et al. 2013) resulted from the use of unskilled healthcare professionals, who fail to recognize clinical deterioration or incorrectly use provided medical equipment. Since competence does not exist in a vacuum (Schroeter, 2008), its development requires adequate time for effective reflective and deep learning to occur. Training time less than 12 months gives trainee little time to be supervised and mentored (Critical Care Networks-National Nurse Lead, 2012). Therefore, six-to-twelve-week orientation programs has little significant on the competence of nurses (DeMYSTIFIED, 2011).

2.3.3 Work Experience

The critical care environment requires both newcomers and experienced personnel to work (Huggins, 2004:39 cited in Perrie, 2009). Polinsky and Hillery, (2013) cites Benner (1982) who describes experience as “not the mere passage of time”. Experience is the exposure to nursing practice; one must have which is more of an impact than the actual time spent during training. Therefore, appropriate experience to facilitate the development of clinical critical care competence should be advocated. Chase, (2010) in India revealed that nurse managers with more management experienced had higher competence levels, demonstrating the great impact experience has on level of competence. Thus, ability of nurses in critical care units to perform can be enhanced by their experience. Lakanmaa, (2013) in Finland found that nurses with longer experience, had higher scores of performance in critical care setting. In USA, DeMYSTIFIED, (2013) report recommends adequate experience as a stepping-stone into critical care units and that a very strong, supportive, prolonged pre-ceptorship program is needed to expose new graduates without experience in critical care nursing.

Toth, (2003) cited in Botha, (2012) in SA revealed that nurses with more experience had higher scores of performance during the provision of nursing care. McCormick, et al. (2012)'s survey in South Africa suggest that critical care nurses depends on their experience in providing specialized nursing care. Inexperienced nurses make clinical decisions that overlook individualized patient care. They are too rigid and procedure oriented, regardless of the individual patient circumstances (Botha, 2012). They tend to develop a “one size fits all” program of care in contrast to individualized care (Perrie, 2009). In South Africa, Botha, (2012)'s study showed that neither age nor years of experience had an influence on the competence levels of ICU nurses. Mwewa, (2010) suggested that experience had an impact on developing competencies among nurses.

2.3.4 Critical Care Working Environment

The environment helps critical care nurses understand how equipment functions and to use available equipment safely on critically-ill patients (Chase, 2010). Any exposure to the unique critical care nursing setting enhances development of competence. Critical care environment must be organized for staff to learn and train in resuscitation skills as part of their prior posting requirement (Resuscitation Council (UK), 2008). Training in resuscitation is a fundamental requirement for medical and nursing staff (Resuscitation Council (UK), 2008). Staff wishing to work in the critical care area is expected to be exposed to a range of environmental experiences and opportunities to enable them learn and develop competence in the said specialty field.

The learning environment is expected to provide theoretical courses which act as basis for building on knowledge and simulation laboratories which prepares students' psychomotor skills before they actually handle the patient. Simulation laboratories encourage hands-on pre-ceptored exposure to an intensive care unit. This helps students to refine their skills and build on the required competencies.

Critical care nursing interventions require to be customized around reducing mortality among critically-ill patients. There is no existing critical care specific scope of practice to guide the critical care nursing in practice. As such in Zambia, a non-critical care qualified nurse can legally work in high dependent units as the GNC does not restrict nurses to have specialist qualification to work in the critical care units. However, it is suggested that developing and implementing guidelines for critical care nursing practice is the best way to improve the quality of care delivered to patients and to guarantee the level of critical care nursing competencies among nurses caring for critically-ill patients. It will also enhance the application of evidence based nursing. To this effect General Nursing Council of Zambia's priority is to strengthen nursing and midwifery practice in line with expanded scope of practice spelt out in the Act of 1997 No. 31. In addressing this priority, GNC in collaboration with Ministry of Health, embarked on critical care nursing program that is hoped to equip nurses and midwives with knowledge and skill in

caring for critically-ill patients. This is in collaboration with international professional bodies, such as the University of Brighton and National Health Service in the UK.

To sum it up, having incompetent medical staff in critical care medicine, work in critical care units compels countries like Zambia to introduce basic life support orientation training programs to all nurses before posting them to high dependent units.

2.4. CONCLUSION

The study sought to evaluate the critical care nursing competence levels among nurses, whose specific objectives are to; determine competence levels in relation to critical care nursing establish factors influencing nurses' competence levels and suggest strategies to relevant authorities on how to improve critical care nursing competence levels. Though critical care nursing practice is a pivotal practice in reducing mortality among critically-ill patients (Thomson, et al. 2007), no studies locally were found looking into the critical care nursing competence levels. This has prompted the need for this study to be undertaken.

The following chapter describes the methods used to undertake the study to ascertain nurses' levels of competence in critical care nursing at University Teaching Hospital.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology is a system of study, the strategy, the plan and action, the process or design lying behind the choice and use of a particular method used by the researcher to collect and order data, using statistical manipulations and arrive at a logical conclusion (ATLAS.ti, 2002). It involves identifying research design, tools and sampling techniques to be used in the study. Furthermore, it incorporates the pilot study to be done and ethical consideration of the study. The methodology refers to the development, testing and evaluation of research instruments and to ensure reliability and validity in the data collection tools.

3.2 RESEARCH DESIGN

A research design can be thought of as the structure of the research project in totality. A design was used to structure the research, to show how all major parts of the research project worked together to try and address the central research question. Orodho and Kombo, (2002) defined it as the scheme outline or plan that is used to generate answers to research problem. It constitutes the blue print for the collection, measurement and analysis of data (Kombo and Delno, 2006). A cross-sectional study design was used to evaluate the critical care nursing competence levels and determine the influences of demographic variables on nurses' competence levels.

3.3 RESEARCH SETTING/SITE

Research setting is "the physical location and conditions in which data collection takes place in a study" (Polit and Hungler, 2002). The study was conducted at University Teaching Hospital because it not only had full access to a state-of-the-art of nurses and equipment ideal for caring for critically ill patients, but also offered a postgraduate course in critical care nursing, which deemed it appropriate for the characteristics of the participants.

University Teaching Hospital is a state-of-the-art simulation training centre equipped with life-sized manikins, simulating nearly an acute and critical patient episode, including, respiratory distress, cardiac decompensation and acute neurological events. Audio and video systems in the classroom enabled trainees and faculty to observe teaching sessions, interact with the instructor and participate in guided performance feedback sessions. It offers the ideal experiences in the simulation laboratory and critical care units where the nurses practice. It is a Referral Hospital receiving all types of patients with complex and severe conditions, with characteristics and needs which influence nurses' competencies. Furthermore, it was convenient because it was easily accessible.

3.4 STUDY POPULATION

The study population is the entire number of units under study (Polit and Hungler, 2002). The study population comprised all nurses working in the selected (n=8) high dependent units at University Teaching Hospital.

3.5 SAMPLING METHOD

Convenience sampling method was used to recruit and access the respondents working in high dependent units at UTH where critically ill patients are nursed. Convenience sampling involves recruiting available participants conveniently and allows them to volunteer to participate in the study. Convenient sampling, which is a non-probability technique, is a sampling method that includes respondents in the study because they happen to be in the right place at the right time, entering available respondents into the study until the desired sample size is met (Burn and Grove, 2005). Convenient sampling technique was used as the sampling frame was limited.

Participants in the study, volunteered from selected (n=8) critical care units of the University Teaching Hospital in Lusaka. The units included: the Main Intensive Care Unit, Adult Medical Emergency Unit, Casualty, Neonatal Intensive Care Unit, Paediatric Intensive Care Unit, Paediatric Outpatient Department, Renal Unit and Special Observation Unit in Labour Ward.

3.5.1 Inclusion Criteria

All nurses whether trained in critical care nursing or not, currently working in identified critical care units at UTH, registered by General Nursing Council of Zambia and willing to participate were recruited into the study. This was to avoid low input resulting from those participants who were on different leave of absence.

3.5.2 Exclusion Criteria

Nurses who were not working from selected high dependent units, those who were on leave during the time of the study and those who refused to participate were excluded from the study.

3.6 SAMPLE SIZE DETERMINATION

Based on an expected mean of 75 percent competence indicator for critical care nurses from previous studies cited, it was necessary to enrol minimum of 91 participants in order to have 50 percent power to detect level of significance set at <0.05, with 95 percent confidence. The Krejcie and Morgan prevalence Formula (1970) was used since it assisted in determining sample size for limited study population which was known and it allowed for inclusion of 50 percent proportion of the study population. Since the accessible study population for this study was only 119, the minimum sample size was calculated as follows:

$$S = \frac{X^2 NP (1-P)}{d^2 (N-1) + X^2 P (1-P)}$$

Where;

- S = Required sample size
- X^2 = degree of freedom at the desired confidence level ($1.96^2 = 3.4816$)
- N = Accessible study population size (119)
- P = Population proportion (assumed at 0.50)
- d = Degree of accuracy (assumed at 0.05)

Therefore, $S = \frac{X^2 NP (1-P)}{d^2 (N-1) + X^2 P (1-P)}$

$$S = \frac{3.8416(119) \times 0.50 (1-0.50)}{0.0025 (119-1) + (3.4816) (0.50) (1-0.50)}$$

$$S = 91.033680 \text{ 1202}$$

The total minimum sample size was 91. However, all the 119 participants were recruited to participate in the study.

3.7. DATA COLLECTION TOOL

Data collection “refers to gathering specific information aimed at providing or refuting some facts” (Polit and Hungler, 2002). Before data collection, it is necessary to understand what is hoped to be obtained and how data is hoped to be obtained. Usually, two major sources of data are used. These are primary and secondary sources. Primary Source was when data was collected from ordinary sources and it was gathered directly through questionnaires and observation approach. Secondary Sources were information sourced either collected by the user or specifically for the user. It involved gathering data that had already being collected by someone else. It involved analysis of published material and information from internal sources.

Unite State Census Bureau, (2013) referred data collection tools to the device as an instrument or equipment used to collect data. It may take the form of questionnaire, interview schedule, Likert scale, checklist, project device or computer assisted interviewing system for eliciting information. The study employed a Self administered questionnaire, Likert scale and Observation checklist. A semi-structured questionnaire with closed ended questions and one space for open ended response was provided for additional information on ways of improving critical care nursing practice in critical care areas.

3. 7.1 Data Collection Tool for the Study

The research techniques were combined during data collection process in evaluating nurses' level of competence (Vancouver Island Health Authority, 2004) by using less flexible and flexible tools. Less flexible tools were the questionnaire and Likert scale, while flexible tool was the observation checklist tool.

A Clinical Vignette questionnaire modified from Botha, (2012) tool was used. Permission was sought from the owner of the tool used in the study. Vignettes were found to be valid and reliable tools for measuring the application of knowledge to the clinical situation (Botha, 2012), and that, if knowledge competence was being evaluated, like in this study), Multiple Choice Questions (MCQ"s) derived from a clinical scenario were sufficient to evaluate the level of knowledge competence being studied. As such each of the three clinical vignettes developed consisted of a clinical scenario developed with reference to one of the three key physiological systems for critically-ill patients (Thomson, et al. 2007; Frost and Wise, 2007; Luettel, et al. 2007). Each clinical vignette had MCQ's with four single response options. An added fifth option of "I don't know" was included in an effort to reduce the number of "guess" answers, when the nurse did not know the answer.

A "Likert scale" is the sum of responses to several Likert items (Vanek, 2012), presented in a very specific format (Vagias and Wade, 2006), with Likert items displayed with a horizontal bar representing a simple scale. The Likert-type scale self-reported responses modified from Hicks, Coke and Li, (2009) and Siegle, (2010); and zeroing in skill competence identified by Chipepo, (2011) and PROMED Agency, (2013), was used and combined with clinical vignette questionnaire. The Likert items were balanced in both sides with neutral options. A "Likert Item" was a statement that the respondent was asked to evaluate themselves on (Vanek, 2012). The Likert scale items were very useful question type in order to get an overall measurement of the research topic, opinion, or experience. In addition, it collected specific data on contributing factors to the nurses' level of competence.

Observation technique involved a systematic selecting, watching and recording behaviour and characteristics of nurses. Observations gave additional, more accurate information on behaviour of nurses in the critical care areas as they provided care to the critically ill patients. Observations assisted in checking nurses' performance in critical care settings. Observation technique was also helpful for collecting qualitative data to give an insight into nature, causes and effects of critical care nursing levels of competence problems in the high dependent units at UTH. The study endeavoured to assess the presence or absence of equipment in the acute units. Furthermore, it evaluated the abilities of nurses to use the available equipment during the care of the critically-ill patients. Since observations technique was time consuming, it was used in this study to evaluate quality of nursing care provided to patients in units with optimized equipment or nothing at all. The technique's result gave power to the study. The data obtained from observation technique was compared with participants' self-responses on the Likert scale to make precise conclusion.

Table 2: Vignettes on Key Physiological Systems of Critically ill patients

Vignette	Key physiological System Observations
Vignette One	Patent airway and breathing management
Vignette Two	Cardiovascular monitoring
Vignette Three	Neurological monitoring

These Clinical Vignettes in the questionnaire addressed the research objectives of measuring:

1. Critical care nursing competencies by describing nurses' competency levels in relation to participants' response to the 30 items under section 2 of the questionnaire. Therefore, the respondents were either competent or incompetent. Respondents were said to be:
 - a. Competent if they scored >50% on competency questions

- b. Incompetent if they scored <50% on competency questions
- 2. Critical care nursing knowledge was evaluated using three clinical Vignettes on selected physiological systems. Vignette one was on patent airway and ventilation management, vignette two was on cardiovascular monitoring and vignette three was on neurological monitoring. This was done by validating and modifying scenarios and MCQ"s from previously vignettes to adapt the case scenarios and MCQ"s to Zambian setting. The knowledge levels were described in two categories. i.e.:
 - a. ≥ 6 scores (37%) on knowledge question = Knowledgeable
 - b. ≤ 5 scores (36%) = Low Knowledge
- 3. Critical care nursing skills were evaluated by requesting nurses to make self-reported response on the Likert scale and rate their best practice in performing specific critical care nursing procedures without supervision. The skill levels were described in two categories. i.e.:
 - a. ≥ 28 scores (41%) on the Likert scale rating = Skilled
 - b. ≤ 27 Scores (40%) on the Likert scale rating were unskilled
- 4. Demographic data and questions relating to the participants' own perceptions of their competency with regard to critical care nursing practice were also developed.
- 5. A direct observation checklist was used to assess the critical care nursing settings for respondents in trying to evaluate the availability of critical care nursing ward equipment and their usage.

3.7.2 Validity of the data collecting tool

During this exercise, validity and reliability were tested and measured. "Validity is the degree to which an instrument measures what it intends to measure (Polit and Hungler,

2002). Essentially, validity is concerned with the question, “are you measuring what you think you are measuring?” Validity of the instrument used in the study was maintained by making questions simple, concise and brief. Then all variables related to aspects of competence on demographic related factors were included on the questionnaire.

3.7.2.1 Internal Validity

Internal validity refers to the degree to which a study can make good inferences about a possible existence of the causal relationship (Huitt, et al. 2015). The essence of internal validity was whether or not the research findings could definitively state the effects observed in the study that they were due to the manipulation of the independent variable. Therefore, a cross-sectional study design was used for this study to ensure that data is collected at once. Participants to this study were selected conveniently as they had specific nursing characteristics depicting the expertise in critical care nursing competence. Furthermore, the variables of interest were drawn from an intense literature search, obtaining clear view from other authors on the study variables. In addition, the same data collection tool was used to collect data from all the participants. The research tool was assessed by experts to ensure no important items were missed. The data was analyzed using Chi- Squares test studies and interpreted according to variables and findings of the research study, and presented as aggregated results.

3.7.2.2 External validity

External Validity refers to the extent to which a study's results can be generalized or applied to other people or settings the study reflects (Huitt, et al, 2015). A pilot study on the questionnaire was conducted to a 10 percent study population with similar characteristic to the main study sample prior embarking on the main study. This was to ensure that the tool measured exact what it was intended to measure.

3.7.3 Reliability of the data collecting tool

Reliability is the degree of consistency and dependability with which an instrument measures the attributes it is designed to measure (Polit and Hungler, 2002). Reliability was obtained by testing the tool before the main study was conducted. The results from the study were used as baseline data.

3.8 DATA COLLECTING TECHNIQUE

Permission to conduct this study was obtained before embarking on the study. After obtaining a clearance and approval from Excellence in Research Ethics and Science Converge (ERES CONVERGE) and UTH management, the Ward Managers of each critical care units were approached to agree on dates and time for the data collection process to start.

Two techniques were used. A structured clinical vignette questionnaire (see appendix V) and an observation check lists (see appendix VI) were used. Each questionnaire was assigned a number as a “code number” for follow up. In addition, each of the selected units was assigned a code numbers on the checklist for easy follow up and privacy.

3.8.1 DATA COLLECTING PROCEDURE

Each questionnaire was placed in individual unsealed blank envelopes and taken to the critical care areas at the specified time and date. A separate envelope not associated with the questionnaire was used to place the signed consent forms from participants who consented to participate in the study. An information sheet (see appendix I) was included and attached to the consent form.

The respondents were given brief oral overview of the purpose of the study. Explanations of the format of the instrument and what was required of them with regard to completing the instrument was done. The respondents who agreed to participate in the study signed a consent form (see appendix II) which was placed in the envelope not associated with the instrument to ensure confidentiality. The respondents, who were given the instrument, were allowed to answer it at their free time and bring it back to the

respectful unit after they had finished. This was because the units had few nurses who could not stop working to fill in the questionnaire at the time of instrument distribution. The completed instruments in sealed envelope were collected, and later placed in a bag for safe keeping. The investigator was contacted via email or cell phone during and after the data collection period. The envelopes with completed instruments were only opened after they were removed from the unit and data collection process was completed.

The data was also collected using an observation checklist from the selected (n=8) units on date agreed upon with Unit Managers. The wards were not informed the days of conducting an observation to prevent the nurses from changing their natural and usual practices.

3.9 PILOT STUDY

A pilot study is a small scale version of the actual study conducted with the purpose of testing and potentially refining the research plan (Dempsey and Dempsey, 2000). Nicolas (1991) refers to it as a mock study or pre-test, "A small survey in advance of the main fieldwork to test the form sampling procedures and fieldwork arrangement procedure.

The pilot study was conducted in the month of October 27th to 31st 2014, at Levy Mwanawasa Hospital. Twelve respondents from critical care units were selected by convenience sampling method, with similar characteristics with the actual study units. The pilot study was useful in knowing the accessibility of the questionnaires, identifying that question ten in section two on cardiovascular knowledge vignette had no correct response and estimated how much time was required to sample participants. The questionnaire was adjusted by cancelling out question 'nine' in Section under 1, demographic data, as the question did not obtain valuable information to the study. In addition, question 'ten' in 'Section 2' on the knowledge vignettes which did not have a correct response was removed. This was done to avoid confusing respondents and prevent obtaining untrue study results.

3.10 ETHICAL CONSIDERATION

“Ethics are a set of moral values that is concerned with the degree to which research procedures adhere to professional, legal and social obligation to the study participants (Polinsky, 2004). The general acceptable ethical rights of participants included: privacy, confidentiality, anonymity and voluntary participation. Approval and clearance of this study was sought from ERES CONVERGE. Written permission was sought from Levy Mwanawasa Hospital and University Teaching Hospital authorities for pilot study and actual study, respectively.

The purpose of the study was explained to participants. No names or identifying information were placed on the instrument to uphold anonymity. Those who declined to participate were reassured that no privilege would be taken away from them. Each collection tool was given a code number not associated with the questionnaire, to ensure that anonymity and uphold confidentiality. Separate envelops for signed consent form and information sheet were provided to ensure anonymity and privacy.

Furthermore, the raw data was only accessed by the researcher to uphold participants' privacy and confidentiality. Privacy was also maintained by allowing participants to answer the questionnaires in private rooms at their own time and those not willing to participate were not forced. Those who agreed to take part in the study were requested to sign a consent form before administering the questionnaire to uphold voluntary participation into the study.

The participants were not exposed to any physical and emotional danger or harm as the research did not involve any invasive procedure. The participants were treated with respect by greeting and talking to them politely. They were given the questionnaires written in the language they understand best.

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS OF FINDINGS

4.1 INTRODUCTION

In this chapter, data consolidation was described together with the approach used for data analysis. Data analysis is “the systematic organization and synthesis of research data and testing of research hypothesis using these data” (Polit and Hungler, 2002). After analysis using SPSS version 20.0 and Microsoft Excel 2010 version data was presented in tables and graphs for ease of understanding. The frequency distributions were computed to organize the demographic data of respondents. Descriptive and inferential statistics were used to analyse the data to ensure the study objectives were met. Statistical tests used include mean and Chi-Square Tests. The data were cross-checked in conjunction with a statistician for accuracy.

A total of 120 questionnaires were handed out, with 95 being completed, resulting in a sample of 95 respondents (n=95). About 12 respondents approached to participate in the study failed to return the questionnaire. Thirteen (13) questionnaires were rejected for data analysis as respondents did not fill them in adequately. These questionnaires had less than 20 percent completeness and so they were rejected from the analysis process.

4.2 Data Processing and Analysis

Data analysis was done using SPSS. Knowledge scores and Likert scale data analysis was done by summing up the scored values of each respondent, the score were computed in line with the competence indicator set at 75% with $P = 0.05$ and confidence interval of 95%. The scores were used to create frequency distribution charts for opinion across the population under study. With the help of the statistician, further analysis of scores was done by cross tabulating and Chi-square tests. The observation data results were analyzed using the logistic regression to help understand how the nurses' competencies changed when equipment in the high dependent units varied.

All statistical analyses were done using Statistical Package for Social Sciences (SPSS) version 20.0 and Excel Microsoft of 2010 to analyze qualitative data, with the help of the statistician. Results were reported as absolute values at baseline and further analyzed as means and standard deviation. The threshold competence levels for statistical significance was $P = 0.05$ unless stated otherwise. Knowledge vignettes and Likert scale score values were represented as mean and standard deviation. To ensure validity and reliability, results were compared with previous studies done elsewhere in similar populations that used this method.

4.3 Presentation of findings

The findings of this study were presented in summary form in frequency tables, percentages, cross tabulations and bar graphs. The use of graph charts in data presentation was to make work presentable and easily understood. The frequency tables summarized the results of the study for easy reference and comprehension. Cross tabulations of the variables helped to show clearly the relationship between variables. Data was presented into three (3) sections, demographic data, describing critical care nursing competence levels and main factors believed to influence competence levels among nurses.

4.3.1 DEMOGRAPHIC DATA

Tabled 3: Demographic Information (n=95)

Variable	Frequency	Percentage
Sex of Respondents		
Male	19	20
Female	76	80
Age of Respondents		
20-30 years	37	38.9
31-40 years	38	40
41-50 years	15	15.8
51-60 years	5	5.3
General Nursing Ward Experience Prior Working in the Critical Care Areas		
1-2 years	24	25.5
3-5 years	25	26.3
6-8 years	7	7.4
9-11 years	1	1.1
>11 years	9	9.5
Not applicable	29	30.5
Nurse categories by qualification		
Critical Care Nurse	9	9.5
Midwife	12	12.6
Paediatric Nurse	2	2.1
Registered Nurse with experience in CC Unit	43	45.3
Enrolled Nurse with experience in CC Unit	19	20
Not Applicable	10	10.5
Position held in the Critical Care Units		
Unit Manager	7	7.5
Crew Leader	15	15.8
Clinical Instructor	1	1.1
Others	72	75.8
Total	95	100

In respect to Table 3, 20% (n=19) respondents were male and 80% (n=76) were female. The table also shows that 38% (n=37) of the respondents were aged between 20-30 years, 40% (n=38) were aged between 31-40 years and 15.8% (n=15) were aged between 41-50 years, only 5 (n=5.3%) were aged between 51-60 years.

Table 3 further shows that most (30.5%; n=29) of the respondents had no experience in general nursing ward prior to working in critical care areas, 26.3% (n=25) had worked for 3-5 years and 25.5% (n=24) had worked for 1-2 years. Only 9.9% (n=9) had worked for more 11 years.

According to Table 3, of 100% (n=95) respondents in the study, only 9.5% (n=9) were trained in critical care nurses. Most (45.3%; n=43) of the respondents were registered nurses with experience in critical care settings, 20% (n=19) were enrolled nurses with experience in critical care settings, 12.6% (n=12) were midwives and only 2.1% (n=2) were paediatric nurses. One third of respondents (10.5%; n=10) stated that the question was not applicable to them as their qualifications did not fall in any of the categories provided. Table 3, further shows that 15.5% (n=15) of the respondents were Crew Leaders on a shift, 7.5% (n=7) were Unit Managers, 1.1% (n=1) was a Clinical Instructor and most (75.8%; n=72) of the respondents had different positions in the critical care units, such as cardiothoracic scrub nurse, general nurse with Bachelor of Science and Ward Nurse.

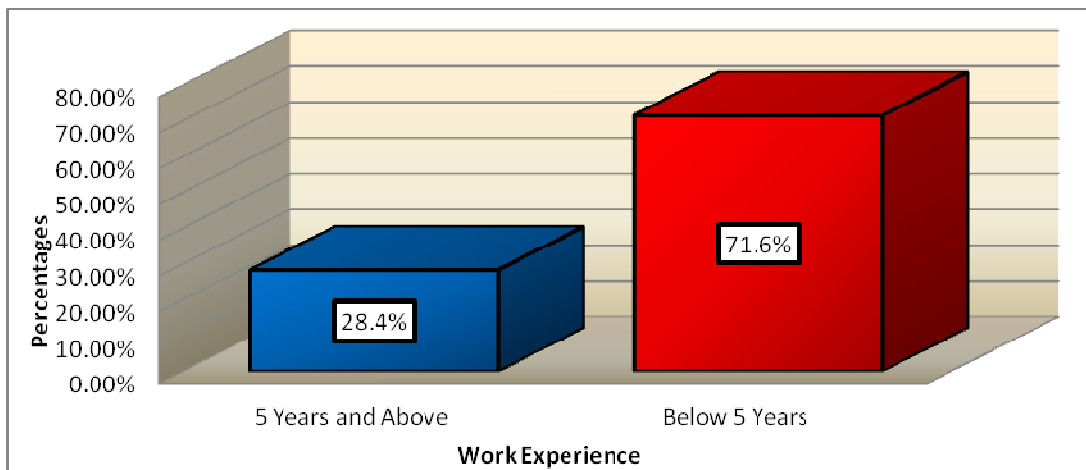


Figure 1: Work duration in critical care area (n=95)

According to Figure 1, most (71.6%; n=68) of the respondents had worked in the critical care setting less than 5 years. Whereas 28.4% (n=27) had worked for 5 years and above. Therefore, majority of the respondents had less experience in the critical care areas.

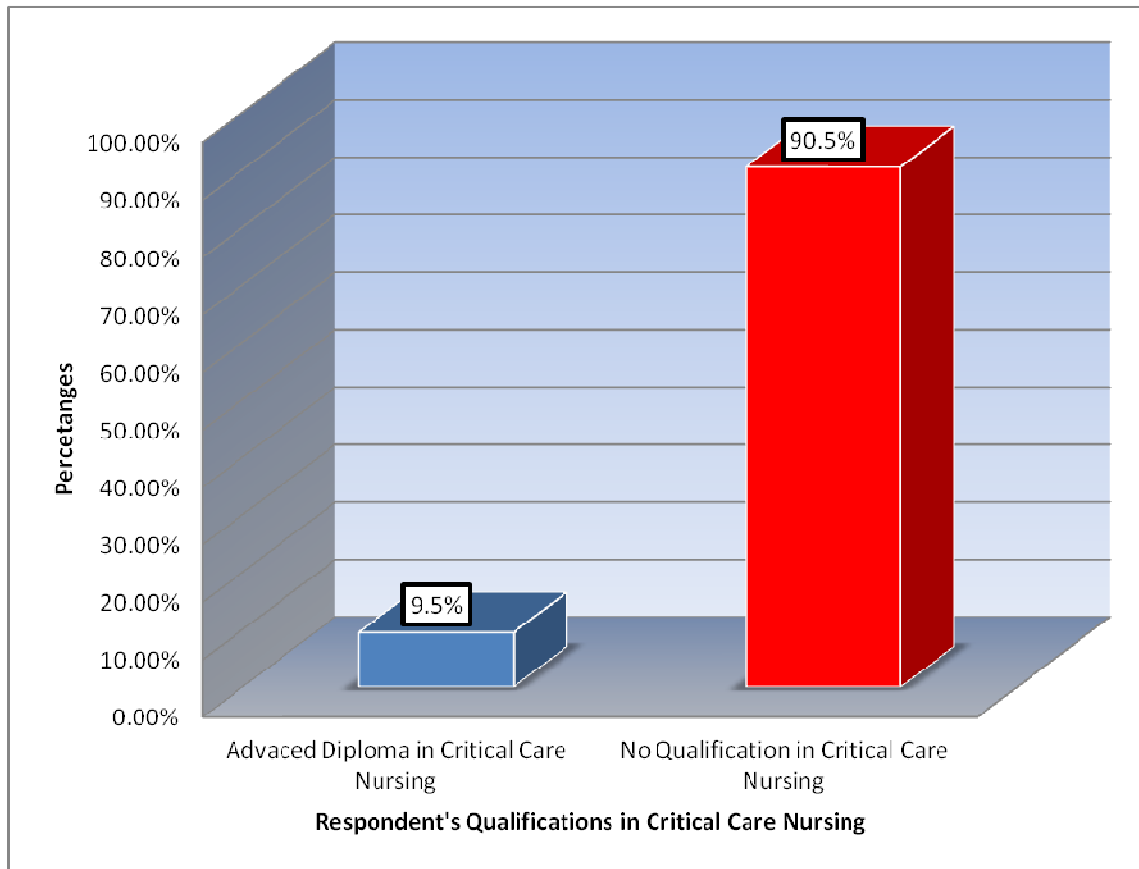


Figure 2: Respondents' qualification in critical care nursing (n = 95)

According to Figure 2, of 100% (n=95) respondents, only 9.5% (n=9) had Advanced Diploma qualification in Critical Care Nursing, whereas most (90.5%; n=86) state that they had qualifications in other nursing fields.

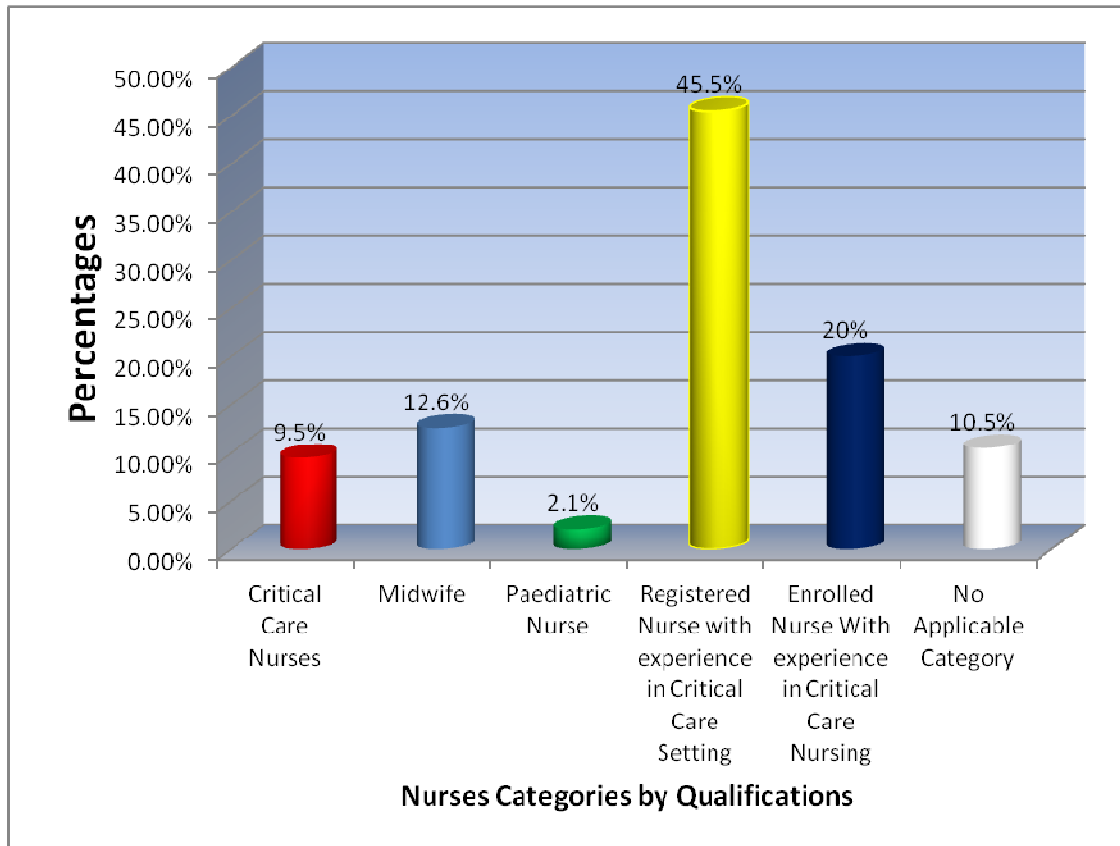


Figure 3: Nurses categories by qualifications (n=95)

The Figure 3 shows that most (45.3%; n=43) of the respondents were Registered Nurses with experience in critical care setting, 20% (n=19) were Enrolled Nurses with experience in critical care nursing, 12.6% (n=12) were Midwives, 10.5% (n=10) did not belong to any of the stated categories and only 9.5% (n=9) were critical care nurses.

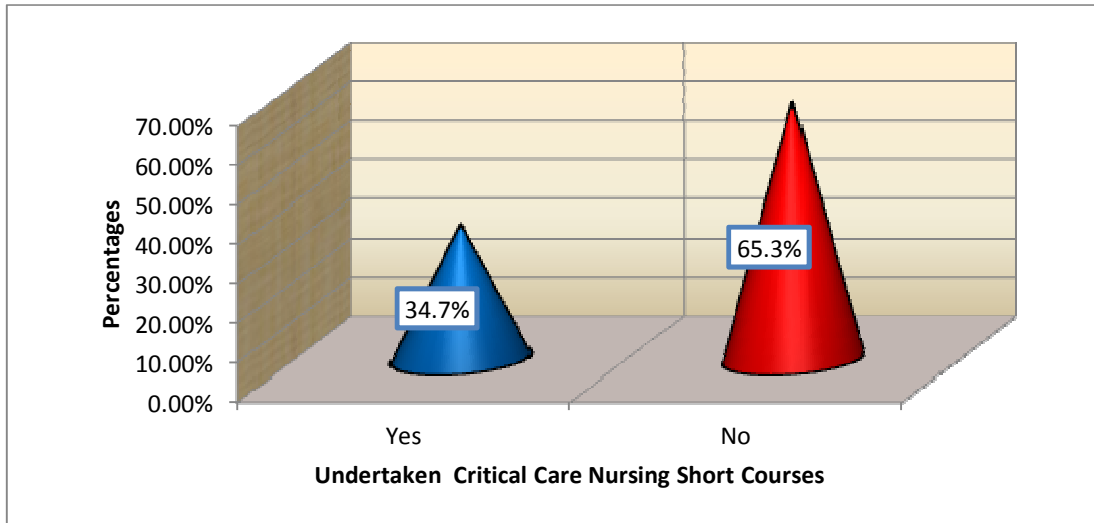


Figure 4: Undertaken any short courses in critical care nursing (n=95)

According to the presentaiton on Figure 4 above, 34.7% (n=33) of the respondents had undertaken short courses in critical care nursing whereas majority of 65.3% (n=62) had not.

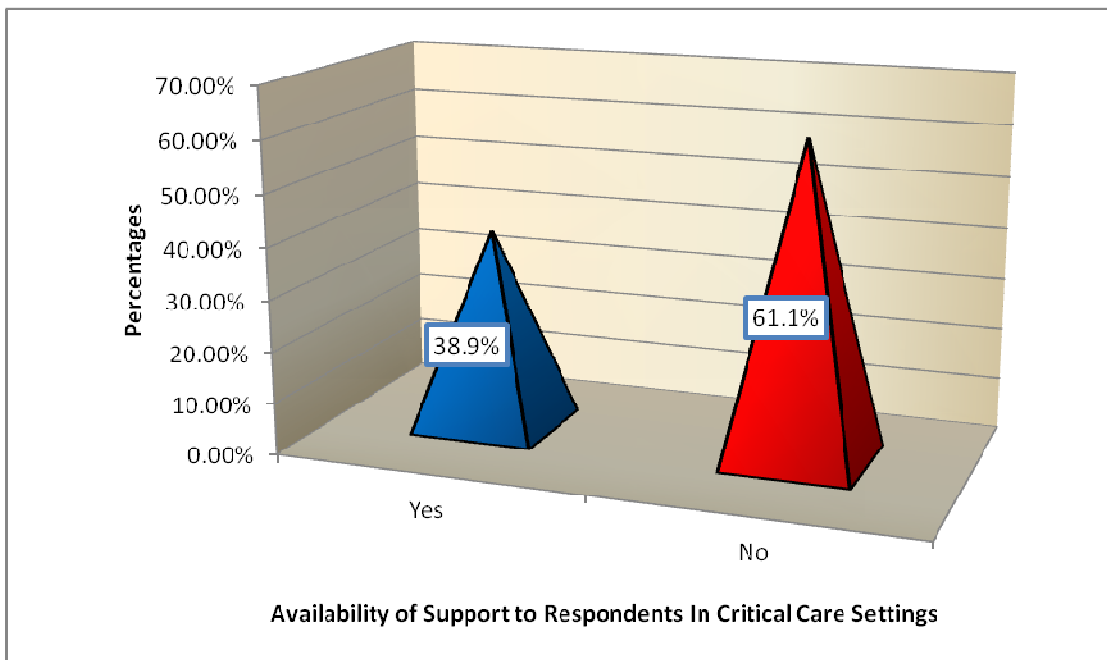


Figure 5: Receive logistics for managing an emergency (n = 95)

The Figure 5 shows that 38.9% (n=37) of the nurses in critical care units stated having adequate support and provided with logistics used to care for the critically ill patients whereas majority, 61.1% (n=58) do not.

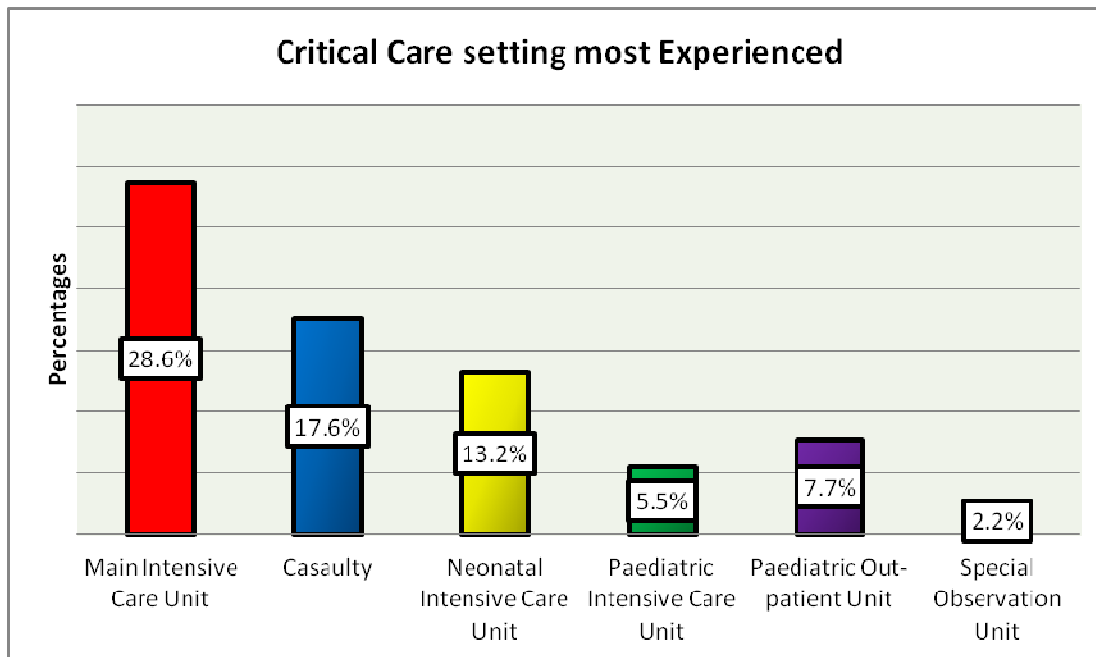


Figure 6: Critical area where you have the most experience (n =95)

According to Figure 6, most of the respondents (28%; n=26) had more experience in the main intensive care unit. A moderate percentage of respondents (17%; n=16) had most experience in casualty and Adult Medical Emergency Unit, 7.7% (n=7) had most experience in Renal Unit and Paediatric Out-patient Department, 5.5% (n=5) had most experience in Neonatal Intensive Care Unit and had most experience in neonatal intensive care unit. Minor percentage (4.2%; n=4) of the respondents did not answer the question.

4.3.2 DATA ON COMPETENCE LEVELS

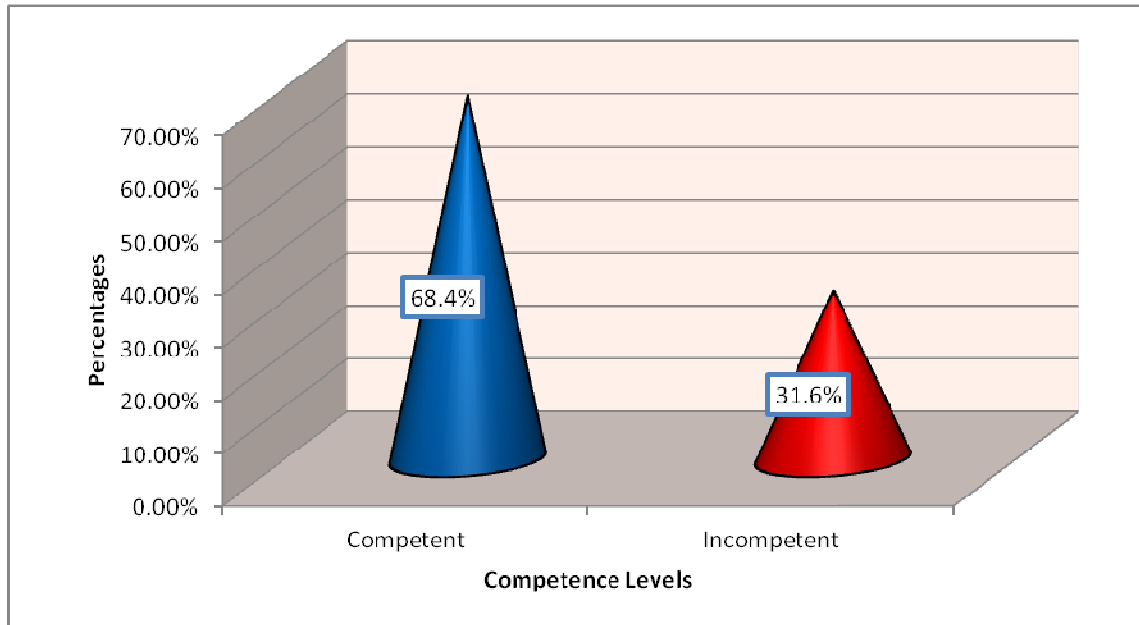


Figure 7: Respondents' competence levels

According to Figure 7, most of the respondents 68.4% (n=65) were competent in the care of the critically ill patient and 31.6% (n=30) were incompetent.

4.3.3: Factors Identified to Influence Critical Care Nursing Competence

Competence in critical care nursing settings reflects nurses' clinical performance. It entails that "nurses' competencies" be linked to "patients' needs" (AACN Certifying Corporation, 2014). This is because each patient brings a set of unique characteristics to acute hospital setting, influencing nurses' competencies, (AACN Certifying Corporation, 2014; Gentile, 2012). The following critical care nurse variable's findings were presented and interpreted in relation to nurses' competence levels.

4.3.3.1 NURSES' KNOWLEDGE LEVEL

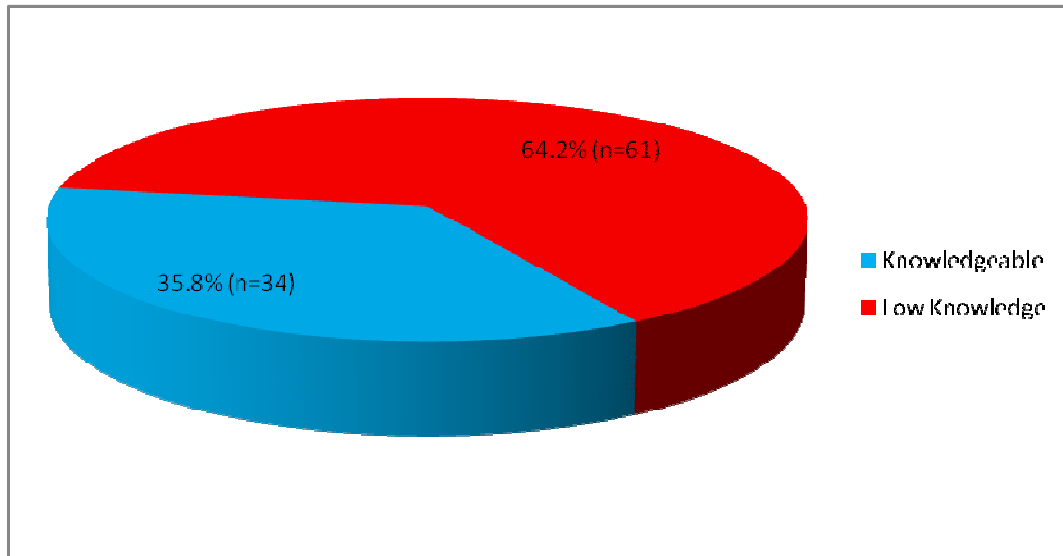


Figure 8: Respondents' knowledge levels (n=95)

In Figure 8, most of the respondents (64.2%; n=61) had low knowledge in critical care nursing practice. However, 35.8% (n=34) were Knowledgeable.

Respondents' scores on knowledge levels observed from their responses on specific physiological care areas of a critically ill patient is shown in Table 4 below.

Table 4: Summary results on Knowledge Levels from Three Clinical Vignettes

Vignette 1: Airway and Breathing Management; Score Summary (n=95)			
Question Number	Correct answers	Wrong answers & No Response	Level of knowledge
1	48	47	51%
2	37	58	39%
3	9	86	9%
4	12	83	13%
5	28	67	29%
Average level of knowledge on Vig. 1			28%
Vignette 2: Cardiovascular Management; Score Summary (n=95)			
Question Number	Correct answers	Wrong answers & No Response	Level of knowledge
6	25	70	26%
7	53	42	56%
8	26	69	27%
9	18	77	19%
Average level of knowledge on Vig. 2			32%
Vignette 3: Neurological Management Score Summary (n=95)			
Question Number	Correct answers	Wrong answers & No Response	Level of knowledge
11	13	82	14%
12	19	76	20%
13	15	80	16%
14	56	39	59%
15	9	86	9%
Average level of knowledge on Vig. 3			24%
Overall Knowledge level Scores among the respondents (n=95)			
Vignette No	Title of the Vignette	Total Average Score	
Vignette 1	Airway management	28%	
Vignette 2	Cardiovascular Management	32%	
Vignette 3	Neurological Management	24%	
Total Score		84%	
Average Score		28%	

Table 4 shows further analysis of the critical care nursing competency level among nurses caring for the acutely and critically ill patient, in order to determine respondents' general knowledge levels, using the three clinical vignette results. All the 3 mean scores results were lower than the set 75% confidence interval, indicating poor levels of competency. Therefore, Clinical vignette 1 on a patient with airway and breathing problems show that respondents had low knowledge levels with mean score of 28%. Clinical vignette 2 on a patient with cardiovascular problems shows that respondents also had low knowledge levels with mean score of 32%. Lastly, Clinical vignettes 3 on a patient with neurological problems show that respondents had low knowledge levels with mean score of 24%. The average score for all the 3 clinical vignettes was 28%. Therefore, critical care nursing competency level of nurses was poor in this study.

4.3.3.2: SKILLS FOR CRITICAL CARE NURSES

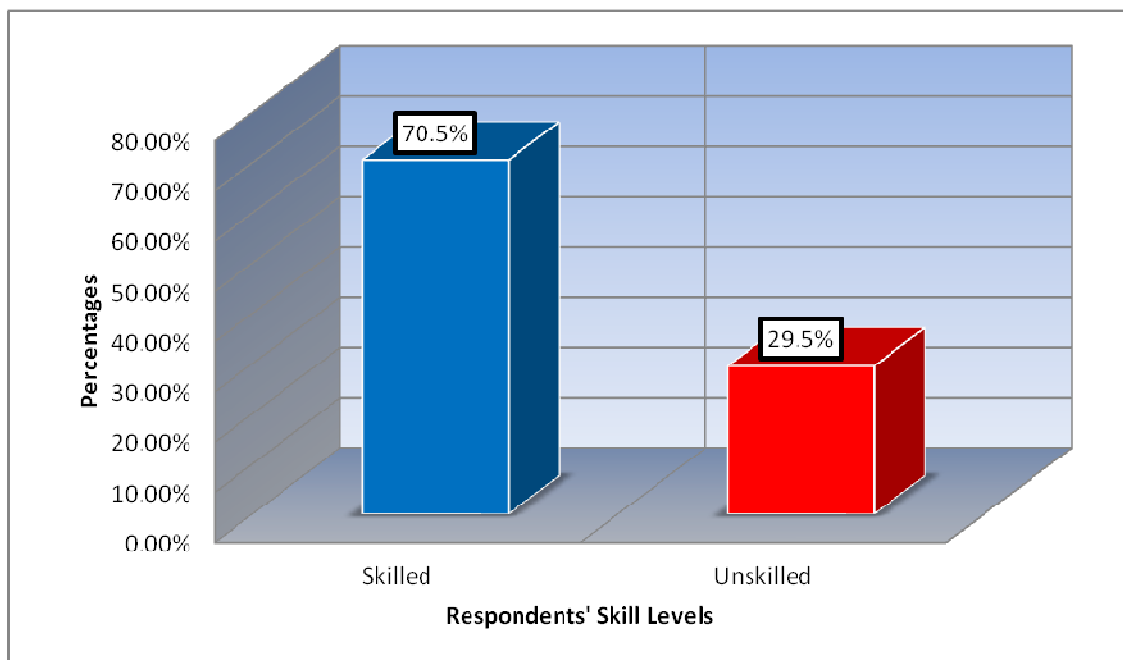


Figure 9: Respondents' skill levels (n=95)

In respect of critical care nursing skills, Figure 9 shows that 70.5% (n=67) of the respondents were skilled and 29.5% (n=28) were unskilled. The nurses' skill was to be intergrated with the technical knowledge of interpreting the physiological uses of the equipment found in critical care set-up during patient management. For the nurse to be deemed skilled in critical care nursing, one is expected to perform highly specialised procedures using equipments listed in Table 5 below.

Table 5: Critical Care Nursing Skill Level among nurses (n=95)

Critical Care Nursing Procedures	Strongly agree + Agree	Strongly Disagree, and Uncertain	Average Skill level
Use infusion pump	59	36	62%
Monitor critically ill patient on vasodilator medication	43	52	45%
Interpret arterial blood gases	37	58	39%
Manage patient on ventilator	52	43	54%
Demonstrate safe suctioning	72	23	75%
Carry out respiratory assessment	55	40	58%
Intubate	30	65	32%
Weaning patient from ventilator	35	61	37%
Extubation	39	56	41%
Cardiopulmonary resuscitation	56	39	59%
Read and interpret basic electrocardiogram	41	54	43%
Interpret laboratory test results	50	45	53%
Manage patient with traumatic brain injury	50	45	53%
Manage patient with endocrine emergencies	38	57	40%
Effectively carry out basic life support	68	27	72%
Manage renal inefficiencies	44	51	46%
Manage neonatal and paediatric emergencies	55	40	58%
		Average skill level	51%

Table 5 shows the level of skills with regards to care of critically ill patients among respondents, which was fairly good. The skill level among respondents was on average 51%, far below 75% the set confidence interval.

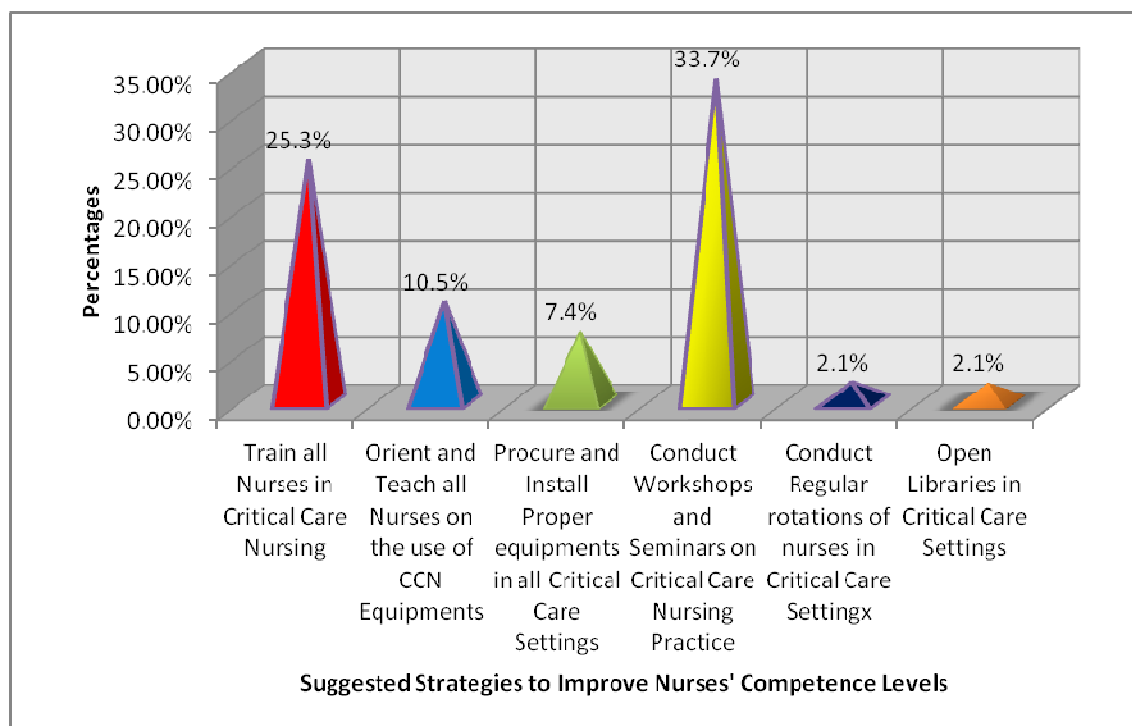


Figure 10: Suggested strategies to improve nurses' competence levels (n=95)

According to Figure 10, most of the respondents (33%, n=32) suggested conducting workshops, seminars and short courses in critical care nursing as strategies that can be used to improve nurses' competence levels. Other respondents who suggested training all nurses in critical care nursing practice to improve their competence levels were 25.3% (n=24). Those who suggested orienting and teaching new nurses on equipments used in critical care nursing practice to improve their competence levels were 10.5% (n=10). Other respondents who suggested procuring and installing ideal and proper critical care nursing equipment to help improve competencies were 7.4% (n=7). The other two groups who suggested conducting regular rotations of nurses to all critical care units and opening libraries in critical care units were 2.1% (n=2). However, the remaining 17.9% (n=17) of the respondents did not respond to the question.

4.3.3.2.1. Association between Variables

This section presents results of the relationship between the levels of critical care nursing competence levels and factors which influences acquisition of competencies among nurses. The Chi-Square correlation tests were used to establish the relationships between variables. There are nine (9) tables in this section. The first three tables show the relationships of competence with other variable, the second two shows the relationship of knowledge with demographic variables and the last four show the relation of skill with demographic variables.

4.3.3.2.1.1 Relationship between Demographics and Competence

Table 6: Relationship between Competency Level and Work Experience of Respondent (n=95)

Respondents' Competence Levels	Work Experience		Total	P value
	5 Years and Above	Below 5 Years		
>50 = Competent	26.2% (n=17)	33.3% (n=10)	28.4% (n=27)	0.471
<50 = Incompetent	73.8% (n=48)	66.7% (n=20)	71.6% (n=68)	
Total	100% (n=65)	100% (n=30)	100% (n=95)	

Table 6 shows that there was no association between competence levels of the respondents with their work experience. Further analysis found that there was no significant correlation between the two variables with a *P* values of $p=0.471$. The result may mean that experience has no influence on the level of competence among nurses caring for critically ill patients.

Table 7: Relationship between competency Level and Nurses' Qualification (n=95)

Respondents' Competency Levels	Nurses Categories by qualification		Total	P value
	Qualification in Critical Care	No Qualification in Critical Care		
>50 = Competent	13.8% (n=9)	86.2% (n=56)	100% (n=65)	0.027
<50 = Incompetent	0% (n=0)	100% (n=30)	100% (n=30)	
Total	9.5% (n=9)	90.5% (n=86)	100% (n=95)	

In Table 7, with respect to relationship between competency level and qualification, a significant statistical association was revealed. A correlation of P value of $p=0.027$ 1-tailed was observed. The finding implies that qualification in critical care nursing significantly influence competence levels among nurses.

Table 8: Relationship between Competence Levels and Knowledge (n=95)

Respondents' Competency Levels	Respondents' Knowledge Levels		Total	P value
	Knowledgeable	Low Knowledge		
>50 = Competent	46.2% (n=30)	53.8% (n=35)	100% (n=65)	0.001
<50 = Incompetent	13.3% (n=4)	86.7% (n=26)	100% (n=30)	
Total	35.8% (n=34)	64.2% (n=61)	100% (n=95)	

This result in Table 8 revealed that there was a significant relationship between knowledge and nurses' level of competence. Further analysis shows that a significant correlation existed with the P value of $p=0.001$, 1-tailed. The result implies that knowledge, significantly, influenced the levels of competence among nurses working in critical care units.

4.3.3.2.1.2 Relationship between Demographic Data, skill and Knowledge

Table 9: Relationship between Knowledge Level and Nurses' Qualification

Respondents' Knowledge Levels	Nurses' Qualification		Total	P value
	Has Qualification	No qualification		
Knowledgeable	100.0% (n=9)	29.1%(n=25)	35.8%(n=34)	0.000
Low Knowledge	0% (n=0)	70.9% (n=61)	64.2% (n=61)	
Total	100% (n=9)	100% (n=86)	100% (n=95)	

Table 9 shows that there is a significant association between knowledge and nurses' qualifications in critical care nursing. A statistical significant correlation between the two variables was observed with a P value of $p=0.000$, 1-tailed. The result may mean that knowledge influenced nurses' qualification and, ultimately, the nurses' level of competence. Therefore, training in critical care nursing is necessary to acquire specialised qualification superior to any other nursing field in order to be competent

Table 10: Relationship between Knowledge Level and Nurses' Work Experience (n=95)

Respondents' Knowledge Levels	Work Experience		Total	P value
	5Years and Above	Below 5 Years		
Knowledgeable	51.9%(n=14)	29.4%(n=20)	35.8% (n=34)	0.035
Low Knowledge	48.1% (n=13)	70.6% (n=48)	64.2% (n=61)	
Total	100% (n=27)	100% (n=68)	100% (n=95)	

The findings in Table 10 show that knowledge was associated to nurses' work experience. A significant statistical relationship was revealed with P value of $p=0.035$. The result implies that having a specialised education in critical care nursing and having acquired knowledge was influenced by experience for best comprehending patient care.

4.3.3.2.1.3 Relationship between Demographic, Skill and Competence Level.

Table 11: Relationship between Competence Levels and Skill (n=95)

Respondents' Competency Levels	Respondents' Skill Levels		Total	P value
	Skilled	Unskilled		
>50 = Competent	67.2%(n=45)	71.4%(n=20)	68.4% (n=65)	0.439
< 50 = Incompetent	32.8% (n=22)	28.6% (n=8)	32.6% (n=30)	
Total	100% (n=67)	100% (n=28)	100% (n=95)	

Table 11 results revealed that there was no significant association between competence and nurses' skill. Further statistical analysis show that nurses' skill did have any significant correlation with competence levels, with a *P* value of $p=0.439$, 1-tailed. The result implies that nurses' skill had no influence on critical care nursing competence levels.

Table 12: Relationship between Skill and Knowledge Levels (n=95)

Respondents' Skill Levels	Respondents' Knowledge Levels		Total	P value
	Knowledgeable	Low Knowledge		
Skilled	82.4%(n=28)	63.9%(n=39)	70.5% (n=67)	0.059
Unskilled	17.6% (n=6)	36.1% (n=22)	29.5% (n=28)	
Total	100% (n=34)	100% (n=61)	100% (n=95)	

Table 12 shows that nurses' skill in critical care nursing was not associated with their knowledge levels. The statistical analysis revealed that there was no significant correlation between nurses' skill in critical care nursing and levels of knowledge, with *P* value of $p=0.059$; 2-sided. The result implies that nurses' skills in critical care nursing did not influence their knowledge and, ultimately, the critical care nursing competence levels.

Table13: Respondents' Relationship between Skill Levels and Work Experience (n=95)

Respondents' Skill Levels	Work Experience		Total	P value
	5 years and Above	Below 5 years		
Skilled	77.8%(n=21)	67.6% (n=46)	70.5% (n=67)	0.329
Unskilled	22.2%(n=6)	32.4% (n=28)	29.5% (n=28)	
Total	100% (n=27)	100% (n=68)	100% (n=95)	

Table 13 shows that experience had no influence on nurses' skill and ultimately, the critical care nursing competence levels. Further analysis revealed that there was no significant correlation between experience in critical care nursing and the levels of skill with a P values of $p=0.329$. The result implied that nurses experienced in acute care units were less likely to be skilled. Furthermore, experienced did not influence critical care nursing skill and ultimately, no influence on nurses' competence level

Table 14: Respondents' Skill Levels and Nurse' Qualification (n=95)

Respondents' Skill Levels	Nurse categories by qualification		Total	P value
	Has Qualification	No qualification		
Skilled	55.6% (n=5)	72.1% (n=62)	70.5% (n=67)	0.301
Unskilled	44.4% (n=4)	27.9% (n=24)	29.5% (n=28)	
Total	100% (n=9)	100% (n=86)	100% (n=95)	

The result in Table 14 shows that nurses' qualification had no influence on their skills. Further analysis revealed that the current qualification of nurses had no significant correlation with nurses' critical care nursing skills, with a P value of $p=0.301$. The result implies that nurses' current skill did not significantly influence critical care nursing practice and, ultimately, competency levels were not significantly associated with their practice in critical care nursing.

4.3.3.3 Nurses Working Environment

This section presents results from the data obtained using an observation checklist evaluating the nurses' working environment, in the eight (n=8) sampled critical care units at University Teaching Hospital. The findings present a real-life-time insight of the effect of work environment on critical care nursing competencies, showing how current work environment influenced nurses' performance.

The data in this section was analysed using Microsoft Excel 2010 in quantitative form. In addition, a Logistic Regression Assumption was used to establish relationship among other identified and discussed variable. The data is presented in sixteen (16) tables, each pair of the tables show the status of work environment and the availability of ideal equipment in the stated unit necessary during the provision of specialised patient care.

4.3.3.3.1 Status of Nurses' Working Environment and Availability of Equipment

According to this study's findings, one-third of the visited units (38%; n=3) revealed nurses' normal establishment were 34, 40 and 80 members of staff respectively, three-third of the units (62%; n=5) did not disclose. The findings also indicate that 38% (n=3) of the units sampled had 12, 29 and 61 members of staff respectively on their establishments. However, 62% (n=5) of the units did not disclose information.

The result revealed that 26% (n=2) of the units had 1:1 nurse to patient ratio, 13% (n=1) had 1:17 and the other 13% (n=1) had 1:25. Furthermore, 13% (n=1) revealed that they had 1:3 nurse to patient ratio, 13% (n=1) had 1:4 and lastly 26% (n=2) did not reveal their nurse-patient ratio.

The following findings illustrate the state art of respective acute care units' working environment status and ward equipment availability observed from each of the 8 sampled units.

KEY	Yes and 1=	Implies the item in question is available
	No and 0=	Implies the item in question is lacking

Table 15: Status of Casualty working environment

Staffing	Yes	No
Current Establishment		0
Normal establishment		0
Nurse: patient Ratio	1:6	
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management		0
Resources		
Medical/surgical supplies	1	
Drugs		0
Basic patient observation in the previous 8 hours		
Respiratory Rate		0
Heart rate		0
oxygen saturation		0
inspired Oxygen Concentration		0
Blood Pressure	1	
Fluid Balance chart		0
Completed fluid balance sheet		0
Patient fed in the last 48 hours		0
Patient urine out-put recorded hourly		0
Available 'Early warning scoring system		0

Table 15 above shows that casualty Unit has nurse: patient ratio of 1:6. The nurses in the unit checked only 10% of all the basic patient parameters in the first 8 hours.

Table 16: Status of ward equipment availability in Casualty Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray	1	
Oximetry	1	
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder	1	
Ambu bag	1	
Face masks	1	
Nasal cannula	1	
Endotracheal tubes	1	
Intubation trolley		0
Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion	1	

Stethoscope and Sphygmomanometer	1	
Infusion pump	1	
Cardiac monitor	1	
12 lead ECG apparatus	1	
Defibrillator	1	
Functional Glucometer	1	
Rechargeable batteries and charger		0
Lumbar puncture set and needles		0
Steam tent or kettle		0
Refrigerator	1	
Mobile operating lamp	1	
6-electrical sockets	1	
Bed with movable head section	1	
Waterproof mattress	1	

Table16 shows that, Casualty Department has 70% of the basic equipment required during critical care nursing practice. However, other technologies used during critical care nursing practice were missing.

Table 17: Status of Neonatal Intensive Care Unit working environment

Staffing	Yes	No
Current Establishment		0
Normal establishment		0
Nurse: patient Ratio	1:1	
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management	1	
Resources		
Medical/surgical supplies	1	
Drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory Rate	1	
Heart rate	1	
Oxygen saturation	1	
inspired Oxygen Concentration	1	
Blood Pressure		N/A
Fluid Balance chart	1	
Completed fluid balance sheet		0
Patient fed in the last 48 hours		0
Patient urine output recorded hourly		N/A
Available 'Early warning scoring system	1	

Table 17 shows that Neonatal Intensive Care Unit has a 1:1 nurse: patient ratio. It also shows that most of the basics requirements for critical care nursing practice are available. Furthermore, the table shows that nurses on the unit did carryout 75% of the basic patient observations.

Table 18: Status of ward equipment availability from Neonatal Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray		0
Oximetry	1	
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder		0
Ambu bag	1	
Face masks	1	
Nasal cannula	1	
Endotracheal tubes	1	
Intubation trolley	1	
Functional Mechanical ventilators	1	
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion		0
Stethoscope and Sphygmomanometer		N/A
Infusion pump	1	
Cardiac monitor	1	
12 lead ECG apparatus		0
Defibrillator		0
Functional Glucometer	1	
Rechargeable batteries and charger	1	
Lumbar puncture set and needles		0
Food liquidifier		0
Steam tent or kettle		0
Refrigerator		0
Mobile operating lamp		0
6-electrical sockets		0
Bed with movable head section		0
Waterproof mattress		0

Table 18 shows that only 45% of the equipment needed for patient in Neonatal Critical Care Unit was availability.

Table 19: Status of Paediatric Intensive Care Unit working environment

Staffing	YES	NO
Current Establishment		0
Normal establishment		0
Nurse: patient Ratio		0
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management	1	
Resources		
Medical/surgical supplies	1	
Drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory Rate	1	
Heart rate	1	
oxygen saturation	1	
inspired Oxygen Concentration		0
Blood Pressure	1	
Fluid Balance chart	1	
Completed fluid balance sheet	1	
Patient fed in the last 48 hours	1	
Patient output urine recorded hourly	1	
Available 'Early warning scoring system	1	

Table 19 shows that nurse: patient ratio was not disclosed and nurses did 90% of the basic patient observation on the Paediatric Intensive Care Unit in the first 8 hours.

Table 20: Status of ward equipment availability in Paediatric ICU

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Oximetry	1	
Complete and functional Diagnostic Set	1	
Functional Oxygen cylinder	1	
Ambu bag	1	
Face masks	1	
Nasal cannula	1	
Endotracheal tubes	1	
Intubation trolley	1	
Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion	1	
Stethoscope and Sphygmomanometer	1	
Infusion pump	1	

Cardiac monitor	1	
12 lead ECG apparatus		0
Defibrillator	1	
Functional Glucometer	1	
Rechargeable batteries and charger	1	
Lumbar puncture set and needles	1	
Steam tent or kettle		0
Refrigerator	1	
Mobile operating lamp		0
6-electrical sockets	1	
Bed with movable head section	1	
Waterproof mattress	1	

Table 20 shows that Paediatric Intensive Care Unit had 83% of the basic equipments needed during critical care nursing practice.

Table 21: Status of Paediatric Out-Patient Unit working environment

Staffing	Yes	No
Current Establishment		0
Normal establishment		0
Nurse: patient Ratio	1:17	
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management		0
Resources		
Medical/surgical supplies		0
Drugs		0
Basic patient observation in the previous 8 hours		
Respiratory and Heart rates		0
oxygen saturation		0
Blood Pressure		0
Fluid Balance chart	1	
Completed fluid balance sheet	1	
Patient fed in the last 48 hours		0
Patient urine output recorded hourly		0
Available 'Early warning scoring system	1	

Table 21 shows that Paediatric Out-patient Unit had a nurse: patient ratio of 1:17. It also shows that only 30% of the basic patient parameters were done.

Table 22: Status of Ward equipment availability in Paediatric Out-patient Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray		0
Oximetry		0
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder	1	
Ambu bag	1	
Face masks	1	
Nasal cannula	1	
Endotracheal tubes		0
Intubation trolley		
Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion	1	
Stethoscope and Sphygmomanometer	1	
Infusion pump		0
Cardiac monitor		0
12 lead ECG apparatus		0
Defibrillator		0
Functional Glucometer	1	
Rechargeable batteries and charger	1	
Lumbar puncture set and needles		0
Steam tent or kettle	1	
Refrigerator	1	
Mobile operating lamp		0
6-electrical sockets	1	
Bed with movable head section	1	

Table 22 shows that Paediatric Out-patient Department had 50% of the equipment required for critical care nursing practice.

Table 23: Status of Main Intensive Care Unit working environment

Staffing	Yes	No
Current Establishment	29	
Normal establishment	40	
Nurse: patient Ratio	1:1	
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management	1	

Resources		
Medical/surgical supplies	1	
Drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory Rate	1	
Heart rate	1	
oxygen saturation	1	
inspired Oxygen Concentration	1	
Blood Pressure	1	
Fluid Balance chart	1	
Completed fluid balance sheet	1	
Patient fed in the last 48 hours	1	
Patient urine output recorded hourly	1	
Available 'Early warning scoring system		0

Table 23 shows that Main Intensive Care Unit had a nurse: patient ratio of 1:1 and most of the basic observations (90%) were obtained and recorded.

Table 24: Status of ward equipment availability in Main ICU

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray	1	
Oximetry	1	
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder	1	
Ambu bag	1	
Face masks	1	
Nasal cannula	1	
Endotracheal tubes	1	
Intubation trolley	1	
Functional Mechanical ventilators	1	
Completely Tracheostomy tray set	1	
Accessories for intravenous catheter insertion	1	
Stethoscope and Sphygmomanometer	1	
Infusion pump	1	
Cardiac monitor	1	
12 lead ECG apparatus	1	
Defibrillator	1	
Functional Glucometer	1	
Rechargeable batteries and charger		0
Lumbar puncture set and needles		0
Steam tent or kettle		0

Refrigerator	1	
Mobile operating lamp	1	
6-electrical sockets	1	
Bed with movable head section	1	
Waterproof mattress	1	

Table 24 shows that Main Intensive Care Unit had 90% of the equipment ideal for critical care nursing practice.

Table 25: Status of Adult Medical Emergency Unit working environment

Staffing	Yes	No
Current Establishment		0
Normal establishment		0
Nurse: patient Ratio	1:25	
Office Displays		
Presence of Emergency Phone call line	1	
Protocol on patient management		0
Resources		
Medical/surgical supplies	1	
Drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory and Heart Rate		0
oxygen saturation		0
Blood Pressure		0
Fluid Balance chart	1	
Completed fluid balance sheet		0
Patient urine output record hourly		0
Patient fed in the last 48 hours		0
Available 'Early warning scoring system		0

Table 25, shows that the nurse: patient ratio for Adult Medical Emergency Unit was 1:25 and 10% of the basic parameters on the patient were done.

Table 26: Status of Ward equipment availability in Adult Medical Emergency Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray		0
Oximetry		0
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder	1	
Ambu bag	1	

Face masks	1	
Nasal cannula		0
Endotracheal tubes	1	
Intubation trolley		0
Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion		0
Stethoscope and Sphygmomanometer	1	
Infusion pump	1	
Cardiac monitor	1	
12 lead ECG apparatus		0
Defibrillator	1	
Functional Glucometer	1	
Rechargeable batteries and charger	1	
Lumbar puncture set and needles		0
Steam tent or kettle	1	
Refrigerator	1	
Mobile operating lamp		0
6-electrical sockets		0
Bed with movable head section		0
Waterproof mattress	1	

Table 26 shows that Adult Medical Emergency Unit lacked ideal equipment required for critical care nursing practice. The unit only had 73% of the required equipment.

Table 27: Status of Special Observation Unit (Labour Ward) working environment

Staffing	Yes	No
Current Establishment	61	
Normal establishment	80	
Nurse: patient Ratio	1:4	
Office Displays		
Presence of Emergency Phone call line		0
Protocol on patient management	1	
Resources		
Medical/surgical supplies and drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory Rate	1	
Heart rate	1	
oxygen saturation		0
inspired Oxygen Concentration		0
Blood Pressure	1	
Fluid Balance chart	1	

Completed fluid balance sheet		0
Patient fed in the last 48 hours		0
Patient urine output recorded hourly		0
Available 'Early warning scoring system		0

Table 27 shows that Special Observation Unit in Labour Ward had 1:4 nurse: patient ratio. Very few basic patient parameters (40%) were recorded in the first 8 hours of admission.

Table 28: Status of ward equipment availability in Special Observation Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray		0
Oximetry		0
Complete and functional Diagnostic Set	1	
functional Oxygen cylinder		0
Ambu bag	1	
Face masks	1	
Nasal cannula		0
Endotracheal tubes		0
Intubation trolley		0
Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion		0
Stethoscope and Sphygmomanometer	1	
Infusion pump		0
Cardiac monitor		0
12 lead ECG apparatus		0
Defibrillator		0
Functional Glucometer	1	
Rechargeable batteries and charger		0
Lumbar puncture set and needles		0
Steam tent or kettle		0
Refrigerator	1	
Complete set of Rigid bronchoscope		0
Mobile operating lamp		0
6-electrical sockets		0
Bed with movable head section		0
Waterproof mattress	1	

Table 28 shows that only 27% of the standard equipment required during practice in the critical care nursing were available in the Special Observation Unit in Labour Ward.

Table 29: Status of Renal Unit working environment

Staffing	Yes	No
Current Establishment	34	
Normal establishment	8	
Nurse: patient Ratio	1:3	
Office Displays		
Protocol on patient management	1	
Presence of the Emergency Phone call line		0
Resources		
Medical/surgical supplies and drugs	1	
Basic patient observation in the previous 8 hours		
Respiratory Rate	1	
Heart rate	1	
oxygen saturation	1	
Blood Pressure	1	
Fluid Balance chart	1	
Completed fluid balance sheet	1	
Patient fed in the last 48 hours and		0
Patient urine output recorded hourly		0
Available 'Early warning scoring system	1	

The Table 29 shows that the nurse: patient ratio for Renal Unit was 1:3. The table also shows that nurses in the unit recorded 88% of the important parameters required to be observed on a patient in the first 8 hours to detect early deteriorating patient condition.

Table 30: Status of ward equipment availability in Renal Unit

Ward Equipment Availability	Yes	No
Suction machine and suction tubes	1	
Suction tray		0
Oximetry		0
Complete and functional Diagnostic Set		0
functional Oxygen cylinder	1	
Ambu bag	1	
Face masks		0
Nasal cannula	1	
Endotracheal tubes	1	
Intubation trolley		0

Functional Mechanical ventilators		0
Completely Tracheostomy tray set		0
Accessories for intravenous catheter insertion	1	
Stethoscope and Sphygmomanometer	1	
Infusion pump		0
Cardiac monitor	1	
12 lead ECG apparatus		0
Defibrillator		0
Functional Glucometer	1	
Rechargeable batteries and charger		0
Steam tent or kettle		0
Refrigerator	1	
Mobile operating lamp		0
6-electrical sockets		0
Bed with movable head section	1	
Waterproof mattress	1	

According to Table 30, Renal Unit lacked ideal equipment required for standard critical care nursing practice, with only 40% of the equipment available.

The findings from the observation checklist revealed that half of the units (50%) had unacceptable nurse: patient ratios (Tables 15, 19, 21 and 25). At the same time, half of the units (50%) had omitted taking and recording basic parameters on critically ill patients in the first 8 hours, leading to failures in recognising clinical deteriorating condition (Tables 15, 21, 25 and 27). The result also found that none of the identified units had 100% ideal equipments needed for the optimal critical care nursing practice. The result shows that half of the units (50%) had critical care nursing practice equipment less than 50% or less (Tables 18, 22, 28 and 30). However, majority (71.4%) of the nurses had most experience in these units which lacked ideal equipment (Figure 7). Therefore, during the time of the study, nurses' practice was not directed by patients' needs, leading to the provision of suboptimal care.

4.4 Conclusion

This Chapter presented the findings of the study. The results showed an average competence of 68.4% amongst the nurses working in critical care units. Most (90.5%; n=86) had no qualifications in critical care nursing, hence, they had inadequate knowledge 64.2% (n=61).

Nurses were skilled in carrying out specific procedures in critical care set-up. Years of experience revealed to have had no influence on the levels of competence demonstrated by the *P* value of $p=0.471$. Nurses' skill was not congruent with their level of competence and knowledge. Categories of nurses by qualification were in contrast with their competence. This deceived nurses to perceive themselves as competent, when they were not.

Nurses' working environment had little influence on nurses' competence. Although nurses felt that well equipped unit would improve their competence. The opinion was not congruent with their level of competence.

CHAPTER FIVE

5.0 DISCUSSION OF FINDINGS

Chapter five of this study presented the discussion of the results and limitations of the study. It will also have the recommendations and conclusions of the study.

5.1 INTRODUCTION

The purpose of the study was to evaluate the critical care nursing competence level among nurses working in critical care areas by determining nurses' critical care competence levels and establish factors which influence nurses' competence level. This chapter presents a discussion of data obtained from respondents through self-administered clinical vignette questionnaire at the University Teaching Hospital from December, 2014 to January, 2015. An observation check list was used as a data collection tool to evaluate the real working environment for the respondents and show how working environment impact has on critical care nursing practice.

5.2 DEMOGRAPHIC DATA

5.2.1 Influence of sex and age on critical care competence levels

Most (80%) of the respondents sampled were females. This could be attributed to the fact that from time in memorial, nursing was perceived to be women career. This may be the reason why more women were sampled than men.

The study shows that on average the respondents were aged between 20 and 30. Majority of the respondents (38.9%) sampled were young and probably newcomers to the high dependent units. This is in agreement with Msidi, (2010) who reported that most of the newly qualified general nurses falling on this aged group are posted to critical care units.

The results of the study showed that regardless of sex and age, nurses working in the critical care setting had inadequate competencies in critical care nursing practice. Therefore, it may be suggested that, in future, nurses to be posted to high dependent units should be provided with specialised education in the critical care nursing to improve their competencies.

5.2.2 Influence of Nurses Qualification on Competence Level

Majority of the respondents (90.5%) had no qualifications in critical care nursing and only 9.5% had. However, it was observed that nurses' qualification had a significant influence on critical care nursing competence levels ($p=0.027$, 1-tailed). This is evident enough to show that specialised qualification in critical care nursing is necessary for competence acquisition. However, Msidi, (2010) and Armitage, (2007) argued that lacking of critical care nursing qualifications resulted from lack of education in this field of nursing. On the hand, DeMYSTIFIED, (2013) report suggests that non-trained nurses in critical care nursing must be offered pre-ceptor internship. In line with this study, posting of nurses without orientation in critical care nursing practice, may have contributed to high incidence of mortality in critical care areas (98%) observed from critical care units in 2013 at UTH (HIMS, 2013).

Thomson, et al. (2007) and Armitage, (2007) stress that nurses without critical care nursing specialty qualification, provide suboptimal quality of care. While Botha, (2012) argued that non-qualified nurses were only useful to make up for the nursing staffing levels in the units and merely to provide basic nursing care. The qualified and competent critical care nurse could be defined as "a nurse who is able to make autonomy decisions, empowered to make quick clinical judgments and engage into critical thinking on patient's clinical condition (Gawande, 2009). In line with this study, inability to take such tasks implies that the nurse is incompetent. This mean that nurses took patient observations, recorded them, however, they were not able to make quick autonomous decision to initiate treatment.

They waited for the clinicians' or doctors' opinion, delaying treatment. This is because "they get so complacent" (Fletcher, et al. 2007) with their practices. Hence, they need the specialised training in this field.

The mixed categories of nurses working in critical care unit makes it difficult to know which category of nursing qualification was more incompetent than the other, if specialty qualification was ignored. According to Botha, (2012), Enrolled Nurses' training background was unlikely to prepare nurses to acquire the competence levels congruent to critical care nursing levels of competence. They are assumed to offer suboptimal care, which may be catastrophic to patient outcome. Canadian Association of Critical Care Nurses cited in Botha, (2012) disputes the allocation of non-qualified critical care nurses to provide direct care to the critically ill patients. It is acceptable that care be delivered by specialized nurses in critical care nursing to help reduce mortality in critical care units.

It is crucial to note that posting qualified critical care nurses to critical care unit is an important intervention to ensure competent practice. PENN, (2013) acknowledges that qualification in critical care nursing lead to competence acquisition and optimal patient outcome. This is because critical care nurses are able to interpret the deteriorating basic observations from the patient's core physiological care areas and respond immediately by starting treatment (GULLO, 2005; Sprigings and Chambers, 2008; Karthika, 2011; Thomson et al, 2007). According to literature review and findings of this study, it could be suggested that, specialised education in critical care nursing be provided to all nurses posted to acute care units in a hospital.

5.2.3 Influence of nurses' position in the critical care unit and requirement to take charge on Competence

It was observed that most nurses (75.8%) who offered bedside nursing care had never held any responsible position in critical care units. Cullinate, et al. (2005) and Chase (2010) suggest that influential positions held by nurses in the clinical practice builds

their abilities to make independent decisions, to quickly stabilize deteriorating patient's physiological parameters. However, there was no evidence found on the influence of nursing position in critical care units on nurses' competence level. The highly recommended factor to improve the competence levels for nurses is offering them with specialty education in critical care nursing (Frost and Wise, 2007, Armitage, 2007; Thomson, et al. 2007).

5.2.4 Influence Undertaking Short Courses in Critical Care Nursing on competence

The majority of the reviewed studies (Critical Care Networks-National Nurse Lead, 2012; Sun, et al. 2012; PROMED Agency, 2013 and Resuscitation Council (UK), 2004) favour the use of short courses and clinical drills to improve critical care nursing practice, but the results were contradictory. It is notable that most of the respondents (65.5%) had not undertaken any short course in critical care nursing. Some studies suggest that undertaking short courses and orientation programs in critical care nursing were effectiveness strategies of enhancing nurses' practice (DeMYSTIFIED, 2011; PENN, 2013). Therefore, it is recommended that short courses like Basic Life Support, Advanced Life Support, Trauma Management, Emergence Care, Emergence Response and many more be offered to all nurses working in critical care units. Involvement of all nurses in the critical care units may be more easily achieved in improving nurses' performance.

The effectiveness of short courses in empowering nurses with basic critical care nursing competencies is that it prevents them from mismanaging critically ill patients during the "Golden Hour" of their illness (Mallett, et al. 2013). The "Golden Hour" is the periods during which a patient is more vulnerable, such as, at the onset of illness, during surgical or medical interventions and during recovery from critical illness (Thomson, et al. 2007; McCormick, et al. 2012; Armitage, 2007). This study finding implies that the best strategy, to be used to improve non-qualified nurses' performances is organizing short courses to stimulate their competence levels. This is because, it costly and unprofessional to send all of them at once for training.

5.2.5 Nurses opinion in receiving support for managing an emergency and competence development

Support given to nurses during the management of a critically ill patient reduces their delays in implanting treatment (Frost and Wise, 2007; Thomson, et al. 2007). Armitage, (2007); Thomson, et al. (2007) and Fletcher, et al. (2007), affirms that logistical support offered to nurses in times of emergency, encourage them to make an active contributions towards patient survival.

However, when an inquiry was made on whether nurses received logistic support during the management of an emergence, most of the nurses (61.1%) affirmed that they did not receive support. Only 38.9% agreed having received support during the management of a patient with an emergency. This finding could attribute to the non availability of logistic resources need to help nurses perform.

This study established that most nurses in the critical care units did not receive logistic support, needed when implementing treatment on a patient with deteriorating clinical condition. The result further shows the institution do not provide the logistic support to nurses that assists them to respond on time to patients' physiological instability and assure patient's subsequent survival. The current situation compromises nurses' practice.

Armitage, (2007) and McCormick, et al. (2012), argue that providing logistic support to nurses during the management of a patient with unstable condition, improved survival of patients treated in critical care settings. It has further been attributed to improvements in the processes of care, rather than the introduction of individual therapies or diagnostic modalities. Provision of incentives like an emergence line for calling for help early, offering training and skills development programs and ensuring that appropriate drugs and equipment are available is essential for preventing subsequent cardiopulmonary arrest and to reduce mortality.

This study result has demonstrated that offering logistic support to nurses during the emergency care to critically ill patient, alone, had no significant association with nurses' critical thinking and competence levels.

5.2.6 Nurses' Experience and Competence

Critical care setting with ideal equipment from which nurses had most experience years of work was believed to enhance nurses' skill. Thapa, (2013) affirms that experience in a particular critical care setting simulates the nurse to build the knowledge and help refine their psychomotor skills to enhance competence development. Furthermore, Synergy Model and the two theories (Benner and Bloom) (AACN Certifying Corporation, 2014; Polinsky and Hillery, 2013) observed that nurse's competence improvement was enhanced by working for sometime in an environment with ideal equipments. These nurses learn to use available and ideal equipment in relation to patient's needs. However, there was no evidence supporting the influence of experience on critical care nursing competencies ($p=0.471$).

Surprisingly, majority of nurses (28.6%) had more experience in Main Intensive Care Unit, although, only 9.5% of them were critical care nurses. It was encouraging to note that non-trained critical care nurses with experience in Main Intensive Care Unit, assisted in providing basic nursing care to patients. This indicates that exposing nurses to ideal critical care environment stimulates critical care practice and improves performance.

Gawande, (2009) observed that the challenge of patient safety in acute care setting was to be addressed by bringing together the expertise of specialists to ensure safety care. Therefore, experience without expertise in critical care nursing education, influenced unsafe competence levels. As such competence based on nurses' experience cannot be substantiated.

Lakanmaa, (2013) argues that nurses with long experience in general nursing practice provide quality patient care when posted to critical care areas. DeMYSTIFIED, (2013) report, states that nurses' experience in a general nursing ward was important for quality of practice. This is contrary to the findings of this study which show that few nurses (26.3%) had worked for 3-5 years in general nursing wards prior posting to critical care areas. This may be due to the fact that majority of the nurses had less years of experience working in general wards before being posted to critical care units. Others were posted directly to the critical care units upon graduating as general nurses. This finding is in agreement with Msidi, (2010) who observed that most nurses in the critical care units lacked critical care nursing competencies. However, the result contradicts with Armitage, (2007) who recommends that trained and experienced staff in critical care should deliver care in acute care units.

Botha, (2012) and PROMED Agency, (2013) disputed the fact that experience could significantly influence critical care nursing competencies. The two authors argue that years of experience without formal training in critical care nursing was not varied. They recommended that nurses should be offered specialised education to enable them interpret and explain patients physiological needs, laboratory results and parameters on the equipment used to support critically-ill patients' failing organs.

Furthermore, the competence based on experience does not promote critical thinking, advocated for in the Synergy model. Botha, (2012) argues that nurse with this type of competencies results into being too rigidly and procedure oriented, regardless of the individual patient condition. These nurses tend to develop a "one size fits all" program of care in contrast to individualized care (Perrie, 2009), signifying the inadequacies in the care provided. However, these nurses are allowed to care for critically ill patients who entirely depend on the nurses' cognitive articulation of physiological data presented. The most promising action to take to assist improve nurses' competence levels based on experience is to offer them education in critical care nursing field of practice (McCormick, et al. 2012).

5.3: CRITICAL CARE NURSING COMPETENCE LEVELS

The investigator sought to evaluate in-depth levels of competence in critical care nursing in relation to tasks assigned to nurses and diagnose the abilities in applying specialised knowledge and skill during clinical practice. The evaluation of competencies was done in respect to the integration of nurses' characteristics with patient's needs elaborated in the Synergy Model.

AACN Certifying Corporation, (2014), states that the Synergy model is ideal in guiding nurses' competencies and standards of practice in critical care settings. Armitage, (2007) states that staff caring for patients in acute hospital settings should have competencies in monitoring, measurement, interpretation and prompt response to the acutely ill patient appropriate to the level of care they are providing. Therefore, nurses affirmed to be competent by their knowledge and skill of engaging into critical thinking and making precise clinical judgments, base on patient clinical status.

This study established that 68.4% of the respondents were competent, despite 90.5% lacking critical care nursing qualifications. Armitage, (2007) argued that there is yet evidence to the contrary. This is may be as a result of the fact that nurses felt confident with the routine way of doing things and did not attach importance to clinical judgment during patient care (Fletcher, et al. 2007). Despite their claim to be competent, Armitage, (2007) affirmed that nurses mostly failed to recognise deteriorating patient condition or were unable to act upon it sufficiently and rapidly. Armitage, (2007) further argue that nurses' communication and documentation practices were often poor and provision of critical care expertise was delayed. The striking result is the complacent state in which nurses were, leading to inabilities in appreciating their deficits in performance. They did not realize that their practices "place the patient at risk" as they manipulated equipment settings without relating the actions taken to meaningful interpretations.

According to the Synergy Model in AACN Certifying Corporation, (2014), nurses are entrusted with patients' safety and are expected to make big autonomous decisions during "Golden Hour" of patients' unstable condition. However, findings in this study revealed that only 31.6% of the respondents agreed having been incompetent, admitting their limitations during patient care. It is interesting to know that these nurses actually took charge of the critical care unit on their shifts, though they were not up-to-date with technologies in critical care settings and still believed that they were knowledgeable in critical clinical practice.

Polinsky and Hillery, (2013) suggest that Benner and Bloom theories support the opinion that mere knowing how to operate equipment without clear understanding of how the equipments function in line with patient's physiological parameters did not make the nurse competent, but was unsafe. These nurses' practice was suboptimal (Chellel, et al. 2002). The nurses' opinion could be attributed to the fact that the environment where they worked may have been well equipped with high technology used in patient care. However, AACN Certifying Corporation, (2014) and Gentile, (2012) recommend that all nurses working in the critical care set-up ought to have specialised body of knowledge to proficiently care for patients with multiple health needs.

Studies by Thomson, et al. (2007), Gawande, (2008), Armitage, (2007) and Fletcher, et al. (2007) observed that health-care providers whose competencies depended on experience had a narrow scope of practice. This notion is in agreement with the statistical correlation result which revealed that experience never played any role in competence development ($p=0.314$). This may be due to the fact that nurses who depend on experience for their performances did not have appropriate education in critical care nursing practice. As such, "they don't know" their expected standard of practice. These nurses "did not know" that they had limited scope of practice. Therefore, even the nurses claiming to be competent (68.4%) could actually be incompetent, as they "did not know" that "they don't know". The danger of nurses with these levels of competence is inability to integrate patients' needs with nurses' practice. This compromises patients' safety.

Elliot, et al. (2007) spelt out the principles of critical care nursing which are in line with the Synergy Model for Patient Care that emphasizes on provision of training to develop competencies. This study revealed that 90.5% of nurses lacked appropriate qualifications for critical care nursing competence development. However, many scholars propose that nurses caring for critically ill patients should have appropriate competencies (Frost and Wise, 2007; Fletcher, et al, 2007; Armitage, 2007; Gawande, 2009). This indicates that risks like not checking and recording patients' observations, delaying or not recognising clinical deteriorating illness, delay in offering medical attention, use of inappropriate therapies or giving suboptimal care to patients, are posed on patient care.

Scribante and Bhagwenee, (2007) suggest having 75% competence levels for nurses caring for critically-ill patient. This study finding revealed a 68.4% competence level among nurses. This study finding could be attributed to lack of necessary critical care nursing education among respondents that was found to have significant influence on competence ($p=0.027$). Lakanmaa, (2013) and Botha, (2012) revealed that low competence levels 25% and 48%, respectively, among nurses caring for the critically ill patient are attributed to lack of specialised education. This study's result, whose competence levels for nurses were equally lower than the set competence indicator, is worrying.

The nurses' lack of an understanding on guidelines and strategies used for patients' identification of being at risk of clinical deterioration prevent them from attempting to use the actions for reducing harm and deaths (Armitage, 2007; Fletcher, et al. 2007; Thomson, et al. (2007). Therefore, specialty education in critical care nursing must be provided to all nurses posted to critical care units.

Botha, (2012) revealed that competence level among nurses without critical care nursing training was influenced by their misconceptions. Having majority of the nurses (68.4%) claiming to be competent, translates into poor nursing practice, since 90.5% of nurses lacked critical care nursing education.

Botha, (2012) reports that non-trained nurses had poor levels of competence in critical care nursing, though they were allowed to take care of critically-ill patients. However, this study result contradicts with Thomson, et al. (2007) and Frost and Wise, (2007), who recommend that nurses with excellent competence levels in critical care nursing offered best quality care to acutely ill patients. This is in the sense that these nurses have the superior knowledge base, required to draw conclusions from patients' recorded observations, act safely upon patient's parameters to prevent deaths. Literature review suggests that the problem of having nurses with poor competencies was that they are said to be too rigid and procedure oriented, regardless of the individual patient circumstances. They tend to develop a "one size fits all" program of patient care in contrast to individualized care (Botha, 2012; Perrie, 2009), advocated for by the Synergy Model.

Competence level among nurses was poor, far below the standards of critical care nursing practice, set by the General Nursing Council of Zambia and other regulatory bodies. It shows that nurses lacked the required depth of knowledge and skills (Gawande, 2009), leading to the delivery of suboptimal quality of care. This could be attributed to the revealed high prevalence of mortality cases in the critical care areas in 2013 at UTH (HIMS, 2013).

5.4 Factors Identified to Influence Critical Care Nursing Levels of Competence

Competencies in critical care settings relates to clinical practice and patient's "needs". Patient needs drive "nurses' levels of competencies", linked to nurses' multiple dimensions of practice employed for care of critically-ill patients (AACN Certifying Corporation, 2014). Nurses' dimensions in this study were derived from the Synergy Model which guides both patient and nurses characteristics.

Therefore, nurses' characteristics reflect the quality of nursing care offered to critically-ill patients, based on an integration of nurses' knowledge, skills and environment necessary to meet the needs of patient. The nurses' characteristics were discussed relating their influence on nurses' levels of competence.

5.4.1: Knowledge level from the clinical vignettes with its influence on competence

The levels of competence for nurses were assumed to be influenced by the knowledge in critical care nursing practice. Knowledge levels were categorized into two, knowledgeable with score of $\geq 37\%$ and low knowledge for scores of $\leq 36\%$. As a determinant of competence, knowledge levels were discussed with respect to performance and scores of nurses on three clinical vignettes. The clinical vignettes looked into the critical care areas for a critically-ill patient which are; the patent airway and breathing management for a normal post operative patient, cardiovascular management and neurological management. The questions included vignette 1: The most cause of agitation and restlessness in a post operative patient, choosing the most appropriate choice with regard to Synchronized Intermittent Mandatory Ventilation, selecting the one true statement regarding Pressure Support Ventilation, selecting one Incorrect statement regarding inhaled tidal volume and selecting one correct response regarding the correct sequence of weaning procedure. Vignette 2 questions included: naming the landmark for detecting Apical Pulse and Point of Maximum Intensity used during resuscitation, correct course of action to take during cardiopulmonary resuscitation, selecting the intervention to take for a patient with hypertensive crisis and calculating cerebral perfusion pressure.

Vignette 3 questions included; making a clinical diagnosis for head injury in relation to patient's clinical features, identifying an intervention used in managing increased intracranial pressure, choosing the pharmacological agent to treat raised intracranial pressure, identifying the action to take in managing increased intracranial pressure and selecting the cranial nerve being evaluated on doing corneal reflex. The knowledge vignette consisted of 14 questions. One question, 'question 10' was excluded because it had no correct response. The expected highest score was to be 14/14 (100%), once the obtained scores were aggregated into percentages.

The Synergy Model of Patient Care developed by the AACN Certifying Corporation, (2014) demands that nurses must have specialized knowledge in the care of critically ill patients to assist in harmonizing their competencies with the needs of the patient in a clinical unit. Frost and Wise, (2007), Thomson, et al. (2007), PROMED Agency, (2013) and Armitage, (2007), emphasize the importance that nurses must have knowledge in the patho-physiological set of numerical observations of the patient. Knowledge in the core care areas assists nurses to accurately take and record patients' observations, appreciate their relevance appropriately for correct courses of action. In addition, knowledge was found to have a significant association with critical care nursing competencies ($p=0.001$, 1-tailed). This result is in agreement with Armitage, (2007), Gawande, (2009) and Fletcher et al, (2007). On the other hand, the low knowledge levels (28%), obtained from the clinical vignette reveal that nurses' knowledge is in this study contradicted the recommendations from these scholars. This prevented respondents from understanding the relevance of the recorded patient observations and recognising deteriorating clinical condition.

The finding of this study further revealed that most respondents (64.2%) were knowledgeable in critical care nursing. Fletcher, et al. (2007) argues that staff in critical care settings, usually, takes patient observation so routinely, do not attach any importance to obtained numerical parameter and "*so they get unworried*" which clearly show that they lack knowledge in recognising critical illness in patients. Fletcher, et al. (2007)'s opinion of having knowledgeable nurses in critical care nursing, is not supporting this results, that yielded 28% knowledge levels. This result need to be addressed to improve nurses' knowledge.

The low knowledge level scores revealed in this study on each clinical vignette; vignette 1, vignette 2 and vignette 3, lower than the set competence indicator of 75%, thus 28% 32% and 24%, respectively is worrying, signifies that nurses had poor competencies in critical care. McCormick, et al. (2012) emphasizes the importance of nurses' abilities to recognise and respond to unstable individual patient's clinical circumstances. Therefore,

this finding suggests improving the current critical care nursing practice rather than endangering patients' safety.

The finding in this study revealed that there was a significant association between qualification and knowledge ($p=000$, 1-tailed). Lakanmaa, (2013) declare that incompetent nurses lack knowledge and skills required for taking actions to rapidly stabilize patients' condition. On the other hand, PROMED, (2013) and Kylvänen and Spasic, (2010) argue that poor levels of competence among nurses resulted from a lack of knowledge superior to initial Registered Nursing preparation. Furthermore, Fletcher, et al. (2007), argue that incompetence among practising nurses results from poor knowledge levels due to insufficient training to understand the relevance of observations, compromising the care delivered to the patient.

The result revealed that knowledge in critical care nursing is inseparable from special qualification one possesses. Thomson, et al. (2007)'s notion supports the opinion of having a superior body of knowledge that enables nurses to, effectively and quickly, interpret patient's parameters, make big decisions and take appropriate interventions to stabilize patient's condition.

According to Sprigings and Chambers, (2008) and Karthika, (2011) nurses without specialised knowledge in critical care nursing, were missing the characteristics that guided nurses' practice in a critical care set-up. It is interesting to take note that McCormick, et al. (2012) suggests that advanced knowledge in critical care nursing enabled the nurse to comprehend critically-ill patient's physiological reserves, noting any deviations from normal and, decisively, stabilize patient's deteriorating condition. Therefore, critical care nursing qualification developed from specialised body of knowledge is necessary for competencies that are safe for practice. This can only be achieved by providing specialised education to all nurses allocated to the critical care settings.

Fletcher, et al. (2007) indicates that consistently and effectively detecting and acting upon patient deterioration is a complex issue, as the nurse is expected to use a specialised body of knowledge over a period of time. This study, revealed that work experience and knowledge in critical care nursing had a significant association ($p=0.035$; 1-tailed). This indicates that gained specialty knowledge after training needed to be used over a period of time to improve critical care nursing practice. This is in the light of providing good nursing care (McCormick, et al. 2012).

McCormick, et al. (2012) observed that appropriate training, joined with experience, had a far greater impact on patient outcome in critical care than use of expensive, invasive equipment. This opinion indicates that undertaking training in critical nursing and experience enabled nurses to adopt an approach of integrating nursing competencies with patient needs (AACN Certifying Corporation, 2014). The notion implies that experience is useful for refining critical care nursing competencies. In addition, experience enable nurses to improve their competencies by using their knowledge and clinical judgment to recognise and respond appropriately early to deteriorating clinical condition.

AACN Certifying Corporation, (2014); Armitage, (2007) and GULLO, (2008) support the notion when saying that superior knowledge in critical care nursing, significantly, influence competency, as it enhances nurses' better understanding of deteriorating patients condition. This implies that advanced education beyond general nursing training is important to achieve standard critical care nursing competence levels. This finding also indicates that experience influenced critical care nursing competence level only if the nurse is trained. This enables nurses to provide timely and quality care to critically-ill patients during the "Golden Hour" of their healthcare continuum. In addition, experience obtained after training enables nurses, to promptly, progress unstable patient condition towards recovery (McCormick, et al. 2012).

5.4.2: Skills for Critical Care Nurses

Self reported responses on a Likert scale were given to the respondents to rate their ability to carry out specific critical care nursing procedures without supervision. Nurses' responses were quantified, aggregating to percentages. The maximum score was 64/64 (100%). The scores were further categorized into skilled ($\geq 41\%$) and unskilled (for $\leq 40\%$), to enable the evaluation of nurses' skill be successful. The set of procedures mostly done in critical care setting were obtained from PROMED, (2013) and Waters, (2004), presented in Table 5. The responses on the Likert scale provide the basis to determine the proficiency and confidence (competence levels) of nurses using effectively corrective interventions during the management of the critically ill patient.

Schroeter, (2008) argues that poor specialist skill levels among nurse in any area of practice impacts negatively on their levels of competence and practice. This study revealed that despites having majority of the nurses (70.5%) being skilled in carrying out specific critical care nursing procedures, skill itself, did not influence critical care nursing competencies ($p=0.439$; 1-tailed). However, PROMED, Agency (2013), Sun, et al. (2012), Elliot, et al. (2007) and Fletcher, et al. (2007) affirm that variations in performance among nurses caring for critically ill patients have implications on quality of care patients receives. This finding indicates that skill levels among nurses were not congruent with their competence levels. The Synergy Model for Patient Care in AACN Certifying Corporation, (2014) and Armitage, (2007) recommend that training of all nurses working in critical care units is important to ensure acquisition of in depth skills.

Armitage, et al. (2007); Mallett, et al. (2013); Chellel, I et al. (2002) and Botha, (2012), argue that allocating unskilled and incompetent healthcare providers during patients' "Golden Hour" of an illness results into provision of suboptimal care, contributing to about a third of the deaths among critically ill patients. This is in line with the findings of this study which clearly show that nurses had very low skill levels (51%), lower than the 75% competence indicator. Furthermore, the result revealed that unskilled nurses working in acute care units at UTH had contributed to mortality cases observed in 2013 (HIMS, 2013)

American Association of Critical Care Nurses, (2013); American Association of Critical-Care Nurse (2008); Critical Care Networks-National Nurse Lead, (2012) and Critical Care Nurses Association of The Philippines Inc. (2012) recommend that nurses in critical care units must performance in line with their level of competence, derived from a specialised body of knowledge. Yet there is evidence to the contrary in this study. Despite having promising result of 70.5% of nurses being skilled, most of them were not trained in critical care nursing (90.5%), indicating that the majority of the nursing staff (90.5%) did not have the in-depth skills required. This is affirmed by the low levels of skill (51%), signifying that 90.5% of them had in-adequate competence.

McCormick, et al. (2012) argue that quality of training offered in critical care nursing try to achieve a balance between making the theory relevant to workers in 'high-tech' equipment and achieving appropriate level of skills for use on more advanced equipment. This study revealed lack of an association between qualifications attained from a specialised education among nurses working in critical care nursing units with their skill ($p=0.301$, 2-tailed). This study finding show, clearly, that qualifications for nurses were not congruent with their skill. Water, et al. (2004); Karthika, (2011) and Kylmänen and Spasic, (2010) assert that skill based on special education among nurses caring for critically-ill patients it is very important, as opposed to having skill without qualification. This implies that special education is credible in assisting nurses refine their skills of detect patients' clinical observations deviating from normal ranges. To avoid nurses' practice using "trial and error," Frost and Wise, (2007); the College of Nurses of Ontario, (2014) and Kapu, (2011), declare that nurses must demonstrate skills in critical thinking and diagnostic reasoning for making clinical decision, prior to posting to critical care units. It is apparent that from this result, majority of the nurses (90.5%) lacked skills and required qualifications with respect to critical care nursing competencies. In additions, there was a mismatch between nurses' skill and competence level, which contributed to nurses' misconception on their competencies. This mismatch prevented nurses from knowing their limitations during practice and identifying early clinical deterioration in the patient.

Thomson, et al. (2007) points out that nurse's skills to carry out highly technical critical care nursing activities relates to knowledge, which in turn depicted nurses' competence. Interestingly, this study finding revealed that there was lack of significant association between critical care nursing skills and knowledge ($p=0.059$; 2-tailed). Armitage, (2007) affirm that nurses' knowledge in specialised field of practice made patients admitted to hospital, believe that they are entering a place of safety, where they, and their families, have a right to believe that they will receive the best possible care. At the same time, the UK Resuscitation Council, (2008) emphasize that performance of staff in critical care settings using available equipment must be related to critical care nursing knowledge. The findings of this study reveal that nurses' practice was not related to their knowledge levels. This result conflicts with the trust and confidence patients have in the nurse.

Furthermore, findings in this study indicates that majority of the nurses (65.3%) had not done any short course in critical care nursing practice, and most the nurses (63.9%) claimed to be skilled though they had low knowledge in critical care nursing. This finding may pose a great harm to patients' safety. This result conflicts with Schroeter, (2008) and Chipepo (2011)'s definition for competence, which entails that the nurse must perform successfully and efficiently, while incorporating the understanding of clinical situation and solve the problem using clinical judgment. McCormick, et al. (2012) and Frost and Wise (2007) argue, that low knowledge in operating equipment in critical care practice culminates into low level thinking which is grave for patient survival.

This study result show that nurses' skills were not associated with their work experience, despite their claims of being skilled ($p=0.329$). This finding point toward the misconception that nurses had with respect to critical care nursing competencies that they did not know that "they didn't know". Moeti, Van Niekerk, Van Velden, (2004) cited in Botha, (2012) reported similar misconceptions among the newly qualified registered nurses, who did not appreciate the need to have in-depth knowledge on how to recognise and respond to impending critical illness. This study established that when

nurse perform high technological procedures to the extent of integrating patient needs, they are more likely to reduce mortality in high dependent units.

Chellel, et al. (2002) point out that work experience without specialized education lead to the provision of suboptimal care. In addition, Scribante and Bhagwanjee, (2007) declare that nurses must continue learning to move along the competency-continuum scale towards expertise. This finding may be explained that experience had no significant on nurses' skill and ultimately, competence.

This study findings obtained the following Chi Square tests values of $P=0.0471$, $P=0.027$, $P=0.001$, $P=0.000$, $P=0.035$, $P=0.439$, $P=0.059$, $P=0.329$ and $P=0.301$. These results show the relationships between competence and experience, competence and qualification, competence and knowledge, knowledge and qualification, knowledge and experience, competence and skill, skill and knowledge, skill and experience and skill with qualification, respectively. This study result clearly affirms that relationship between competence levels with knowledge and qualifications in critical care nursing is statistically significant. However, the association between competence level with skill and experience was not significant.

This study finding demonstrated that any intervention to improve critical care nursing competence levels should consider using strategies that will improve nurses' in-depth cognitive and psychomotor aspects of nurses' practice, important to this specialty in nursing.

5.4.3 The Influence of nurses' Working Environment on Competence levels.

The working environment variable of study was evaluated to determine its influence on other variables under study in a Logistic Regression Analysis Model. Nurses' competence level was placed on the Y axis. Knowledge, skill, work experience and environment were placed on the X axis. The assumption of the Logistic Regression Model was assumed as the cause and effect relationship, where the function of the independent variable influenced its effects on the outcome. The evaluation was done to

detect the degree to which working environment influenced critical care nursing competence levels with the existence of other identified variables.

5.4.3.1 Status of the Working Environment

McCormick, et al. (2012) and Lakanmaa, (2013) stress that critical care units in the hospital are areas where the sickest patients are admitted for close monitoring and more aggressive organ support and therapy. Inherently, treatments in these units incur far higher costs than standard care, making them unachievable in many settings. Armitage, (2007) and McCormick, et al. (2012) emphasize that combination of high technological equipment and the staff expertise confers the most dramatic advantage of providing effective care to critically ill patients.

This study evaluated the basic parameters suggested by Armitage, (2007); PROMED Agency, (2013); Water et al, (2004) to constitute good nursing care in light of critical care nursing competencies. This meant having standards and locally agreed upon data concerning nursing establishments, presence of protocols and resources, recording of patients' multiple-parameters, thus respiratory rate, heart rate, oxygen saturation (SpO₂) and inspired oxygen percentage (FiO₂), blood pressure, presence of early warning scoring system, the feeding of patients and the recording of fluid intake and output collected to allow for graded response to be employed.

According to McCormick, et al. (2012); Waters, (2014); Critical Care Networks-National Nurse Lead, (2012); Thomson, et al. (2007); Critical Care Nurses Association of the Philippines Inc., (2012), the ideal nurse-patient ratio in critical care units ranges from 1:1 to 1:4 (in poor resource hospital units). This study findings show that only 50% of the units met the set standard of the nurse: patient ratio. This result showed clearly that, two of the units had nurse: patient ratio ranging from 1:17 and 1:25. This finding indicates that one nurse managed on average 25 critically ill patients per shift, which is not acceptable, as it induce poor performance among nurses.

According to the findings in this study, half of the units (50%) had evidence of 50% omissions on patient basic observations done in the first 8 hours. This specifies that basic observations on the sickest patients were not done for prolonged periods on admission.

Having omissions on basic observations on admission was in line with reports by Armitage, (2007); Frost and Wise, (2007); Thomson, et al. (2007); Fletcher, (2007), who observed that failures in recognising clinical deterioration and/or delay in initiating treatment on the sickest patients, was influenced by lack of initial parameters. Armitage, (2007) affirmed that poor nursing practices, observed in this study, were attributed to lack of training and skill development in critical care.

Frost and Wise, (2007) and Armitage, (2007) reports observed that use of local systems for detecting clinical deterioration help nurses identify hazards and evaluate why patients were being harmed, rather than helped. The striking result in this study is the lacking of “early warning scoring system” or “track and trigger systems” on half of the units (50%). Armitage, (2007) encourages the use of “track and trigger system” (“early warning scoring system”) to monitor, record and interpret patients’ observations, as it obliges nurses to use their knowledge and clinical judgment to make appropriate decisions in the light of the individual patient’s circumstances. McCormick, et al. (2012) claims that quality of training on local systems in nursing, impact on patient care. In line with the finding in this study, “track and trigger system” tempts longevity critical care nursing competencies among the non-trained critical care nurses to recognize and respond early to clinical deteriorating condition.

5.4.3.2 Availability of Equipments on Critical Care Units

McCormick, et al. (2012), PROMED Agency, (2013); Water et al, (2004), further, suggest that good critical care nursing practices may occur when ideal equipment is available and nurses are able to use it. This opinion mean that absence of the indicators identified in the unit contributed to poor critical care nursing performance.

This study revealed that only 75% of the units had required more ideal equipment for supporting the failing vital organs in critically ill patients. PROMED, (2013) and McCormick, et al. (2012) predicted that having well equipped working environment was good for enhancing nurses' competencies, dissimilar to the findings of this study.

The result shows that none of the acute units (100%) had all the ideal high technological equipment. McCormick, et al. (2012) and Chase, (2010) states that availability of ideal equipment on the work environment influenced nurses' understanding on the function of the equipment and its use during patient care. Furthermore, the result show that the current working environment compromised nurses' practice as most of them (90.5%) were not trained, and most of the acute units (100%) lack ideal art of technology necessary for use when supporting patients' failing vital organs. The current situation could have contributed to challenges faced by nurses in providing quality nursing care.

In agreement, Lakanmaa, (2013) and Smith, et al. (2007) affirms that competence in critical care nursing practice is associated with effectiveness and proficient manipulation of sophisticated equipment for care of critically ill patients. Polinsky and Hillery, (2013) and UK Resuscitation Council, (2004) adds that well stocked working environment enhance critical care nurses' understanding of the usage of available equipment safely, but only if the staff is trained. The striking finding is that half of the units (50%) had inadequate equipment, far below 50%, needed in critical care. DeMYSTIFIED (2013) states that it is important to restocked high dependent units without ideal equipment to prevent patient's death resulting from shortcomings in the safety of their care and improve nurses' practices.

At the same time, McCormick, et al. (2012), Thomson, et al. (2007) and Gawande, (2009) suggest that good nursing care in critical care units entails having basic set of essential equipment and laboratory tests need for adequately and safe care practice. In addition, Armitage, (2007) declare that it is important for trained and experienced nurses to obtain patient observations, as they understand their relevance, and act on them without delay. The findings of this study show that majority of nurses (90.5%) working in

the acute units lacked the critical care nursing qualifications, half of the units had 50% omissions of recording basic patient observation, the nurse: patient ratios were not acceptable for half of the units (50%) and all of the units (100%) lacked required technology for care of critically ill patients.

In addition, the result shows that right people to do the right things and right equipment to use on carrying out right interventions are not always available leading to poor competencies and unrealized limitation during practice among nurses. Therefore, nurses provide suboptimal care.

The findings of this study revealed that the competence levels for critical care nursing were strongly influenced by nurses' specialized qualifications and knowledge ($p=0.027$ and $p=0.001$, respectively). The statistical significant of the qualification with respect to knowledge in critical care nursing on competence development was very strong ($p=0.000$), implying that quality of knowledge was strongly associated with competence development in critical care nursing. This in line with Thomson, et al. (2007), who recommends that it is important to review local systems and improve critical care nursing competencies to help nurses be robust enough in their efforts to prevent, detect and treat decompensating patients. This study revealed that most nurses (90.5%) did not have the depth of knowledge and skills required for them to be competent in their practice. This finding suggests that nurses need training to be empowered with in-depth knowledge and skill to competently practice in critical care units.

5.5 Conclusion

This review of literature and research findings leads to a number of conclusions on the study. It is evident that most of the problems associated with an evaluation of critical care nursing competencies are technical, and are in line with lack of in-depth knowledge and skills. Hence, there is need for further investigations to give the study findings an attitude dimension's influence on critical care nursing competence levels.

6.0 IMPLICATIONS TO NURSING

6.1 Nursing Practice

Nurses with poor competence levels determined in this study, are taking charge of critical care units and making autonomous decisions in the management of critically ill patients while using highly challenging equipment. They engage into “trial and error” practice.

Category of nurses not trained or exposed to critical care nursing, for example, the Registered Nurses and Enrolled Nurses should not deliver direct care to the patient requiring support of their physiological functioning using equipments like ventilators and cardiac monitors. Otherwise, they require orientation in critical care practice to help out in the care of the patient.

Nurses caring for the critically ill patients should have ongoing clinical assessments with regard to their current critical care practice. They must be assessed by a senior member of staff who him/herself has been assessed as competent.

Patient turnover and acuity levels must be considered; and ensure that nurses with congruent knowledge and skills be allocated to care for critically-ill patient.

Guidelines and protocols for practice in high dependent units must be developed and implemented

The General Nursing Council of Zambia and the Ministry of Health must reconsider its stance on using Enrolled Nurses in the high dependent to combat the staff shortage.

6.2 Nursing Management

The nurse managers manning the critical care units must advocate for policy and guidelines for practice in critical care settings to be developed and implemented

Nurses not trained in critical care nursing, but offering bedside nursing must be closely supervised and taught the skill of critical care practice.

Nurses in critical care units must improve their own competence in critical care nursing by attending courses, congresses and in-service workshops in order that they remain up to date with new technologies and critical care practice strategies.

Unit managers must ensure that they provide proper supervision of the nurses caring for critical care ill patient, and be mindful of acuity levels and skill mix when allocating staff.

6.3 Nursing Education

Education prepares nurses to handle specialized patient cases. In order to ensure the safety of our patient in the critical care areas, nurses working in these units must undergo specialized training in critical care nursing practice.

All nurses not trained in critical care nursing must be taken through an orientation program to assist them acquire basic knowledge on patient management. At the same time, educational programs specific to care of critically ill patient must be organized and introduced into the clinical critical care settings.

Critical Care Nursing program lecturers and Critical Care setting Nurse Managers must be up to date with current clinical practice and critical care nursing technology.

Critical Care setting Nurse Managers must be trained in critical care nursing and their competence evaluated prior to be appointed to the post of Nurse Managers.

Competence Indicators for nurses undertaking assignments to the critical care units must be developed and made stricter, to be used as practical assessment tools prior nurses' posting to the critical care setting.

Continuing Professional Development should be instituted as a hospital based program, linked to appraisal and motivation policy. This system will motivate nurses to undertake more workshops in critical care nursing, ultimately, competence levels will improve.

6.4 Nursing Research

Other investigations can be done to address other issues influencing nurses' competency levels which were not looked into by this research.

This study may be expanded to a greater number of the nursing population within critical care settings in Zambia.

A similar study can be undertaken targeted on the Doctors and Nurses in the critical care nursing settings and the results compared.

The instrument used in this study requires to be further developed to improve validity and confirm reliability.

6.5. New issues in this study

The study revealed that:

- Most of nurses in critical care units lacked Critical Care Nursing qualifications
- Placement of nurses to sensitive and specialised Critical Care Nursing Units was contrary to UK Resuscitation Council, Critical Care Networks-National Nurse Lead, Critical Care Nurses Association of the Philippines Inc. and American Association of Critical-Care Nurses.
- Trained critical care nurses were found to have competency levels far below set competency indicator.
- Nurse: patient ratio were far beyond acceptable levels
- Most of unit had omitted recording all basic patient parameters on admission.
- All the acute units lacked required technology for use when supporting failing organs in critically ill patients.

6.6 Strength of the study

The major strength of the study is that by using different research methods to collect data, it was possible to identify and understand contributing factors to poor levels of critical care nursing competencies among nurses, which was the main goal of the project. Secondly, the research is acting as a base line data for future studies on critical

care nursing competency levels in Zambia. Lastly, the study will guide policy makers come up with strategies to improve critical care nursing competency levels at University Teaching Hospital.

7.0 LIMITATIONS OF THE STUDY

Limitations that constrained the effective conduct of the study were:

- i) The inability to recruit a representative sample size due to limited pool of the accessible study population.
- ii) Failure to cover a wide sample size because of financial and time limitation.
- iii) Inadequate time for the research project.
- iv) The respondents were administered the questionnaires to answer at their free time, contrary to research ethics. This was due to the fact that acute units are understaffed. Respondents could not stop carrying out their day to day tasks. This led to poor return rate of the answered questionnaires.
- v) Some questionnaires were wrongly filled in by the respondents. This was observed from the 20% of none completeness in the 12 returned questionnaires. This is attributed to the fact that most respondents stated the tool was difficult, different from the previous tools they were given and most questions did not relate to their current practice.

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

The review of literature and the research findings lead to a number of conclusions on the topic, which include;

The overall critical care nursing competency level discussed was poor. From literature review, there was no data to conclude that age, sex and work experience influenced critical care nursing.

Critical care nursing qualification was essential for competency development. From literature, qualifications in critical care nursing demonstrated an improved nurses' quality of care provision.

Position held in the critical care units had no evidence that it influenced competency levels. Furthermore, all other factors indicated chance variation relationships due to confounding situations that exist in the critical care set-up, but were refuted by the statistically tests.

Undertaking short courses in critical nursing is a promising strategy for improved practice among non-trained critical care nurses, but is not as yet an evidence-based intervention for competency development.

There is evidence that knowledge in critical care nursing influenced competency levels. If critical care nursing service is provided by an experienced and trained nurse, the care is beneficial for patients with critical illness.

The description of self-reported skills is difficult. Though it seems obvious in critical care settings, mere performing of tasks does not conclude the correct competency level. It was established that nurses had misconceptions with their skills in critical care nursing. For non-trained nurses in a specific field of practice, there is very little research available on the effectiveness of other factors to influence competency levels and thus, conclusions made that they must undergo formal training.

8.2 Recommendations

Arising from the study are the following recommendations:

- All nurses working in high dependent units must undergo a Post Graduate training in Critical Care Nursing to enable them provide highly specialised practice.
- In areas where Doctors and/or critical care nurses are not available, Registered and Enrolled Nurses should be empowered to make independent and succinct decisions on clinical deteriorating patients' conditions.

- Critical care units must be equipped with ideal technology to assist nurses engage into simulations of performing specific procedures cardinal in the care of critically and acutely ill patients.
- There is need for coming up with standards and protocol to guide all new personnel to the critical care setting on the care of critically ill patients.
- Courses like Basic Life Support, Advanced Life Support, Trauma Management, Emergency Care, Emergency Response and many more should be offered to all nurses working in critical care areas.
- While most of the strategies were suggested, it is important to state that none of the strategies alone could sort the problem of low competency levels among nurses in critical care, unless implemented together. All these strategies are very important. They must be employed and implemented alongside others in order to successfully improve competency levels in critical care nursing.
- Other studies can be done on a larger scale, incorporating attitude, to ascertain the critical care nursing' competency levels among nurses working in critical care areas at different health institutions.

9.0 DISSEMINATION AND UTILISATION OF FINDINGS

The findings of the study were presented to the Faculty of Nursing Sciences Department. They will be disseminated to major stakeholders like University Teaching Hospital management, Ministry of Health, General Nursing Council of Zambia and the University of Zambia

Copies of the report will be deposited in the Medical Library, Department of Nursing Sciences and the Ministry of Health. The findings will be published in the *Zambian Journal for Agriculture and Biomedical Sciences (JABS)*.

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APPENDIX 1

INFORMATION SHEET

TOPIC: EVALUATION OF CRITICAL CARE NURSING COMPETENCE LEVEL AMONG NURSES AT UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA

Dear Colleague,

My names are Vine Hamwiibu. I am a Tutor and am currently registered to read for a Masters Degree in Nursing Science at the University of Zambia, Department of Nursing Sciences. As part of my course requirement was expected to conduct clinical research under supervision. The title of my research was: **“Evaluation of Critical Care Nursing Competence level among Nurses at University Teaching Hospital, Lusaka, Zambia,”** and I would like to invite you to participate in the study.

PURPOSE OF THE STUDY

The study described the competence level of nurses working in critical care areas at the UTH, with respect to the care of critically ill patients. The study participants involved all nurses working in the critical care units. The study suggested strategies for improving nurses’ practice and addressing mortality in critical care settings.

PARTICIPATION

Participation in this study was voluntary. Participants, who were not interested in participating in this study, were free to refuse and withdrew as they wished, and this did not affect their working relationship at the institution. Those who were willing to participate were asked to sign a consent form as an agreement to participate. But this never resulted into any immediate benefits. Participants were advised to ask where they did not understand.

PROCEDURE

The study involved a set of questions in a structured questionnaire. After signing the consent form, participants were given a self-administered questionnaire to answer overnight as they were busy and there was shortage to make them stop work to answer the questionnaire.

RISKS AND DISCOMFORTS

There was no risk involved in this research though part of participants' time was utilized to answer some questions. Participants who needed further discussion were offered help to help them understand the topic more.

BENEFITS

This document was of academic in nature, hence, there was no monetary gain by participating in this study, but obtained information helped policy makers to take measures that would ensure that development of critical care nursing competence level among nurses was given a priority in Zambia. Health care providers would receive necessary training on critical care nursing practice through ongoing capacity building, provision of orientation programs and improved and strengthened networking system.

CONFIDENTIALITY

Participants' research record and any information were confidentially handled to the extent permitted by law. Participants were identified by a number, and personal information was not released without their written permission except when requested by law. The Ministry of Health, ERES CONVERGE, 33 Joseph Mwilwa Road, in Rhodes Park, Lusaka may have reviewed participants' records again, but this was to be done with confidentiality.

APPENDIX II

INFORMED CONSENT FORM

The purpose of this study has been explained to me and I understand the purpose, benefits, risks, and discomforts and confidentiality of the study.

I further declare that:

If I agree to take part in this study I can withdraw at any time without having to give any explanation and taking part in this study is purely voluntary.

I _____

(Print name)

Hereby agree to take part in this study.

Signed: _____ Date: _____

(Participant's signature)

Signed: _____ Date: _____

(Witness)

Signed: _____ Date: _____

(Researcher)

Persons to Contact for Problems or Questions:

Ms Hamwiibu Vine, UNZA School of Medicine, Department of Nursing Sciences, Lusaka, Mobile Phone; **0955887789**, Email: vhamwiibu@yahoo.com

The Head, Department of Nursing Sciences, School of Medicine, P.O. Box 50110, Lusaka Tel: 252453.

The Chairperson, ERES CONVERGE IRB, 33 Joseph Mwilwa Road, Rhodes Park LUSAKA. Tel: 0955 155633/4

.

APPENDIX III
STUDY BUDGET

BUDGET CATEGORY	UNIT COST (K)	QUANTITY	TOTAL (K)
STATIONERY			
a) Bond paper	30	05	150
b) Pens/Pencils	2	10	20
c) Note books	10	01	10
d) Stapler	75	01	75
e) Book files	25	01	25
f) Calculator	150	01	150
g) Flip Chart	5	01	5
h) Ink cartridge	8 000	02	1 600
i) Printer	500	01	500
SUBTOTAL			2 535
PERSONNEL			
Lunch/Transport			
a) Researcher	100 X 01	1 X 20 days	2 000
b) Research assistants	50 X 02	2 X 20 days	2 000
SUBTOTAL			4 000
SECRETARIAL SERVICES			
a) USB Flash Disc	150	01	150
b) Questionnaire typing	300	01	300
c) Printing of Proposal	200	04	800
d) Binding of Proposal	10	04	40
e) Data analysis	1 500	1 500	1 500
f) Printing of a Dissertation	200	05	1 000
g) Binding of a Dissertation	50	05	250
SUBTOTAL			4 040
TOTAL			10 575
CONTINGENCY 10%			1 057.5
GRAND TOTAL			11 632.5

BUDGET JUSTIFICATION

STATIONERY

The 5 reams of bond paper were used for the research proposal development and the final report. Paper was also required to make extra copies of the proposal for submission to ERES CONVERGE, 33 Joseph Mwilwa Road, in Rhodes Park, Lusaka for approval and to Research Ethics Committee and the Board of Graduate Studies for marking. In addition 12 copies of the questionnaires were printed for the pilot and 120 copies for the actual study. The note book was used for taking notes of all important points during data collection and analysis. Pens and pencils were required for data collection during research field work. Stapler and staples were needed to put together the papers for the questionnaires and maintain their proper arrangement. Files were used for storing the questionnaires during data collection and analysis period.

SECRETARIAL SERVICES

Funds for typing and photocopying services and binding of the proposal and dissertation report were needed. The charge for photocopying implied that one copy of each document was printed and the rest of the copies of the proposal to submit to Post Graduate Research Committee for approval and dissemination for marking were done. A USB (8g) was needed to store all research information and data. In addition typing, printing and binding of the proposal and final report were required.

PERSONNEL

Data collection was conducted throughout the day as such the researcher needed transport and lunch allowance. The research had allocated 1 month to allow adequate time for distribution and collection of questionnaires. A statistician was consulted to help with data analysis.

CONTINGENCY

Contingency fund which was 10% of the total amount of the budget was required to cater for any unforeseen expenses during the research fieldwork.



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SCHOOL OF MEDICINE
DEPARTMENT OF NURSING SCIENCES

APPENDIX V

Structured questionnaire for evaluating Critical Care Nursing Competence Levels among Nurses at University Teaching Hospital, Lusaka, Zambia

TOPIC: Evaluation of Critical Care Nursing Competence Levels among Nurses at University Teaching Hospital, Lusaka, Zambia

CODE NO OF THE QUESTIONNAIRRE SCRIPT _____

DATE OF ANSWERING THE QUESTIONNAIRE _____

INSTRUCTIONS:

- You are given **one hour (1 hour)** to complete answering this questionnaire.
- Please complete the demographic and competence data prior to completing the three clinical vignettes (questionnaires) and Likert-scale. Please answer ALL the questions.
- This information is required to carry out the data analyses of the research study and is strictly confidential. Your name **MUST NOT** appear anywhere to ensure confidentiality.
- Thank you for agreeing to participate in this study

SECTION 1 DEMOGRAPHIC DATA

Instructions: Complete this section by placing an 'x' in the appropriate box.

1. Sex

Male	
Female	

2. Age category

20-30years	
31-40years	
41-50years	
51-60years	

3. How long have you been working in critical care area?

0-5 years	
>5years	

4. What is your position in the critical care area unit?

Unit manager	
Crew Leader	
Clinical Instructor	
Other (please state position)	

5. How many years of general nursing ward experience did you have prior to working in critical care area?

1-2 years	
3-5years	
6-8years	
9-11 years	
>11years	

6. How long did you work in critical care area prior to undertaking the critical care nursing course/degree?

Never worked in ICU prior training	
1-2 years	
3-5years	
6-8years	
9-11 years	
>11years	
Not Application	

7. Mark the qualification which applies to YOU.

Critical Care Nursing	
Midwifery	
Paediatric Nursing	
Registered Nurse with experience in critical care setting	
ENROLLED Nurse with experience in critical care setting	
OTHER	

8. Is your qualification in critical care nursing a:

Qualifications	Mark	Institution attended	Year
Master's degree			
Degree			
A/Diploma			
Certificate			
Not Applicable			

9. What year did you obtain your Midwifery/Paediatric/Registered Nurse/ Enrolled Nurse qualification?

19_____
20_____

10. Have you done any short courses in critical care nursing?

Yes	
No	

11. If the answer is yes to question 10, what are they.....

Basic life support	
Advanced life support	
Trauma management	
Any other, specify	

12. Does the nurse on duty receive logistic for managing an emergency like emergency line, to call when patient's condition deteriorates, airtime to call the emergency team/ physician on call, transport to pick the physician on call?

Yes	
No	

13. Do you leave the ward unattended when your colleague has challenges relieving you?

Yes	
No	

14. Please state the critical care area where you have the MOST experience.

Main Intensive Care Unit	
Adult Medical Emergence Unit	
Casualty	
Neonatal Intensive Care Unit	
Paediatric Out-patient Department	
Paediatric Intensive Care Unit	

SECTION 2 COMPETENCE LEVEL

15. Do you work in critical care area on?

Full time	
Part Time	
Combination of full time and part-time	

16. Are you required to take charge of the critical care area on your shifts?

Yes	
No	
Sometimes	

17. If you are required to take charge is this on:

Day duty	
Night duty	
Both	

18. Do you rate your understanding on care for critically ill patient as

Poor	< 50%	
Average	50-59%	
Good	60 – 69%	
Very good	70 – 74%	
Excellent	≥75%	

19. Are you required to make autonomous decisions regarding care of critically ill patients?

Yes	
No	
Sometimes	

20. Nurses trained in critical care nursing who have worked for ≥ 2 years have more knowledge and skill on care of the critically ill patients than those nurses who have experience and have worked in critical care area for < 2 years. What is your opinion?

Strongly agree	
Agree	
Disagree	
Strongly disagree	

21. Are you competent in the care of the critically ill patient?

Yes	
No	

22. Are you up to date with new critical care nursing technology?

Yes	
No	

23. Are the majority of patients you care for in critical care area critically ill?

Yes	
No	

24. Are you given adequate support and supervision by your senior nursing staff when caring for the critically ill patients?

Yes	
No	

SECTION 3: KNOWLEDGE LEVEL

VIGNETTE ONE: AIRWAY MANAGEMENT: NORMAL POST OPERATIVE PATIENT

INSTRUCTIONS: Select the correct answer from the options provided.

Mr. Mbusi 48yrs old, weighing 70kg (ideal bodyweight 72kg) is admitted to the ICU post operatively having undergone major abdominal surgery. He has no history of lung pathology and the surgeon wants him ventilated only overnight, with a view for extubation 24hrs later. Soon after his admission to the ICU, Mr. Mbusi becomes agitated and restless. You do a blood gas which is normal.

25. Which **ONE** of the following is the **MOST LIKELY** cause of his agitation and restlessness?
- a) Hypoxia
 - b) Uncontrolled pain
 - c) Low blood pressure
 - d) Angina
 - e) Don't know
26. Mr. Mbusi settles down after your intervention and his vital signs are stable. The ventilator mode is Pressure Control SIMV. Select the **ONE** correct answer from the choices below with regard to SIMV mode of ventilation.
- a) The ventilator cycles with each respiratory effort made by the patient
 - b) The ventilator supplements each breath with positive pressure
 - c) The ventilator delivers a preset number of ventilator breaths per min. ONLY
 - d) The ventilator delivers a preset number of ventilator breaths per minute and allows the patient to breathe spontaneously between ventilator breaths.
 - e) Don't Know
27. The doctor having assessed Mr. Mbusi asks you to increase the pressure support pressure from 10 cm/H₂O to 15 cm/ H₂O. The PEEP is 5 cm/H₂O. Select the **ONE TRUE** statement from the choices below regarding Pressure Support Ventilation (PSV)
- a) PSV breaths always have the same tidal volume
 - b) PSV is not used when weaning patients from the ventilator
 - c) PSV breaths are triggered and cycled by the ventilator
 - d) PSV aids in ventilation and is adjusted in response to CO₂ levels.
 - e) Don't Know.

28. During the night you notice Mr. Mbusi exhaled tidal volume is 100mls less than his inhaled tidal volume. Select the **ONE INCORRECT** statement from the choices below.
- a) There is a leak in the ventilator circuit.
 - b) The ventilator was not calibrated with the humidification system in place
 - c) The exhaled tidal volume SHOULD be larger than the INSPIRATORY tidal volume
 - d) The ET tube cuff is leaking
 - e) Don't know
29. The decision to wean Mr. Mbusi from the ventilator with a view to extubation is made. With regard to the weaning process which **ONE** of the following is the correct sequence of weaning?
- a) O₂ is reduced to 35-40% followed by a decrease in mandatory respiratory rate, followed by decreasing the pressure support, followed by decreasing CPAP.
 - b) CPAP /PEEP is decreased first, followed by reduction in pressure support, followed by reduction of O₂% followed by reduction of mandatory respiratory rate.
 - c) Pressure support reduced first, followed by reduction of mandatory respiratory rate, followed by reduction in O₂% followed by reduction in PEEP/CPAP.
 - d) Rate reduced first, followed by reduction of O₂% followed by reduction of pressure support, followed by reduction of PEEP/CPAP.
 - e) Don't Know

VIGNETTE TWO: CARDIOVASCULAR MANAGEMENT

INSTURCTIONS: Select the correct answer from the options provided.

30. What is the name of landmark area found over the Left Ventricular Area, where Apical Pulse and the Point of Maximum Intensity (PMI) can be detected?
- a) Pulmonic Area
 - b) ERB's Point
 - c) Mitral Area
 - d) Aortic Area
 - e) I don't know

31. What is the correct course of action to take during cardiopulmonary resuscitation when cardiac arrest occurs? It involves;

- a) Recognition of the cardiopulmonary arrest, summoning help, starting CPR using airway adjuncts and attempting defibrillation within 3 minutes of collapse
- b) Summoning help, starting CPR using airway adjuncts, recognition of the cardiopulmonary arrest and attempting defibrillation within 3 minutes of collapse
- c) Starting CPR using airway adjuncts, recognition of the cardiopulmonary arrest, summoning help, and attempting defibrillation within 3 minutes of collapse
- d) Attempting defibrillation within 3 minutes of collapse, summoning help, recognition of the cardiopulmonary arrest, starting CPR using airway adjuncts
- e) I don't know

32. Mrs. Ploutette is admitted with a hypertensive crisis. Her BP is 240/190. Which one of the following interventions would you anticipate?

- a) Labetolol (Tandate)
- b) Nitroglycerine
- c) Phenylephrine (Neosynephrine)
- d) Isoproterenol (Isuprel)
- e) Don't know

33. Calculate Cerebral Perfusion Pressure (CPP) based on the following observations: HR 75 BP 120/80 (MAP 65) CVP 12 ICP 15 RR 25 Minute Volume 10.5 L/min

- a) 60
- b) 50
- c) 105
- d) 52
- e) Don't know

34. (Exclude from data presentation and analysis as there was no response

Ventricular Tachycardia (VT) and Ventricular Fibrillations (VF)

Which of the following pair of fibrillations rhythm are shockable?

- a) Atrial fibrillation and Ventricular fibrillation
- b) Ventricular fibrillation and Cardiac systole
- c) Cardiac arrhythmias and Ventricular fibrillation
- d) Cardiac systole and Cardiac arrhythmias
- e) Don't know

VIGNETTE THREE: NEUROLOGICAL MANAGEMENT

Mohammad is an 18 year old man who was struck by a baseball bat in the Left temporal bone while playing baseball. He sustained a depressed skull fracture and is started on a dopamine infusion to support his BP.

35. On his way to the CT scanner, Mohammad's L pupil suddenly becomes fixed and dilated. Which one of the following problems is consistent with these findings?

- a) Epidural hematoma with compression of CN V
- b) Pupillary dilation secondary to dopamine administration
- c) Left mass effect with tentorial herniation
- d) Bleeding from the ophthalmic artery
- e) Don't know

36. Mohammad's pupil remains dilated and his blood pressure has increased to 180/70 with a HR of 45. Which one of the following interventions is the priority?

- a) Position head of bed flat
- b) Administer lasix
- c) Hyperventilation
- d) Administer labetolol
- e) Don't know

37. Which pharmacological agent would you anticipate to treat Mohammad's raised intracranial pressure with a BP of 180/55 and HR 45?

- a) Dobutamine
- b) Nimodipine
- c) Hypertonic saline
- d) Atropine
- e) Don't know

38. Mohammad's condition deteriorates and he no longer responds to stimulation. He develops Glasgow coma scale of less than 8 with Heart rate >150, Respiratory rate <8, Systolic blood pressure <80mmhg and Oxygen saturation < 90%. Which one of the following action you are expected to take?

- a) Intubate the patient
- b) Call the Cardiac Arrest Team
- c) Assess patient for brain death
- d) Place patient in recovery position
- e) Don't know

39. Which pair of cranial nerves is being evaluated when a corneal reflex test is performed on the Left eye?

- a) L CN V and VII
- b) R CN V and VII
- c) L CN III and VII
- d) R CN III and VII
- e) Don't know

THE END OF VIGNETTE 3

You are not finished yet!!!

GO TO THE NEXT PAGE AND COMPLETE LIKERT SCALE ON YOUR ABILITY TO PERFORM SPECIFIC PROCEDURES IN THE CRITICAL CARE NURSING SETTINGS.

SECTION 4- SKILLS FOR CRITICAL CARE NURSES

Kindly rate your best practice in performing the following procedures without supervision in the table provided by placing an "X".

Score To what level do you agree that you can perform the following procedures without supervision?	Strongly disagree 0	Disagree 1	Uncertain 2	Agree 3	Strongly Agree 4
1. Use infusion pump for fluid management					
2. Monitor critically ill patient on inotropic/vasodilator medication					
3. Interpret arterial blood gases					
4. Manage a patient on ventilator					
5. Demonstrate safe suctioning skills					
6. Carryout respiratory assessment					
7. Intubate					
8. Weaning patient from ventilator					
9. Extubation					
10. Cardiopulmonary resuscitation					
11. Read and interpret basic electrocardiogram (12 lead ECG)					
12. Interpret laboratory test results					
13. Manage patient with traumatic brain injury					
14. Manage patient with endocrine emergencies					
15. Effectively carry out basic life support procedures					
16. Manage renal insufficiency					
17. Manage neonatal and Paediatric emergencies					

Possible highest score = 68. Possible lowest score = 0

Therefore, these scores will be given percentages to compare with set competence levels for description.

18. Suggest how performance among nurses in critical care units can be improved?

.....
.....

THE END

Thank you for participating in my research. On completion of the questionnaire please place the completed questionnaire in the brown envelope provided and seal it, and hand it back to the researcher.



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Appendix VI

OBSERVATION CHECKLIST

The Observation Checklist for evaluating parameter with an influence on Critical Care Nursing Competence Levels among Nurses at University Teaching Hospital

TOPIC: Evaluation of Critical Care Nursing Competence Levels among Nurses at University Teaching Hospital, Lusaka, Zambia

TOPIC: Evaluation of Critical Care Nursing Competence Levels among Nurses at University Teaching Hospital, Lusaka, Zambia

CODE NO OF THE OBSERVATION CHECKLIST _____

DATE OF CONDUCTING THE OBSERVATION _____

INSTRUCTIONS:

- I will be observing the nurses in your unit for one hour (1 hour).
- I will not disturb their usual nursing practice, but will record nurses' ability to use the available equipment
- This information is required to carry out the data analyses of the research study and is strictly confidential. The name of the unit WILL NOT appear anywhere to ensure confidentiality.
- Thank you for allowing me to collect the data for this study

OBSERVATION CHECKLIST

Parameters to be observed.	Yes	No		
1. Staff : <ul style="list-style-type: none"> • Normal establishment • Current establishment • Nurse: Patient Ratio 				
2. Office displays: <ul style="list-style-type: none"> • Presence of emergency line • Protocols on patient management 				
3. Resources <ul style="list-style-type: none"> • Availability of med/surgical supplies • Availability of drugs 				
4. Basic patient observations in the previous eight hours for signs of critical illness: <ul style="list-style-type: none"> • Respiratory rate • Hear rate • Oxygen saturation • Inspired oxygen concentration • Blood pressure 				
5. Other areas: <ul style="list-style-type: none"> • Do all patients have fluid balance chart? • Are the fluid balance charts well completed? • Has the patient been fed in the last 48 hours? • Do patients have their hourly urine recorded? • Is an 'early warning' or patient at risk scoring system tool available? 				
Are the following equipments available in the unit and do nurses using them?	Availability		Utilization	
	Yes	No	Yes	No
6. Ward Arrangement and enough equipment <ul style="list-style-type: none"> • Suction machine • Suction tray • Oximetry • Oral airway • Laryngoscope set • O₂ therapy and medical delivery systems • Ambu bag and mask • Face masks • Nasal cannula • Portable O₂ tank • Endotracheal tube 				

<ul style="list-style-type: none"> • Ventilators with its accessories/tubes • Intravenous catheter insertion accessories • Stethoscope • Sphygmomanometer • Infusion pump • Cardiac monitor and its accessories • 12 lead ECG apparatus/ set • Defibrillator • Glasgow coma scale charts • Pathologic reflexes charts • Nerve stimulators • Lab specimen containers • Glucometer • Urinary catheters 				
--	--	--	--	--