CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

In this chapter an overview of the study is provided. This includes the background to the study, the problem statement, the purpose, the objectives, the importance of the study, the research assumptions, relevant definitions, an overview of methodology, validity and reliability, ethical considerations and concludes with a brief outline of the study to describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

1.2 BACKGROUND TO THE STUDY

Nursing today is faced with the challenge of providing high quality, cost-effective, evidence-based holistic care in a financially restricted climate. Protocols are an effective way of introducing evidence-based practice into the ICUs, and have been shown to reduce morbidity and mortality and decrease the cost of critical illness (Meade & Ely, 2002:2601).

Nurses aspire to provide individualised care to their patients, whereby each patient is treated according to their own unique circumstances and needs. A potential problem when protocols are used is that care is provided in strict accordance with the instructions regardless of the specific circumstances of the individual patient. Variation in clinical presentation is not taken into consideration and this is not in keeping with holistic patient care, where patients are viewed as individuals. There is a difference between nurses using their experience and clinical judgement in conjunction with guidelines and protocols to provide individualised care and nurses following protocols rigidly, regardless of the individual circumstances of a patient (Hewitt-Taylor, 2004:50).

To safely implement protocol-based care, the ICU nurse needs to have a good knowledge level to allow sound judgements to be made related to the care of a critically ill patient.

Without this knowledge, safe implementation of nursing care cannot be assured. Individualised nursing care is more than strictly applying the steps of a guideline or protocol and involves having an adequate knowledge on which to base decision making regarding the suitability of the instruction for a given patient in a given situation. If nurses do not have adequate knowledge on which to base their decisions, there is a danger that the needs of the individual patient will be overlooked and a "one size fits all" programme of care, in contrast to individualised care, will be provided.

Competence is currently assumed on successful completion of a nursing qualification (Muller, 1996:80). Competence in nursing has many definitions; almost all of these include knowledge. It is recognised that not all nurses function at the same level of expertise and knowledge, and therefore there is always a risk of nurses acting in ignorance (Lowe, Fulbrook, Aldridge et al., 2001:124). If nurses do not have adequate knowledge on which to base decision-making, patients in ICU may be exposed to unsafe practices leading to complications, increased length of ICU stay, increased morbidity and mortality and the possibility of litigation, as nurses are accountable for all their actions. Protocols can be used to safeguard the implementation of treatment to a patient, but need to be considered in the context of each individual patient in order to assess the suitability of the instruction for a given patient in a given situation. Such protocols include but are not limited to pain management, glycaemic control and weaning from mechanical ventilation. Protocols, in the form of nurse-led protocols, are increasingly being used in ICU (Kollef, Shapiro, Silver, et al., 1997:572). The use of protocols in ICU provides extended practice to nurses working in the area, whereby nurses are required to undertake tasks which traditionally were not thought of as the task of the nurse.

There is a shortage of nurses working in South African intensive care units (ICUs) (Critical Care Society of Southern Africa [CCSSA], 2004), and nurses working in the ICUs lack experience (CCSSA, 2004) and speciality knowledge (Van Huyssteen & Botha, 2004; Windsor, 2005). These problems are however not unique to South Africa as there is a global shortage of nurses and internationally nurses have also been found to lack speciality knowledge (Fothergill-Bourbonnais & Wilson-Barnett, 1992; Johnston, Jane, Fraser, et al., 2004). With the rapid increase in complex knowledge and technology in the ICUs "nurses simply must know more than ever before in order to deliver safe and effective care that

meets each patient's unique needs" (American Association of Critical-Care Nurses [AACN], 2003:155).

All nurses, both experienced and inexperienced, are responsible and accountable for patients with complex health problems and failure to match nursing expertise to the type and complexity of problem can result in costly human and financial outcomes (Reischman & Yarandi, 2002:25). ICU treatment is at best very costly. Evidence-based practice enhances clinical care, reduces morbidity and mortality, and reduces costs in the ICU (Meade, et al., 2002:2601).

Studies looking at the knowledge of ICU nurses both locally and internationally were found, but only one (Oosthuizen, 2000) compared the knowledge of an ICU trained nurse to that of a non-ICU trained nurse working in ICU. No studies were found that looked at the impact of years of experience on the knowledge of ICU nurses relevant to ICU nursing issues such as pain management, glycaemic control and weaning from mechanical ventilation. However, a study that has become accepted as a standard for measuring basic knowledge of ICU nurses in the United States of America (USA) found that nurses with longer experience consistently had higher scores (Toth, 2003:45). Therefore, the purpose of this study was to describe and compare ICU nurses' knowledge related to care areas commonly used in ICU and frequently directed by protocols, namely pain management, glycaemic control and weaning from mechanical ventilation.

1.3 STATEMENT OF THE PROBLEM

There is an increasing use of protocols in ICU which requires nurses to extend their practice. Review of the literature indicates that not only is there a shortage of nurses working in ICU but that those working in the area lack experience and knowledge. This raises the question as to whether nurses have the knowledge to safely implement protocols for the advanced management of critically ill patients.

Nurses aspire to provide individualised care to their patient which is more than strictly applying the steps of a guideline or protocol. However, this requires an adequate

knowledge on which to base decision-making regarding the suitability of the instruction for a given patient in a given situation, eg. patient instability.

Because of the increasing use of protocols in ICU, current evidence from a number of studies reporting poor knowledge of nurses working in ICU, and the fact that no studies to date had been found that investigated nurses' knowledge related to care areas commonly guided by protocols, it is therefore important to examine this knowledge.

1.4 PURPOSE OF THE STUDY

The purpose of this study was to determine the knowledge levels of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

1.5 STUDY OBJECTIVES

To meet the purpose of the study, the research was conducted in two phases and the following objectives were set:

Phase One:

- To develop and validate an instrument to assess knowledge of ICU nurses in three specific care areas, namely pain management, glycaemic control and weaning from mechanical ventilation.

Phase Two:

- To describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.
- To compare the difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.

- To determine to what extent the knowledge of nurses working in ICU is influenced by their years of ICU experience relative to pain management, glycaemic control and weaning from mechanical ventilation.

1.6 IMPORTANCE OF THE STUDY

The importance of this study is that it will attempt to quantify scientifically the current knowledge of nurses related to care areas commonly used in ICU, namely pain management, glycaemic control and weaning from mechanical ventilation. The study will cover both public and private sector ICUs in Gauteng and will include both ICU trained and non-ICU trained nurses. Quantification of this knowledge will facilitate appropriate education programmes to ensure successful implementation of protocols into the ICUs. Successful implementation of protocols by personnel with appropriate knowledge should result in improved patient safety as high-quality, cost-effective, evidence-based care would be provided. If a lack of knowledge is found among ICU nurses, interventions and recommendations to correct the situation may be instituted. One of the obstacles to providing appropriate education to nurses and thereby improving patient safety is the lack of information regarding the current knowledge of nurses working in ICU.

1.7 RESEARCH ASSUMPTIONS

The researcher based this study on the following assumptions:

1.7.1 Meta-theoretical assumptions

Meta-theoretical assumptions are described as “those aspects of a discipline that are shared by its scientific community” (Meleis, 2005:11) and are not meant to be tested. The meta-theoretical assumptions in nursing comprise four key concepts: the person, the environment, nursing care and health/illness. The researcher’s meta-theoretical assumptions regarding these concepts, in the context of intensive care, are as follows:

The person

The person is inclusive of the ICU patient, the patient's significant others and the ICU nurse. In nursing, the patient is central to this interrelationship. The ICU patient is a person in a life threatening or unstable condition, who needs skilled intervention in order to have their health care needs met. The ICU patient is usually totally dependent on knowledgeable professionals for the safe implementation of all therapeutic interventions. The functional abilities of the ICU patient's significant others are threatened by the critical illness of the patient and they must rely on their internal and external supports to restore their equilibrium during this time (Clochesy, Breu, Cardin, et al., 1993:91). The nurse is central to the context of this study. The nurse is present at the patient's bedside twenty-four hours a day, and is therefore key to provision of "best practice" to each individual patient according to their unique and specific needs. In order for the nurse to be able to provide this best practice, adequate, up-to-date knowledge is essential.

The environment

Health care provision to all is a fundamental right of citizens in this country, but this is often unrealistic within the ICU environment due to limited distribution of resources. Both public and private sector hospitals provide health care to individuals. The ICU environment is subject to complex technological advances, new knowledge and increasing complexity of patient care. At the same time high quality care needs to be provided while controlling costs.

Nursing care

Nursing the ICU patient requires the nurse to have an in-depth knowledge in order to provide optimal care to people in unstable and life-threatening conditions. Knowledge and caring go hand in hand and quality care does not occur if either one is missing. ICU nurses require high levels of decision-making. Three factors that influence this decision making process are: factors associated with the nurse, primarily knowledge and experience; factors associated with the complexity of the task; factors associated with the environment (Currey & Botti, 2003:207). Protocols and guidelines are being used more and more frequently to guide this decision-making process. These instruments provide a reference framework on which decisions can be based but leave space for analysing the situation and for choosing the best intervention based on the individual patient's situation. This is in keeping with nursing's holistic approach to care, where patients are viewed as individuals.

Health/illness

Health is defined as "the absence of illness, handicap or physical-psychological limitation" (Pitacco, Silvestro, Drigo, et al., 2001:27). In the ICU setting definition, of the health/illness continuum starts with the illness and not the health of the patient. Pitacco, et al., (2001:27) define the critically ill patient as "a seriously ill person for whom initial care is not even aimed at restoring partial health, but towards the stabilisation of the condition so that it becomes a manageable illness". The authors further state that this process, which starts with illness and ideally moves towards health, is unpredictable because "the results of intensive or resuscitation interventions cannot always be foreseen", but that without these interventions there would be no movement towards health.

1.7.2 Theoretical assumptions

Accountability forms the basis of professional nursing practice. South African nurses function within a framework of professional-ethical responsibilities as defined by the Scope of Practice (South African Nursing Council [SANC] Regulation R 2598 as amended), which regulates the scope of practice of registered nurses in this country. According to Bergman's Model (1982:8), which is depicted as a pyramid, there are several preconditions to accountability, the lowest level being ability, which includes the knowledge, skills and values needed in order to decide and act on specific issues. It is the nurses' responsibility to ensure patients' safety based on their training, the Scope of Practice and the rules relating to the Acts and Omissions (SANC Regulation R 387 as amended). Nurses are responsible for ensuring that they have the necessary knowledge for their specific speciality (Muller, 1996:27). The nurse, as the patient's advocate, should always strive to promote and safeguard the wellbeing of the patient and to ensure that no action or omission on her part is to the patient's detriment. Therefore it is essential for nurses to maintain an up-to-date knowledge by continuing their professional development.

1.7.3 Definitions of terms for purpose of this research

ICU Nurse - A person registered by the South African Nursing Council as a registered nurse, who has the responsibility of caring for patients in the ICU. These nurses may be ICU trained or non-ICU trained and working in the ICU permanently or part-time through an agency. In this study reference will be made to either the ICU nurse or the nurse.

ICU trained Nurse - For the purpose of this study, the ICU trained nurse refers to a person registered by the South African Nursing Council as having a recognised post-graduate registration in Intensive Care Nursing Science.

Non-ICU trained nurse - For the purpose of this study, the non-ICU trained nurse will mean a person registered by the South African Nursing Council as a registered nurse with no post-graduate qualification in Intensive Care Nursing Science but with practical ICU experience.

Intensive care unit (ICU) - is a specifically designated area, with specialised technology and personnel, where patients with unstable and life-threatening conditions are monitored and cared for. The term ICU and critical care unit are often used interchangeably.

Public sector ICU - is an ICU within a state-owned hospital where members of the population who generally do not have a medical aid scheme or adequate financial resources to be treated in private institutions receive medical care.

Private sector ICU - is an ICU within a privately owned hospital or group of hospitals in which members of the population on medical aid schemes or with adequate financial resources receive medical care.

Protocol and Nurse-led protocol - is a protocol for the implementation of treatment to a patient where a physician's orders are not required if the treatment to be implemented can be met based on the parameters specified by the protocol. These protocols are usually introduced to guide the actions and decision making of nurses when they are undertaking tasks which extend the practice from that which has been traditionally thought of as the role

of the nurse. For the purposes of this study, protocol will mean nurse-led protocol. The protocols included in this study are those for pain management, glycaemic control and weaning from mechanical ventilation.

Knowledge - can be defined as "…familiarity or understanding gained by experience or study or from instruction … learning … cognition, the process of knowing" (Cassell, 1997:812). Skill can be defined as "familiar knowledge of any art or science combined with dexterity … ability … practical mastery of a craft, trade, often attained by training" (Cassell, 1997:1381). According to Huggins (2004:40), these definitions imply that knowledge is "knowing and understanding" whereas skill is the "doing". ICU nurses use knowledge and skills together. For the purpose of this study, knowledge will be taken to mean the awareness, consciousness or familiarity gained by experience or learning and knowledge will be considered to be adequate with a score of at least 70%. In this study knowledge is further divided into basic, applied and advanced level knowledge, which are defined as follows:

- **Basic knowledge** is knowledge of fundamental facts and can often be acquired from textbooks.
- **Applied knowledge** is the ability to consider a range of possible actions and make considered decisions on which action to follow in a given situation, grounded on basic knowledge.
- **Advanced knowledge** is the ability to integrate performance and decision making with understanding.

The above definitions for level of knowledge were based on the three levels of competence (foundational, practical and reflective) as described by Morolong & Chabeli, (2005:40), and modified for use in this study by a panel of expert nurses.

1.7.4 Methodological assumptions

The researcher has based this research on Botes' Research Model in Nursing (1992:36-42). A central theoretical proposition of this model is that the research is undertaken with a view to improving clinical practice by giving prescriptions for actions.

In Botes' Model, nursing activities are shown in three levels as follows:

- The first level is the reality or the practice of nursing. In this study the first level is nursing within the ICU. The researcher identified a lack of knowledge in the ICU as a barrier to nurses being able to use protocols in the specific context of each patient.
- The second level, where the researcher functions, is the level of nursing research and theory development. The researcher who functions on this level continually interacts with the first level (i.e. the research field). In this study the research process addresses this. The research methodology is descriptive and comparative.
- The third level is the paradigmatic perspective of the study. The researcher accepts certain paradigmatic assumptions for this study.

1.8 OVERVIEW OF METHODOLOGY

In the following section an overview of the research methodology is provided. Research design, research method, target population, sample and sampling method, data collection and data analysis for each phase of the study are discussed.

1.8.1 Research design

A non-experimental, descriptive, and contextual two-phase research design was used to determine the knowledge levels of nurses working in the ICU with regard to pain management, glycaemic control and weaning from mechanical ventilation.

1.8.2 Research method

This study was conducted in two phases. Phase one was the development and quantification (i.e. validation) of a data collection instrument and phase two used the instrument that emerged on completion of phase one to test the knowledge levels of nurses

working in ICU with regard to pain management, glycaemic control and weaning from mechanical ventilation.

1.8.3 Target population

Phase one

Phase one consisted of two stages. Both stages i.e. the developmental (Stage one) and the quantification (Stage two) stages had as their target population ICU trained nurses considered to be experts in ICU. These two stages were used to validate the instrument. Different expert nurses were used in each of these stages. Stage one used local ICU expert nurses (n=6), whereas stage two sought ICU expert nurses both locally and nationally (n=11).

Phase two

All registered nurses (n=136) working in the adult ICUs of three public sector hospitals (n=3) and two private hospitals (n=2) in Gauteng were the target population of the second phase of the study.

1.8.4 Sample and sampling method

Phase one

A non-probability purposive sampling method was used to select ICU nursing experts to assist the researcher with the two stages of this phase. This ensured that those who were particularly knowledgeable regarding the chosen care areas were selected.

Phase two

Consecutive sampling was used in phase two of the study. This method was used to select the widest variety of participants that were typical of the population under study. The sample size was achieved according to the response rate.

1.8.5 Data collection

Phase one

This comprised two stages, the development stage and the quantification stage, to validate the data collection instrument.

Phase two

The instrument developed in Phase one was taken to the selected ICUs by the researcher and an assistant where it was distributed to those nurses who consented to participate in the study. On completion of the instrument the participants were asked to place it into an envelope and to seal it. The consent forms were collected and sealed in a separate envelope. All data was handled confidentially.

1.8.6 Data analysis

Phase one

The content validity of the questions in the instrument and the instrument as a whole was assessed by a group of ICU nursing experts. Descriptive statistics were used in this phase.

Phase two

Descriptive and inferential statistics were used to describe and compare the knowledge levels of nurses, both ICU trained and non-ICU trained, working in the ICUs of selected public and private hospitals with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

1.9 VALIDITY AND RELIABILITY

Reliability concerns the consistency with which the measurement technique measures a concept and validity is the extent to which the instrument measures what it is supposed to be measuring (Burns & Grove, 2003:45).

Phase one

Validity of the data collection instrument was established by using a structured two-stage model to develop and quantify the instrument. Trained ICU nurses, locally and nationally, who are considered experts in the field participated in phase one of this study, which was to develop a data collection instrument to measure the knowledge of ICU nurses with respect to pain management, glycaemic control and weaning from mechanical ventilation.

Phase two

A pilot study was undertaken before the main study was conducted in order to refine the data collection instrument and to ensure that there was clarity and understanding of the questions in the instrument. The researcher and an experienced assistant were the only data collectors. The data were entered into a spreadsheet designed with multiple data integrity checks and were then verified by the biostatistician. These steps were taken to ensure validity and reliability of the study. This is discussed in more detail in Chapter 3.

1.10 ETHICAL CONSIDERATIONS

According to Burns and Grove (2001:191), the conduct of nursing research requires not only expertise and diligence but also honesty and integrity. In order to generate sound scientific knowledge, ethical research is essential. Burns et al., (2001:196) further state that the researcher has an ethical responsibility to protect the rights of human research subjects. To avoid research misconduct and ensure a balance between risks and benefits of a study involving human subjects, ethical review and clearance is necessary prior to commencing the study (Burns et al., 2001:213).

Permission to conduct the study was obtained from the Postgraduate Committee, University of the Witwatersrand and the Committee for Human Research, University of the Witwatersrand. Within each participating hospital, the permission of the CEO/Medical director was sought and thereafter the nursing managers and unit managers were approached. Informed, written consent was obtained from all the participants. The researcher adhered to the Democratic Nursing Organisation of South Africa's (DENOSA) ethical standards of research (1998:2.3.1-2.3.4.) to protect the rights of the participants.

1.11 OUTLINE OF THE STUDY

This study will be presented as follows:

Chapter 1: Overview of the study
This chapter provides an overview of the study and includes the background to the study, the purpose and problem statement, the aim and objectives, the significance of the study, the paradigmatic perspectives and relevant definitions and concludes with a brief overview of the of the research process.

Chapter 2: Literature review
In this chapter, a review of the literature relevant to the various aspects of the study is covered.

Chapter 3: Research methodology
This chapter describes the research methodology used in this study including the research design, the study setting, eligibility criteria, the sampling process and data collection procedures as well as the development and quantification (i.e. validation) of the research instrument used for data collection.

Chapter 4: Data analysis and discussion of results
In this chapter the results of both phases of the study are presented and discussed.

Chapter 5: Summary, conclusions, limitations and recommendations.
In this chapter a summary and conclusions from the main findings are presented, followed by a discussion of the limitations of the study and recommendations for clinical practice, nursing management, nursing education, and for further research in this area.

1.12 SUMMARY

Protocols detailing the implementation of evidence-based practice are being used more and more frequently in the ICU setting. By using these protocols nurses can improve the quality

of care delivered to patients, improve patient outcome and decrease the cost associated with intensive care. In order to safely implement protocol-based care and to know when to deviate from a protocol, the nurse needs a certain level of knowledge in the given care area. If the knowledge level of the nurses is known, this will facilitate the tailoring of educational initiatives to assist nurses for their extended roles of safely implementing protocol-based care.

In this chapter an overview of the research has been given including the background to the study, the statement of the problem, the purpose, the aim and objectives and the importance of the study. In addition, the research assumptions were defined.

A non-experimental, descriptive and contextual two-phase research design was used to determine the knowledge levels of nurses working in the ICU with regard to pain management, glycaemic control and weaning from mechanical ventilation.

In the following chapter a review of the literature related to the topic under study will be presented.

CHAPTER TWO

LITERATURE REVIEW AND BACKGROUND

2.1 INTRODUCTION

There has been a need by ICU nurses and other healthcare professionals to move away from the culture of basing decisions on past practice and opinions and to move towards the incorporation of research-based evidence into clinical practice (Thomson, Angus and Scott, 2000:164). The use of protocol-based care has been shown to improve both clinical practice and patient outcome (Meade, et al., 2002:2602), and is also an effective way of introducing evidence-based practice into the ICU. It has been suggested that protocols directing the recommended treatment of specific care areas are increasingly being used in the ICU environment (Kollef, et al., 1997:572).

The introduction of protocols has the potential to expand the role of the nurse and as such it is important to ensure that nurses working with protocols are competent and confident to do so (Hewitt-Taylor, 2004:50). The correct and accurate use of protocols is the responsibility of the nurse implementing the protocol, as nurses are accountable for all their actions. The nurse must decide for herself whether she is knowledgeable and competent enough to act in any given situation (Searle, 2002:171).

This chapter will begin with a review of the current status of ICU nursing in South Africa, including the development of ICUs, the shortage of ICU nurses, and nursing education and training. Thereafter the discussion focuses on accountability and the Scope of Practice, evidence-based practice and protocol-based care. The knowledge levels of ICU nurses are discussed together with existing knowledge studies and the influence of years of experience and formal training on these knowledge levels. Three care areas, which are frequently directed by protocols, namely pain management; glycaemic control and weaning from mechanical ventilation, will be highlighted.

2.2 CURRENT STATUS OF ICU NURSING

2.2.1 Development of ICU and ICU nursing in South Africa

The first single-function ICUs in South Africa came into being in the 1960s and the first multidisciplinary ICU was opened at Addington Hospital in Durban in October 1970. The first full-time intensivist in Africa, Dr Neil Goodwin, managed this unit. The South African Nursing Council (SANC) granted permission for a post-basic diploma course in intensive care nursing in 1964, and two years later the Johannesburg Hospital offered the first intensive care nursing course in the country (Schreiber, 1990). At present, South Africa has approximately 444 ICUs and/or high care units distributed between both the public and the private health care sectors (CCSSA, 2004). There is a critical shortage of adequately trained nurses to staff these ICUs (Department of Health [DOH], 2003).

2.2.2 Shortage of ICU nurses

There are many reasons for the nursing shortage in South Africa including the fact that nurses are being lured overseas by lucrative contracts. The DOH, in the "Modernisation of Tertiary Services" (MTS) report has referred to critical care nursing in South Africa as "being in a state of critical crisis" due to the shortage of ICU nurses (DOH, 2003). Only 25% of nurses working in South African ICUs are ICU trained (CCSSA, 2004). In the MTS follow-up report it is stated that if medical staffing in South African ICUs is deficient "the nursing situation is disastrous" as many ICUs in tertiary academic centres do not have ICU trained nurses as unit managers or shift leaders. This is contrary to the findings of the audit of South African ICUs (CCSSA, 2004) where it was found that the majority of ICUs had an ICU trained unit manager. In a local study by Cilliers (1991:1), in which one of the aims was to investigate possible causes of the crisis in South African hospitals, it was found that less than one third of the ICU nurses in the study were ICU trained. This is not very different to the present day situation. Binnekade, Vroom, de Mol, et al., (2003:190) quote various authors (Van Servellen & Schultz, 1999; Tarnow-Mordi, Hau, Warden, et al.,

2000) as stating that adequate staffing of ICUs with appropriately trained ICU nurses is a major determinant in ensuring safe, quality care.

To address the problem of shortages of ICU nurses, the DOH (DOH, 2003) has suggested the placement of sub-professional nurses in the ICUs. This has been supported by feedback from the speciality focus group which did not include any input from trained ICU nurses. It is intended that the sub-professionals would work under the supervision of professional nurses (DOH, 2003), who themselves may be inexperienced and lacking the necessary knowledge to provide safe care to critically ill patients. This could add to the burden and strain of professional nurses working in ICU. In a study by Ball and McElligot (2003:232), ICU nurses admitted that health care assistants were very helpful in maintaining a safe environment for patients and in assisting nurses to deliver basic patient care, but that these nurses could not replace experienced and knowledgeable nurses.

Due to the shortage of ICU trained nurses in the Netherlands, Binnekade, et al., (2003:191) conducted a study to determine whether the employment of nurses without ICU training would cause a significant change in the quality of ICU nursing care. These nurses were referred to as second level nurses, which are comparable to registered nurses in South Africa. The study was conducted in a 30-bed ICU staffed with 90 fulltime ICU trained nurses and 36 ICU students in a large tertiary care university teaching hospital. The ICU trained nurses supervised and took responsibility for the non-ICU trained nurses, whose functions were to provide basic physical and nutritional care to patients and to assist the ICU trained nurses. The authors concluded that the non-ICU trained nurses enhanced the quality of certain aspects of care mainly because they increased the availability of ICU speciality nursing time. These nurses were not sub-professionals and were employed in addition to, and not in place of, ICU trained nurses.

If knowledge is found to be lacking among professional nurses, can it realistically be expected that sub-professional nurses without a theoretical nursing background or any specialist training will be able to safely and competently nurse ICU patients? Unlike the level two nurses in the Binnekade, et al., study (2003:190), where the second level nurses are registered nurses, a second level nurse in South Africa is either an enrolled nurse or an enrolled nurse auxiliary (Searle, 2002:57) and are referred to as sub-professional nurses.

With the increasing numbers of inexperienced nurses working in the ICUs, the increasing severity of illness in these patients, the complexity of treatment and the rapidly advancing technology in the area, the employment of sub-professionals in the area may not be in the best interest of the patients if employed for direct patient care.

2.2.3 Nursing education and training

In South Africa, general nursing training is a 4-year comprehensive course that can be completed at either diploma or degree level. On completion of the programme, the nurse is registered in general nursing, psychiatry, community health and midwifery (SANC, 1985a; 1985b). The first two years of this training are in general nursing followed by two years in psychiatry, community health and midwifery. A newly qualified general nurse has therefore not worked in a general ward for two years when she qualifies. In a study by Khoza & Ehlers (1998), senior professional nurses surveyed found that newly qualified nurses were incompetent in performing the cognitive, affective and psychomotor skills that were expected of them. Newly qualified nurses are permitted to work in the ICU environment where they are expected to perform at an advanced level while they may not even be competent at a basic level. This is in contrast with the assumption that "… the nurse must have the necessary knowledge to perform all the acts relating to the various aspects of the scope of her practice." (Searle, 2002:120). Benner (1984) reported that the educational process only initiates the acquisition of competence which is then developed through professional experiences.

Competence is currently assumed on successful completion of a nursing qualification (Muller, 1996:80). Morolong et al., (2005:39) state that it is a constitutional right of patients and clients to receive quality nursing care delivered by competent nurses. Competence in nursing has many definitions, almost all of which include knowledge. Maynard (1996:14) found that cognitive, psychomotor and affective abilities are necessary to develop professional competence. In South Africa, the higher education and training system is outcome-based, and the underlying principle of the system is to produce a competent learner who can provide a quality service in the working environment (Morolong, et al., 2005:41).

ICU nursing education is undertaken either at diploma level through a nursing college or as a Masters degree through a university. No general ward experience is necessary prior to working in an ICU but it is recommended that the nurse have at least six months ICU experience before commencing the ICU course. The majority of ICU qualifications in South Africa are at diploma level. Either of the qualifications should enable the ICU trained nurse to function at a level superior to that of a general nurse. In a study by Scribante, Muller & Lipman, (1996:221), participants of a focus group stated that having an ICU qualification was no assurance of competence. Without good knowledge, the ICU nurse cannot be described as being competent. Furthermore, nursing shortages, lack of experienced nurses and the workload in the ICU mean that nurses may have to take on responsibilities outside their sphere of competence (Mollerup & Mortensen, 2004:72).

Intensive care units are highly technical and dynamic environments requiring nurses working in such ICUs to be both intellectually and clinically competent. In addition, these nurses often enter ICU immediately after completion of their general training and are admitted to the ICU course without the required foundational basic nursing skills and knowledge to develop an advanced level of functioning. Mollerup, et al., (2004:71) reported that an important requirement before being accepted to work in an ICU in Denmark was having at least two years of clinical experience on a ward. After a six-month introductory period in the ICU they are expected to begin specialist education. The DOH (2003) suggests that entry to intensive care for nurses should only occur after a minimum of two years experience outside of the intensive care and that, during the third and fourth years of basic training, nursing students should spend time in ICU.

2.3 ACCOUNTABILTY AND THE SCOPE OF PRACTICE

Accountability forms the basis of professional nursing practice (Searle, 2002:120). Nursing in South Africa is regulated by the SANC through the Scope of Professional Practice of Persons Registered and Enrolled under the Nursing Act of 1978 (SANC Regulation R2598 as amended) and the regulation detailing the Acts and Omissions (SANC Regulation R387 as amended). Thomson, et al., (2000:165), state that accountability rests on having an adequate knowledge base for interventions.

Intensive care, by its very nature, offers extended practice to nurses, particularly those holding an ICU qualification as they are expected to operate at a level superior to that of a general nurse. “If a person holds an additional qualification in some area of nursing she is expected to give a higher quality of care in that specialised area than can be expected from a nurse who does not hold that qualification” (Searle, 2002:57). “Specialisation increases the role expectations of practitioners” (Searle, 2002:63). Holding an intensive care nursing qualification should acknowledge that the ICU nurse has attained a knowledge base that is essential to critical care nursing practice, as well as the ability to synthesise, interpret and apply this knowledge to patient care (Gonce Morton, Fonteine, Hudak, et al., 2005:5). All nurses, experienced and inexperienced, are responsible and accountable for patients with complex health problems and failure to match nursing expertise to the type and complexity of problem can result in costly human and financial outcomes (Reischman, et al., 2002:25).

The implementation of protocols to provide care for patients is an interdependent function of the nurse (Searle, 2002:168). This means that although the doctor and the nurse have a collaborative relationship, whereby each has definite responsibilities for which he or she is accountable, the action or intervention would not be possible without both participants. “When the nurse accepts a prescription, request or direction for treatment of a patient from a doctor, she does so as an independent practitioner, as a shared responsibility with the doctor on behalf of the patient, but she remains accountable for her actions in this collaborative situation” (Searle, 2002:172). The correct and accurate use of protocols is therefore the sole responsibility of the nurse implementing the action as directed by the protocol. The nurse must decide for herself whether she is knowledgeable and competent enough to act in any given situation (Searle, 2002:171).

The Scope of Practice (R 2598 as amended) describes the professional-ethical responsibility of the South African nurse. These regulations are not specialisation specific but can be adapted for use in each specific nursing speciality area. The Scope of Practice as applied to ICU nurses has been described by Scribante, Muller & Lipman, (1995). Many of the clauses within the Scope of Practice (SANC Regulation R 2598 as amended) pertain to protocol use and the areas of pain management, glycaemic control and weaning from mechanical ventilation as indicated in Table 2.1. This study can therefore be justified within the Scope of Practice.

Table 2.1: Relevant clauses from the Scope of Practice (SANC Regulation R 2598 as amended)

Scope of Practice Clause	Pertains to:
a) "The diagnosis of a health need and the prescribing, provision and execution of a nursing regimen to meet the needs of a patient or a group of patients or where necessary, by referral to a registered person"	Pain management, glycaemic control and weaning
b) "The execution of a programme of treatment or medication prescribed by a registered person for a patient"	Pain management, glycaemic control and weaning
c) "The treatment and care of and the administration of medicine to a patient, including the monitoring of the patient's vital signs and of his reaction to disease conditions, trauma, stress, anxiety, medication and treatment"	Pain management, glycaemic control and weaning
d) "The prevention of disease and the promotion of health and family planning by teaching and counselling individuals and groups of persons"	Pain management, glycaemic control and weaning
e) "The prescription, promotion or maintenance of hygiene, comfort and physical reassurance of the patient"	Pain management, weaning
f) "The promotion of exercise, rest and sleep with a view to healing and rehabilitation"	Pain management, weaning
g) "The facilitation of body mechanics and the prevention of bodily deformities in the execution of the nursing regimen"	Weaning
h) "The supervision over and maintenance of a supply of oxygen"	Pain management, weaning
i) "The supervision over fluid, electrolytes and acid base balance of a patient"	Glycaemic control, weaning
j) "The facilitation of the healing of wounds and fractures, the protection of the skin and the maintenance of sensory functions in a patient"	Glycaemic control
k) "The facilitation of the maintenance of bodily regulatory mechanisms and functions in a patient"	Pain management, glycaemic control and weaning
l) 'The facilitation of the maintenance of nutrition of the patient"	Glycaemic control
n) "The facilitation of communication by and with a patient in the execution of a nursing regimen"	Pain management, glycaemic control and weaning from mechanical ventilation
o) "The facilitation and attainment of optimal health for the individual, the family, groups and the community in the execution of the nursing regimen"	Pain management, glycaemic control and weaning
p) "The establishment and maintenance, in the execution of the nursing regimen, of an environment in which the physical and mental health of a patient is promoted"	Pain management, glycaemic control and weaning
r) "The co-ordination of the health care regimens provided for the patient by other categories of health personnel"	Pain management, glycaemic control and weaning
s) "The provision of effective patient advocacy to enable the patient to obtain the health care he needs"	Pain management, glycaemic control and weaning

2.4 EVIDENCE-BASED PRACTICE AND PROTOCOL-BASED CARE

Evidence-based practice is the application of the best available empirical evidence, including recent research findings, to clinical practice in order to aid clinical decision-making (Thomson, et al., 2000:164). The implementation of evidence-based practice has resulted, in part, from the desire to avoid patients receiving care based on the unproven opinions of individual clinicians (Hewitt-Taylor, 2004:45) and on tradition and hearsay (Considine & Hood, 2000:330). According to Closs and Cheater (1999:11) evidence-based practice has an underlying assumption that "science-based evidence will tell us what the most successful and cost-effective approaches to nursing care are" and that nurses will then be in a position to provide "best possible care at least possible cost in an environment of limited resources". As ICU care is known to be extremely expensive, it appears that introducing evidence-based practice into ICUs could improve patient care and reduce costs.

Protocol-based care is an effective way of introducing evidence-based practice into the ICU. Protocols can also improve the quality of patient care as they guide nurses in their decision-making processes and reduce the time delay that would have resulted if the nurse had sought medical approval before continuing with the treatment (Lowe, et al., 2001:124). Protocols have also been shown to improve patient mortality and morbidity and reduce costs in intensive care (Meade, et al., 2002:2601). Protocols, in the form of nurse-led protocols, are increasingly being used in ICU (Kollef, et al., 1997:572,). A nurse-led protocol is one where a physician's order is not needed if the intervention required can be met based on the parameters specified by the protocol (Moores, Wilson & Bartels, 2005:4). It is anticipated that an increasing number of protocols and guidelines addressing specific areas of nursing care will be developed in the future (Hewitt-Taylor, 2004:45). The DOH (2003) identified the implementation of protocols, particularly nurse-driven protocols, to drive the care of many ICU issues as one potential solution to undertake more patient activity without a net increase in resources. Protocol-based care offers potential benefits to both critically ill patients and nurses working in ICU.

2.5 PROTOCOLS

Hewitt-Taylor (2004:49) suggests that protocols dictate actions that must be adhered to, whereas a guideline offers advice that is less rigid. Fessler and Brower (2005:S223) state that a spectrum of decision support tools is available to assist in the management of complex patients. They suggest that protocols are sets of explicit, algorithmic rules whereas guidelines are more general, flexible and tolerant of latitude amongst practitioners and both are located at different points of the spectrum. They define a protocol as a set of rules that will lead varied practitioners, faced with an identical clinical situation, to reach the identical decision. Considine, et al., (2000:330) indicate that the terms protocol and clinical guideline are often used interchangeably, but whatever the label, they are statements of evidence to inform best practice.

Protocols and guidelines are intended to facilitate or complement decision-making and clinical judgement rather than to replace it completely (Considine, et al., 2000:330; Ely, Meade, Haponik, et al., 2001:461S). Crocker (2002:277) states that protocols are not set in stone and there is always room for clinical judgement. It must be remembered that protocols and guidelines are a part of, not the entirety, of nursing care (Hewitt-Taylor, 2004:49). Clinical practice is always more complex and presents many more realities than can adequately be captured by a protocol, therefore the nurse needs to have both the knowledge to know when to deviate from the protocol and the insight to seek medical assistance when necessary.

Competence in working with a protocol includes the ability to respond to the individual need of the patient and to exercise professional judgement (Hewitt-Taylor, 2004:50). She states that where guidelines or protocols are not followed, the reason for this decision must be clearly documented. Protocols should not be so rigid that patient safety is compromised (Meade, et al., 2002:2602). Fulbrook (2003:97) reports on a Royal College of Nursing definition of nursing effectiveness as “doing the right thing in the right way for the right patient at the right time”. Nurses, by virtue of the fact that they are present at the patient’s bedside twenty-four hours a day, are key personnel responsible for providing “best practice” to patients.

The reported benefits of protocols are listed below (Baird, 2001; Crocker, 2002; Grap, Strickland, Tormey, et al., 2003; Fessler, et al., 2005; Goodman, 2006):

- Improves patient outcomes
- Improves nursing efficiency
- Standardizes patient care by providing consistency across all types and levels of provider experience
- Enhances multidisciplinary working
- Decreases costs in ICU
- Decreases morbidity and mortality
- Gives nurses more autonomy over patient decisions and care thus improves personnel morale
- Assists decision making
- Complements clinical judgement of healthcare professionals and thereby enhances clinical care
- Increases confidence of nursing personnel
- Improves knowledge through education
- Introduces evidence-based practice into ICU
- Gives structure to procedures and helps maintain continuity
- Reduces the time delay that would have resulted if the nurse had sought medical approval before continuing with the treatment

Reported difficulties associated with protocols include (Baird, 2001; Chan, Fischer, Stewart, et al., 2001; Grap, et al., 2003; Hewitt-Taylor, 2004; Fessler, et al., 2005):

- Non-acceptance of protocols
- Ensuring consistency in use of protocol
- Ensuring compliance with protocol
- Difficulty in developing protocols
- Difficulty in developing effective educational programmes
- Potential loss of individualised care
- Constrains clinicians' choice of judgements
- Protocols are only part and not the entirety of nursing care
- Patients may require care by more than one protocol and these may be in conflict with one another

- Even when following protocols, clinicians are accountable for all the decisions that they make.

2.5.1 Care areas frequently directed by protocols

Clinical protocols in intensive care have been shown to improve, amongst others, medication use, weaning from mechanical ventilation, nutritional support and glycaemic control (Fessler, et al., 2005:S224). The three areas of care chosen for this study are pain management, glycaemic control and weaning from mechanical ventilation. They have been chosen not only as they are the care areas in which protocols are most commonly found, but also as pain management is often poorly managed in ICU, (Blenkharn, Faughnan & Morgan, 2002:332), glycaemic control has been shown to improve morbidity and mortality of critically ill patients (Van den Berghe, Wouters, Bouillon, et al., 2003:360), and weaning from mechanical ventilation, as the shorter the duration of mechanical ventilation the fewer associated complications (Lowe, et al., 2001:124).

2.5.1.1 Pain management

Pain has been cited as one of the greatest stressors to ICU patients (Erkes, Parker, Carr, et al., 2001:52; Blenkharn, et al., 2002:332). Patients in ICU often have substantial pain due either to their pathology or to the treatment interventions to which they are subjected, but this group of patients often has difficulty in communicating their pain (Fothergill-Bourbonnais, et al., 1992:364; Puntillo, Miaskowski, Kherle, et al., 1997:1159). Because of the subjective nature of pain, the single most reliable indicator is the patient's own verbal assessment. ICU patients are often unable to verbalise their pain due to the many communication barriers encountered in this environment such as a decreased level of consciousness, the use of sedation and restraints and the presence of a tracheostomy or endotracheal tube. These barriers hinder communication and force the personnel to rely on behavioural and physiological indicators to diagnose and manage pain (Puntillo, et al., 1997: 1159).

Although pain is associated with many complicating factors (Erkes, et al., 2001:52; Blenkharn, et al., 2002:333), it is possible that pain control is being neglected in ICU (Blenkharn, et al., 2002:332). Fear of opioid addiction (Fothergill-Bourbonnais, et al., 1992:369), haemodynamic instability and respiratory compromise has led to analgesia being withheld from intensive care patients. Mac Lellan (2004:180) sites various authors as listing nausea, respiratory complications, decreased return of normal gut activity, increased risk of deep vein thrombosis, damage to pressure areas and psychological effects as further complications associated with unrelieved pain. Nurses are not responsible for prescribing pain medication but the decision to administer or withhold this medication usually rests with the nurse (Erkes, et al., 2001:48). Deficits in nurses' knowledge of pain management can impede optimal management (Fothergill-Bourbonnais, et al., 1992:369; Mac Lellan, 2004:180). Fothergill-Bourbonnais, et al., (1992:363) also state that the effectiveness of pain management by nurses is related to factors such as attitudes and knowledge and that it is important for nurses to have a good knowledge of pain management and that this knowledge be translated into practice. As nurses spend more time with the patient than any other health care professional, they are in the best position to evaluate whether effective pain management has been achieved and if not to make the necessary adjustments to treatment (McCaffrey & Ferrel, 1997:176; Mac Lellan, 2004:184).

In a study by Erkes, et al., (2001:50), which elicited the knowledge and attitudes of critical care nurses regarding pain management; it was found that on average, nurses in the study showed low baseline scores, but that scores increased significantly following educational intervention. The sample was however small, as only 30 critical care nurses completed the self-administered questionnaire (Erkes, et al., 2001:50). Nineteen of these nurses scored below the competency indicator of 75% in the pre-test, but only one of the nurses failed to improve this score post the educational intervention. These authors concluded that the nurses' knowledge and attitude regarding pain management was less than adequate and that education of nurses regarding pain control was crucial if unnecessary suffering, leading to costly complications, is to be addressed (Erkes, et al., 2001:52).

Lack of knowledge regarding pain management leads not only to poorer patient outcome and unnecessary suffering, but also to added health care expenditure (Erkes, et al., 2001:52). Lack of knowledge has been a consistent finding in studies assessing nurses' and other health care professionals' knowledge and attitude of pain management (Shannon &

Bucknall, 2003:156). These authors state that nurses in ICU need assistance with assessing and managing pain as their knowledge in this area has proven to be inadequate (Shannon, et al., 2003:160). McCaffrey, et al., (1997:176) state that nurses require an extensive knowledge of pain management as they play an important role in this area.

2.5.1.2 Glycaemic control

Hyperglycaemia, due to excessive production of counter-regulatory hormones (glucocorticoids, catecholamines, growth hormone, glucagons), cytokines, insulin resistance and pre-existing diabetes (McMullin, Brozek, Jaeschke, et al., 2004:799), is common during critical illness (Van den Berghe, et al., 2003:359). Hyperglycaemia has been associated with an impaired immune response and increased susceptibility to infection (Kanji, Singh, Tierney, et al., 2004:804) and may well contribute to the morbidity and mortality in ICU (Finney, Zekveld, Elia, et al., 2003:2041).

Glycaemic control to maintain normoglycaemia has been shown to have beneficial effects on the outcome of critically ill patients (Van den Berghe, et al., 2003:360). The landmark study by Van den Berghe, Wouters, Weekers, et al., (2001) was stopped after interim analysis indicated that conventional insulin treatment was inferior to intensive insulin treatment (i.e. tight glycaemic control). Since Van den Berghe's study, protocols to maintain the blood glucose of the critically ill patient within the normal range have been introduced into many ICUs. Protocols that standardize prescribing and monitoring for glycaemic control have been found to be the most appropriate strategy to ensure that the patient receives maximum benefit from the therapy while trying to ensure patient safety (Kanji, et al., 2004:808). These authors found that even when using a narrow target blood glucose range, glycaemic control could be achieved rapidly and safely when using a protocol (Kanji et al., 2004:808).

In 2003, an international team of critical care and infectious disease experts developed management guidelines in an attempt to reduce the unacceptably high morbidity and morality associated with sepsis (Dellinger, Carlet, Masur, et al., 2004:859; Poulton, 2006:97). In what has become known as the "Surviving Sepsis Campaign" these experts reviewed the relevant literature that would be of practical use to clinicians managing

critically ill patients (Poulton, 2006:97). Again it was stated that the recommendations made were to provide guidance to clinicians and not to replace their decision making capacity, and that due to the uniqueness of each patient the guidelines were not applicable to all patients (Dellinger, et al., 2004:859). Although these guidelines have specifically targeted the septic patient in ICU, many of the recommendations can be translated for use in non-septic ICU patients. Included in the surviving sepsis guidelines is glucose control. Although the best results in the Van den Berghe study were obtained with tight control of blood glucose (i.e. blood glucose between 4,4 and 6,1 mmol/L) maintaining the blood glucose at less than 8,3 mmol/L also improved the outcome of patients when compared with higher blood glucose concentrations. This higher concentration of blood glucose was also likely to be associated with a reduced risk of hypoglycaemia (Dellinger, et al., 2004:865).

As glycaemic control is a relatively new management strategy, no studies assessing the knowledge of nurses regarding glycaemic control were found. However in order to safely implement glycaemic control and avoid unnecessary complications associated with this practice, the nurse needs to have an adequate knowledge base.

2.5.1.3 Weaning from mechanical ventilation

Timely weaning from mechanical ventilation has been associated with a decreased risk of complications (Tobin, 2001:1992), decreased length of stay in ICU and reduced cost of ICU (Marelich, Murin, Battistella, et al., 2000:459; Lowe, et al., 2001:124; Grap, et al., 2003:454). Mechanical ventilation plays a significant role in the high cost of treatment of a patient in ICU (Grap, et al., 2003:454). Approximately 41% of time required for ventilation is spent on the weaning process (Estban, Alia, Ibanez, et al., 1994: 1188). Many studies have found that by using a weaning protocol, the duration of mechanical ventilation can be reduced (Kollef, et al., 1997: 570; Marelich, et al., 2000:465; Henneman, Dracup & Ganz, et al., 2001:300; Gelsthorpe & Crocker, 2004:214).

Kollef, et al., (1997: 571) found that protocol-directed weaning was safe for nurses to use. Nurse-led weaning is being widely advocated and implemented across the United Kingdom (Gelsthorpe, et al., 2004:214). The use of protocols for weaning has been found to provide

consistency in the weaning process "across all types and levels of provider experience" which is ultimately beneficial to the patient (Grap, et al., 2003:455). These authors state that nurses can effectively achieve weaning goals by using protocols, but that implementing a protocol requires a consistent team effort.

2.6 KNOWLEDGE LEVELS

ICUs are highly technical and dynamic areas that require caregivers, both medical and nursing, to have a vast array of knowledge and skills in order to deliver effective evidence-based patient care (Huggins, 2004:39). The Collins English Dictionary (1986:849) defines knowledge as "awareness, consciousness or familiarity gained by experience or learning and is a combination of both practical and theoretical knowledge". Practical knowledge is that gained from experience while theoretical knowledge is that gained from learning. Fulbrook (2003:96) states that critical care nursing requires an advanced level of both technical and human expertise and that nurses must draw on an extensive scientific knowledge base ranging from physiology and pharmacology through to psychology and sociology.

Fulbrook (2003:98) cites Liaschenko and Fisher (1999) as proposing a tripartite classification of knowledge based on nursing work comprising case knowledge, patient knowledge and personal knowledge. According to Fulbrook (2003:98), case knowledge comprises knowledge about disease processes, therapeutic protocols and pharmacology; patient knowledge is that which defines the individual within the health care system, e.g. their response to therapeutics and personal knowledge relates to knowledge of the individual as a person. Case knowledge is the most highly valued form of knowledge in healthcare, whereas nurses in their practice use patient and personal knowledge.

The ICU environment is not static and requires both newcomers to ICU and experienced personnel to continuously learn in order to keep abreast of developments (Huggins, 2004:39). According to Huggins (2004:40), knowledge is "knowing and understanding", whereas skill is the "doing", and ICU nurses use knowledge and skills together. A respondent in this author's study stated that "without knowledge of why you are

performing skills, you are unable to perform them competently" and that "to perform skills without knowledge is unsafe" (2004:40). Toth (2003:41), states that knowledge does not ensure safe practice, but that without knowledge, safe practice is not possible. Burns, et al., (2003: 14) state that the quality of nursing practice is dependent on the knowledge learnt.

Quality nursing care has moved from being regarded as a series of tasks to the provision of holistic care to each individual patient (Hewitt-Taylor, 2004:49). In order to provide this individualised care to patients, the nurse will need adequate knowledge to assess the patient's needs and to know what treatment options are available. "Nursing cannot rely solely on natural scientific knowledge because this does not provide a holistic view of the person" (Blackwood, 1999:933). A negative aspect of protocol-based care is that it mitigates against individualised care (Hewitt-Taylor, 2004:49). If the knowledge of ICU nurses can be assessed, suitable education programmes can be structured around the protocols being introduced or those already in use in the ICUs. This may result in improved individualised care of patients receiving protocol-based care.

Many studies, both internationally and in South Africa, have indicated that nurses working in ICU may lack appropriate knowledge. In a study in which 230 critical care nurses reflected on their perceived problems associated with decision making, 35.7% of respondents stated that they had difficulty with decision making due to a lack of knowledge on at least a weekly basis (Bucknall & Thomas, 1997:233). Furthermore, 94.8% said that they, at times, had difficulty making decisions due to a perceived lack of knowledge (Bucknall, et al., 1997:235). Comments made by the nurses included …"decisions need a good knowledge base…" and "…insufficient knowledge to allow appropriate clinical decision" (Bucknall, et al., 1997:235). These nurses frequently mentioned the demands that new critical care technology made upon their knowledge base and that in-service education was needed to address this problem (Bucknall, et al., 1997:236).

In order for ICU nurses to be able to render quality care to their patients and be accountable for their actions, they need to possess certain abilities, namely knowledge, skills and values (Bergman, 1982:8). In order to demonstrate competence, the ICU nurse needs an advanced level of knowledge which can be applied to the clinical situation. Benner states that experience and formal education are required to develop competency (1982:406).

The existence of guidelines or protocols does not obviate the need for nurses to exercise their professional judgement in making appropriate decisions in relation to individual circumstances. In all situations, nurses are responsible for the decisions they make regarding patient care and must be able to demonstrate that these were reached with the belief that they were in the best interests of the patient (Hewitt-Taylor, 2004:50).

2.6.1 Knowledge studies

A recent local study conducted within the intensive care environment (Van Huyssteen, et al., 2004) looked at the knowledge of recovery room nurses regarding post-operative airway emergencies in adults. Only one of the 21 nurses that consented to participate in the study (a response rate of 49%) demonstrated the set competence (Van Huyssteen, et al., 2004:12). This was however a small study. In another recent local study (Windsor, 2005) conducted in intensive care, only fifteen (13.5%) of the 111 participants (a response rate of 69%) achieved a score of, or above, the set competency indicator. This study was conducted to determine the knowledge of ICU nurses regarding ventilator waveforms in order to develop an educational programme on this topic.

This problem is however not unique to South Africa. In an Australian study (Johnston, et al., 2004:566) addressing knowledge of the use, safety and complications of pulmonary artery catheters, only 42.8% of the nurses demonstrated competence. In this study 139 questionnaires were completed, realising a response rate of 46%. Of concern is that participation in these studies was voluntary and that those who chose not to participate probably did not have enough confidence in their knowledge to do so, leading to the results appearing to be better than if participation had been compulsory. Based on these findings it can be concluded that nurses in speciality areas may lack the knowledge to safely implement the advanced care that the ICU patient requires.

2.6.2 Influence of years of experience and formal training on knowledge of ICU nurses

Benner (1982:407) describes experience as "not the mere passage of time or longevity; it is the refinement of preconceived notions and theory by encountering many actual practical situations that add nuances or shades of difference to theory". Therefore, the experiences that one is exposed to in nursing, have more of an impact than the actual time spent nursing. In a study by Toth (2003), in which basic knowledge of ICU nurses in the USA was compared to that of nurses in other countries, the greatest variance in scores was from years of experience in ICU, with nurses with more experience having higher scores. A study by Blegen, Vaughn & Goode (2001:37) provided consistent support for the belief that nurses with more experience provide higher-quality care.

Only one study was found that compared the knowledge of ICU trained nurses to that of non-ICU trained nurses working in ICU. In this study by Oosthuizen (2000), which tested ICU nurses' knowledge of intra-aortic balloon counterpulsation, the ICU trained nurses scored better than the non-ICU trained nurses. This is however, what would be expected. If knowledge is basic to safe practice (Toth, 2003:45), all nurses working in ICU should have an appropriate level of knowledge in order to render safe practice to critically ill patients.

2.7 SUMMARY

Due to the shortage of nurses in ICU, critical care nursing in this country has been described as "being in a state of critical crisis". A recent national audit has revealed that only 25% of nurses in working in the area are ICU trained. Local studies have indicated that nurses may lack knowledge on completion of their basic training as a general nurse. These nurses are permitted to work in the ICU where they are expected to perform at an advanced level. Further studies have questioned the knowledge of not only newly trained ICU nurses but all nurses, including those who are ICU trained. This is in contrast with the assumption that "… the nurse must have the necessary knowledge to perform all the acts relating to the various aspects of the scope of her practice" and that nurses are responsible for ensuring that they have the necessary knowledge for their specific speciality. ICUs are

highly technical and dynamic environments requiring nurses to be both intellectually and clinically competent.

As protocols to direct treatment are becoming more and more common in the ICU environment, it was deemed relevant to determine the knowledge of ICU nurses in care areas commonly directed by protocols. Three of the care areas most commonly directed by protocols were chosen for this study, namely pain management, glycaemic control and weaning from mechanical ventilation. Protocols bring evidence-based practice into the ICUs. Evidence-based practice has been described as the application of the best available empirical evidence, including recent research findings, to clinical practice in order to aid clinical decision-making. A concern with protocol-directed care is that all patients will receive exactly the same care regardless of their individual circumstances. This would lead to a "one size fits all" programme of care unless the nurse had the knowledge to deviate, when appropriate, from the protocol to accommodate individual patient's needs. In order to make informed decisions regarding individual patient care, the nurse needs an adequate knowledge of the specific care area. Even where protocols or guidelines exist, there will always be a need to consider the numerous factors which impact on care decisions such as other procedures being performed and individual patient preferences, needs and responses to care. This will require knowledge of what options exist outside of the guideline or protocol and what the most appropriate response is under the specific circumstances.

Gonce Morton, et al., (2005:5) relate an incident where, in an address to ICU nurses, the speaker stated that registered ICU nurses give certain gifts to their patients. One being the "gift of knowledge" as these nurses require a high level of preparation and an in-depth knowledge in order to provide optimal care. Another being the "gift of caring". The speaker further stated that knowledge and caring go hand in hand and that one without the other does not translate into quality care.

This study will focus on the knowledge of nurses working in ICUs relative to pain management, glycaemic control and weaning from mechanical ventilation, three care areas commonly directed by protocols.

In this chapter a review of the literature was provided. The following chapter will address the research methodology used in this study.

CHAPTER THREE

RESEARCH DESIGN AND RESEARCH METHODS

3.1 INTRODUCTION

This chapter describes the research methodology used in this study including the research design, the study setting, sample criteria, the sampling process and data collection procedures as well as the development and validation of the research instrument used for data collection. According to Sim and Wright, (2000:2), methodology refers to the research design and the research method.

3.2 PURPOSE AND OBJECTIVES

For consistency, the purpose and objectives of this study are repeated here.

The purpose of this study was to determine the knowledge levels of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

In order to meet these aims, the following objectives were set:

Phase one:

- To develop and validate an instrument to assess knowledge of ICU nurses in three specific care areas, namely pain management, glycaemic control and weaning from mechanical ventilation.

Phase two:

- To describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

- To compare the difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.
- To determine to what extent the knowledge of nurses working in ICU is influenced by their years of ICU experience relative to pain management, glycaemic control and weaning from mechanical ventilation.

3.3 RESEARCH DESIGN

A non-experimental, descriptive and contextual two-phase design was used to determine the knowledge levels of nurses working in ICU with regard to pain management, glycaemic control and weaning from mechanical ventilation.

Non-experimental

According to Brink (2003:108), in non-experimental research, the study is carried out in a natural setting and the phenomena are observed as they occur without manipulation of the independent variable. The main purpose of this type of research is to describe phenomena and to explain and explore the relationship between variables (Brink, 2003:108). A non-experimental design is suitable for this study as it takes place in a natural setting (ICUs in selected hospitals) and there is no treatment or intervention (i.e. no manipulation of variables).

Descriptive

A descriptive study was chosen in order to "gain more information about characteristics in a particular field of study" and "its purpose is to provide a picture of a situation as it happens naturally" (Burns, et al., 2003:200). This study is descriptive in nature as it aims to gain information about the knowledge levels of ICU nurses working in selected ICUs, pertaining to pain management, glycaemic control and weaning from mechanical ventilation.

Contextual

Critically ill patients are nursed in the ICUs of both public and private hospitals. The multiple and complex pathologies frequently encountered in this patient population requires that the nurses in these areas be able to use their knowledge and clinical judgement to make decisions regarding the often unstable and rapidly changing condition of their patients.

Accountability forms the basis of professional nursing practice (Searle, 2002:120). Nursing in South Africa is regulated by the South African Nursing Council (SANC) through the Scope of Professional Practice of Persons Registered and Enrolled under the Nursing Act of 1978 (SANC Regulation R2598 as amended) and the regulation detailing the Acts and Omissions (SANC Regulation R387 of 1985 as amended), by which the SANC may take disciplinary action.

This study is contextual in nature as it was conducted within a specific context. De Vos (2001:281) describes context as a "small-scale world" of, amongst others, gangs, clinics, hospital wards or critical care units. This research was conducted among nurses working in the ICUs of selected public and private sector hospitals in Gauteng. In order to be accountable for their practice nurses require an adequate knowledge base for interventions.

3.4 RESEARCH METHODOLOGY

The research methodology progressed through two phases. The objectives of this study were used to provide order to the process. For clarity and consistency the ethics and the validity and reliability of each phase will be discussed in the relevant phase. Refer to Figure 3.1 for an overview of the research plan.

3.4.1 Phase one: Developmental and Quantification stages

The objective of this phase was to develop and quantify (i.e. validate) an instrument to assess knowledge of ICU nurses. The three areas of care chosen for this study are pain

management, glycaemic control and weaning from mechanical ventilation. They have been chosen as a literature search revealed them to be the care areas most commonly found in protocol form, where there is a strong association between the intervention and the outcome, and also as pain management is often poorly managed in ICU, (Blenkharn, et al., 2002:332), glycaemic control has been shown to improve morbidity and mortality of critically ill patients (Van den Berghe, et al., 2003:360), and weaning from mechanical ventilation, as the shorter the duration of mechanical ventilation the fewer associated complications (Lowe, et al., 2001:124).

The researcher developed a provisional instrument covering the above care areas, based on an extensive review of the literature, the researcher's own clinical experience and discussions with clinical facilitators and intensivists (medical specialist trained in intensive care) experienced in the fields of pain management, glycaemic control and weaning from mechanical ventilation. Existing protocols were not used in the development of the instrument as protocols are not standardised between hospitals and many of the protocols viewed by the researcher were not evidence based.

Following a further review of the literature the researcher decided to use Lynn's Model (Lynn, 1986) to further develop the instrument as this model describes a structured process of both instrument development and instrument quantification. Lynn (1986:382) states that using a two-stage process to determine and quantify content validity is fundamental to the validation of almost all instruments. The two-phase model as described by Lynn (1986) will be described as a research methodology.

Lynn (1986:382) states that validity of an instrument is a crucial factor in selecting or applying an instrument, as it is the extent to which the instrument measures what it is supposed to measure. Lynn uses a two-stage process to determine validity, namely the developmental and the quantification stages. The subsequent redesign and quantification (i.e.validation) of the provisional research instrument followed the guidelines recommended by Lynn (1986).

The developmental stage consists of three steps: domain identification, item (question) generation and instrument formulation. A group of local ICU nursing experts met to achieve these three steps. The quantification stage is a two-step process in which a number

of experts are asked firstly to assess the individual questions in the instrument for content validity and secondly to assess the validity of the entire instrument. A second, national group of nursing experts was used for this stage. Table 3.1 shows the various stages of Lynn's Model and Figure 3.1 shows an overview of the research plan.

Table 3.1: Stages of content validity determination for Lynn's model

Stage One: Developmental stage
1. Identification of content domain
2. Question generation
3. Assimilation of questions into a usable form
Stage Two: Quantification stage
1. Quantification of content validity of each question
2. Quantification of content validity of the entire instrument

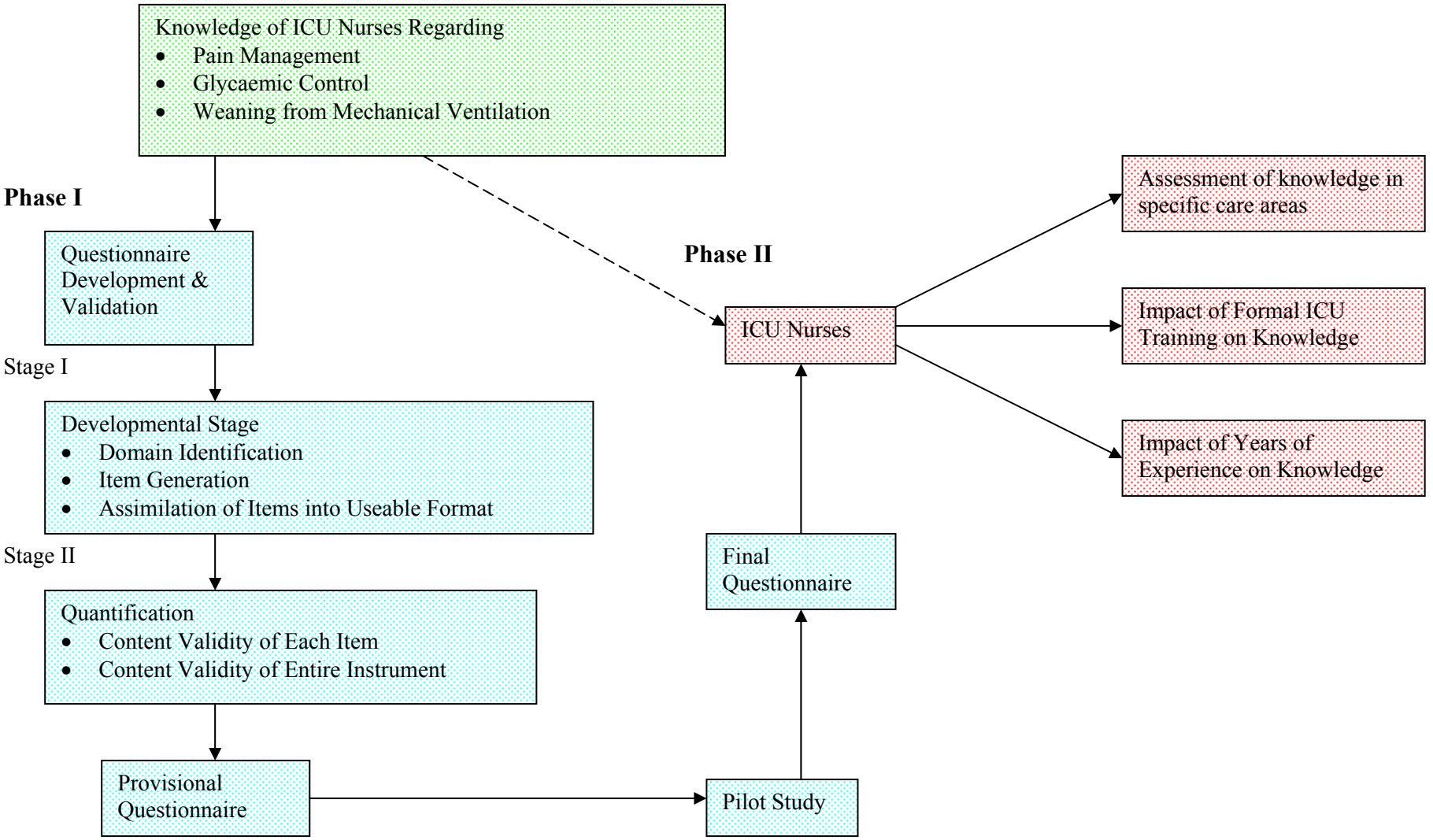

Figure 3.1: Overview of research plan

3.4.1.1 Stage one: Developmental stage

Target population

The population from which the panel of ICU experts for the development of the instrument were selected consisted of local ICU nurses considered to be experts in ICU. These experts consisted of:

- Registered ICU trained nurses working in public and private sector hospitals in Johannesburg
- Intensive care unit managers
- Intensive care clinical facilitators
- Intensive care lecturers and educators

Sampling of care areas

Nursing interventions that improve patient outcomes is the ultimategoal of nursing care. When selecting these interventions it is important to select measures where the evidence regarding the association between the intervention and the outcome is strong (Berenholtz, Dorman, Ngo et al., 2002:8). Protocols, in the form of nurse-led protocols, are increasingly being used in ICU (Kollef, et al., 1997:572). Following an informal review of the literature, care areas found in protocol form and with a strong association between the intervention and the outcome were identified. Due to the limited scope of this study only the three areas most commonly found namely pain management, glycaemic control and weaning from mechanical ventilation were selected for this study.

Sample and sampling method

A non-probability purposive sampling method was used to select local experts to redevelop and quantify (i.e. validate) the data collection instrument, as this ensured that those who were particularly knowledgeable regarding the chosen care areas were selected. Lynn (1986:383) states that there is no consensus on the number of experts that should be included in this process and it depends on the number of accessible and willing persons that

the researcher can identify and not on a population estimation principle. Six (n=6) local ICU nursing experts who met the inclusion criteria were invited to participate in the panel. This number was chosen, as the process was similar to that of a focus group and between six and ten participants has been described as being suitable for focus groups (Burns, et al., 2003:287).

Criteria for inclusion of participants in this stage of the study were as follows:

- Registered ICU nurses currently involved in either a public or private sector ICU, who were familiar with the chosen care areas through clinical experience.
- A minimum of five years experience in ICU.
- Involvement in either formal or informal education in ICU.

Data collection process

Method

The researcher followed the three steps as advocated by Lynn (1986) in the developmental phase of the instrument being redeveloped for use in this study. These steps were modified slightly as the researcher had already drawn up a provisional instrument.

Panel of experts

Potential participants from the target population were contacted telephonically to elicit their willingness and availability to take part in the panel of experts. The aim being to recommend changes to the provisional research instrument that had been developed by the researcher following an extensive review of the literature, the researcher's own clinical experience and discussions with clinical facilitators and intensivists with experience in these fields, by adding additional questions and changing the wording of existing questions where deemed necessary, and by deleting questions deemed irrelevant or unimportant.

Prior to the expert panel meeting, all those who had agreed to take part were sent the following documentation (See Appendix A):

- Two information letters
- A copy of the provisional instrument
- A demographic questionnaire
- A consent form
- A list of critical issues identified in each care area and a rating form to assess the relevance of the critical issues identified in each care area, or to add further critical issues identified (Form 1)
- A rating form to assess each question (Form 2)
- A rating form to assess the level of knowledge of each question (Form 3)

The panel of experts met in the Department of Nursing Education of the University of the Witwatersrand Faculty of Health Sciences in Johannesburg on the 17 February 2006. The researcher facilitated the discussion. Many of the participants knew each other, but some needed an introduction. Participants were encouraged to interact with each other which created a comfortable and non-threatening environment in which the discussion could take place. The researcher gave a short PowerPoint presentation to orientate the participants to the study and as to what was expected of them during the panel session. To facilitate good communication, seating was arranged to ensure that all the group members could see each other.

The way the three steps in Lynn's method were used in this study is detailed below.

Step 1: Domain identification

For cognitive measures, such as used in the instrument for this study, the full content domain must be identified (Lynn, 1986:383). As this research covered three domains or care areas namely pain management, glycaemic control and weaning from mechanical ventilation, the researcher identified what she thought were the most critical issues in each domain. This identification was based on an extensive review of the literature, the researcher's own clinical experience and discussions with clinical facilitators and intensivists with experience in these fields. The ICU nursing experts were asked to recommend any additional issues that should be added to the domains and to assess the relevance or otherwise of the issues listed (Form 1 in Appendix A). During the meeting agreement was reached on which issues should be included in the instrument.

Step 2: Question generation

As the researcher had already developed a provisional instrument, this step was used to ensure that the questions were appropriate and covered relevant aspects of the three care areas. The experts were asked to individually rate each question using a rating scale before coming to the meeting in order to expedite proceedings when the panel met. The wording of this rating scale was changed to incorporate terminology deemed more suitable for achieving the objective of this phase of the study. The rating scale, as modified for this study, was:

1 = irrelevant

2 = relevant but unimportant

3 = relevant and important

4 = relevant and very important

A rating form (Form 2 in Appendix A) was used for the assessment. In this phase, the ratings were used to further develop the instrument, and not to assess content validity of the questions. During the meeting, irrelevant questions were deleted and all those questions receiving ratings of two and three were altered or amended based on agreement of the ICU nursing experts. Questions receiving a rating of four were included in the instrument without further discussion if the majority of the experts were in agreement. Questions were reworded where deemed necessary. Further questions recommended by the panel of experts were added to the instrument. Asking for substantiation of the answer given extended some of the questions in the instrument.

During the meeting, the participants were also asked to rate each question as follows using Form 3 in Appendix A:

1 = Basic

2 = Applied

3 = Advanced

The level of knowledge being tested by each question in the instrument was debated until agreement was reached.

Step 3: Instrument formation

During the meeting, the instrument was organised into a useable format. This provisional instrument (See Appendix B) was divided into four sections:

- The first section requested demographic information from the participants.
- The second section addressed pain management.
- The third section addressed glycaemic control.
- The fourth section addressed weaning a patient off mechanical ventilation.

Data management

During the discussion, data regarding domain identification, question generation, instrument formation and assessment of level of knowledge of each question was captured onto a flip chart by a co-facilitator. The co-facilitator was used to enable the facilitator to interact fully with the group and to ensure accurate capture of the data. This data was transferred onto a computer spreadsheet immediately after the expert panel meeting had ended.

The researcher sent the provisional instrument that had been finalised during the meeting back to all the participants for verification that the agreed changes had been made.

Data analysis

Data analysis was not necessary at this stage as each question and the level of knowledge of each question was debated until agreement was reached. Agreement was based on the importance of each question to clinical practice.

Ethical considerations

Telephonic consent was obtained from the ICU nursing experts when they indicated their willingness to participate in the panel meeting. During the meeting written consent was

obtained from these participants. No consent was obtained from the authorities as the ICU nursing experts were invited to participate in their private capacity and did so in their own time. The researcher adhered to DENOSA's ethical standards of research (1998: 2.3.1-2.3.4) to protect the rights of the participants.

Validity

Lynn (1986:382) states that the use of a two-stage process to determine and quantify content validity is fundamental to the validation of virtually all instruments. This author further states that the assessment of content validity begins with the development of the instrument (1986:383). The expert panel was used to begin the process of determining content validity of the instrument to determine the knowledge of ICU nurses in regard to pain management, glycaemic control and weaning from mechanical ventilation.

3.4.1.2 Stage two: Quantification stage

The second stage of Lynn's Model is the judgement or quantification stage. During the quantification stage, experts assess the content validity of the instrument in a two-step process. Firstly the experts independently reviewed each question of the instrument for content validity and secondly assessed whether the entire instrument was content valid.

Target population

The population, from which the ICU experts for the quantification stage were selected, consisted of ICU nurses considered to be experts in ICU from around the country. Experts used in the developmental phase were not considered for this stage. These ICU nursing experts consisted of the following

- ICU trained nurses practicing in private and public sector hospitals in South Africa
- ICU unit managers
- ICU trained and experienced shift workers

- ICU lecturers and educators from universities and nursing colleges (from both public and private sectors)
- ICU nursing managers with both an ICU qualification and current involvement in ICU

Sample and sampling method

A non-probability purposive sampling method was used to select experts to quantify the data collection instrument, as this ensured that those who were particularly knowledgeable regarding the care areas to be covered in the instrument were selected.

Lynn (1986:383) states that the number of experts necessary for content validity determination is debatable and depends on how many accessible and willing persons the instrument developer can identify. Lynn (1986:383) suggests that a minimum of three and a maximum of ten experts be used, which differs from other authors who have suggested any number from two to twenty as being suitable (Grant & Davis, 1997:269). In discussion with local ICU nursing experts, additional ICU nursing experts who had not been involved in the developmental stage were identified both locally and nationally to participate in the second or quantification stage of the instrument development.

Criteria for inclusion of participants in this stage of the study were as follows:

- Registered ICU nurses currently involved in either a public or private sector ICU, who were familiar through clinical experience with the chosen care areas.
- A minimum of five years experience in ICU.
- Involvement in either formal or informal education in ICU.

Thirteen (n=13) ICU nursing experts who met the inclusion criteria were identified and invited to participate in the quantification stage. In total 11 usable responses were received.

Data collection process

ICU nursing experts who met the inclusion criteria were invited to participate in the quantification stage. Lynn (1986:384) states that regardless of the number of experts used in this stage, these experts must be given a structured procedure by which to evaluate content validity of the instrument, specific instructions by which to determine the content validity of the questions and the instrument as a whole must be issued. Lynn suggests the use of a Content Validity Index (CVI). According to Lynn (1986:384) quantification of content validity using the CVI, which rates the relevance or importance of the questions on an instrument using an ordinal rating scale is widely used. Lynn (1986:384) is of the opinion that a four point rating scale should be used, as it does not include the ambivalent middle rating common in odd number rating scales.

Prior to data collection, those ICU nursing experts who agreed to participate in the quantification process were sent the following documentation (See Appendix B):

- An information letter giving details of the assessment to be carried out
- A demographic questionnaire
- A consent form
- A copy of the provisional instrument
- A form for assessment of content validity (Form 2)
- A form for assessment of the knowledge level of questions being asked. (Form 4)

Data management

Data received from the ICU nursing experts for the rating of content validity and for assessing the knowledge level of the question being asked was entered onto a computer spreadsheet as soon as the data were received.

Data analysis

Data analysis for this stage consisted of the determination of content validity for each question in the provisional instrument and for the instrument as a whole. In addition the experts assessment of the level of knowledge tested in each question was analysed.

Content validity

Validity is the extent to which an instrument measures what it is supposed to measure (Burns, et al., 2003:45). An instrument should not only measure a specific construct, but should also measure the construct consistently and accurately. Content validity, as described by Brink (2003:168) assesses how well the instrument represents the different components of the variable being measured.

According to Lynn (1986:384) the content validity of each question is determined by the proportion of the experts who rate that question as content valid by scoring it as either a three or a four on the rating scale. A table published in Lynn's article (1986:384) is used to determine the number of experts needed to rate a question as being content valid.

The content validity of each question was assessed individually by ICU nursing experts using the Content Validity Index (CVI) rating scale used by Lynn. The rating scale adapted for this study was:

1 = irrelevant
2 = relevant but unimportant
3 = relevant and important
4 = relevant and very important

The content validity index of the entire instrument is the percentage or proportion of questions judged as content valid by the experts (Lynn, 1986:384). Grant, et al., (1997:273) quote Davis (1992) as stating that a new instrument should have a minimum content validity index of 0.8.

The content validity of the entire instrument was determined as the proportion of questions rated either three or four using the CVI.

Reliability

Tests of an instrument's internal consistency are usually used with pencil-and-paper tests and measure the correlation of various questions within the instrument (Burns et al., 2003:272). The statistical procedure normally used for this process is the Cronbach's alpha coefficient. A reliability of 0.8 – 0.9 is the lowest acceptable coefficient for a well-developed measurement instrument, but a reliability of 0.7 is considered acceptable for a newly developed instrument (Burns, et al., 2003:270). Burns, et al., (2003:291), state that when using questionnaires, individual questions may address different aspects or topics that are associated with the research subject and therefore attempting to determine reliability using tests of internal consistency (e.g. Cronbach's alpha coefficient) may not realise an acceptable coefficient. The individual questions in this study covered different aspects of each topic, however the Cronbach's alpha coefficient was still used.

Level of knowledge of questions

Participants were asked to rate the level of knowledge of each of the questions in the instrument by scoring as follows:

1 = Basic
2 = Applied
3 = Advanced

Ethical considerations

Telephonic consent was obtained from the expert ICU nurses when they indicated their willingness to participate in the quantification process. Written consent was obtained thereafter from these participants. No consent was obtained from the authorities as the experts were invited to participate in this process in their private capacity and did so in

their own time. The researcher adhered to DENOSA's ethical standards of research (1998:2.3.1-2.3.4) to protect the rights of the participants.

Limitations to the CVI procedure

Lynn (1986:384) quotes Waltz and Bausell (1981) as identifying two limitations to the CVI procedure for assessment of content validity. These are the possibility of chance agreement of the CVI and the dependence of the CVI on the number of rating categories being used. The first limitation is addressed by the number of experts and the minimum number of these experts that must agree by using the table provided by Lynn (1986:384). The second limitation is addressed by using a four option rating scale and thereby not having the ambivalent middle rating common to odd number rating scales.

3.4.1.3 Summary of phase one

Phase one of this study described in detail the process by which the instrument for this study was developed and content validity achieved. The two stages used by Lynn (1986) and the steps in each stage are described as applied to this study. On completion of phase one the instrument that emerged was used in phase two of the study. Phase two of the study is described in the following section.

3.4.2 Phase two: Research phase

The objectives of this phase were:

- To describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.
- To compare the difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation

- To determine to what extent the knowledge of nurses working in ICU is influenced by their years of ICU experience relative to pain management, glycaemic control and weaning from mechanical ventilation

3.4.2.1 Research setting

The research was conducted in three public sector hospitals and two private sector hospitals (n=5) in Gauteng. They represented highly specialized public and private sector ICUs that accept critically ill adult patients from all disciplines. These hospitals were selected because of the following attributes:

- The combined number of ICU beds in the three public sector hospitals is similar to the number of beds in the two private sector hospitals (CCSSA, 2004).
- Nursing training takes place in all of these hospitals and clinical facilitators are available for teaching in all the units.
- Doctors from academic institutions do ward rounds in all of these hospitals and therefore there is a sharing of academic knowledge.
- Many nurses train in the public sector and then move to the private sector.
- Nurses in the public sector frequently do overtime in the private sector and vice versa.

3.4.2.2 Target population

The target population as described by Burns, et al., (2003:233) is "the entire set of individuals who met the sampling criteria" and an accessible population is described as "the portion of the target population to which the researcher has reasonable access". All registered nurses working in the adult ICUs of three public sector hospitals and two private hospitals in Gauteng were invited to participate in the study. According to CCSSA (2004) the approximate number of nurses permanently employed in these ICUs at that time was ninety (n=90) ICU trained nurses and 140 (n=140) non-ICU trained nurses. Although the selection of the above-mentioned units contextualises this study, the nurses in these units constituted an accessible population.

3.4.2.3 Sample and sampling method

In consultation with the biostatistician, it was decided that a sample size of 120 nurses (N=120), i.e. 60 in each group (i.e. ICU trained and non-ICU trained), would have 90% power to detect a difference in mean knowledge levels (primary objective) of 10 percentage points assuming that the common standard deviation (SD) is 16.7 percentage points using a two-group t-test with a 0.05 two-sided significance level (p=0.05). The standard deviation of 16.7 is assumed where SD = range/6 and range is 100%.

Consecutive sampling was used for this phase of the study. Consecutive sampling, a version of convenience sampling where every available individual or event within an accessible population is chosen, is the best choice of the non-random sampling methods (Endacott and Botti, 2005:52). This method was used to select the widest variety of participants who are typical of the population under study. The sample size was achieved according to the response rate. It was necessary for both groups to be fairly equal in size as equal group sizes would increase power as the effect size is maximised (Burns, et al., 2003:253), therefore the sample was stratified to include a similar number of ICU trained and non-ICU trained nurses. Due to the need for informed consent, probability sampling would potentially result in an inadequate sample size being realised.

The inclusion criteria for the sample were:

- ICU trained nurses currently working in ICU willing to participate in the study.
- Non-ICU trained nurses currently working in ICU with at least four months experience in ICU, willing to participate in the study.

The exclusion criterion for the sample was:

- Non-ICU trained nurses currently working in ICU with less than four months ICU experience. This group has been excluded because although pain management and glycaemic control questions will be representative of general nursing knowledge, valid research results regarding weaning will not be obtained where nurses have not been exposed to at least four months experience in ICU.

3.4.2.4 Data collection process

Once permission had been obtained from each institution, the permission of the nursing services managers was sought and thereafter the unit managers were approached for permission. The instrument was taken to the selected ICUs by the researcher and an assistant who was an experienced researcher. A presentation was made to a small group of nurses at a time, outlining the purpose of the study and its procedures, thereafter the instrument developed for data collection was distributed to those nurses who consented to participate in the study. A small incentive (chocolate) was offered to encourage participation. An instrument (See Appendix C) together with a consent form (See Appendix D) and an information letter (See Appendix D) were given to each participant in an unsealed envelope. On completion of the instrument the participants were asked to place the instrument back into the envelope and to seal it. In order to protect anonymity of the participants, the signed consent forms from each unit were placed together in one envelope, which was then sealed in the participants' presence and one participant signed across the seal.

All participants were assured of anonymity and confidentiality. All data was handled confidentially as only the researcher and her supervisor had access to the raw data. This was stated in the covering letter. Asking no questions that could identify individuals ensured anonymity, and the data collection instruments were not marked for identification in any way. The researcher was contactable via telephone at all times during data collection should participants have had any queries relating to the study. The researcher and assistant waited in the units until the instruments had been completed. These were then taken with the researcher for safekeeping. The researcher only opened the envelopes when all the instruments from a particular institution had been completed.

Instruments

According to Brink (2003:154) a questionnaire is a self-report instrument where the participants write their responses to printed questions on a document. Brink (2003:153) states that questionnaires have many advantages including:

- Being quick, easy and relatively inexpensive way to collect data from a large number of people.
- The format of questionnaires is standard for all participants.
- They promote a sense of anonymity, which was considered beneficial, as some individuals might perceive measuring the knowledge of professionals as threatening.
- Questionnaires are one of the easiest research instruments to test for validity and reliability as they promote accurate and consistent measurement.

Brink (2003:153) however also highlights the problems associated with questionnaires as including:

- A low response rate,
- The cost associated with mailing,
- Failure to answer some of the questions,
- No opportunity for clarification should any questions be misunderstood,
- Those who participate may not be representative of the population
- Subjects must be literate.

Many of these disadvantages were not applicable to this study as the researcher hand delivered the instruments to the units, encouraged participation by offering a small incentive and, as all the participants were professional people, literacy was not an issue in this population. A further potential problem identified by the researcher was participants asking colleagues for assistance in answering the instrument. This was prevented by the researcher's and the assistant's continued presence in each unit while the instruments were being completed.

3.4.2.5 Data analysis

Burns, et al., (2001:794) state that data analysis is conducted to reduce, organise and give meaning to the data that has been collected. The raw data was loaded onto an Excel spreadsheet and was double-checked. The biostatistician was consulted for assistance with analysing the study data.

Demographic data were analysed using descriptive statistics to describe the characteristics of the sample group. Descriptive and inferential statistics were used to describe and compare the knowledge levels of nurses working in the ICUs of public and private hospitals with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols. Subgroups were created during the analysis by splitting the sample into two groups; ICU trained and non-ICU trained nurses, in order to elicit the effect of formal ICU training on the knowledge levels of ICU nurses.

Following statistical consultation it was decided that groups would be compared with respect to their mean assessment of knowledge level using the Students two-sample t-test. Furthermore, to be sure that years of experience did not influence the results, the groups were compared with respect to mean assessment using an analysis of covariance (ANCOVA) with years of experience as a covariate. The impact of years of experience on the participants' level of knowledge was further analysed using Pearson's product moment correlation.

The instrument to test the knowledge of ICU nurses in regard to pain management, glycaemic control and weaning from mechanical ventilation was presented to a number of expert nurses in ICU to obtain their opinion about the minimum mark that should be achieved by the participants. These experts included ICU clinical facilitators and trained ICU nurses who had not been involved in the development or quantification of the instrument. It was agreed that this mark should be 70%. It is generally accepted that the pass rate for a clinical assessment is 60% and for practical procedures is 80%. The **competency indicator** of 70% used in this study was therefore between the two levels. No distinction was made between the mark expected from the ICU trained as opposed to the non-ICU trained nurses as all nurses in ICU deal with patients requiring pain management, glycaemic control and being weaned from mechanical ventilation on a regular basis, and should be able to effectively manage the care of patients for whom they are responsible.

3.4.2.6 Pilot study

A pilot study was conducted prior to the main study. The pilot study was a small-scale simulation of the main study. The instrument was tested on both ICU trained and non-ICU trained nurses, working in the ICUs of a public health care institution in Gauteng. Following consultation with a biostatistician it was decided that five ICU trained (n=5) and five non-ICU trained nurses (n=5) should participate in the pilot study. These nurses were not invited to participate in the main study. The purpose of the pilot study was to refine the data collection instrument and to ensure that there was clarity and understanding of the questions in the instrument. The results of the pilot study were not included in the main study.

Following the pilot study it was decided that two of the questions needed to be rephrased, as they appeared to be too broad to elicit the expected response (i.e. Section 3, Question 4b and Section 4, Question 3b). Two questions (Questions 8 and 12) were deleted from section 2 in order for this section to have the same number of questions as sections 3 and 4. The last four questions in section 1 (demographic questionnaire) were eliminated as they were an expansion of a previously asked question and it was decided that the value that they added to the study was not significant. The panel of experts used in the developmental phase confirmed these changes. The predicted time for completion of the instrument of 25-30 minutes was realised during the pilot study.

3.4.2.7 Layout of final instrument

The final instrument used for the main study is described (See Appendix C):

Section 1
This section consisted of nine questions eliciting demographic information from the participants. This was necessary in order to accurately describe the population participating in the study and to relate their knowledge to formal ICU training and to years of ICU experience.

Section 2

Section 2 consisted of eleven multiple-choice questions (MCQs), three of which were extended to assess an advanced level of knowledge of the pain management, resulting in fourteen questions in total. Of these, four tested for basic knowledge of pain management, seven for applied knowledge and three for a more advanced knowledge.

Section 3

Knowledge related to glycaemic control was tested in this section. The format of this section was the same as for section 2, with six questions testing for basic knowledge, three for applied knowledge and five for advanced knowledge.

Section 4

This section was designed to elicit knowledge of weaning a patient from mechanical ventilation. The format was the same as for the above two sections, with three questions testing for basic knowledge, seven for applied knowledge and four for advanced knowledge.

3.4.2.8 Validity and reliability of the data collection process

The process by which data was collected enhanced the validity of the study:

- A non-threatening environment was created by assuring the participants that participation in the study was voluntary and that anonymity and confidentiality would be ensured
- The instrument was handed to the participant in an envelope
- The completed instrument was sealed in an envelope by the participant and placed in a box
- The signed consent forms were placed in a separate envelope by the researcher and sealed. Thereafter a participant was asked to sign across the seal and participants were assured that the seal would only be broken if there was an enquiry into the study
- The circumstances under which the participants participated in the study were similar between the hospitals and the ICUs within each hospital.

Reliability was maintained by:

- Ensuring consistency of data collection, which was achieved through compliance with the data collection instrument
- The researcher collected the data together with another experienced researcher.
- Data was collected at a predetermined time. The data collection period was identified as a three-month period commencing on 15 April 2006.
- A large sample group was utilised and no mention of ICU trained and non-ICU trained nurses was made until the data was analysed.

3.4.2.9 Ethical considerations

The conduct of nursing research requires not only expertise and diligence but also honesty and integrity (Burns, et al., 2001:191). Ethical research is essential to generate sound knowledge for practice, while at the same time protecting the rights of human subjects. Ethical review and clearance is necessary to ensure a balance between risks and benefits of a study and prevent research misconduct. The following steps were taken to address ethical considerations in the proposed study:

- The research proposal and instrument were submitted to the Postgraduate Committee (Faculty of Health Sciences) of the University of the Witwatersrand for permission to undertake the research. Permission was obtained. (See Appendix E)
- The research proposal and instrument were submitted to the Committee for Research on Human Subjects of the University of the Witwatersrand to ensure compliance with ethical standards. The committee issued a clearance certificate. (See Appendix E)
- Permission to conduct the research was obtained from appropriate Hospital Management for both public and private sector institutions and the Department of Health, Gauteng. (See Appendix E)
- Informed consent was obtained in writing from the ICU experts involved in the development and quantification of the instrument. (See Appendices A and B)
- Informed consent was obtained in writing from the nurse participants. (See Appendix D)

- Anonymity of the participants was guaranteed in that names were not recorded. Consent forms and instruments were separated at time of data collection to maintain the anonymity of the participants.
- Confidentiality was guaranteed in that the researcher and the supervisor were the only people with access to the raw data.
- Participants were allowed to withdraw from the study at any time without penalty.

3.5 SUMMARY

In this chapter the research methodology of the study has been described. The design, the study setting, eligibility criteria, the population and sample were described, data collection and analysis were discussed, methods to ensure validity and reliability described and related to this study and ethical considerations were explained. In addition the development and quantification of the instrument used for data collection was described in detail. The next chapter will deal with the data analysis and discussion of the results.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

In this chapter the method of data handling is described together with the approach used for analysis of the results. The results from the study are described and analysed using descriptive and inferential statistics and the research findings are discussed.

Phase one of the study covered the development and quantification (i.e. validation) of an instrument to test the knowledge of ICU nurses. The process followed to produce the final instrument for use in phase two of the study is described. Descriptive statistics are used to describe the characteristics of the two sample groups participating in each of the two stages in this phase of the study. At the end of phase one, the raw data was entered on Microsoft Excel spreadsheets for analysis.

Phase two describes the results of the testing of the knowledge of ICU nurses using the instrument developed in phase one. Descriptive and inferential statistics were used to analyse the results and to determine whether the study objectives were met.

In total, 142 instruments were handed out in the five hospitals. The researcher and an assistant remained in the unit while the instruments were being completed to prevent any contamination of the data. The participants completed the instrument during on-duty time. Only one nurse approached to participate in the study refused to do so. One instrument was returned incomplete, with only one section having been filled in and it was therefore decided not to include this instrument in the study. Five instruments were not completed at all as the nurses who had volunteered to complete them subsequently became too busy attending to their patients to do so. The researcher and the research assistant remained in each unit for two-and-a-half to three hours, which gave most of the participants' adequate time to complete the instrument while attending to their patients. None of the units were exceptionally busy on the days that data were collected, with no admissions, theatre cases or cardiac arrests occurring during the time that the researchers were in the units. Out of

the 142 instruments actually handed out, only 136 instruments were included in the study. The sample size was therefore 136 participants.

At the end of data collection in the second phase of the study, the researcher marked each instrument on the original form filled in by the participant. A standardised answer sheet was used for retrospective evaluation of the instrument. The assumption was made that questions not answered indicated that the participant was not sure of the correct answer. Unanswered questions were therefore considered to be incorrect. The raw data was then entered on a Microsoft Excel spreadsheet. A programme had been set up whereby the participants' response to each question was captured and on completion of each instrument the points and the percentage obtained by the participant were automatically calculated. This served to double-check the manual calculation on each instrument that had been done by the researcher. Furthermore, an electronic data entry system was designed with multiple data integrity checks. The three questions in each section that required a written response from the participant were double-checked by the researcher before they were entered as either correct or incorrect into the spreadsheet. The data in the spreadsheet were then set within the computer statistical package STATA 8.0 (2003) for Windows and verified by the biostatistician.

4.2 APPROACH TO DATA ANALYSIS

The data were analysed in sections starting with phase one, stages one and two, followed by phase two of the study. A significance level of 0.05 was decided upon for all statistical tests and all confidence intervals given are at the 95% level. The approach to data analysis is shown diagrammatically in Figure 4.1 and followed by a more detailed discussion.

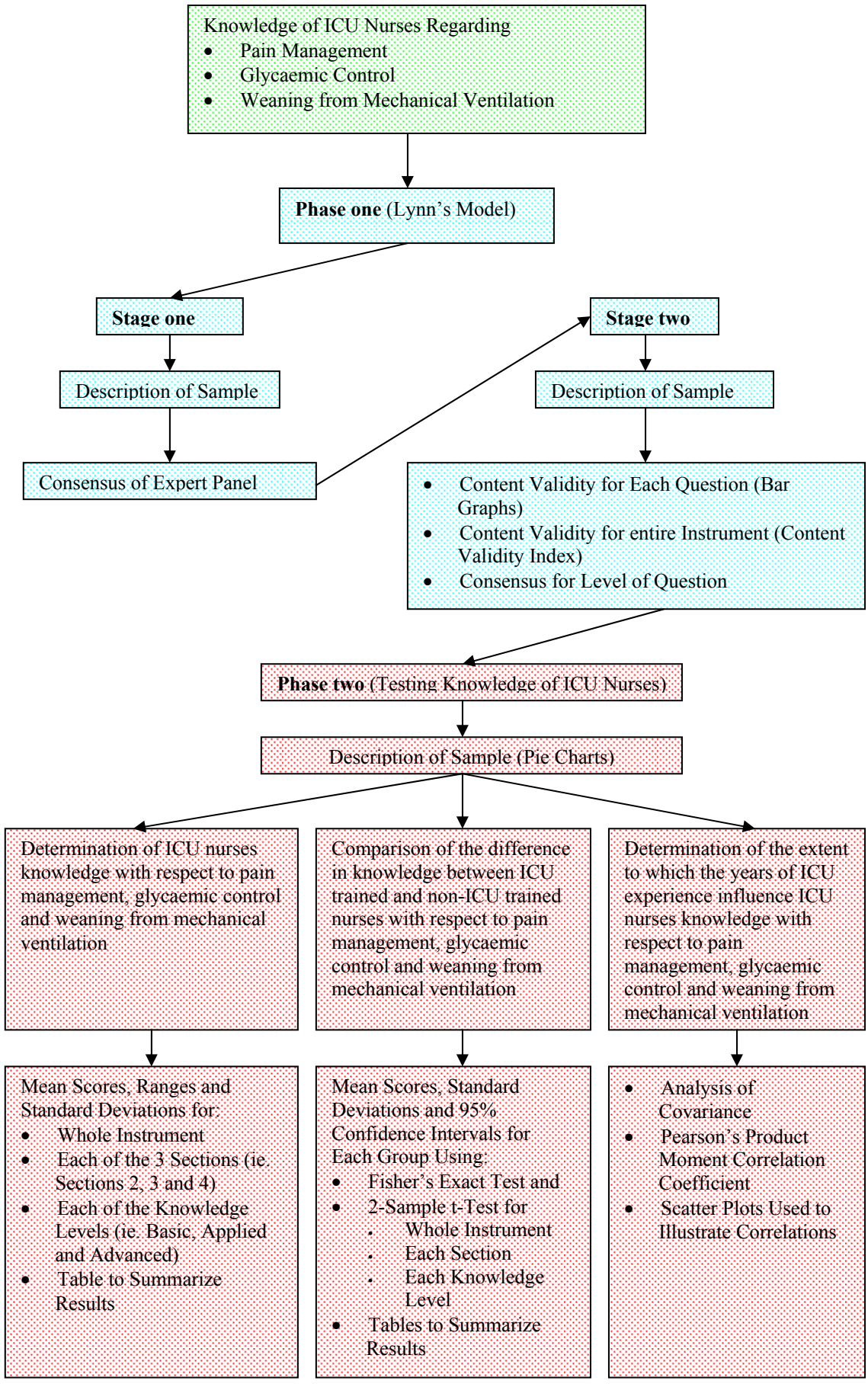

Figure 4.1: Approach to data analysis

4.2.1 Phase one

4.2.1.1 Stage one: Developmental stage

Descriptive statistics were employed to analyse the demographic data of the expert panel. The results of this stage of the study needed no analysis as each question and the knowledge level of each question in the instrument was debated and only included if agreement was reached. New questions were also added only if the whole group agreed to their inclusion.

4.2.1.2 Stage two: Quantification stage

Descriptive statistics were used to describe the outcome of phase one, stage two of the study. Firstly the demographic data of the participants' was analysed and thereafter the content validity of each question in the instrument and the instrument as a whole was determined using the statistical method reported by Lynn (1986), and the outcome thereof is described. The level of the question (i.e. basic, applied or advanced) was then decided according to the participants' ratings and the agreement of the majority was accepted.

4.2.2 Phase two.

The data were analysed to determine whether the objectives of the study had been met. The demographic data of the participants (Section one) was analysed using descriptive statistics, including percentages and ranges where applicable. The following three sections (Section 2 on pain management, section 3 on glycaemic control and section 4 on weaning from mechanical ventilation) were analysed using descriptive and inferential statistics.

4.2.2.1 Objective one

Objective one was to describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.

The mean scores for the instrument as a whole, each of the three sections mentioned above and the level of the question (basic, applied and advanced) were assessed against a predetermined pass mark (70%). The percentage of participants that met this predetermined pass mark in each of the above categories was assessed.

4.2.2.2 Objective two

Objective two was to compare the difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.

To detect a difference in means of 10%, a sample size of n=120 (n=60 participants per group i.e. ICU trained and non-ICU trained) was used. This ensured an accuracy of at least 90% with a 0.05 two-sided significance level. The standard deviations were calculated to indicate how much the scores deviated from the mean (Burns, et al., 2003:327).

Fisher's exact test was used to examine the significance of the association between answers given to each individual question (i.e. correct or incorrect) and the level of training of the participant (i.e. ICU trained or non-ICU trained). Fisher's exact test is used when the data to be analysed are divided into two categories in two separate ways (www.wikipedia.org/wiki/Fisher's exact test, 2006), as was the case with this data.

The two-sample t-test with unequal variances was used to determine whether there was a significant difference between the mean score obtained by participants from each of the two groups (i.e. ICU trained or non-ICU trained) for the instrument as a whole, section 2 (pain management), section 3 (glycaemic control) and section 4 (weaning from mechanical ventilation) and the basic, applied and advanced level questions. The two-sample t-test is one of the most common analyses used to test for significant differences between two

samples (Burns, et al., 2003:338). A 95% confidence interval for the true difference between non-ICU trained and ICU trained participants' scores was also obtained. A 95% confidence interval gives the range in which the actual difference between the groups' scores has a 95% likelihood of occurring (Clarke & Cooke, 2003:406).

4.2.2.3 Objective three

Objective three was to determine to what extent the knowledge of nurses working in ICU is influenced by their years of ICU experience relative to pain management, glycaemic control and weaning from mechanical ventilation.

In order to ensure that years of ICU experience did not influence the results of the study ANCOVA was used with years of ICU experience as a covariate. ANCOVA allows the effect of a treatment (i.e. knowledge) to be examined apart from the effect of one or more potentially confounding variables. This analysis can be used when it is not possible to design a study so that potentially confounding variables are controlled (Burns, et al., 2003:343). In addition, Pearson's product moment correlation coefficient, which can range from –1 to 1, with correlation getting less as zero is approached, was used as a measure of the strength of the linear relationship that exists between the two variables. (i.e. years of ICU experience and knowledge of the selected care areas). Scatter plots were used to illustrate the dispersion of values on the variable (years of experience).

4.2.2.4 Internal consistency

Following analysis of the data, the Cronbach's alpha coefficient was determined by the biostatistician to assess the internal consistency of the various questions within the instrument. Internal consistency examines the extent to which all questions consistently measure the construct (Burns, et al., 2003:273). However the same authors (Burns, et al., 2003:291) state that when using questionnaires, individual questions may address different aspects or topics that are associated with the research subject and therefore attempting to determine reliability using tests of internal consistency may not be logical. In this study

questions were generated from the different issues identified for each care area, thus addressing different aspects within each care area.

4.3 RESULTS AND ANALYSIS

4.3.1 Results and analysis of Phase one

4.3.1.1 Stage one: Developmental stage

The demographics of the participants in the developmental stage are contained in Table A1 in Appendix A and are summarised below.

The **sector distribution** of the experts in the developmental stage was as follows: Of the six participants who attended the expert panel meeting, 1 participant was from the public sector and 5 participants were employed in the private sector. The **positions held** by participants in the expert panel were as follows: 3 participants were clinical facilitators, 2 participants were lecturers/tutors and 1 participant was a unit manager. See Table 4.1.

Table 4.1: Sector distribution and positions held by participants in the expert panel

		No of participants
Sector	Public	1
	Private	5
Position Held	Clinical facilitators	3
	ICU lecturer/tutor	2
	Unit manager	1

The **academic qualifications** of the participants were as follows: 5 of the participants held a diploma in Intensive Care Nursing and the remaining participant held a Masters Degree in Intensive Care Nursing. In addition 2 participants held Diplomas in Nursing Education and 1 held a diploma in both Nursing Education and Nursing Administration.

Years of ICU Experience of the participants ranged from 10 – 34 years, with the mean years of experience being 23.

Step 1: Domain identification

During the expert panel meeting, it was agreed that all the critical issues identified by the researcher in each of the three care areas were relevant and no additional issues were identified for inclusion in the instrument.

Step 2: Question generation

During the meeting, irrelevant questions were removed and other more relevant questions were added to the instrument. All those questions receiving CVI ratings of 2 and 3 were altered or amended based on agreement of the experts. Questions were reworded where deemed necessary.

Step 3: Instrument formation

During the meeting, the instrument was organised into a useable format.

4.3.1.2 Stage two: Quantification stage

Of the 13 instruments distributed nationally to experts (not the same experts as those in the panel for stage one), 12 responses were received, a sample realisation of 92%. One of the responses could not be used as the participant completed the instrument and not the assessment forms as requested. Eleven of the responses received were therefore useable. The demographics of the experts in the quantification stage are contained in Table B1 in Appendix B and are summarised below.

The **sector distribution** of the participants in this stage was as follows: 3 participants were from the public sector, 4 participants were from the private sector and 4 were from the education sector. The **provincial distribution** of the participants in this stage was as follows: 7 participants were from Gauteng, 2 participants came from KwaZulu-Natal and 2 from the Western Cape. **Positions held** by participants were as follows: 2 of the participants were practicing ICU nurses, 2 participants were Nursing Services managers (ICU), 1 was a unit manager and 6 were ICU lecturers/tutors. See Table 4.2.

Table 4.2: Sector and provincial distribution and positions held of quantification stage participants

		No of participants
Sector	Public	3
	Private	4
	Education	4
Provincial distribution	Gauteng	7
	KwaZulu-Natal	2
	Western Cape	2
Position held	Practising ICU Nurses	2
	Nursing Services Managers	2
	Unit Manager	1
	ICU Lecturers/Tutors	6

Post-graduate Academic qualifications of participants included:

- 10 Diplomas in ICU
- 3 Masters degrees in ICU
- 1 Doctorate in ICU
- 1 Degree in nursing administration
- 2 Diplomas in nursing administration
- 2 Degrees in nursing education
- 2 Diplomas in nursing education
- 2 Diplomas in emergency and trauma nursing
- 1 Degree in community health

Years of ICU experience of the participants ranged from 8 – 38 years, with the mean years of experience being 17.

Question content validity

The statistical method advocated by Lynn (1986:384) was used to determine content validity of each question. According to this method, the proportion of experts whose endorsement is required to establish content validity beyond the 0.05 level of significance is 0.8 (Lynn, 1986:384). For this study which had eleven participants, at least nine had to rate each question as either a three or four to ensure a proportion of 0.8. The results are shown graphically below for section 2 on pain management (Figure 4.2), section 3 on glycaemic control (Figure 4.3) and section 4 on weaning from mechanical ventilation (Figure 4.4).

Some of the questions in each section were extended by asking for substantiation of the answer given. These questions thus had an a) and b) section. During the determination of content validity of the questions in the instrument, both parts of the questions which had been extended were rated as a whole.

Section 2: Pain management
Questions 5, 11 and 12 received ratings of 3 or 4 from ten of the eleven experts (a proportion of 0.91). All the other questions in this section received ratings of 3 or 4 from all eleven of the experts (a proportion of 1.0). Therefore, all the questions in this section on pain management were endorsed by a proportion of more than 0.8 of the experts, ensuring content validity (See Figure 4.2).

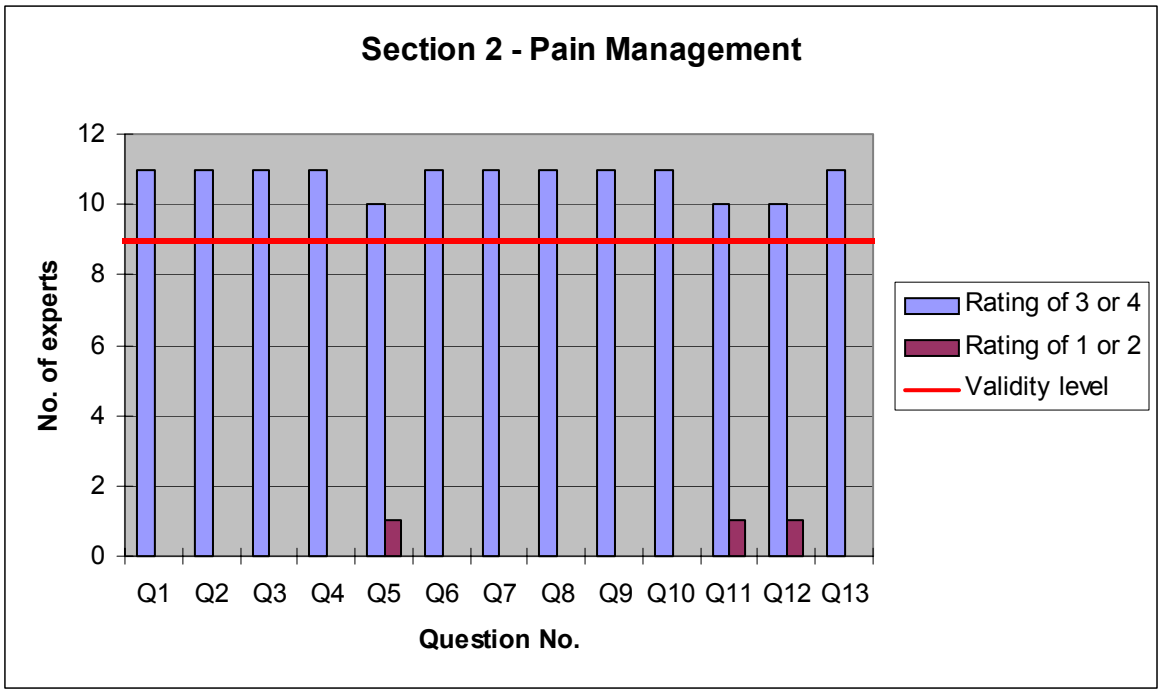

Figure 4.2: Determination of content validity for each question in Section 2 on pain management.

Section 3: Glycaemic control

Question 3 received ratings of 3 or 4 from nine of the eleven experts (a proportion of 0.82). Questions 6, 9 and 11 received ratings of 3 or 4 from ten of the eleven experts (a proportion of 0.91). The remaining questions in this section received ratings of 3 or 4 from all eleven of the experts (a proportion of 1.0). Therefore, all the questions in this section on glycaemic control were endorsed by a proportion of more than 0.8 of the experts, ensuring content validity (See Figure 4.3).

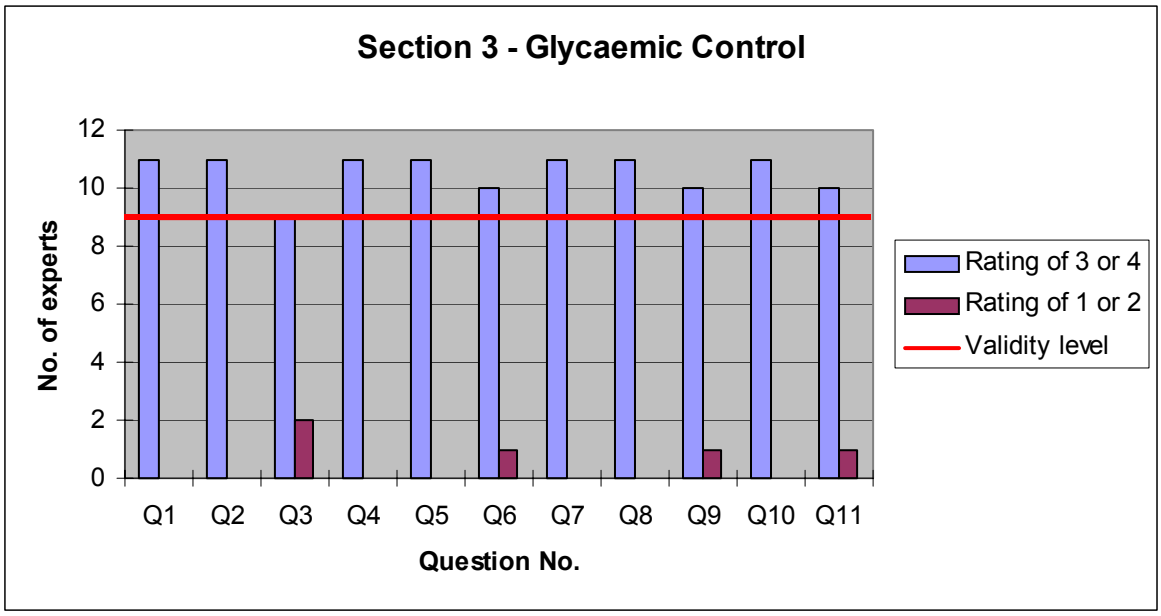

Figure 4.3: Determination of content validity for each question in Section 3 on glycaemic control.

Section 4: Weaning from mechanical ventilation

Question 4 received ratings of 3 or 4 from ten of the eleven experts (a proportion of 0.91). The remaining questions in this section received ratings of 3 or 4 from all eleven of the experts (a proportion of 1.0). All the questions in this section on weaning from mechanical ventilation were endorsed by a proportion of more than 0.8 of the experts, ensuring content validity (See Figure 4.4).

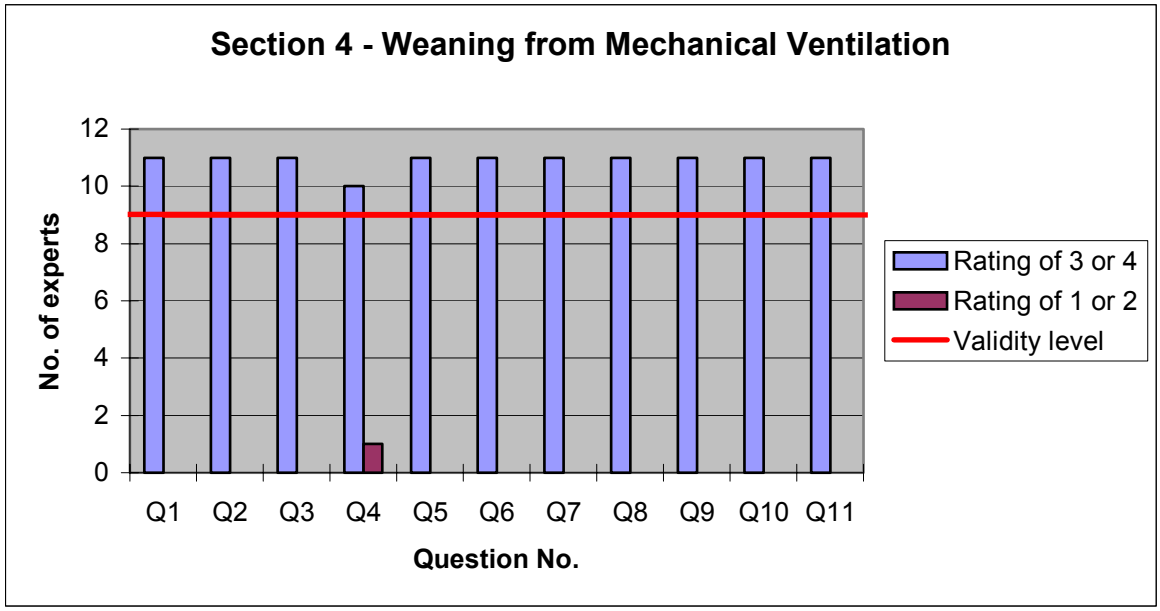

Figure 4.4: Determination of content validity for each question in Section 4 on weaning from mechanical ventilation.

As can be seen from the above, all the questions in all three sections of the instrument were rated as being content valid based on the statistical method advocated by Lynn (1986:384).

Instrument content validity

The content validity of the whole instrument is the proportion of questions judged as content valid by the experts. Grant, et al., (1997:273) quote Davis (1992) as stating that a new instrument should have a minimum content validity index of 0.8. As all questions were rated as content valid by the experts, the content validity index for the whole instrument as indicated above was 1.0 thereby exceeding the 0.8 minimum level. The experts in the quantification stage therefore rated the whole instrument as being content valid.

Level of knowledge of questions

Participants were asked to rate the level of knowledge of each of the questions (including both parts of questions with extensions i.e. an a and b section) in the instrument by scoring as follows:

1 = Basic

2 = Applied

3 = Advanced

Knowledge levels of questions in section 2 on pain management were rated as follows:

- For questions 1, 6a, 7, 9 and 12, all the experts agreed with the level of knowledge suggested by the expert panel.
- For questions 2, 3, 4a, 5, 6b, 8, 11 and 13b, one expert did not agree with the level of knowledge suggested by the expert panel. This was a 91% agreement.
- For questions 10 and 13a, two experts did not agree with the level of knowledge suggested by the expert panel, giving an 86% agreement.
- For question 4b, three experts did not agree with the level of knowledge suggested by the expert panel. This gave a 73% agreement.

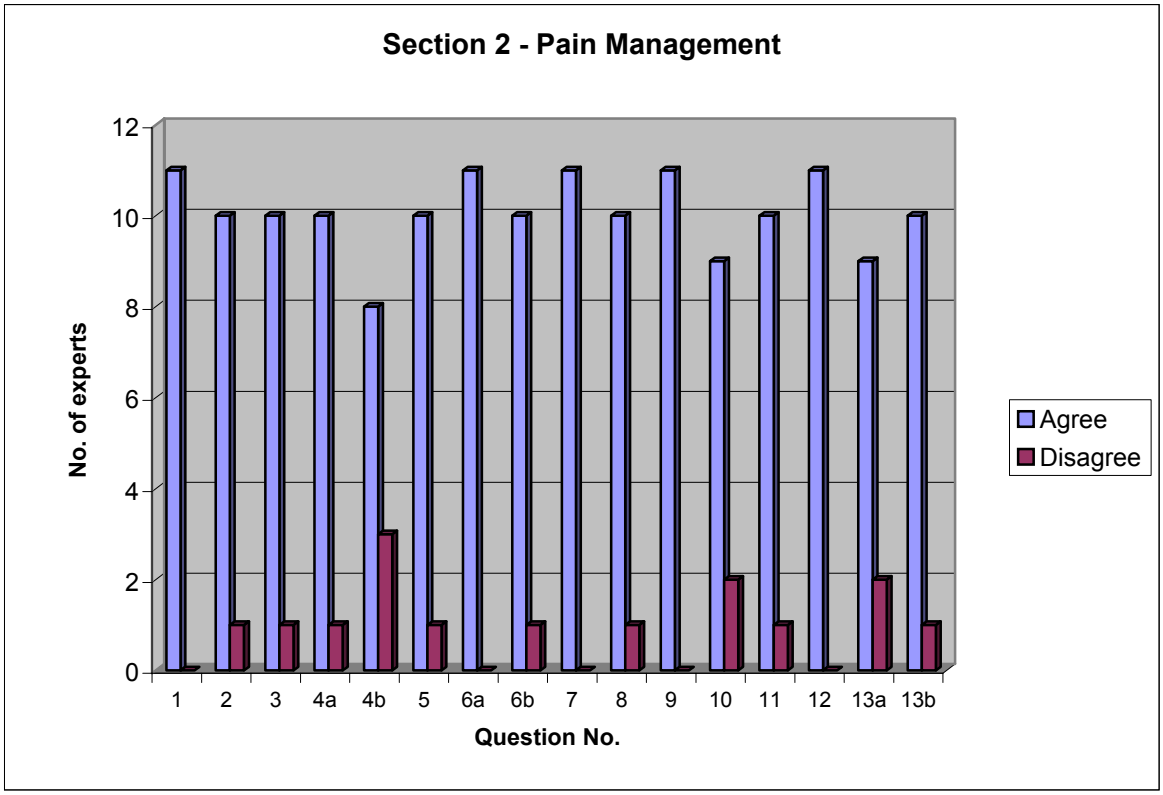

Figure 4.5: Participants' ratings of level of knowledge of each question in Section 2, pain management

Knowledge levels of questions in section 3 on glycaemic control were rated as follows:

- For questions 6 and 11, all the experts agreed with the level of knowledge suggested by the expert panel
- For questions 1, 2, 5, 7b, 9 and 10a, one expert did not agree with the level of knowledge suggested by the expert panel. This was a 91% agreement.
- For questions 3, 4a, 7a and 8, two experts did not agree with the level of knowledge suggested by the expert panel. This was an 82% agreement.
- For question 10b, three experts did not agree with the level of knowledge suggested by the expert panel. This was a 73% agreement.
- For question 4b, four experts did not agree with the level of knowledge suggested by the expert panel. This was a 64% agreement.

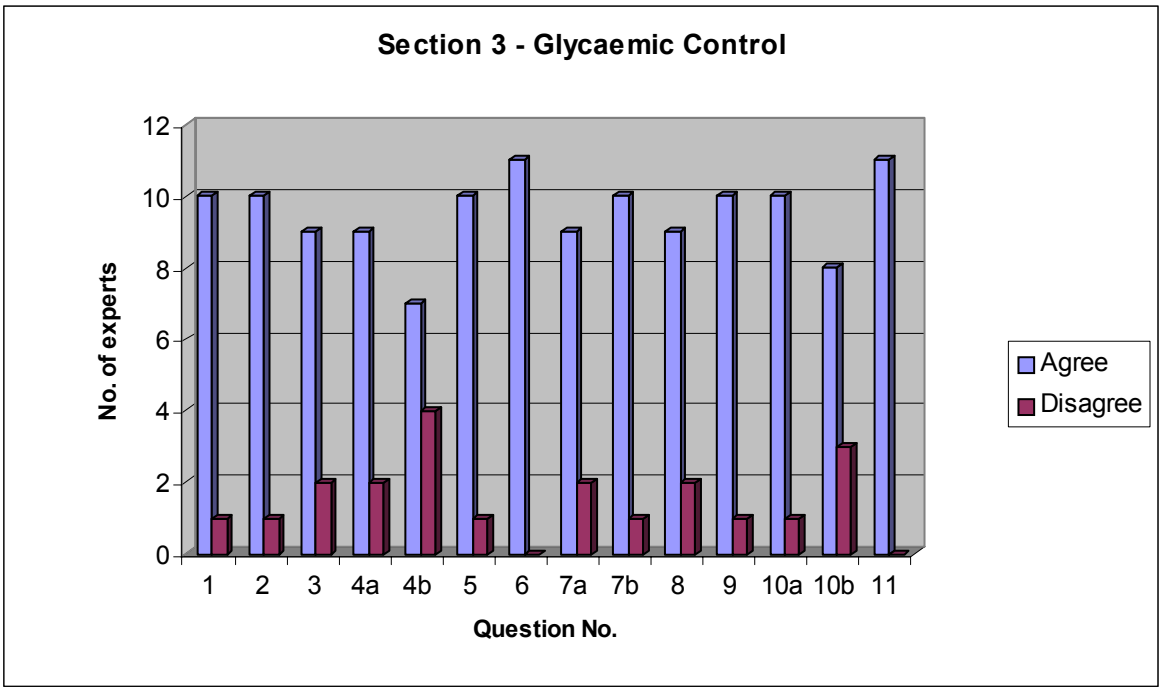

Figure 4.6: Participants' ratings of level of knowledge of each question in Section 3, glycaemic control

Knowledge levels of questions in section 4 on weaning from mechanical ventilation were rated as follows:

- For questions 1, 3a, 3b, 7, 8, 9a and 11, all the experts agreed with the level of knowledge suggested by the expert panel.
- For questions 2 and 5, one expert did not agree with the level of knowledge suggested by the expert panel. This was a 91% agreement.
- For questions 4b and 6, two experts did not agree with the level of knowledge suggested by the expert panel. This was an 82% agreement.
- For questions 4a, 9b and 10, three experts did not agree with the level of knowledge suggested by the expert panel. This was a 73% agreement.

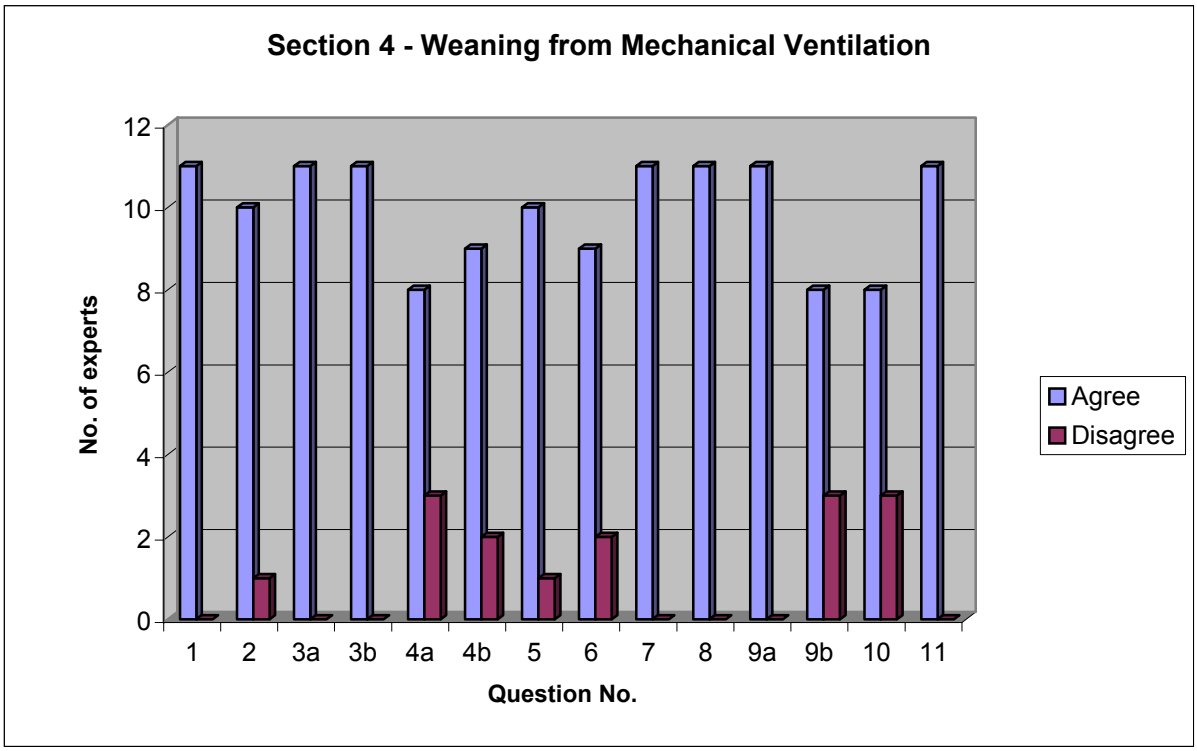

Figure 4.7: Participants' ratings of level of knowledge of each question in Section 4, weaning from mechanical ventilation

On completion of phase one of the study, the instrument was ready for use in phase two. Prior to use, a pilot study was conducted to ensure clarity of questions and to refine the instrument.

4.3.2 Results and analysis of Phase two

In this section the demographic data of phase two are presented followed by the results and analysis of the data.

4.3.2.1 Demographic data

Question 1: Participants' age

Of the 136 participants in the study 20 (14.71%) were aged between 20 and 30 years; 60 (44.12%) were between 31 and 40; 46 (33.82%) were between 41 and 50; and 10 (7.35%) were between 51 and 60 years old. Figure 4.8 shows the ages of the participants in the study.

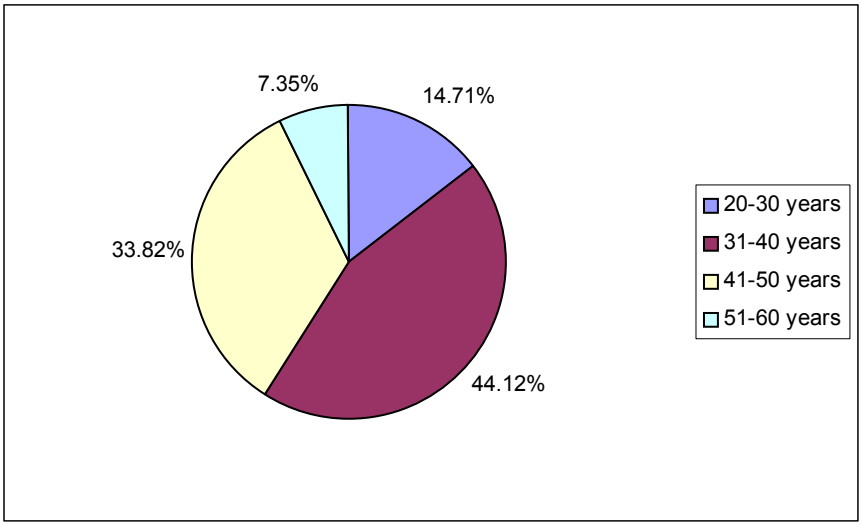

Figure 4.8: Distribution of the ages of all participants (n=136)

Of the 68 ICU trained participants in the study 7 (10.29%) were aged between 20 and 30 years; 24 (35.29%) were between 31 and 40; 31 (45.59%) were between 41 and 50; and 6 (8.82%) were between 51 and 60 years old. Figure 4.9 shows the ages of the ICU trained participants in the study.

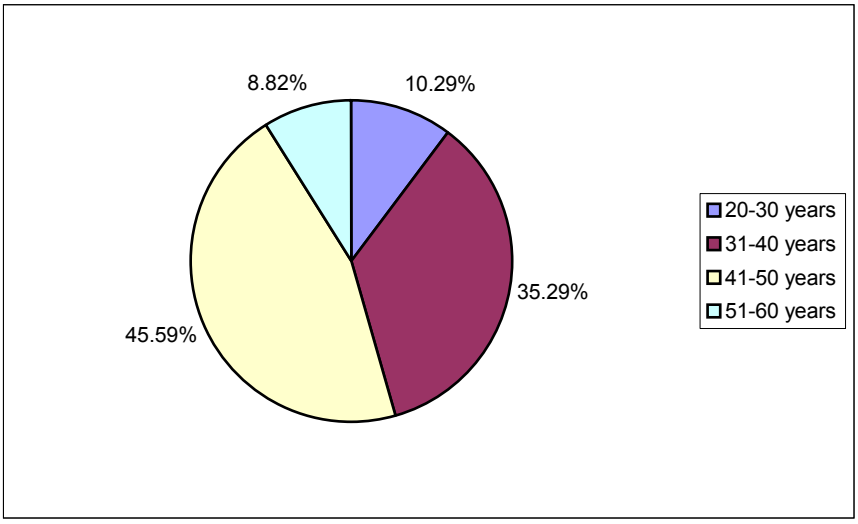

Figure 4.9: Distribution of the ages of all ICU trained participants (n=68)

Of the 68 non-ICU trained participants in the study 13 (19.12%) were aged between 20 and 30 years; 36 (52.94%) were between 31 and 40; 15 (22.06%) were between 41 and 50; and 4 (5.88%) were between 51 and 60 years old. Figure 4.10 shows the ages of the non-ICU trained participants in the study.

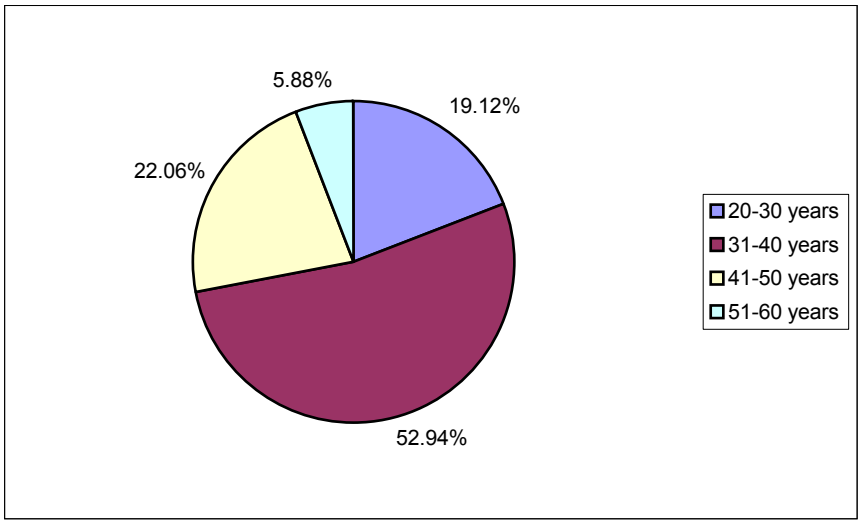

Figure 4.10: Distribution of the ages of all non-ICU trained participants (n=68)

Question 2: Type of employment

The participants were asked if they were permanently employed by the hospital where they were working or whether they were working through an agency. A total of 116 participants (85.29%) were permanent staff members in the ICUs of their hospitals, and 20 participants

(14.71%) were working through an agency. Of the 68 ICU trained participants, 64 (94.12%) were permanent staff members in the ICUs of their hospitals, and 4 (5.88%) were working through an agency. Of the 68 non-ICU trained participants, 52 (76.47%) were permanent staff members in the ICUs of their hospitals, and 16 (23.53%) were working through an agency.

Question 3: Employment sector

A total of 87 participants (63.97%) were employed in the public sector and 49 participants (36.03%) were employed in the private sector. A total of 45 ICU trained participants (66.18%) were employed in the public sector and 23 (33.82%) were employed in the private sector. A total of 42 non-ICU trained participants (61.76%) were employed in the public sector and 26 (38.42%) were employed in the private sector.

Question 4: Participants working overtime in addition to their permanent employment.

A total of 109 participants (80.15%) worked overtime in addition to their permanent employment while 27 participants (19.85%) did not work any overtime. A total of 56 ICU trained participants (83.35%) worked overtime in addition to their permanent employment while 12 (17.65%) did not work any overtime. A total of 53 non-ICU trained participants (77.94%) worked overtime in addition to their permanent employment while 15 (22.06%) did not.

Question 5: Qualification

The participants were asked whether they had acquired their qualification in general nursing at degree or diploma level. A total of 115 participants (84.56%) held a diploma in general nursing while 21 participants (15.44%) had a degree in general nursing. A total of 56 ICU trained participants (82.35%) held a diploma in general nursing while 12 (17.65%)

had a degree in general nursing. A total of 59 non-ICU trained participants (86.76%) held a diploma in general nursing while 9 (13.24%) had a degree in general nursing.

Question 6: ICU training

There were 68 participants in each of the ICU trained and the non-ICU trained groups of nurses.

Question 7: Years of ICU experience

Two of the non-ICU trained nurses omitted their years of experience on the demographic data form resulting in only 66 non-ICU trained nurses being included in this comparison instead of 68 which would have resulted in equal group sizes between the ICU trained and non-ICU trained nurses. The ICU experience of the participants varied from 4 months to 25 years with the mean years of ICU experience being 6.32 years with a standard deviation of 5.21 years. The ICU experience of the ICU trained participants varied from 1 year to 25 years with the mean years of ICU experience being 8.45 years with a standard deviation of 5.19 years. The ICU experience of the non-ICU trained participants varied from 4 months to 25 years with the mean years of ICU experience being 4.14 years with a standard deviation of 4.23 years. The mean difference between years of experience between the two groups was 4.31 years. This resulted in a statistically significant difference in the average years of experience between the two groups ($p=0.000$).

Question 8: Years of general ward experience

Of the 136 participants in the study, 5 (3.68%) had no experience in a general ward prior to commencing work in ICU; 11 (8.09%) had less than 1 year's experience; 22 (16.18%) had between 1 and 2 years experience; 40 (29.41%) had between 3 and 5 years experience and the remaining 58 participants (42.65%) had in excess of 5 years general ward experience. Figure 4.11 shows the years of general ward experience of all participants.

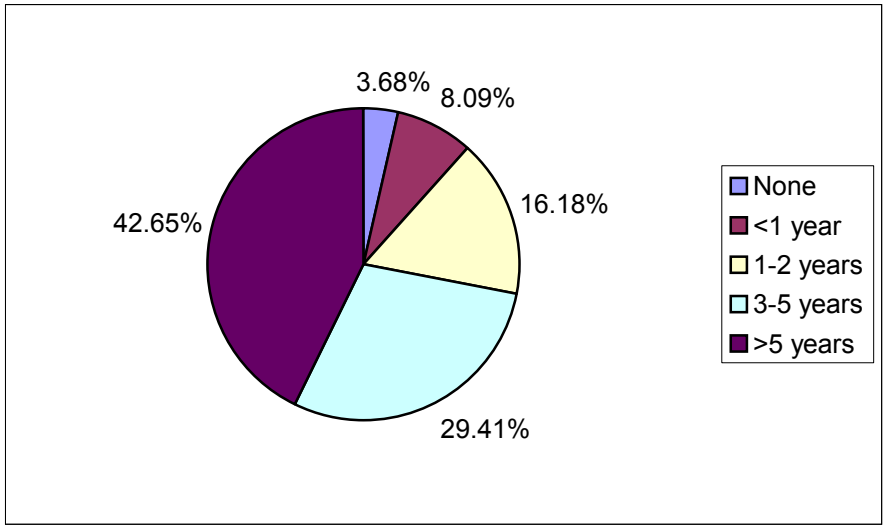

Figure 4.11: Distribution of the years of general ward experience of all participants (n=136)

Of the 68 ICU trained participants in the study, 4 (5.88%) had no general ward experience prior to commencing work in ICU; 6 (8.82%) had less than 1 year's experience; 8 (11.76%) had between 1 and 2 years' experience; 20 (29.41%) had between 3 and 5 years' experience and the remaining 30 ICU trained participants (44.12%) had in excess of 5 years' general ward experience. Figure 4.12 shows the years of general ward experience of all ICU trained participants.

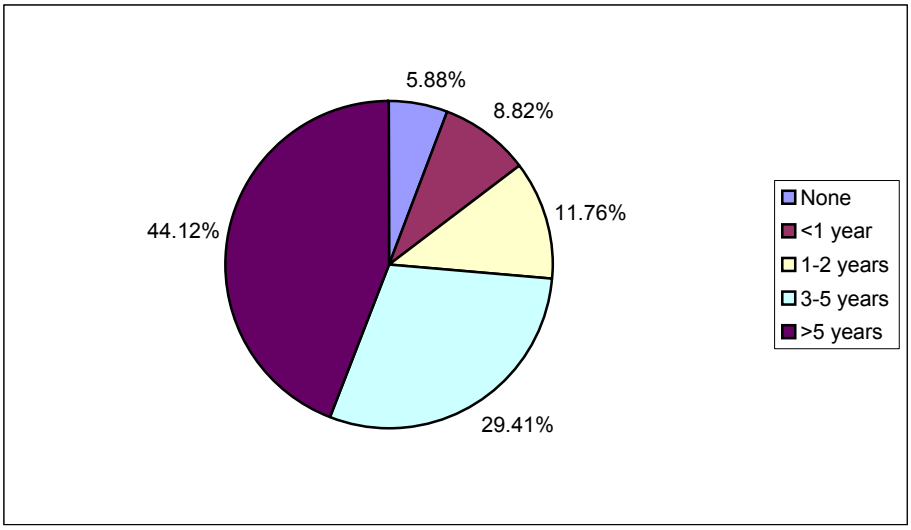

Figure 4.12: Distribution of the years of general ward experience of all ICU trained participants (n=68)

Of the 68 non-ICU trained participants in the study, 1 (1.47%) had no general ward experience prior to commencing work in ICU; 5 (7.35%) had less than 1 year's experience; 14 (20.59%) had between 1 and 2 years' experience; 20 (29.41%) had between 3 and 5 years' experience and the remaining 28 non-ICU trained participants (41.18%) had in excess of 5 years' general ward experience. Figure 4.13 shows the years of general ward experience of all non-ICU trained participants.

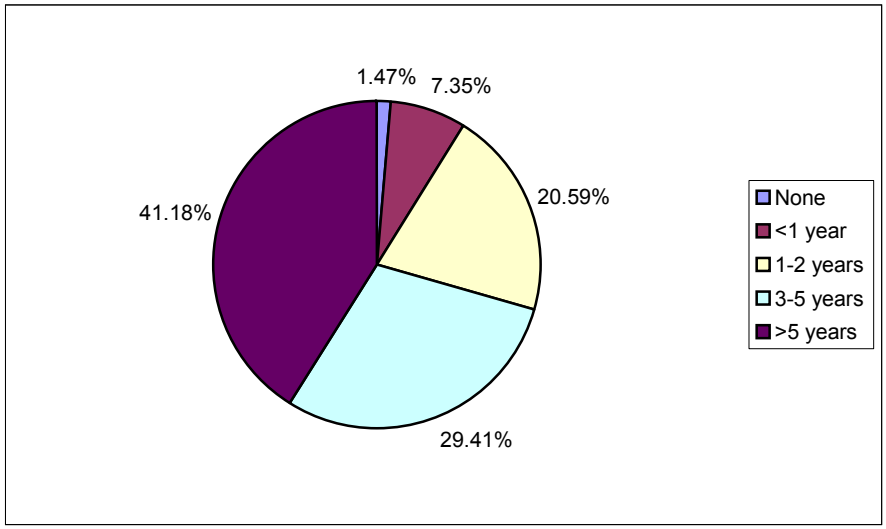

Figure 4.13: Distribution of the years of general ward experience of all non-ICU trained participants (n=68)

Question 9: Continuing professional growth

The participants were asked how they ensured their own continuing professional growth. The four options included in the instrument were, ICU Congress attendance, academic ward round attendance, reading scientific journals and attendance at scientific talks. The participants could also indicate other activities that they undertook to ensure continuing professional growth. Of the 136 participants, 6 (4.41%) indicated that they made use of at least five options; 20 (14.71%) indicated four options; 27 (19.85%) made use of three options; 41 (30.15%) indicated two options; 34 (25%) made use of one option and only eight (5.88%) did not do anything to ensure their continuing professional growth. Figure 4.14 shows the continuing professional growth options of all participants.

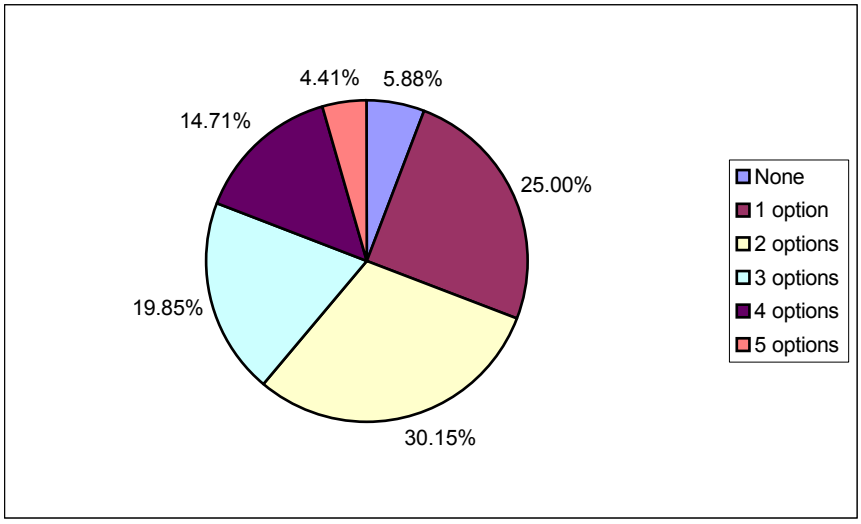

Figure 4.14: Distribution indicating the continuing professional growth options of all participants (n=136)

Of the 68 ICU trained participants, 6 (8.83%) indicated that they made use of at least five options; 17 (25%) indicated four options; 14 (20.59%) made use of three options; 20 (29.41%) indicated two options; 8 (11.76%) made use of one option and only three (4.41%) did not do anything to ensure their continuing professional growth. Figure 4.15 shows the continuing professional growth options of all ICU trained participants.

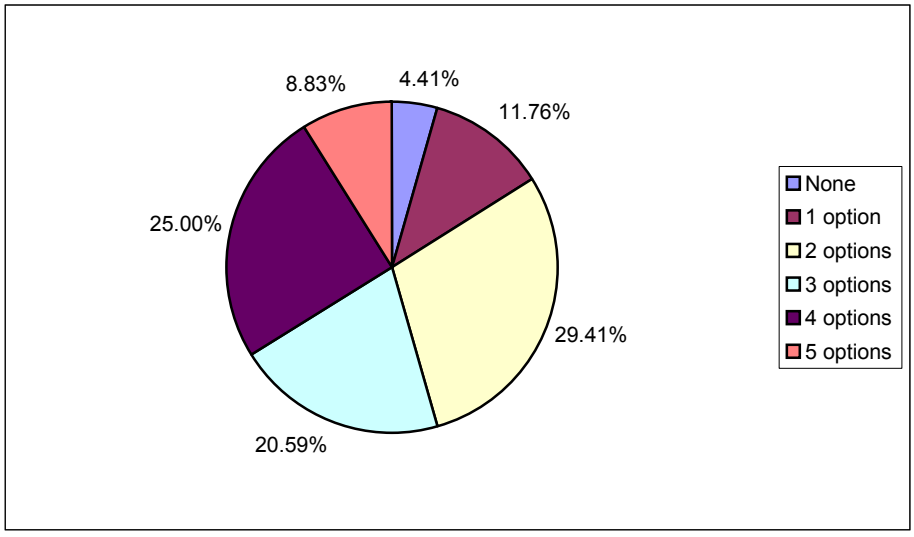

Figure 4.15: Distribution indicating the continuing professional growth options of ICU trained participants (n=68)

Of the 68 non-ICU trained participants, none made use of five or more options; 3 (4.41%) indicated four options; 13 (19.12%) made use of three options; 21 (30.88%) indicated two options; 26 (38.24%) made use of one option and only five (7.35%) did not do anything to ensure their continuing professional growth. Figure 4.16 shows the continuing professional growth options of all non-ICU trained participants.

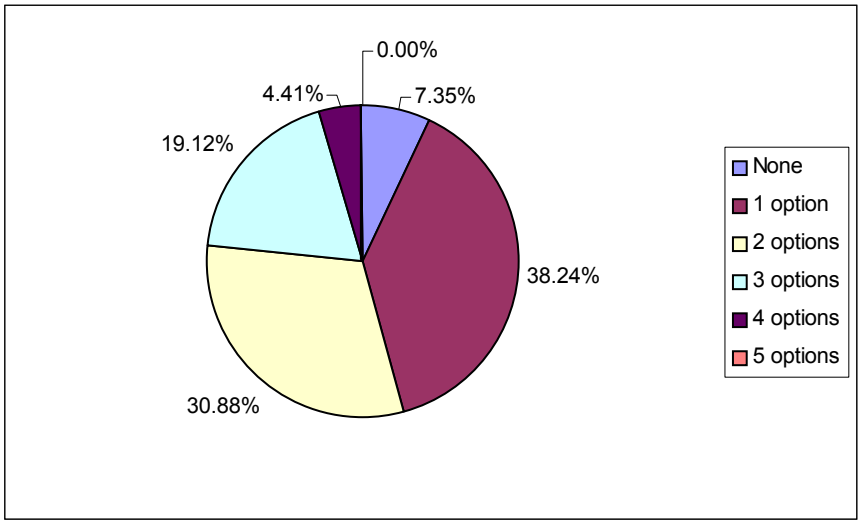

Figure 4.16: Distribution indicating the continuing professional growth options of non-ICU trained participants (n=68)

4.3.2.2 Knowledge instrument

Knowledge of ICU nurses with respect to pain management, glycaemic control and weaning from mechanical ventilation.

For the instrument as a whole, the mean score of all the participants was 47.56% with a standard deviation of 11.61, a 95% confidence interval of 45.59% to 49.52% and a range of 19% to 75%.

For the section on pain management the mean score of all the participants was 43.97% with a standard deviation of 15.45, a 95% confidence interval of 41.35% to 46.59% and a range of 7.1% to 85.7%.

The mean score of all the participants for the section on glycaemic control was 48.71% with a standard deviation of 13.30, a 95% confidence interval of 46.45% to 50.97%; the range of scores being from 14.3% to 75%.

For the section on weaning from mechanical ventilation the mean score of all the participants was 50.00% with a standard deviation of 17.16 and a 95% confidence interval of 47.09% to 52.91%. The range was 0% to 85.7%.

For the questions rated as assessing basic knowledge, the mean score of all the participants was 55.14% with a standard deviation of 16.90 and a 95% confidence interval of 52.27% to 58.00%. The range was 15.4% to 92.3%.

For the questions rated as assessing applied knowledge, the mean score of all the participants was 56.66% with a standard deviation of 13.22, a 95% confidence interval of 54.42% to 58.90% with a range from 23.5% to 88.2%.

For the questions rated as assessing advanced knowledge, the mean score of all the participants was 26.44% with a standard deviation of 15.92, a 95% confidence interval of 23.74% to 29.14% and the range from 0% to 70.8%.

Table 4.3 summarises the above results.

Table 4.3: Summary of results related to the knowledge of ICU nurses with respect to pain management, glycaemic control and weaning from mechanical ventilation.

	Mean score of participants (%)	Standard deviation	Range (%)
Whole instrument	47.56	11.61	19.00 – 75.00
Section 1 (pain management)	43.97	15.45	7.10 - 85.70
Section 2 (glycaemic control)	48.71	13.30	14.30 – 75.00
Section 3 (weaning from mechanical ventilation)	50.00	17.16	0.00 – 85.70
Basic knowledge questions	55.14	16.90	15.40 – 92.30
Applied knowledge questions	56.66	13.22	23.50 – 88.20
Advanced knowledge questions	26.44	15.92	0.00 – 70.80

The difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.

Results of individual questions

Section 2 consisted of eleven multiple-choice questions (MCQ's), three of which were extended to assess an advanced level of knowledge of pain management, resulting in a total of fourteen questions. Four questions tested basic knowledge of pain management, seven tested applied knowledge and three tested advanced knowledge. As can be seen from Table 4.4, only in Question 11b was there a statistically significant difference ($p=0.028$) between the ICU trained and non-ICU trained nurses with the ICU trained nurses performing better than the non-ICU trained nurses.

Table 4.4: Summary of results of Section 2, pain management

Question Number	Response	Non-ICU trained (n=68) Frequency (n) Percentage (%)	ICU trained (n=68) Frequency (n) Percentage (%)	Total (N=136) Frequency (n) Percentage (%)	Fisher's exact test (p)
1	Correct	22 (32.35)	27 (39.71)	49 (36.03)	0.475
2	Correct	49 (72.06)	50 (73.53)	99 (72.79)	1.000
3	Correct	37 (54.41)	30 (44.12)	67 (49.26)	0.303
4a	Correct	29 (42.65)	31 (45.59)	60 (44.12)	0.863
4b	Correct	19 (27.94)	23 (33.82)	42 (30.88)	0.578
5	Correct	32 (47.06)	22 (32.35)	54 (39.71)	0.114
6a	Correct	23 (33.82)	25 (36.76)	48 (35.29)	0.858
6b	Correct	8 (11.76)	9 (13.24)	17 (12.50)	1.000
7	Correct	58 (85.29)	62 (91.18)	120 (88.24)	0.426
8	Correct	37 (54.41)	40 (58.82)	77 (56.62)	0.729
9	Correct	41 (60.29)	51 (75.00)	92 (67.65)	0.098
10	Correct	11 (16.18)	13 (19.12)	24 (17.65)	0.822
11a	Correct	42 (61.76)	40 (58.82)	82 (60.29)	0.861
11b	Correct	0 (0.00)	6 (8.82)	6 (4.41)	**0.028***

* $p < 0.050$

Knowledge related to glycaemic control was tested in section 3. The format of this section was the same as for section 2, with six questions testing basic knowledge, three questions testing applied knowledge and five questions testing advanced knowledge. As can be seen from Table 4.5, only in three questions, namely 4b, 6 and 7b, was there a statistically significant difference ($p = 0.006$, 0.045 and 0.004 respectively) between the ICU trained and non-ICU trained nurses with the ICU trained nurses performing better than the non-ICU trained nurses.

Table 4.5: Summary of results of Section 3, glycaemic control

Question Number	Response	Non-ICU trained (n=68) Frequency (n) Percentage (%)	ICU trained (n=68) Frequency (n) Percentage (%)	Total (N=136) Frequency (n) Percentage (%)	Fisher's exact test (p)
1	Correct	50 (73.53)	50 (73.53)	100 (73.53)	1.000
2	Correct	46 (67.65)	51 (75.00)	97 (71.32)	0.448
3	Correct	18 (26.47)	14 (20.59)	32 (23.53)	0.545
4a	Correct	57 (83.82)	60 (88.24)	117 (86.03)	0.622
4b	0.5	19 (27.94)	36 (52.94)	55 (40.44)	
	Correct	2 (2.94)	2 (2.94)	4 (2.94)	**0.006***
5	Correct	34 (50.00)	42 (61.76)	76 (55.88)	0.227
6	Correct	57 (83.82)	65 (95.59)	122 (89.71)	**0.045***
7a	Correct	52 (76.47)	59 (86.76)	111 (81.62)	0.183
7b	Correct	6 (8.82)	20 (29.41)	26 (19.12)	**0.004***
8	Correct	43 (63.24)	46 (67.65)	89 (65.44)	0.719
9	Correct	12 (17.65)	21 (30.88)	33 (24.26)	0.109
10a	Correct	39 (57.35)	33 (48.53)	72 (52.94)	0.390
10b	Correct	6 (8.82)	1 (1.47)	7 (5.15)	0.115
11	Correct	8 (11.76)	6 (8.82)	14 (10.29)	0.779

* $p < 0.050$

Section 4 was designed to elicit knowledge of weaning from mechanical ventilation. The format was the same as for the above two sections, with three questions testing for basic knowledge, seven for applied knowledge and four for advanced knowledge. As shown in Table 4.6, only in four questions, namely 4a, 4b, 6 and 10, was there a statistically significant difference ($p = 0.038$, 0.013, 0.007 and 0.037 respectively) between the ICU trained and non-ICU trained nurses with the ICU trained nurses performing better than the non-ICU trained nurses.

Table 4.6: Summary of results of Section 4, weaning from mechanical ventilation

Question Number	Response	Non-ICU trained (n=68) Frequency (n) Percentage (%)	ICU trained (n=68) Frequency (n) Percentage (%)	Total (N=136) Frequency (n) Percentage (%)	Fisher's exact test (p)
1	Correct	44 (64.71)	51 (75.00)	95 (69.85)	0.262
2	Correct	39 (57.35)	37 (54.41)	76 (55.88)	0.863
3a	Correct	43 (63.24)	44 (64.17)	87 (63.97)	1.000
3b	Correct	11 (16.18)	12 (17.65)	23 (16.91)	1.000
4a	Correct	24 (35.29)	37 (54.41)	61 (44.85)	**0.038***
4b	Correct	9 (13.24)	22 (32.35)	31 (22.79)	**0.013***
5	Correct	48 (70.59)	53 (77.94)	101 (74.26)	0.433
6	Correct	17 (25.00)	33 (48.53)	50 (36.76)	**0.007***
7	Correct	45 (66.18)	38 (55.88)	83 (61.03)	0.291
8	Correct	21 (30.88)	20 (29.41)	41 (30.15)	1.000
9a	Correct	54 (79.41)	52 (76.47)	106 (77.94)	0.836
9b	Correct	22 (32.35)	32 (47.06)	54 (39.71)	0.114
10	Correct	33 (48.53)	46 (67.65)	79 (58.09)	**0.037***
11	Correct	28 (41.18)	37 (54.41)	65 (47.79)	0.169

* $p < 0.050$

Comparison of test results between the ICU trained nurses and the non-ICU trained nurses

The non-ICU trained nurses obtained a mean score of 45.01% (SD=10.75) for the whole test, while the ICU trained group of nurses obtained a mean score of 50.11% (SD=11.96). The mean difference between the test results of the two groups was 5.1%. This difference was statistically significant (p=0.0099). (See Table 4.7). The 95% confidence interval for the difference between the groups was 1.24% to 8.96% indicating that ICU trained nurses performed better in the test than the non-ICU trained nurses.

Table 4.7: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the whole instrument.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	50.11	11.96	47.21 - 53.00	0.0099
Non- ICU Trained	45.01	10.75	42.40 - 47.61	

The non-ICU trained nurses obtained a mean score of 42.86% (SD=14.91) for section 2 (pain management) of the instrument, while the ICU trained group of nurses obtained a mean score of 45.07% (SD=16.01). The mean difference between the results of the two groups was 2.2%. Statistically there was no significant difference between the two groups (p=0.4075). (See Table 4.8). The 95% confidence interval for the difference between the groups was –3.04% to 7.45%.

Table 4.8: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the section on pain management.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	45.07	16.01	41.19 - 48.94	0.4075
Non-ICU Trained	42.86	14.91	39.26 - 46.47	

The non-ICU trained nurses obtained a mean score of 46.16% (SD=14.34) for section 3 (glycaemic control) of the instrument, while the ICU trained group of nurses obtained a

mean score of 51.26% (SD=11.74). The mean difference between the results of the two groups was 5.1%. This difference was statistically significant (p=0.0249). (See Table 4.9).The 95% confidence interval for the difference between the groups was 0.65% to 9.54%.

Table 4.9: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the section on glycaemic control.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	51.26	11.74	48.42 – 54.10	0.0249
Non-ICU Trained	46.16	14.34	42.69 – 49.63	

The non-ICU trained nurses obtained a mean score of 46.01% (SD=15.18) for section 4 (weaning from mechanical ventilation) of the instrument, while the ICU trained group of nurses obtained a mean score of 53.99% (SD=18.19). The mean difference between the results of the two groups was 7.98%. This difference was statistically significant (p=0.0063). (See Table 4.10). The 95% confidence interval for the difference between the groups was 2.30% to 13.67%.

Table 4.10: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the section on weaning from mechanical ventilation.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	53.99	18.19	49.59 – 58.40	0.0063
Non-ICU Trained	46.01	15.18	42.34 – 49.68	

The non-ICU trained nurses obtained a mean score of 51.69% (SD=17.35) for the basic level questions, whereas the ICU trained group of nurses obtained a mean score of 58.58% (SD=15.82). The mean difference between the two groups was 6.89%, resulting in a statistically significant difference between the two groups (p=0.0169). (See Table 4.11). The 95% confidence interval for the difference between the groups was 1.26% to 12.52%.

Table 4.11: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the basic level questions.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	58.58	15.82	54.75 – 62.41	0.0169
Non-ICU Trained	51.69	17.35	47.49 – 55.89	

The non-ICU trained nurses obtained a mean score of 56.66% (SD=12.57) for the applied level questions, and the ICU trained group of nurses similarly obtained a mean score of 56.66% (SD=13.93). The mean difference between the two groups was 0.00%, resulting in no statistically significant difference between the two groups (p=0.9990). (See Table 4.12). The 95% confidence interval for the difference between the groups was -4.50% to 4.50%.

Table 4.12: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the applied level questions.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	56.66	13.93	53.29 – 60.03	0.9990
Non-ICU Trained	56.66	12.57	53.61 – 59.70	

The non-ICU trained nurses obtained a mean score of 21.26% (SD=13.16) for the advanced level questions, whereas the ICU trained group of nurses obtained a mean score of 31.61% (SD=16.83). The mean difference between the two groups was 10.35%, resulting in a statistically significant difference between the two groups (p=0.0001). (See Table 4.13). The 95% confidence interval for the difference between the groups was 5.23% to 15.48%.

Table 4.13: Comparison of test results between the ICU trained nurses and the non-ICU trained nurses for the advanced level questions.

Group	Mean Score (%)	Std. Deviation	95% Confidence Interval (%)	p-Value
ICU Trained	31.61	16.83	27.54 – 35.69	0.0001
Non-ICU Trained	21.26	13.16	18.08 – 24.45	

The extent to which the knowledge of nurses working in ICU, relative to pain management, glycaemic control and weaning from mechanical ventilation, is influenced by their years of ICU experience.

The number of participants included in this part of the study was 134 as two of the non-ICU trained participants omitted to fill in their years of ICU experience. Scatter plots have been used to illustrate the dispersion of values on the variable (years of experience).

As can be seen from the scatter plot in figure 4.17 there was only a weak correlation between years of ICU experience and the marks obtained for the instrument as a whole. A coefficient of correlation of 0.137 was obtained, confirming the weak correlation (p=0.1142).

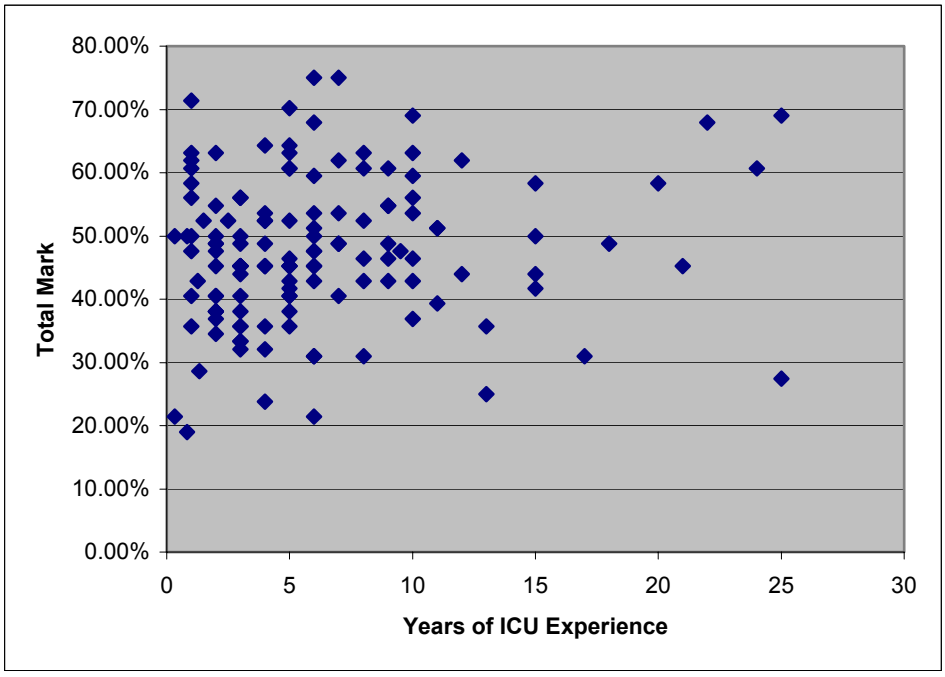

Figure 4.17: Marks obtained for the instrument as a whole and years of ICU experience

The scatter plot in figure 4.18 shows that there was only a weak correlation between years of ICU experience and the marks obtained for the questions relating to pain management. A correlation coefficient of 0.031 was obtained, confirming the weak correlation. (p=0.7242)

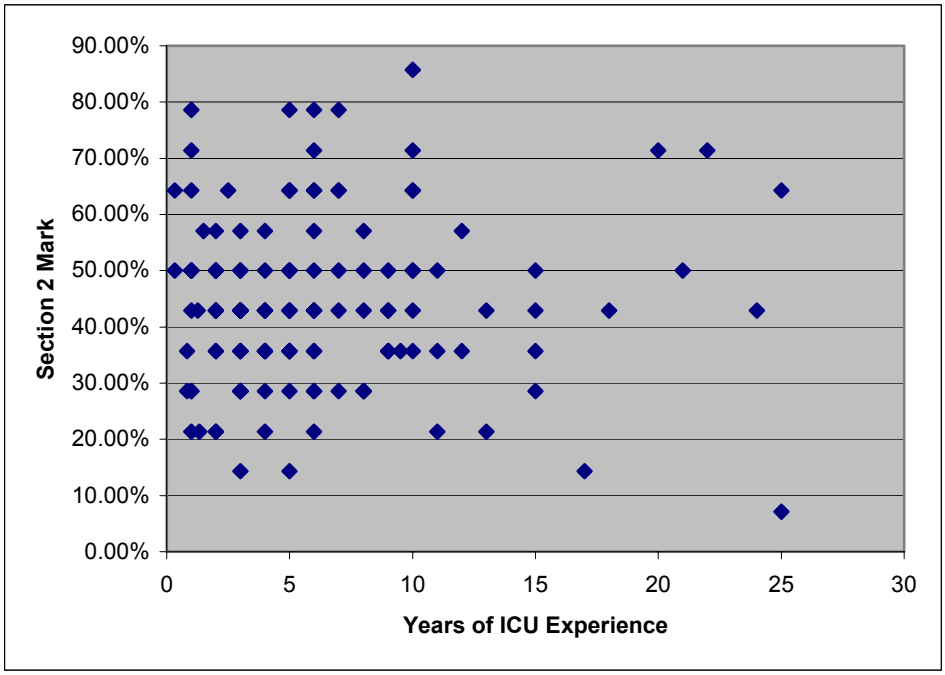

Figure 4.18: Marks obtained for the questions relating to pain management and years of ICU experience

As can be seen from the scatter plot in figure 4.19 there was only a weak correlation between years of ICU experience and the marks obtained for the questions relating to glycaemic control. A coefficient of correlation of 0.168 was obtained, confirming the weak correlation (p=0.0520).

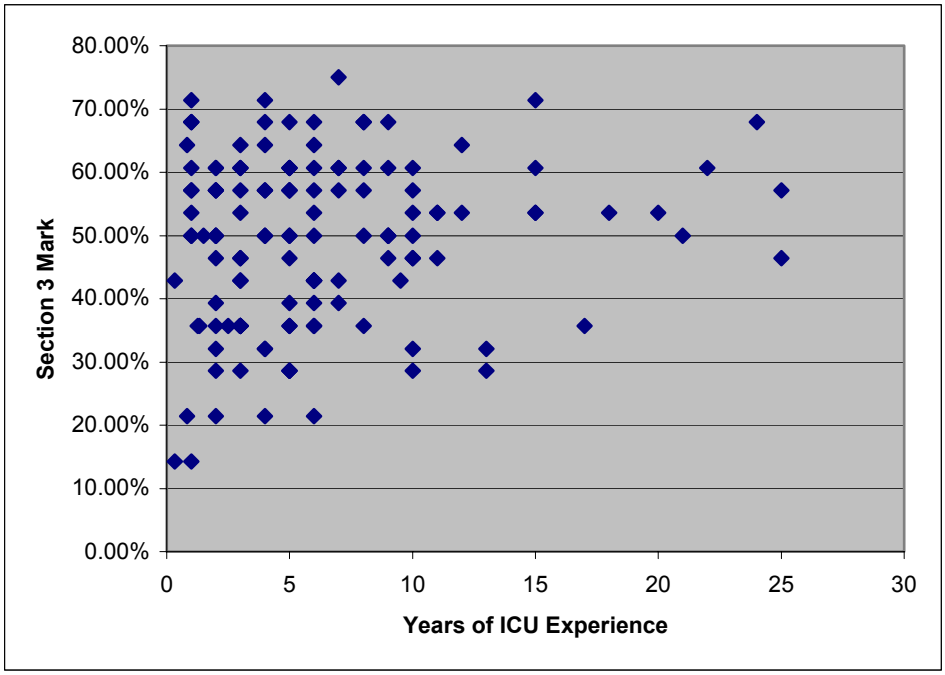

Figure 4.19: Marks obtained for the questions relating to glycaemic control and years of ICU experience

It can be seen from the scatter plot in figure 4.20 that there was only a weak correlation between years of ICU experience and the marks obtained for the questions relating to weaning from mechanical ventilation. A correlation coefficient of 0.118 was obtained, indicating a weak correlation. (p=0.1749)

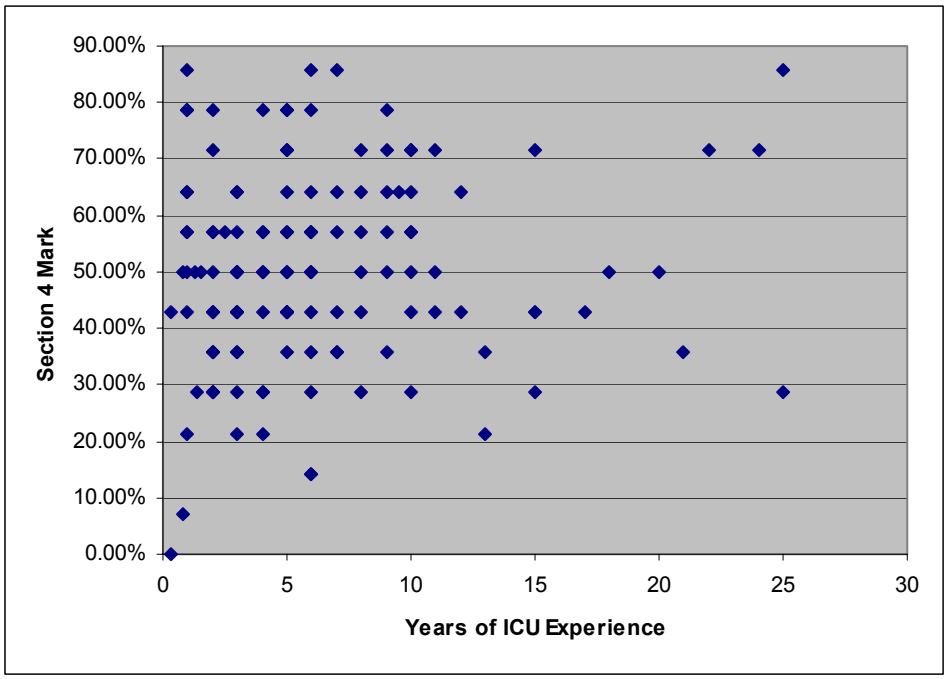

Figure 4.20: Marks obtained for the questions relating to weaning from mechanical ventilation and years of ICU experience

The scatter plot in figure 4.21 shows that there was only a weak correlation between years of ICU experience and the marks obtained for the basic level questions. Analysis returned a correlation coefficient of 0.134, indicating a weak correlation. (p=0.1222)

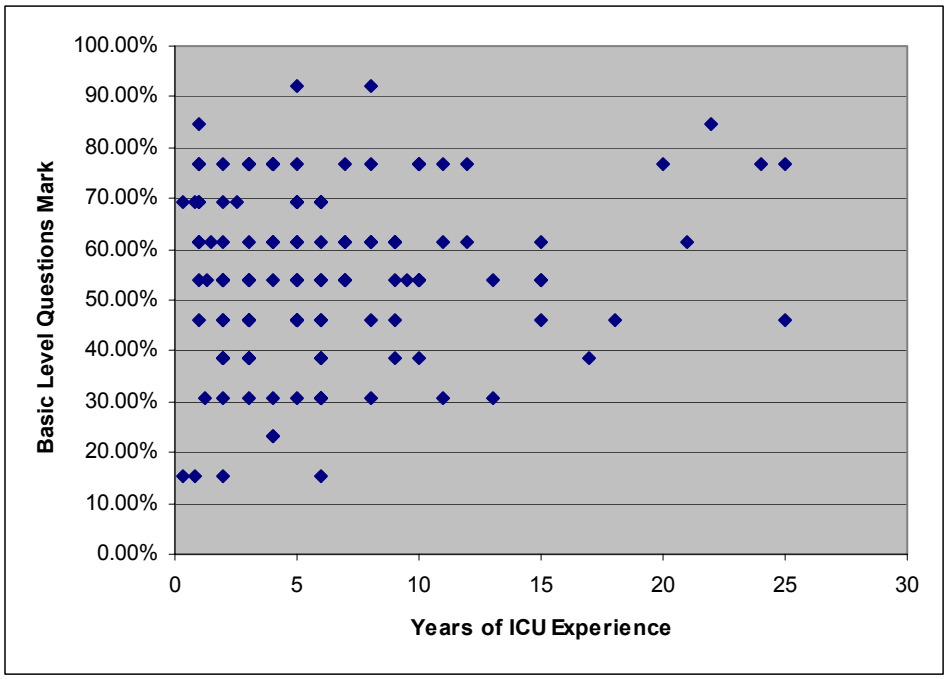

Figure 4.21: Marks obtained for the basic level questions and years of ICU experience

As can be seen from the scatter plot in figure 4.22 there was only a weak correlation between years of ICU experience and the marks obtained for the applied level questions. Analysis returned a coefficient of correlation of 0.038, indicating a weak correlation. (p=0.6619)

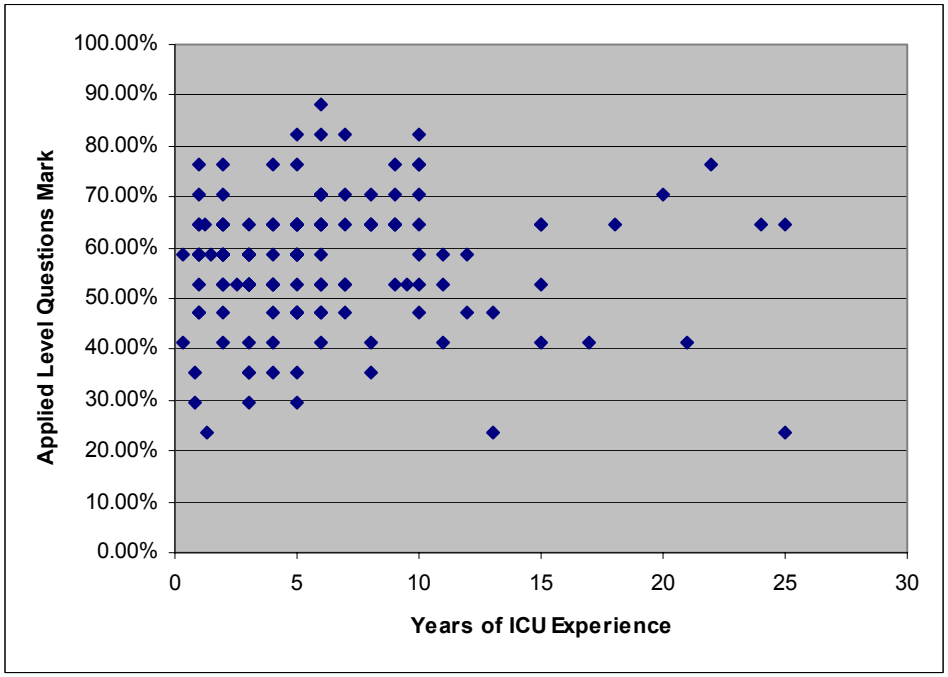

Figure 4.22: Marks obtained for the applied level questions and years of ICU experience

It can be seen from the scatter plot in figure 4.23 that there was a weak correlation between years of ICU experience and the marks obtained for the advanced level questions. A coefficient of correlation of 0.149 was obtained, indicating a weak correlation. (p=0.0865)

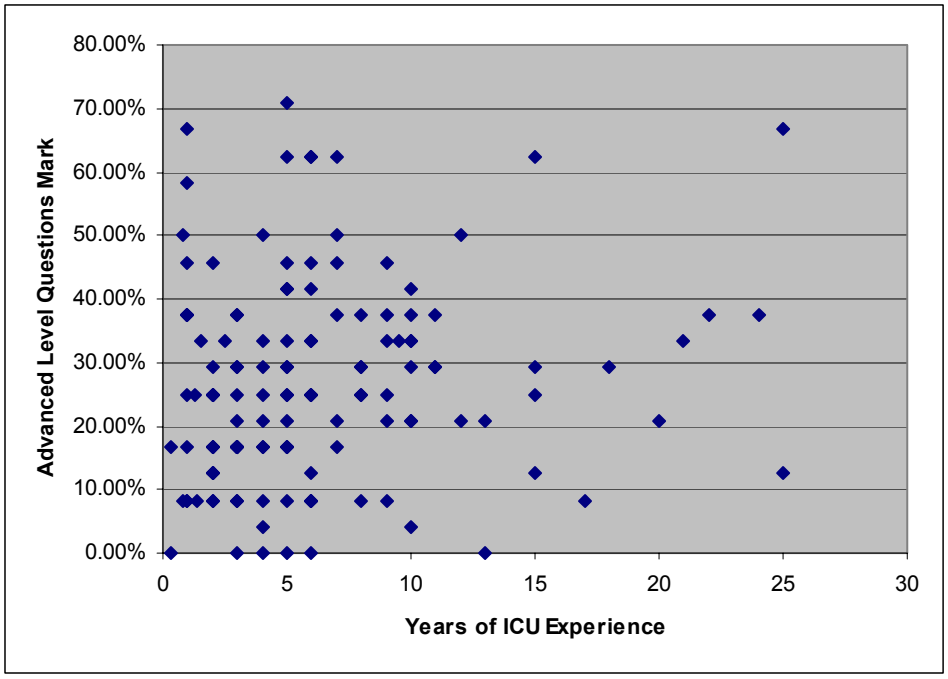

Figure 4.23: Marks obtained for the advanced level questions and years of ICU experience

Participants' assessment of the instrument

On completion of the instrument the participants were asked to rate the difficulty of the instrument as very easy, easy, fair, difficult or very difficult. One participant (0.74%) found the instrument very easy, 4 participants (2.94%) rated it as easy, 108 (79.41%) found it fair, 21 participants (15.44%) found it difficult and 2 participants (1.47%) rated it as very difficult. The results of the rating are shown in figure 4.24. The participants were also invited to comment on the instrument.

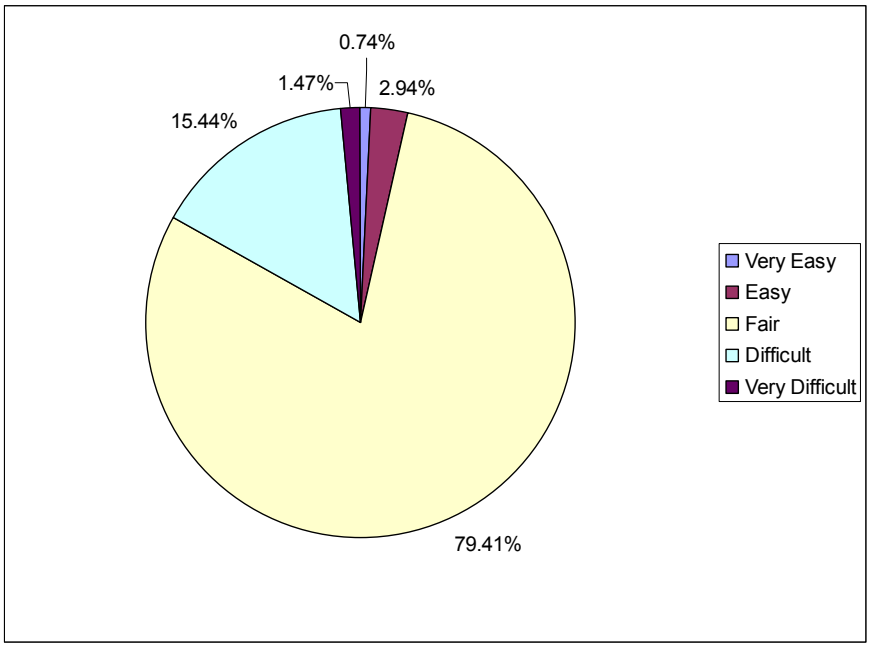

Figure 4.24: Distribution of the ratings of the instrument of all participants (N=136)

Participants' comments on the instrument

Participants were invited to comment on the instrument in addition to rating it as described above. Sixty-five (47.79%) participants did not comment on the instrument. Nineteen (13.97%) of the participants felt that the instrument was too long, there was not enough time to complete it or that they would have been able to do better if they were not looking after a patient at the same time. Twenty-seven (19.85%) of the participants said that they enjoyed "the challenge", it had been an "eye opener" and that it had made them realise that they needed to extend their knowledge and try and keep up to date with developments and research regarding the treatment of ICU patients. The remaining twenty-five (18.38%) participants made comments including "If I didn't know an answer I just guessed", and "there should have been time to study if I was expected to write a test". A few participants made the comment that the researcher and the researcher's assistant made them feel uncomfortable as they were always being watched.

Assessment of internal consistency

Cronbach's alpha coefficient was determined to assess the internal consistency of the various questions within the instrument. It examines the extent to which all questions consistently measure the construct (Burns, et al., 2003:273). However the same authors (Burns, et al., 2003:291) state that when using questionnaires, individual questions may address different aspects or topics that are associated with the research subject and therefore attempting to determine reliability using tests of internal consistency may not be logical. Despite this, Cronbach's alpha coefficient was determined for each of the sections.

Table 4.14: Internal consistency of the sections of the instrument.

Section	Cronbach's alpha coefficient
Section 2: pain management	0.4904
Section 3: glycaemic control	0.4631
Section 4: weaning	0.5390

The first phase of this study was to develop and quantify (i.e. validate) an instrument to test the knowledge of ICU nurses regarding pain management, glycaemic control and weaning from mechanical ventilation. This phase proceeded through two stages, the developmental and the quantification stages, each consisting of expert ICU nurses. The instrument that emerged on completion of phase one had therefore been validated by 17 ICU nursing experts, both locally and nationally, and in their opinion contained questions deemed relevant to ensure that the participants (i.e. ICU nurses) had a broad knowledge of pain management, glycaemic control and weaning from mechanical ventilation. Cronbach's alpha coefficient for each section is displayed in Table 4.14. These values do not meet the required values for ensuring internal consistency of a newly developed instrument, even though the instrument was deemed content valid by experts in the field. Cronbach's alpha coefficients determined for each section, after division into ICU trained and non-ICU trained groups, yielded different values for each group. This was a newly developed instrument and according to Higgins & Straub (2006: 27), estimates of an acceptable alpha coefficient are dependent on not only the sample on which it was tested but also on the instrument's maturity. This instrument was being used for the first time.

4.4 DISCUSSION OF RESULTS

The results from Phase two, the research phase, are discussed below. The purpose of this study was to describe nurses' knowledge related to care areas commonly guided by protocols, namely pain management, glycaemic control and weaning from mechanical ventilation, to compare the difference in knowledge between ICU trained and non-ICU trained nurses and to determine to what extent this knowledge is influenced by their years of ICU experience. Data was collected from 136 ICU nurses (N=136) of which 68 were ICU trained (n=68) and 68 were non-ICU trained (n=68), in three public sector (n=3) and two private sector (n=2) hospitals in Gauteng.

4.4.1 Demographic data

One hundred and thirty six participants took part in this study. The ages of the participants is thought to be representative of the nurses working in ICU as the majority (77.94%) are aged between 31-50 years old, with 14.71% being younger than the majority and only 7.35% being older than 50 years.

Only 20 (14.71%) participants indicated that they were **working through an agency**. This is not consistent with findings (CCSSA, 2004) that showed that some 36% of ICU nurses in South Africa work through an agency. Many of these agency nurses are thought to hold full time positions in addition to working overtime through a nursing agency.

The majority of participants in this study were employed in the **public sector** (63.97%). This can be due to the fact that participants were recruited from all the ICUs in each of the public sector hospitals, but in the **private sector**, due to the pressure of work in the units, management requested that participants were not sought in the cardio-thoracic units. As it was not an objective of this study to compare public and private ICUs no attempt was made to recruit an equal number of participants in the two sectors.

Of the participants, 109 (80.15%) indicated that they **worked overtime** which is in keeping with the trend in South Africa for the majority of nurses to work overtime.

The vast majority of nurses had obtained their **basic nursing qualification** through a nursing college (diploma) rather than a university (degree). This too is in keeping with the trend in South Africa. Cilliers (1991:1) found that only one in every ten ICU nurses in his study had obtained a university degree in nursing.

Just over one quarter of the nurses (27.95%) in the study had two or less years of **general ward experience** prior to commencing work in ICU. Although nurses in South Africa are permitted to work in ICU immediately after completion of their general nursing training, the majority of participants in this study had more than two years of nursing experience outside the ICU environment prior to commencing work in an ICU. The majority of participants in this study would therefore comply with the recommendation by the DOH (2003) that nurses should have at least two years of general ward experience before staring work in an ICU.

Only 8 (5.88%) of the participants indicated that they did not make any effort to ensure their **continuing professional development**. Although the majority of participants indicated that they did undertake activities to keep their knowledge up to date, the impact of these efforts was not evident in this study. Acquiring Continuing Professional Development (CPD) points to indicate that nurses constantly update their knowledge is not compulsory in South Africa. However provision is made in the new Nursing Act (Nursing Act 33 of 2005) for continuing professional development for all nurses in South Africa. In the USA it is a requirement that nurses either acquire a certain number of CPD points over a given period of time or write an exam every three years as proof of ongoing professional development to ensure continued registration (AACN, 2003:159).

4.4.2 Knowledge of ICU nurses

The average score of all participants in the study for the **whole instrument** was 47.56% (SD=11.61) with scores ranging from a low of 19% to a high of 75%. This average score was well below the competency indicator of 70% determined by ICU experts including ICU clinical facilitators and trained ICU nurses. Only 4 participants (2.94%) out of 136

scored higher than the 70% competency indicator. In addition to the studies by Van Huyssteen, et al. (2004) and Windsor (2006) discussed in Chapter 2, two further studies looking at knowledge of ICU nurses similarly found that they lacked knowledge. Oosthuizen (2000) looked at knowledge of intra-aortic balloonpump counterpulsation and Hyde (2006) described knowledge of legal liability issues in ICU. As independent practitioners, ICU nurses are accountable for all their decisions regarding the care of their patients. Decisions made need to be based on the nurse's knowledge regarding the situation. "Knowledge is basic to safe practice" (Toth, 2003:45). According to Searle (2002:120), the nurse must continue to develop her knowledge and skills. This is echoed by Muller (1996:27) who states that nurses, as independent practitioners, are expected to update their skills and knowledge as circumstances demand.

The average score of all participants in the study for the section on **pain management** was 43.97% (SD=15.45) with scores ranging from a low of 7.1% to a high of 85.7%. This was also well below the 70% competency indicator, with only 10 participants scoring higher than this value. The fact that most of the ICU nurses exhibited a poor knowledge of pain management is consistent with other studies assessing knowledge of pain management (Fothergill-Bourbonnais, et al., 1992:369; Erkes et al., 2001:50). Pain has also been cited as one of the greatest stressors to ICU patients (Erkes, et al., 2001:52; Blenkharn, et al., 2002:332). Nurses knowledgeable in pain management could reduce the stress experienced by these patients by appropriate, knowledgeable management of pain.

For the section on **glycaemic control**, the average score of all participants in the study was 48.71% (SD=13.30) with scores ranging from a low of 14.3% to a high of 75%. This average score was well below the 70% competency indicator, with only 4 participants scoring higher than this value. The poor performance on knowledge of glycaemic control was surprising as all the units involved in the study had protocols for glycaemic control and, since the Van den Berghe, et al. study (2001), glycaemic control has been very topical at ICU congresses, on academic ward rounds and in scientific ICU journals. These results may indicate insufficient attention to ongoing professional development by the participants although most of them indicated some level of ongoing professional development in the demographic questionnaire.

The average score of all participants in the study for the section on **weaning from mechanical ventilation** was 50.0% (SD=17.16) with scores ranging from a low of 0% to a high of 85.7%. This average score was again well below the 70% competency indicator, with 23 participants scoring higher than this value. More participants scored higher than the competency level of 70% in this section and the average score was higher than for the other two sections. This may be explained by the fact that the most common reason for admission of an adult patient to ICU is the need for mechanical ventilation (Tobin, 2001:1986) and that approximately 41% of time required for ventilation is spent on the weaning process (Estban, et al., 1994:1188). Therefore ICU nurses probably have more exposure to this aspect of care than the other areas covered in this study.

The average score of all participants in the study for the questions assessing **basic knowledge** was 55.14% (SD=16.90) with scores ranging from a low of 15.4% to a high of 92.3%. This was well below the competency indicator of 70% and only 26 participants scored higher than this. This apparent poor basic knowledge may account for the poor overall scores on the instrument as a whole as the basic knowledge necessary as a foundation for further learning may be inadequate.

The average score of all participants in the study for the questions assessing **applied knowledge** was 56.66% (SD=13.22) with scores ranging from a low of 23.5% to a high of 88.2%. This average score was again well below the 70% competency indicator with only 23 participants scoring higher than this value. Applied knowledge is based on everyday practice and this may account for the slightly better average score than for the basic questions.

The average score of all participants in the study for the questions assessing **advanced knowledge** was 26.44% (SD=15.92) with scores ranging from a low of 0% to a high of 70.8%. This average score was again well below the 70% competency indicator with only 1 participant scoring higher than this value. The scores were far below what is to be expected of ICU nurses who are expected to function at an advanced level. Furthermore, the advanced questions required substantiation or explanation of a previously asked question, thereby indicating that many actions by ICU nurses are possibly being carried out without insight.

4.4.3 Difference in knowledge between ICU trained and non-ICU trained nurses

Of the 42 questions asked of the participants, the answers to only 8 questions indicated both a significant difference between the ICU trained and the non-ICU trained nurses and an association between the answer given and whether the participant was ICU trained or not. Two of these were in Section 2 (pain management), three in Section 3 (glycaemic control) and four in Section 4 (weaning from mechanical ventilation).

The mean scores of both ICU trained and non-ICU trained participants for the **whole instrument** were well below the competency indicator of 70%. The mean score of the ICU trained participants was 50.11% (SD=11.96) whereas the mean score of the non-ICU trained participants was 45.01% (SD=10.75). Although the difference in the mean score of the nurses in the two groups was relatively small at only 5.1%, it was however statistically significant (p=0.0099). Considering that ICU trained nurses have undergone a full year of ICU training, the researcher expected a greater difference between the groups. The mean years of ICU experience for the ICU trained participants was 8.45 years (SD=5.23) while that of the non-ICU trained participants was only 4.14 years (SD=4.26). The fact that the non-ICU trained group had on average 4 years less ICU experience than the ICU trained group makes the relatively small difference in scores surprising. A similar result to this study was found by Oosthuizen (2000:64), where a difference of 9% between ICU trained and non-ICU trained nurses regarding knowledge of intra-aortic balloonpump counterpulsation therapy was found. He concluded that formal ICU training did have an impact on the knowledge of ICU nurses.

In Section 2 questioning knowledge of **pain management**, the mean score of the ICU trained participants was 45.07% (SD=16.01) whereas the mean score of the non-ICU trained participants was 42.86% (SD=14.91). Both groups scored lower in this section than on the instrument as a whole. The difference in the mean scores of the nurses in the two groups was very small at only 2.20%. There was a no statistical significance (p=0.408) between the two groups.

In Section 3 questioning knowledge of **glycaemic control**, the mean score of the ICU trained participants was 51.26% (SD=11.74) whereas the mean score of the non-ICU trained participants was 46.16% (SD=14.34). Both groups scored slightly higher in this

section than on the instrument as a whole. The difference in the mean scores of the nurses in the two groups was relatively small at only 5.10%. This was statistically significant (p=0.025).

In Section 4, questioning knowledge of **weaning from mechanical ventilation**, the mean score of the ICU trained participants was 53.99% (SD=18.19) whereas the mean score of the non-ICU trained participants was 46.01% (SD=15.18). Both groups scored slightly higher in this section than on the instrument as a whole. The difference in the mean scores of the nurses in the two groups was relatively small at only 7.98%. This was statistically significant (p=0.006).

The mean score of the ICU trained participants for the **basic level** questions was 58.58% (SD=15.82) whereas the mean score of the non-ICU trained participants was 51.69% (SD=17.35). Both groups scored higher in this section than on the instrument as a whole. The difference in the mean scores of the nurses in the two groups was relatively small at only 6.89%. This was statistically significant (p=0.017).

The mean score of the ICU trained participants was 56.66% (SD=13.93) for the **applied level** questions whereas the mean score of the non-ICU trained participants was 56.66% (SD=12.57). The mean score for both groups was equal and higher in this section than on the instrument as a whole. There was no difference in the mean scores of the nurses in the two groups and no statistical significance (p=0.999) between the two groups. Applied knowledge is based on everyday practice and this may account for the relatively better scores and the insignificant difference between the two groups.

The mean score for the questions in all three sections determining the **level of advanced** knowledge was 26.44% (SD=15.92). This was much lower than the competency indicator of 70%. The mean score of the ICU trained participants was 31.61% (SD=16.83) whereas the mean score of the non-ICU trained participants was 21.26% (SD=13.16). Both groups scored very poorly. The difference in the mean scores of the nurses in the two groups was larger than in all the above comparisons at 10.35%. The difference between the two groups was statistically significant (p=0.0001). The 95% confidence interval indicated that the ICU trained participants had a better advanced knowledge than the non-ICU trained participants. This was to be expected as the ICU trained group have undergone a year of ICU training

and that they, on the whole, have more years of ICU experience than the non-ICU trained group.

4.4.4 Influence of years of ICU experience on knowledge

There was only a weak correlation between years of ICU experience and the marks obtained for the instrument as a whole, Sections 2, 3 or 4 or the basic, applied and advanced questions. Analysis returned coefficients of correlation ranging from 0.031 to 0.168 confirming a weak or poor correlation.

This finding is at odds with research reported by Toth (2003:42), who found that a statistically significant relationship had consistently been found between basic knowledge and years of experience in the Basic Knowledge Assessment Tool (BKAT) studies. The BKAT has been revised and updated over the years and has been used both nationally and internationally. It has become one of the most widely accepted tools for measuring the basic knowledge of ICU nurses in the United States (Toth, 2003:41).

Windsor's study (2005), which looked at interpreting ventilator graphics, found that the most experienced group of nurses i.e. those with more than 10 years of experience, achieved the lowest mean score for her questionnaire. Scribante et al., (1996:225) cautioned that, although the move up the competency curve from novice to expert, as described by Benner (1984), usually takes place fairly rapidly, if development is not maintained, the ICU nurse will descend this curve. Windsor's results appear to indicate that a descent down the competency curve had occurred.

This study showed a weak correlation between years of ICU experience and level of knowledge which may indicate that the participants in the study, notwithstanding their years of experience, have not continued to develop professionally. This is supported by Benner (1982:407) who describes experience as not the "mere passage of time or longevity" but as the integration of learned theory (knowledge) and practical experience. Benner (1982:407) further states, that theory (knowledge) guides nurses and enables them to ask the right questions which should improve their practical knowledge. In the absence

of adequate knowledge (theory), nurses may not be asking the right questions and this could result in limited further learning and development.

4.5 SUMMARY

This chapter dealt with the results obtained from the study and discusses the descriptive and inferential statistics employed to describe and analyse the data. The research findings are discussed and integrated with findings from the literature.

Although the instrument was developed and quantified by ICU nursing experts and assessed as being content valid, the internal consistency as assessed by Cronbach's alpha coefficient was lower than expected.

Formal training made a statistically significant difference to the knowledge levels of ICU trained as opposed to non-ICU trained nurses, although the clinical significance of a 5% difference is questionable. Years of ICU experience showed no statistically significant difference in knowledge levels of nurses working in ICU. Overall the knowledge levels demonstrated in this study were poor with only four participants achieving a score at or above the competency indicator of 70%.

The final chapter of this study will present a summary of the study findings, the main findings, conclusions, limitations and recommendations.

CHAPTER FIVE

SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS.

5.1 INTRODUCTION

In the final chapter of this study a summary and conclusions from the main findings are presented. This is followed by a discussion of the limitations of the study and recommendations for management, nursing education, clinical practice and for further research in this area. Furthermore, as this study focussed on knowledge related to specific care areas guided by protocols, the development and implementation of protocols is discussed.

5.2 SUMMARY OF THE STUDY

5.2.1 Purpose of the study

The purpose of this study was to determine the knowledge levels of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.

5.2.2 Objectives of the study

To meet the purpose of the study, the research was conducted in two phases with the following objectives:

Phase One:

- To develop and validate an instrument to assess knowledge of ICU nurses in three specific care areas, namely pain management, glycaemic control and weaning from mechanical ventilation.

Phase Two:

- To describe the knowledge of nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation, care areas that are commonly guided by protocols.
- To compare the difference in knowledge between ICU trained and non-ICU trained nurses working in ICU with respect to pain management, glycaemic control and weaning from mechanical ventilation.
- To determine to what extent the knowledge of nurses working in ICU is influenced by their years of ICU experience relative to pain management, glycaemic control and weaning from mechanical ventilation.

5.2.3 Methodology

In phase one of this study a data collection instrument was developed by the researcher together with local ICU nursing experts and thereafter quantified by a further group of ICU nursing experts both locally and nationally. This two-step process followed the model proposed by Lynn (1986) to validate an instrument. Following validation, the researcher and an experienced assistant took the instrument to three public (n=3) and two private sector (n=2) hospitals in Gauteng. Prior to the inception of the study, ethical clearance and permission to conduct the study had been obtained from the relevant authorities and university committees. In order to refine the data collection instrument, a pilot study was conducted. A non-experimental, descriptive and contextual two-phase research design was utilised in order to meet the study objectives. Following consultation with the biostatistician it was decided that 120 participants (i.e. 60 ICU trained and 60 non-ICU trained nurses) would constitute an adequate sample size. Data collection took place during April and May 2006. Following further consultation with the biostatistician, descriptive and inferential statistics were used to analyse the data.

5.2.4 Theoretical assumptions

South African nurses function within the Scope of Practice (South African Nursing Council [SANC] Regulation R 2598 as amended) which describes their professional-ethical responsibilities. Accountability forms the basis of professional nursing practice. A precondition to accountability as described by Bergman (1982:8) is ability which includes the knowledge, skills and values needed in order to decide and act on specific issues. The results of this study indicate an apparent lack of knowledge amongst ICU nurses and therefore the ability to make appropriate decisions in order to provide safe, individualised care to patients may be questionable. As nurses are accountable for their actions, it is the nurses' responsibility to make decisions regarding the appropriateness of an instruction for each individual patient, thereby ensuring patient safety. It is the nurse's responsibility to ensure patient safety based on their training, the Scope of Practice and the rules relating to the Acts and Omissions (SANC Regulation R 387 as amended). However the results of this study does raise concern for patient safety.

5.3 MAIN FINDINGS

The knowledge of 136 ICU nurses (68 ICU trained and 68 non-ICU trained) from three (n=3) public sector and two (n=2) private sector hospitals in Gauteng, regarding pain management, glycaemic control and weaning from mechanical ventilation was tested using a data collection instrument developed by the researcher and two groups of ICU nursing experts.

In general, the ICU nurses did not perform well in the test, with only four nurses obtaining a mark at or above the competency indicator of 70%. Although there was a statistically significant difference between the marks obtained by the ICU trained and the non-ICU trained nurses, the difference in scores between each of the two groups was small and the clinical significance of this small difference is not clear. When years of experience for the whole group (i.e. ICU trained and non-ICU trained) was correlated with the scores obtained, only a weak correlation was found. This implies that insufficient attention may be given to ongoing development of personnel working in the ICUs. Furthermore this

apparent lack of knowledge may have an adverse effect on the quality of care that ICU patients receive. “Knowledge is not wisdom, but the more knowledge an individual possesses, the greater the opportunity to be wise. Decision making is enhanced by information and experience” (Bryan-Brown & Dracup, 2002:191).

In the section on **pain management** the mean score for the group fell far short of the competency indicator. There was no statistical difference between the ICU trained and the non-ICU trained nurses. There only a weak correlation between years of ICU experience and knowledge related to pain management. Patients in ICU often have substantial pain and may have difficulty communicating their pain to their caregivers. Ballard (1981), as cited by Blenkharn et al., (2002:333), describes pain as the second greatest ICU stressor experienced by patients. Ferguson (1992), cited by Blenkharn et al., (2002:333), found that ICU patients had vivid recollections of their pain experiences. By having a good knowledge of pain management, ICU nurses may not only prevent many of the complications associated with pain but also make a positive contribution towards the patients’ ICU experience.

The average score obtained by the participants for the section on **glycaemic control**, while higher than that for pain management, was still below the competency indicator. The difference between the scores of the two groups was small but statistically significant and there was only a weak correlation between knowledge level of the group (ICU trained and non-ICU trained) and years of ICU experience. As many studies conducted in the ICU environment have shown improved outcomes linked to control of blood glucose, a lack of knowledge in this area of care can negatively affect the outcome of this vulnerable group of patients.

The highest score was obtained for the section on **weaning from mechanical ventilation** although this was again well below the competency level of 70%. The difference between the average scores of the two groups was small but statistically significant and there was again only a weak correlation between years of experience and the scores achieved. ICU nurses are continually present at the bedside of the ICU patient and are therefore in an ideal position to manage weaning from mechanical ventilation and to prevent delays in this process. Lack of timeous weaning from the ventilator has been associated with an increased risk of ventilator-associated complications, increased length of ICU stay and

therefore increased cost. Delays in weaning patients from the ventilator results in ICU beds being blocked for longer than necessary. As there is a shortage of ICU beds in South Africa, particularly in the public sector, timely weaning by nurses knowledgeable in this care area could contribute to alleviating this problem to some extent.

The average score obtained by the participants for all three levels of questions was well below the competency indicator with the average score for the advanced questions being much lower than for the basic and applied level questions. The difference between the scores of the two groups was statistically significant for both the basic and advanced level questions but not for the applied level questions. There was only a weak correlation between knowledge levels for the group as a whole and years of ICU experience for all three levels of questions.

The main findings of this study show:

- There appeared to be a lack of knowledge of nurses working in the participating ICUs with regard to pain management, glycaemic control and weaning from mechanical ventilation.
- There appeared to be little difference in the knowledge between ICU trained and non-ICU trained nurses in the three care areas tested.
- There appears to be little improvement in knowledge with increasing years of experience in ICU in the three care areas tested.

This study has made some progress in establishing the current status of knowledge of South African ICU nurses regarding pain management, glycaemic control and weaning from mechanical ventilation. The above findings have implications for patient safety and quality of care, and indicate a possible need either for changes in the education and training of ICU nurses and their ongoing professional development or the recruitment and/or selection process of ICU personnel.

5.4 LIMITATIONS OF THE STUDY

The following were identified as limitations to this study:

- The findings of this study cannot be generalised beyond the study population, as the study was contextual, being conducted in only one province and including only three academic and two private hospitals.
- No existing questionnaire had been found in the literature addressing the topics covered in this study, namely pain management, glycaemic control and weaning from mechanical ventilation. Therefore an instrument had to be developed and validated by ICU nursing experts prior to data collection. The validity and reliability of the instrument had therefore not previously been determined. The possible lack of reliability of the data collection instrument (as measured by Cronbach's alpha coefficient) may preclude any firm conclusion being drawn from the results. However, a group of expert ICU nurses determined the instrument to be content valid, and therefore addressing issues that nurses should be expected to have adequate knowledge of, in order to be able to provide safe, individualised care in the three areas tested. As the data collection instrument had been assessed as valid but reliability, using Cronbach's alpha coefficient, was not demonstrated, refinement and additional testing of the instrument will be required before further use.
- Although the ICUs were not unusually busy, with no untoward events occurring during the times that data were collected, there was a possibility that participants found that completing the instrument while being in the unit more distracting than had they been sitting in a classroom.
- Lynn's model may appear outdated but it has consistently appeared in the literature from the time of its inception and has most recently been cited in an article by Stewart, Lynn and Mishel (2005) entitled "Evaluating Content Validity of Children's Self Report Instruments Using Children as Content Experts".

5.5 RECOMMENDATIONS FROM THE STUDY

The results of this study raise concern about patient safety and quality of care delivered by nurses working in ICU, therefore the following recommendations are made relating to clinical nursing practice, nursing management and nursing educators. In addition recommendations for further research are also given.

5.5.1 Clinical nursing practice

With the increasing severity of illness of ICU patients, the rapid advancement in technology and the emergence of new knowledge, ICU nurses need to quickly grasp new information and develop new skills in order to provide safe, quality care to their patients. To fulfil this increasingly complex role, the ICU nurse needs a complex repertoire of specialised knowledge therefore the following recommendations are made for clinical nursing practice:

- Educational programmes must be introduced into ICUs to improve knowledge regarding pain management, glycaemic control and weaning from mechanical ventilation.
- An orientation programme for staff newly appointed to the ICU should include education with regard to pain management, glycaemic control and weaning from mechanical ventilation.
- As the staff turnover in many ICUs is high, these educational programmes must be presented regularly to ensure that newcomers are exposed to the teaching.

5.5.2 Nursing management

As the ICU environment requires knowledgeable, skilful and competent nursing staff in order to maximise the outcomes of patients, the following recommendations are made for nursing management:

- Extensive and ongoing in-service programmes must be established to address the lack of knowledge of pain management, glycaemic control and weaning from mechanical ventilation.

5.5.3 Nursing education

The following recommendations are made for nursing education:

- Review of curriculum to ensure it reflects the reality of current clinical practice.
- ICU training programmes should include the importance of incorporating evidence-based practice into clinical nursing practice.
- Clinical facilitators and nurse educators should create and use learning opportunities in ICU to ensure adequate knowledge with regard to pain management, glycaemic control and weaning from mechanical ventilation. These may include novel approaches to teaching in order to facilitate learning.
- A continuing professional development system, similar to that for medical practitioners, should be introduced and become compulsory as soon as possible. This would potentially increase the knowledge of ICU nurses.

5.5.4 Further research

The following recommendations are made for nursing research:

- A research study should be carried out to confirm the validity and improve reliability of the data collection instrument developed as part of this study.
- This study could be extended to include other care areas, more hospitals and possibly other provinces in South Africa.
- An experimental study could be carried out to test knowledge related to a specific care area protocol before and after the participants have attended an educational programme regarding that protocol. This would assess the impact of such a programme on the knowledge levels of the participants.
- The views of nurses on protocol-based care and the knowledge they think necessary for implementation of a specific protocol could be canvassed.

- A protocol already in place in a unit could be audited for understanding and/or compliance.
- The impact of the apparent knowledge deficit on patient outcomes should be investigated particularly as the cost of nursing care is increasingly being scrutinised.

5.6 PROTOCOL DEVELOPMENT AND IMPLEMENTATION

The knowledge of specific care areas commonly directed by protocols was addressed in this study. As not all nurses have the same level of knowledge and expertise, there is always the risk of nurses acting in ignorance. The introduction of protocols, supported by relevant education, could improve knowledge, patient safety and the quality of patient care. Therefore, it is deemed salient to briefly address the development and implementation of protocols in this final chapter of the study.

Protocol development and implementation are vital to the success of protocols in the units. "Protocols imposed by an individual are doomed to failure" (Fessler et al., 2005:S224). These authors further stated that there should be a team approach to protocol development with representation from "the disciplines that will be implementing the protocol".

Different approaches to developing and implementing protocols have been suggested in the literature but many have the following recommendations in common. A specific area of care where provision of clear instructions based on current best evidence has the potential to enhance care needs to be identified. (Crocker, 2002:276; Grap, et al., 2003:455; Hewitt-Taylor, 2004: 46; Goodman, 2006:24). A multidisciplinary team needs to be set up to develop the protocol (Chan et al., 2001:350, Crocker, 2002:277; Grap, et al., 2003:455; Hewitt-Taylor, 2004:46; Fessler et al., 2005:S224; Goodman, 2006:24). This team sets goals and objectives (Grap, et al., 2003:455; Fessler et al., 2005:S224; Goodman, 2006:24) and thereafter gathers relevant information. This will include a literature review on the topic and gathering information on similar protocols used in other units and hospitals (Chan et al., 2001:350; Grap, et al., 2003:456; Hewitt-Taylor, 2004: 46; Fessler et al., 2005:S224; Goodman, 2006:26).

Once this has been carried out, the development of the protocol can commence. It is important that the protocol is specific to the local environment and the opinions of all the team members should be taken into consideration, as this will improve staff familiarity with the protocol. (Chan et al., 2001:350; Grap, et al., 2003:456; Hewitt-Taylor, 2004: 46; Fessler et al., 2005:S225; Goodman, 2006:26). Extensive education of the staff and the incorporation of ideas and suggestions raised prior to implementing the protocol are essential. (Chan et al., 2001:350; Grap, et al., 2003:458; Fessler et al., 2005:S225; Goodman, 2006:31).

It is essential that protocol implementation be accompanied by detailed and ongoing education and training of the unit personnel. It must be determined whether the unit personnel are comfortable and capable of implementing the protocol. Ineffective education has been identified as a barrier to the successful implementation of a protocol. (Grap, et al., 2003:458; Fessler et al., 2005:S225; Goodman, 2006:31).

Compliance with the protocol and the outcomes of implementation need to be measured to assess the success of the implementation. (Chan et al., 2001:350, Grap, et al., 2003:458; Fessler et al., 2005:S225; Goodman, 2006:31). To ensure that the protocol remains up-to-date with changes in technology and practice it should be reviewed and refined regularly (Chan et al., 2001:350; Grap, et al., 2003:458; Goodman, 2006:31).

5.7 CONCLUSIONS

To safely implement protocol-based care, ICU nurses need to have a good knowledge level to allow sound judgements to be made related to the care of a critically ill patient. Without this knowledge, safe implementation of nursing care cannot be assured. Holistic nursing care is more than strictly applying the steps of a guideline or protocol and involves having an adequate knowledge on which to base decisions regarding the suitability of the instruction for a given patient in a given situation. From this study it would appear that nurses, both ICU trained and non-ICU trained, working in the ICUs of three public and two private hospitals in Gauteng did not have adequate knowledge in the three care areas

assessed namely pain management, glycaemic control and weaning from mechanical ventilation.

This study also indicated that there was only a small difference in the knowledge levels between the ICU trained and the non-ICU trained nurses. This finding was unexpected as ICU trained nurses are expected to have a better knowledge than those who have not undergone this speciality training.

The correlation between knowledge levels of ICU nurses and years of ICU experience was weak. This finding was not anticipated as nurses with more years of experience would be expected to be more knowledgeable than their less experienced counterparts.

This chapter provided a summary of the study, a presentation of the main findings of the study, the limitations of the study, recommendations of the study and a brief outline on the recommended guidelines of developing and implementing a protocol into a clinical area.

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Appendix A

Developmental Stage Documentation

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

EXPERT GROUP INFORMATION LETTER

Dear Colleague,

My name is Helen Perrie. I am an Intensive care nurse and currently studying for a Masters degree in Nursing Science at the University of the Witwatersrand. I am conducting a research study to describe and compare the knowledge of ICU nurses, both ICU trained and non-ICU trained, with regard to pain control, glycaemic control and weaning patients off a ventilator. These activities can all be carried out by following a protocol, which will direct the nurse in the actions to be taken. Protocols for the implementation of medical therapies are becoming more and more common in the ICU. Protocols are very useful for guiding inexperienced and staff new to an area, but unless the nurse has an adequate knowledge base, the use of these protocols may expose the patient to unsafe practice and the nurse to possible litigation. This study will use a written case simulation, which is a way of gathering information related to actual clinical practice and competence from the participants.

I hereby request you as an expert in the field to be part of an expert panel in assisting me to further develop a data collection instrument. The instrument is divided into three sections, one section will address pain control, another will address glycaemic control and the third section is designed to elicit knowledge about weaning a patient off mechanical ventilation. An additional section is included to gather demographic data from the participants.

Should you agree to participate, I will ask you to allow me to interview you in a small group, with other expert nurses who have agreed to participate in the study on 17 February 2006 at 15:00 in the Masters classroom of the Department of Nursing, University of the Witwatersrand. I will organise parking for you at Medical School. Refreshments will be provided. Prior to the meeting I will send you documentation pertaining to the study, including a demographic questionnaire and a consent form. Please could you bring all of this to the meeting with you.

Participation in the process is entirely voluntary. At the start of the discussion, participants will be requested to maintain confidentiality of what is discussed, but I as the researcher, cannot guarantee that this will be adhered to. Anonymity can also not be guaranteed as some of the other ICU experts may be known to you.

I appreciate that you will not benefit directly from participation in this study, however I hope that the results of the study will help to clarify educational needs of nurses with regard to the implementation of protocols.

The Faculty of Medicine Post Graduate Committee and the Ethics Committee of the University of the Witwatersrand have approved this study.

Should you wish to contact me, or require any further information, my cell number is 073 169 1895.

Thank you for taking the time to read this information letter.

Yours sincerely

Helen Perrie

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

EXPERT GROUP INFORMATION LETTER 2

Dear Colleague,

Further to my previous correspondence regarding your participation in the expert panel to further develop my data collection instrument, herewith further information.

The process will take place in three steps. Firstly the domain identification followed by question refinement or generation and finally consolidation of the instrument into a usable form.

I would request that you return your assessment of the critical issues using Form 1 to me as soon as possible.

I have attached the instrument I am proposing to use. At the meeting, I intend firstly to determine whether there are issues which need to be added to the domains and if so to formulate questions to assess knowledge around these issues.

In order to expedite the process , I would like you to assess each question using the rating scale provided. In other words, have the right questions been asked to assess the knowledge of ICU staff on the critical issues identified in each of the three domains.

The rating scale uses a 4-point ordinal scale where 1 indicates an irrelevant question and 4 an extremely relevant question. I would like your assessment of each question using the attached assessment form (Form 2) using the following ratings:

1 = irrelevant
2 = relevant but unimportant
3 = relevant and important
4 = relevant and very important

Please could you bring your preliminary scoring on Form 2 to the meeting.

I would also like you to indicate whether there are any changes, additions or deletions necessary to the instrument. This will be discussed further when we meet.

To summarise, please:

1. Return Form 1 to me as soon as possible.
2. Bring your preliminary assessment using Form 2 to the meeting.
3. Bring your demographic questionnaire and consent form to the meeting.
4. The panel will meet on 17 February 2006 at 15:00 in the Masters classroom of the Department of Nursing, University of the Witwatersrand.
5. Please let me have your vehicle registration number so that I can organise parking for you at Medical School.

Should you wish to contact me, or require any further information, my cell number is 073 169 1895.

Thank you for your participation.

Yours sincerely

Helen Perrie

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

CONSENT FORM

I, _____ (name), fully understand the contents of this information letter. I have been offered the opportunity to ask questions and these have been answered to my satisfaction. I understand that I may withdraw from this process at any stage without penalty. I have been assured that my anonymity and confidentiality will be maintained.

I hereby give consent to assist in developing the instrument.

_____
(Participant)

_____
(Date)

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

EXPERT GROUP DEMOGRAPHIC QUESTIONNAIRE

Instructions:

Please could you complete the following demographic questionnaire and bring it to the meeting with you.

1. Please state your profession _____

2. Please state your qualification(s) _____
   _____
   _____
   _____

3. How many year of ICU experience do you have? _____

4. Please tick your present role in ICU
   - ICU nurse _____
   - ICU nurse and shift leader _____
   - ICU clinical facilitator _____
   - ICU unit manager _____
   - Other (please specify) _____
     _____

5. If you are involved in teaching, is this
   - Practical teaching _____
   - Theoretical teaching _____
   - Both _____

Thank you for taking time to complete this questionnaire.

Helen Perrie

(MSc Nursing Student)

Domain identification

I have identified three distinct domains that need to be addressed by the questionnaire, namely pain and pain management, glycaemic control and weaning. Using the literature, my clinical experience and the input from two ICU nursing experts and an intensivist, I have identified what I believe are the critical issues in each that nurses working in ICU should have at least a basic knowledge of.

Listed below are the critical issues in each of the three domains.

Pain and pain management

- Physiology
- Assessment of patient – awake patient/unconscious patient
- Knowledge of analgesia /pharmacology
- Addiction
- Interpretation of prescription
- Interaction with other drugs
- Clearance with illness

Glycaemic control

- Physiology
- Normal values
- Knowledge about insulin e.g. storage, half-life, pharmacology, dialysis etc
- Signs and symptoms of hypoglycaemia
- Treatment of hypoglycaemia
- Site blood taken from e.g. arterial, venous, capillary
- Questions about Dextrostix and glucometers
- TPN/critical illness/comorbid diseases – Effect on glycaemic control

Weaning

- Physiology
- Assessment – readiness for weaning
- Spontaneous breathing trial
- Signs and symptoms of not coping
- Modes of ventilation for weaning
- Assessment for extubation

As an ICU expert, I would like your assessment of whether there are important issues which have been omitted and should be included or conversely, if there are ones that could be omitted. Please use Form 1 below.

FORM 1: Critical domain issues

Critical Issue	Important	Irrelevant
Pain Management		
Physiology		
Assessment of patient – awake patient/unconscious patient		
Knowledge of analgesia /pharmacology		
Addiction		
Interpretation of prescription		
Interaction with other drugs		
Clearance with illness		
Glycaemic control		
Physiology		
Normal values		
Knowledge about insulin e.g. storage, ½ life, pharmacology, dialysis etc		
Signs and symptoms of hypoglycaemia		
Treatment of hypoglycaemia		
Site blood taken from e.g. arterial, venous, capillary		
Questions about Dextrostix and glucometers		
TPN/critical illness/comorbid diseases – Effect on glycaemic control		
Weaning		
Physiology		
Assessment – readiness for weaning		
Spontaneous breathing trial		
Signs and symptoms of not coping		
Modes of ventilation for weaning		
Assessment for extubation		

Additional issues that you feel need to be added.

Pain Management

_____
_____
_____
_____

Glycaemic control

_____
_____
_____
_____

Weaning

_____
_____
_____
_____

Instrument development: I have selected the methodology according to Lynn's Model. (Lynn, M .R. 1986. Determination and Quantification of Content Validity. Nursing Research, pp382-385)

Using the critical issues listed above I have developed a case study questionnaire in which I have sketched a scenario or case study relevant to each of the three areas. I have developed questions to assess knowledge of the issues. Some of the questions are based on appropriate action to be taken based on the information in the sketches whilst others attempt to assess basic knowledge. Some of the questions have been extended to further assess applied and more advanced knowledge.

I will forward a copy of the questionnaire shortly.

Please could you look at the questions and at our meeting on 17 February 2006 at 15 00, let me know which ones you feel are acceptable, which ones need adjustment and any that you feel should be omitted. If you can think of any questions that could be added to the questionnaire this will be very useful. All the questions will be debated when we meet.

Thank you once again for agreeing to be part of the panel to further develop this instrument.

Helen

FORM 2: Assessment of questions

1 = irrelevant
2 = relevant but unimportant
3 = relevant and important
4 = relevant and very important

Question	1	2	3	4
SECTION 2 (Pain and pain management)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				
Q.12				
Q.13				
Q.14				

Question	1	2	3	4
SECTION 3 (Glycaemic Control)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				
Q.12				
Q.13				
Q.14				

Question	1	2	3	4
SECTION 4 (Weaning)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				
Q.12				
Q.13				
Q.14				

FORM 3: Level of Knowledge

SECTION 2	Basic	Applied	Advanced
Q.1			
Q.2			
Q.3			
Q.4			
Q.5			
Q.6			
Q.7			
Q.8			
Q.9			
Q.10			
Q.11			
Q.12			
Q.13			
SECTION 3			
Q.1			
Q.2			
Q.3			
Q.4			
Q.5			
Q.6			
Q.7			
Q.8			
Q.9			
Q.10			
Q.11			
Q.12			
Q.13			
SECTION 4			
Q.1			
Q.2			
Q.3			
Q.4			
Q.5			
Q.6			
Q.7			
Q.8			
Q.9			
Q.10			
Q.11			
Q.12			
Q.13			

Table A1: Demographic data of expert panel

Demographic Questions	Participants (n = 6)					
	1	2	3	4	5	6
Academic qualification	Dipl in General Nursing	Dipl in General Nursing	Dipl in General Nursing	Dipl in General Nursing	H.Soc Sc Nursing	Dipl in General Nursing, Midwifery, Psych and Com
	Dipl in Midwifery	Dipl in Midwifery	Dipl in Midwifery	Dipl in Midwifery	Dipl in ICU	B. Cur Critical Care
	Dipl in ICU	Dipl in ICU	Dipl in ICU	Dipl in ICU	Dipl in Community Health	Dipl in Nursing Education
	Dipl in Nursing Education	Dipl in Paediatrics			Dipl in Nursing Administration	Dipl in Nursing Management
					Dipl in Nursing Education	M.Cur Critical Care
Years of ICU Experience	32	34	20	17	24	10
Present Role	Educator	Clinical Facilitator	Unit Manager	Clinical Facilitator	Lecturer (ICU)	Lecturer (ICU)
Teaching role	Practical and theoretical	Practical and theoretical	Practical and theoretical	Practical	Theoretical	Practical and theoretical

Appendix B

Quantification Stage Documentation

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

EXPERT INFORMATION LETTER

Dear Colleague,

My name is Helen Perrie. I am an Intensive care nurse and currently studying for a Masters degree in Nursing Science at the University of the Witwatersrand. I am conducting a research study to describe and compare the knowledge of ICU nurses; both ICU trained and non-ICU trained, with regard to pain control, glycaemic control and weaning patients off a ventilator. These activities can all be carried out by following a protocol, which will direct the nurse in the actions to be taken. Protocols for the implementation of medical therapies are becoming more and more common in the ICU. Protocols are very useful for guiding inexperienced staff and those new to an area, but unless the nurse has an adequate knowledge base, the use of these protocols may expose the patient to unsafe practice and the nurse to possible litigation. This study will use a written case simulation, which is a way of gathering information related to actual clinical practice and competence from the participants.

An initial instrument that had been developed by me following a review of the literature, and with the assistance of intensivists and ICU clinical facilitators was further developed with the assistance of a group of six ICU expert nurses. This group agreed on the critical issues in each of the three domains and also reached agreement on the relevance or otherwise of the questions in the initial instrument in assessing the knowledge in each domain. The questions in the instrument have been modified and/or altered to take into account the input from this group. This completed the developmental phase of assessing the validity of the instrument following Lynn's Model[1]. The next phase is the quantification of the validity. I hereby request you as an expert in the field to be part of an expert group in assisting me in the quantification phase of validity assessment.

Further to our telephonic discussion in which you agreed to assist with the validation process, I have attached the latest draft of the provisional instrument together with a consent form and a demographic questionnaire. The instrument is divided into three sections, one section will address pain control, another will address glycaemic control and the third section is designed to elicit knowledge about weaning a patient off mechanical ventilation. An additional section is included to gather demographic data from the participants. The abovementioned expert panel rated each question in the instrument as questioning basic, applied or advanced knowledge. This rating is shown after each question.

I would like you to assess content validity of each question using a Content Validity Index (CVI) rating. Content validity is the determination of the content relevance of the elements or questions of an instrument. In other words, have the right questions been asked to assess the knowledge of ICU staff on the critical issues identified in each of the three domains.

The CVI rating uses a 4-point ordinal scale in which 1 indicates an irrelevant question and 4 an extremely relevant question. I would like your assessment of each question using the attached assessment form (Form 2) using the following ratings:

1 = irrelevant
2 = relevant but unimportant
3 = relevant and important
4 = relevant and very important

Please would you also rate the level of knowledge being assessed in each question by agreeing or disagreeing with the given rating, i.e. basic, applied or advanced. If you disagree with the given rating, please indicate your suggested rating. Please use Form 4 for this.

Please could you identify any areas that in your opinion have been omitted from the instrument and feel free to suggest areas of question improvement or modification.

Participation in the validation process is entirely voluntary and anonymity and confidentiality is guaranteed.

I appreciate that you will not benefit directly from participation in this study; however I hope that the results of the study will help to clarify educational needs of nurses with regard to the implementation of protocols.

The Faculty of Medicine Post Graduate Committee and the Ethics Committee of the University of the Witwatersrand have approved this study. I have not sought permission from your institution for this phase of the study as I am requesting your personal input as an expert.

Should you wish to contact me, or require any further information, my cell number is 073 169 1895.

In summary, once you have completed validation of the instrument please return the following to me:

- Your consent form
- Your demograhic questionnaire
- Your CVI rating on Form 2
- Your assessment of the level of knowledge being questioned on Form 4

Thank you once again for assisting me to validate my data capture instrument. Your assistance is greatly appreciated.

Yours sincerely

Helen Perrie

1. Lynn, M. R., 1986. Determination and Quantification of Content Validity. Nursing Research, Vol. 35, No. 6, pp. 382 – 385.

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

CONSENT FORM

I, _____ (name), fully understand the contents of the information letter. I have been offered the opportunity to ask questions and these have been answered to my satisfaction. I understand that I may withdraw from this process at any stage without penalty. I have been assured that my anonymity and confidentiality will be maintained.

I hereby give consent to verify the instrument.

_____
(Participant)

_____
(Date)

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

EXPERT DEMOGRAPHIC QUESTIONNAIRE

Instructions:

Please could you complete the following demographic questionnaire.

6. Please state your profession _____

7. Please state your qualification(s) _____
   _____
   _____
   _____

8. How many year of ICU experience do you have? _____

9. Please tick your present role in ICU
   - ICU nurse _____
   - ICU nurse and shift leader _____
   - ICU clinical facilitator _____
   - ICU unit manager _____
   - Other (please specify) _____
     _____

10. If you are involved in teaching, is this
    - Practical teaching _____
    - Theoretical teaching _____
    - Both _____

Thank you for taking time to complete this questionnaire.

Helen Perrie

(MSc Nursing Student)

KNOWLEDGE OF INTENSIVE CARE NURSES WITH REGARD TO THE IMPLEMENTATION OF PROTOCOL-BASED CARE IN PUBLIC AND PRIVATE HEALTH CARE INSTITUTIONS.

PLEASE MARK THE APPROPRIATE BOX WITH AN "X"

SECTION 1: DEMOGRAPHIC INFORMATION

1. Age

<20	
20 - 30	
31 - 40	
41 - 50	
51 - 60	
>60	

2. Are you permanently employed by your hospital or do you work permanently through an agency?

Permanently employed	
Agency staff	

3. In what health care sector are you working permanently? (Either employed by the hospital or agency staff)

Public	
Private	

4. If you are permanently employed do you also do agency work in addition to your permanent employment?

Yes	
No	

5. Do you have a degree or diploma in general nursing?

Degree	
Diploma	

6. Are you ICU trained or ICU experienced?

ICU trained	
ICU experienced	

7. How many years of ICU experience do you have?

Year/years	

8. How many years of general ward experience did you have prior to working in ICU?

None	
1 - 2	
3 - 5	
>5	

9. How do you ensure your own continuing professional growth? (You may tick more than one box)

ICU Congress Attendance	
Academic Ward Round Attendance	
Reading of Journals	
Organised ICU Scientific Talk Attendance (eg Critical Care Society)	
Other	

If Other, please specify.

_____

_____

10. How many ICU Congresses have you attended in the last 3 years?

None	
1 - 3	
4 - 7	
>7	

11. Approximately how many teaching Ward Rounds (medical or nursing) do you attend per month?

None	
1 - 3	
4 - 7	
>7	

12. Approximately how many ICU Journal Articles do you read per month?

None	
1 - 3	
4 - 7	
>7	

13. How many Critical Care Society/Anaesthetic Society etc. Scientific talks have you attended in the last year?

None	
1 - 3	
4 - 7	
>7	

PLEASE ANSWER ALL THE QUESTIONS BY PLACING AN "X" IN THE BOX OPPOSITE THE CORRECT ANSWER. (There is only one correct answer per question)

Example

What is the Oxygen percentage in ambient air?

a)	9%	a
b)	21%	~~b~~
c)	45%	c
d)	60%	d

SECTION 2:

Robert is a 55 year old who has just been admitted to your unit following major abdominal surgery following a gunshot wound to his abdomen. His height is 1.7 m and he weighs approximately 70 kg. The doctor has prescribed 1-3 mg Morphine Intravenously (IV) hourly prn. for his pain. Robert has no medical or surgical history of consequence. On arrival in the unit, Robert is ventilated on SIMV and PS (Synchronised Intermittent Mandatory Ventilation and Pressure Support) at a rate of 10 and not breathing spontaneously. He grimaces when moved but otherwise is not communicative. His BP and HR are as follows: BP 105/65, HR 110.

1. When would you administer Robert his first dose of morphine? (Applied knowledge)

a)	Immediately	a
b)	When his BP comes up a little	b
c)	When he becomes restless and agitated	c
d)	When you as the nurse assesses that he needs analgesia	d

2. Why did Roberts doctor prescribe his analgesia (morphine) to be given IV (intravenously) as opposed to IM (intramuscularly)? (Applied knowledge)

a)	Allows larger doses to be given	a
b)	Allows for closer and more rapid titration to patients needs	b
c)	Is longer acting when given IVI	c
d)	Allows smaller doses to be given	d

3. Which of the following effects of morphine would you be most concerned about in Roberts case? (Applied knowledge)

a)	Sedative effect	a
b)	Constricted pupils	b
c)	Decreased GIT motility	c
d)	Respiratory depression	d

The following day Robert remains ventilated as he will probably need to return to theatre for a relook laparotomy the next day. He is awake but drowsy and cooperative. He is lying quietly in bed but grimaces as you approach him. His vital signs are now BP 135/85 and his HR is 98.

4a. At this stage, who do you think would be the most accurate judge of Roberts pain? (Applied knowledge)

a)	The doctor looking after Robert	a
b)	The nurse looking after Robert	b
c)	Robert himself	c
d)	Roberts relatives	d

4b. Explain why you chose this answer (Advanced knowledge)

_____
_____
_____

5. How should Roberts post-op analgesia initially be given? (Applied knowledge)

a)	On a fixed schedule	a
b)	When Robert requests it	b
c)	When the nurse picks up objective signs that Robert is in pain	c
d)	On the Relatives request	d

6a. How likely is it that Robert will become addicted to the morphine prescribed for treating his pain? (Basic knowledge)

a)	Almost never	a
b)	Sometimes	b
c)	Often	c
d)	Almost always	d

6b. Substantiate your answer (Advanced knowledge)

_____
_____
_____

7. If Robert were unable to communicate, which of the following clinical manifestations could indicate that he is in pain? (Applied knowledge)

a)	Bradycardia, hypotension, grimacing	a
b)	Diaphoresis (Sweating), tachycardia, dilated pupils	b
c)	Hypotension, tachycardia, constricted pupils	c
d)	Constricted pupils, bradycardia, grimacing	d

8. Through which organ would morphine (opioid) administered to Robert be excreted? (Basic knowledge)

a)	The lung	a
b)	The liver	b
c)	The kidney	c
d)	The skin	d

9. Which of the following statements about the morphine (opioid) administered to Robert is INCORRECT? (Basic knowledge)

a)	It stimulates the respiratory system	a
b)	It causes constipation	b
c)	It is most effective by parenteral administration	c
d)	It rapidly enters all body tissues	d

10. If an antidote to morphine (opioid) needed to be administered to Robert, which of the following would be used? (Basic knowledge)

a)	Neostigmine	a
b)	Naloxone (Narcan)	b
c)	Protamine sulphate	c
d)	Anexate	d

11. What is the time to peak effect of the Morphine that Robert was given intravenously? (Basic knowledge)

a)	0 – 15 minutes	a
b)	15 – 30 minutes	b
c)	30 – 45 minutes	c
d)	45 – 60 minutes	d

12. What is the best way to manage the opioid related side effects that Robert may experience? (Applied knowledge)

a)	Discontinue the medication	a
b)	Administer a medication to treat the side effect	b
c)	Reduce the dose of the opioid	c
d)	Give the opioid on an as required (prn) basis only	d

13a. If it was decided to use regional analgesia (epidural) to relieve Roberts pain, who is legally responsible for topping up the epidural? (Applied knowledge)

a)	The sister looking after Robert	a
b)	Roberts surgeon	b
c)	Roberts anaesthetist	c
d)	All of the above	d

13b. Substantiate your answer (Advanced knowledge)

_____

_____

_____

SECTION 3:

Robert requires two re-look laparotomies, and the day after the second laparotomy he becomes pyrexial, with a temperature of 39º C, his white cell count is 20 mm^3, and his blood glucose was normal on admission has been persistently raised for the last few hours.

Robert has developed ARDS and also has renal dysfunction. According to the unit policy glycaemic control is now commenced according to the units glycaemic control protocol using soluble insulin IVI.

1. As a non-diabetic, what would be a normal fasting blood glucose level for Robert prior to his being shot? (Basic knowledge)

a)	< 4mmol/l (± < 70 mg/dl)	a
b)	4-6 mmol/l (± 72 - 110 mg/dl)	b
c)	6-8 mmol/l (± 110 - 140 mg/dl)	c
d)	>8 mmol/l (± >140 mg/dl)	d

2. What is the main function of the insulin being administered to Robert? (Basic knowledge)

a)	To facilitate glucose transport into the cells	a
b)	To breakdown carbohydrates	b
c)	To raise the blood glucose level	c
d)	All of the above	d

3. What is the ½ life of the soluble insulin given to Robert IVI? (Basic knowledge)

a)	< 10 minutes	a
b)	10 – 20 minutes	b
c)	20 – 30 minutes	c
d)	> 30 minutes	d

4a. As Robert is now on a glycaemic control protocol, at what blood glucose level would 50% dextrose water usually be administered? (Applied knowledge)

a)	< 3 mmol/l (± < 55 mg/dl)	a
b)	3.1 - 5 mmol/l (± 56 – 90 mg/dl)	b
c)	5.1 – 7 mmol/l (± 91 - 126 mg/dl)	c
d)	> 7.1 mmol/l (± > 127 mg/dl)	d

4b. Why is 50% dextrose water administered below this level? (Advanced knowledge)

_____

_____

_____

5. Which of the following drugs, if administered to Robert, could cause hyperglycaemia? (Basic knowledge)

a)	Analgesics	a
b)	Steroids	b
c)	Beta-blockers	c
d)	None of the above	d

6. Where in Roberts body is insulin produced? (Basic knowledge)

a)	Liver	a
b)	Spleen	b
c)	Pancreas	c
d)	Kidneys	d

7a. The level of which of the following electrolytes in Roberts body may decrease when insulin is administered? (Advanced knowledge)

a)	Calcium	a
b)	Magnesium	b
c)	Potassium	c
d)	Sodium	d

7b. Explain why the level of this particular electrolyte decreases (Advanced knowledge)

_____

_____

_____

8. Which of the following could be an early sign of hypoglycaemia in Robert? (Applied knowledge)

a)	Flushed skin	a
b)	Constricted pupils	b
c)	Diaphoresis (sweating)	c
d)	Bradycardia	d

9. If Robert required dialysis for his renal dysfunction, on which of the following modes of dialysis would insulin be cleared from his blood? (Advanced knowledge)

a)	Conventional Haemodialysis	a
b)	Peritoneal Dialysis	b
c)	Continuous Veno-Veno Dialysis	c
d)	None of the above	d

10a. By which route should Roberts insulin NOT be given? (Basic knowledge)

a)	IMI	a
b)	IVI	b
c)	Subcutaneously	c
d)	Orally	d

10b. Substantiate your answer (Advanced knowledge)

_____
_____
_____

11. Blood taken from which of the following sites will show the highest blood glucose level? (Applied knowledge)

a)	Arterial line	a
b)	Venous line	b
c)	Finger prick (capillary blood)	c
d)	There is no difference between sites	d

SECTION 4:

A couple of days later, Robert is showing signs of improvement and due to the complications associated with prolonged ventilation it is decided to wean Robert from the ventilator as soon as possible. His ventilation is now as follows: Mode SIMV (Synchronised Intermittent Mandatory Ventilation) and PS (Pressure Support), I:E (Inspiratory:Expiratory) ratio of 1:2, SIMV rate of 8 (his spontaneous rate is 10 breaths/min, with a spontaneous TV (Tidal Volume) of 400 mls), His preset TV is 450 mls, PEEP (Positive End Expiratory Pressure) and PS are both set at 10 cm H_2O and he is on 40% O_2.

1. What would be a normal tidal volume for Robert if he were not being ventilated? (Basic knowledge)

a)	5 – 8 mls/kg	a
b)	8 – 11 mls/kg	b
c)	11 – 14 mls/kg	c
d)	> 12 mls/kg	d

2. Which of Roberts following ventilator parameters would usually be weaned last? (Applied knowledge)

a)	PEEP	a
b)	PS	b
c)	Preset respiratory rate	c
d)	O_2%	d

3a. Do you think Roberts spontaneous TV (Tidal Volume) is: (Applied knowledge)

a)	Appropriate	a
b)	Too small	b
c)	Too large	c
d)	Unsure	d

3b. Substantiate your answer using the case presented (Advanced knowledge)

_____
_____
_____

4a. Which of the following statements regarding Roberts pressure support (PS) ventilation is true? (Basic knowledge)

a)	PS breaths always have the same tidal volume	a
b)	PS breaths are triggered and cycled by the ventilator	b
c)	PS is not usually used when weaning a patient off ventilation	c
d)	PS breaths are triggered by the patient	d

4b. Briefly explain your understanding of PS (pressure support) (Advanced knowledge)

_____
_____
_____

5. Which of the following parameters may indicate that Robert is NOT coping with the weaning process? (Applied knowledge)

a)	Agitation	a
b)	Tachypnoea	b
c)	Sweating	c
d)	All of the above	d

6. Which of the following modes of ventilation could be used to wean Robert? (Advanced knowledge)

a)	BIPAP (Biphasic Positive Airways Pressure)	a
b)	SIMV and PS (Synchronised Intermittent Mandatory Ventilation)	b
c)	PS (Pressure Support)	c
d)	All of the above	d

7. In the absence of respiratory distress approximately how long should Roberts spontaneous breathing trial last? (Applied knowledge)

a)	30-120 minutes (1/2 – 2 hours)	a
b)	120-240 minutes (2 – 4 hours)	b
c)	240-360 minutes (4 –6 hours)	c
d)	> 360 minutes (> 6 hours)	d

Roberts spontaneous breathing trial has been successful.

8. Which of the following is most important before deciding to extubate Robert? (Applied knowledge)

a)	Inotrophic support has been completely weaned	a
b)	Mentation is adequate	b
c)	Renal function has returned to normal	c
d)	He has been kept nil by mouth for six hours	d

9a. Which is the best position to place Robert in prior to extubation? (Applied knowledge)

a)	Sitting up as high as possible	a
b)	Semi recumbent	b
c)	Supine	c
d)	Any position he finds comfortable	d

9b. Substantiate your answer (Advanced knowledge)

_____

_____

_____

10. Which of the following issues are priorities in weaning Robert from ventilatory support? (Basic knowledge)

a)	Adequate nutrition	a
b)	An effective regime for treating pain, anxiety or agitation	b
c)	Normalising electrolyte levels	c
d)	All of the above	d

11. If Robert appears not to be coping with the weaning process, which of the following actions should Roberts nurse take? (Applied knowledge)

a)	Slow down the weaning process	a
b)	Increase Roberts oxygen percentage	b
c)	Increase Roberts respiratory rate by 2 breaths per minute	c
d)	Rest Robert by going back to his pre weaning ventilator settings	d

Robert manages well after extubation and will shortly be ready for discharge from ICU.

Did you find this questionnaire?

a)	Very easy	a
b)	Easy	b
c)	Fair	c
d)	Difficult	d
e)	Very difficult	e

Please add any other comments:

_____

_____

_____

Thank you very much for your participation in this study.

FORM 2: Assessment of content validity

1 = irrelevant
2 = relevant but unimportant
3 = relevant and important
4 = relevant and very important

Question	1	2	3	4
SECTION 2 (Pain and pain management)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				
Q.12				
Q.13				

Question	1	2	3	4
SECTION 3 (Glycaemic Control)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				

Question	1	2	3	4
SECTION 4 (Weaning)				
Q.1				
Q.2				
Q.3				
Q.4				
Q.5				
Q.6				
Q.7				
Q.8				
Q.9				
Q.10				
Q.11				

FORM 4: Assessment of level of knowledge being assessed

SECTION 2 (Pain and pain management)						
Question	Assessed level	Agree	Disagree	If disagree, suggested level		
				Basic	Applied	Advanced
1	Applied					
2	Applied					
3	Applied					
4a	Applied					
4b	Advanced					
5	Applied					
6a	Basic					
6b	Advanced					
7	Applied					
8	Basic					
9	Basic					
10	Basic					
11	Basic					
12	Applied					
13a	Applied					
13b	Advanced					

SECTION 3 (Glycaemic control)						
Question	Assessed level	Agree	Disagree	If disagree, suggested level		
				Basic	Applied	Advanced
1	Basic					
2	Basic					
3	Basic					
4a	Applied					
4b	Advanced					
5	Basic					
6	Basic					
7a	Advanced					
7b	Advanced					
8	Applied					
9	Advanced					
10a	Basic					
10b	Advanced					
11	Applied					

SECTION 4 (Weaning)						
Question	Assessed level	Agree	Disagree	If disagree, suggested level		
				Basic	Applied	Advanced
1	Basic					
2	Applied					
3a	Applied					
3b	Advanced					
4a	Basic					
4b	Advanced					
5	Applied					
6	Advanced					
7	Applied					
8	Applied					
9a	Applied					
9b	Advanced					
10	Basic					
11	Applied					

Table B1: Demographic data of expert quantification group

Demographic Questions	1	2	3	4	5	6	7	8	9	10	11
Academic qualification	Dipl in General Nursing, Midwifery, Psych and Com	Dipl in General Nursing	Dipl in General Nursing, Midwifery, Psych and Com	B.Soc.Sci (Nursing)	Dipl in General Nursing	BA (Cur)	D Cur Intensive Care Nursing	B (Cur)	PhD Nursing	Dipl in General Nursing	Dipl in General Nursing
	Dipl in ICU	Dipl in Midwifery	Dipl in ICU	M.Cur Critical Care	Dipl in Midwifery	Dipl in ICU	B.Soc.Sci (Hons)	Dipl in ICU	M CUR Critical Care	Dipl in Midwifery	Dipl in Midwifery
	Dipl in Emergency Trauma Nursing	Dipl in ICU	M Cur Critical Care	Cert. in Pharmacology for Nurses	Dipl in ICU	ATLS	Dipl in ICU	Dipl in Emergency Trauma Nursing	B CUR Honours Nursing Education	Dipl in ICU	Dipl in ICU
					Deg in Administration	ACLS	Dipl in Education	Dipl in Nursing Administration	Dipl in ICU	B (Cur) Education and Management	Dipl in Nursing Administration
					Degree in Community Health		M.Cur Critical Care				Dipl in Education
Years of ICU Experience	10	14	14	8	13	14	38	8	17	20	31
Present Role	ICU Nurse	Unit Manager	Lecturer (ICU)	Tutor (ICU)	Deputy Nurse Manager	Nursing Services Manager	Lecturer (ICU)	Trauma Tutor	Lecturer (ICU)	ICU nurse	Lecturer (ICU)
Teaching role	Practical and theoretical	Practical and theoretical	Practical and theoretical	Practical and theoretical	Practical and theoretical		Practical and theoretical	Practical and theoretical	Practical and theoretical		Practical and theoretical

Appendix C

Final Data Collection Instrument

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

PLEASE MARK THE APPROPRIATE BOX WITH AN "X"

SECTION 1: DEMOGRAPHIC INFORMATION

1. Age

<20	
20 - 30	
31 - 40	
41 - 50	
51 - 60	
>60	

2. Are you permanently employed by your hospital or do you work permanently through an agency?

Permanently employed	
Agency staff	

3. In which health care sector are you permanently employed? (Either employed by the hospital or agency staff)

Public	
Private	

4. If you are permanently employed do you also do agency work in addition to your permanent employment?

Yes	
No	

5. Do you have a degree or diploma in general nursing?

Degree	
Diploma	

6. Are you ICU trained or ICU experienced?

ICU trained	
ICU experienced	

Please turn over

7. How many years of ICU experience do you have?

Year/years

8. How many years of general ward experience did you have prior to working in ICU?

None	
<1	
1 - 2	
3 - 5	
>5	

9. How do you ensure your own continuing professional growth? (You may tick more than one box)

ICU Congress Attendance	
Academic Ward Round Attendance	
Reading of Journals	
Organised ICU Scientific Talk Attendance (eg Critical Care Society)	
Other	

If Other, please specify.

_____

_____

Please turn over

PLEASE ANSWER ALL THE QUESTIONS BY PLACING AN "X" IN THE BOX OPPOSITE THE CORRECT ANSWER. (There is only one correct answer per question)

Example

What is the Oxygen percentage in ambient air?

a)	9%	a
b)	21%	~~b~~
c)	45%	c
d)	60%	d

SECTION 2:

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a)	Immediately	a
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3. Which of the following effects of morphine would you be most concerned about in Roberts case?

a)	Sedative effect	a
b)	Constricted pupils	b
c)	Hypotension	c
d)	Respiratory depression	d

Please turn over

The following day Robert remains ventilated as he will probably need to return to theatre for a relook laparotomy. He is awake but drowsy and cooperative. He is lying quietly in bed but grimaces as you approach him. His vital signs are now BP 135/85 and his HR is 98.

4a. At this stage, who do you think would be the most accurate judge of Roberts pain?

a)	The doctor looking after Robert	a
b)	The nurse looking after Robert	b
c)	Robert himself	c
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4b Explain why you chose this answer.

_____
_____
_____

5) How should Roberts post-op analgesia be given initially?

a)	On a fixed schedule	a
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d)	On the Relatives request	d

6a. How likely is it that Robert will become addicted to the morphine prescribed for treating his pain?

a)	Almost never	a
b)	Sometimes	b
c)	Often	c
d)	Almost always	d

6b Substantiate your answer.

_____
_____
_____

7) If Robert were unable to communicate, which of the following clinical manifestations could indicate that he is in pain?

a)	Bradycardia, hypotension, grimacing	a
b)	Diaphoresis (Sweating), tachycardia, dilated pupils	b
c)	Hypotension, tachycardia, constricted pupils	c
d)	Constricted pupils, bradycardia, grimacing	d

Please turn over

8) Which of the following statements about the morphine (opioid) administered to Robert is INCORRECT?

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c)	It is most effective by parenteral administration	c
d)	It rapidly enters all body tissues	d

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d)	Anexate	d

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b)	15 – 30 minutes	b
c)	30 – 45 minutes	c
d)	45 – 60 minutes	d

11a. If it was decided to use regional analgesia (epidural) to relieve Roberts pain, who is legally responsible for topping up the epidural?

a)	The sister looking after Robert	a
b)	Roberts surgeon	b
c)	Roberts anaesthetist	c
d)	All of the above	d

11b. Substantiate your answer.

_____

_____

_____

Please turn over

SECTION 3:

Robert requires two re-look laparotomies. On the day after the second laparotomy he becomes pyrexial, with a temperature of 39º C, his white cell count is 20 mm^3, and his blood glucose that was normal on admission has been persistently raised for the last few hours.

Robert has developed ARDS and also has renal dysfunction. According to the unit policy glycaemic control is now commenced according to the units glycaemic control protocol using soluble insulin IVI.

1. As a non-diabetic, what would be a normal fasting blood glucose level for Robert prior to his becoming ill?

a)	< 4mmol/l (± < 70 mg/dl)	a
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c)	6-8 mmol/l (± 110 - 140 mg/dl)	c
d)	>8 mmol/l (± >140 mg/dl)	d

2. What is the main function of the insulin being administered to Robert?

a)	To facilitate glucose transport into the cells	a
b)	To breakdown carbohydrates	b
c)	To raise the blood glucose level	c
d)	All of the above	d

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a)	< 10 minutes	a
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c)	20 – 30 minutes	c
d)	> 30 minutes	d

4a. As Robert is now on a glycaemic control protocol, at what blood glucose level would 50% dextrose water usually be administered?

a)	< 3 mmol/l (± < 55 mg/dl)	a
b)	3.1 – 5 mmol/l (± 56 – 90 mg/dl)	b
c)	5.1 – 7 mmol/l (± 91 - 126 mg/dl)	c
d)	> 7.1 mmol/l (± > 127 mg/dl)	d

4b Which organ of the body is most vulnerable to a low blood glucose level and why?

_____

_____

_____

Please turn over

5) Which of the following drugs, if administered to Robert, could cause hyperglycaemia?

a)	Analgesics	a
b)	Steroids	b
c)	Beta-blockers	c
d)	None of the above	d

6) Where in Roberts body is insulin produced?

a)	Liver	a
b)	Spleen	b
c)	Pancreas	c
d)	Kidneys	d

7a The level of which of the following electrolytes in Roberts body may decrease when insulin is administered?

a)	Calcium	a
b)	Magnesium	b
c)	Potassium	c
d)	Sodium	d

7b Explain why the level of this particular electrolyte decreases

_____
_____
_____

8) Which of the following could be an early sign of hypoglycaemia in Robert?

a)	Flushed skin	a
b)	Constricted pupils	b
c)	Diaphoresis (sweating)	c
d)	Bradycardia	d

9) If Robert required dialysis for his renal dysfunction, on which of the following modes of dialysis would insulin be cleared from his blood?

a)	Conventional Haemodialysis	a
b)	Peritoneal Dialysis	b
c)	Continuous Veno-Veno Dialysis	c
d)	None of the above	d

Please turn over

10a By which route should Roberts insulin NOT be given?

a)	IMI	a
b)	IVI	b
c)	Subcutaneously	c
d)	Orally	d

10b Explain and substantiate your answer

_____
_____
_____

11) Blood taken from which of the following sites will show the highest blood glucose level?

a)	Arterial line	a
b)	Venous line	b
c)	Finger prick (capillary blood)	c
d)	There is no difference between sites	d

Please turn over

SECTION 4:

A couple of days later, Robert is showing signs of improvement. Due to the complications associated with prolonged ventilation it is decided to wean Robert from the ventilator as soon as possible. His ventilation is now as follows: Mode SIMV (Synchronised Intermittent Mandatory Ventilation) and PS (Pressure Support), I:E (Inspiratory:Expiratory) ratio of 1:2, SIMV rate of 8 (his spontaneous rate is 10 breaths/min, with a spontaneous TV (Tidal Volume) of 400 mls), His preset TV is 450 mls, PEEP (Positive End Expiratory Pressure) and PS are both set at 10 cm H_2O and he is on 40% O_2.

1. What would be a normal tidal volume for Robert if he were not being ventilated?

a)	5 – 8 mls/kg	a
b)	8 – 11 mls/kg	b
c)	11 – 14 mls/kg	c
d)	> 12 mls/kg	d

2. Which of Roberts following ventilator parameters would usually be weaned last?

a)	PEEP	a
b)	PS	b
c)	Preset respiratory rate	c
d)	O_2%/FiO_2	d

3a Do you think Roberts spontaneous TV (Tidal Volume) is:

a)	Appropriate	a
b)	Too small	b
c)	Too large	c
d)	Unsure	d

3b Justify your answer using the case presented

_____
_____
_____

4a Which of the following statements regarding Roberts pressure support (PS) ventilation is true?

a)	PS breaths always have the same tidal volume	a
b)	PS breaths are triggered and cycled by the ventilator	b
c)	PS is not usually used when weaning a patient off ventilation	c
d)	PS breaths are triggered by the patient	d

4b Briefly explain your understanding of PS (pressure support)

_____
_____
_____

Please turn over

5) Which of the following parameters may indicate that Robert is NOT coping with the weaning process?

a)	Agitation	a
b)	Tachypnoea	b
c)	Sweating	c
d)	All of the above	d

6) Which of the following modes of ventilation could be used to wean Robert?

a)	BIPAP (Biphasic Positive Airways Pressure)	a
b)	SIMV and PS (Synchronised Intermittent Mandatory Ventilation)	b
c)	PS (Pressure Support)	c
d)	All of the above	d

7) In the absence of respiratory distress approximately how long should Roberts spontaneous breathing trial last?

a)	30-120 minutes (1/2 – 2 hours)	a
b)	120-240 minutes (2 – 4 hours)	b
c)	240-360 minutes (4 –6 hours)	c
d)	> 360 minutes (> 6 hours)	d

Roberts spontaneous breathing trial has been successful.

8) Which of the following is most important before deciding to extubate Robert?

a)	Inotropic support has been completely weaned	a
b)	Mentation is adequate	b
c)	Renal function has returned to normal	c
d)	He has been kept nil by mouth for six hours	d

9a Which is the best position to place Robert in prior to extubation?

a)	Sitting up as high as possible	a
b)	Semi recumbent	b
c)	Supine	c
d)	Any position he finds comfortable	d

9b Explain your answer.

_____

_____

_____

Please turn over

10) Which of the following issues are priorities in weaning Robert from ventilatory support?

a)	Adequate nutrition	a
b)	An effective regime for treating pain, anxiety or agitation	b
c)	Normalising electrolyte levels	c
d)	All of the above	d

11) If Robert appears not to be coping with the weaning process, which of the following actions should Roberts nurse take?

a)	Slow down the weaning process	a
b)	Increase Roberts oxygen percentage	b
c)	Increase Roberts respiratory rate by 2 breaths per minute	c
d)	Rest Robert by going back to his pre weaning ventilator settings	d

Robert manages well after extubation and will shortly be ready for discharge from ICU.

Did you find this questionnaire?

a)	Very easy	a
b)	Easy	b
c)	Fair	c
d)	Difficult	d
e)	Very difficult	e

Please add any other comments:

_____

_____

_____

Thank you very much for your participation in this study.

Appendix D

Participants' Documentation

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

INFORMATION LETTER

Dear Colleague,

My name is Helen Perrie. I am an Intensive care nurse and currently studying for a Masters degree in Nursing Science at the University of the Witwatersrand. I am conducting a research study, and would like to ask your consent to participate in my study.

The purpose of this study is to describe and compare the knowledge levels of ICU nurses with respect to the implementation of protocol-based care in terms of pain, weaning and glycaemic control. The study will cover ICU trained and non-ICU trained nurses with varying degrees of experience working in the intensive care units of public and private health care institutions. The study will also make recommendations for clinical practice and education of intensive care nurses. Should you consent to take part in the study, I will ask you to sign a consent form. I will then ask you to complete an instrument, which will be in the form of a case, which simulates real life situations encountered in ICU. The following topics will be included: pain management, glycaemic control and weaning from mechanical ventilation. This should not take you more than 25-30 minutes to complete. I will obtain permission from your unit manager for you to complete the instrument in "on duty" time and I will personally bring you the instrument. Completed instruments will be placed in sealed unmarked envelopes.

Your participation is voluntary. You may choose not to participate, or to withdraw from the study at any time. Anonymity and confidentiality is guaranteed. No names or identifying information will be asked of you. Only my supervisor and I will have access to the completed instruments. Results of the study will be reported in general terms and no identifying information will be reported. Results of the study will be made available to you if you so wish.

I appreciate that you will not benefit directly from participation in this study, however I hope that the results of the study will help to clarify educational needs of nurses with regard to the implementation of protocols.

The appropriate people and research committees of the University of the Witwatersrand and your health care institution have approved this study.

Should you wish to contact me, or require any further information, please do not hesitate to contact me on cell number 073 169 1895.

Thank you for taking the time to read this information letter.

Yours sincerely

Helen Perrie

KNOWLEDGE OF ICU NURSES IN SELECTED CARE AREAS COMMONLY GUIDED BY PROTOCOLS

CONSENT FORM

I, _____ (name), fully understand the contents of the information letter. I have been offered the opportunity to ask questions and these have been answered to my satisfaction. I understand that I may withdraw from this research process at any stage without penalty. I have been assured that my anonymity and confidentiality will be maintained.

I hereby consent to be included in this study.

_____
(Participant)

_____
(Date)

Appendix E

Ethics Approvals and Permissions

Faculty of Health Sciences
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

7 York Road PARKTOWN Johannesburg 2193 Telegrams WITSMED Telex 4-24655.SA
FAX 643-4318 TELEPHONE 717-2075/2076
E-MAIL healthpg@health.wits.ac.za

MRS. HC PERRIE
14 SHAW ROAD
BLAIRGOWRIE
RANDBURG
RANDBURG
2194

APPLICATION NUMBER 0516363M
STATUS (DEG 25) (MM032) PZZ

2006-01-13

Dear Mrs. Perrie

Approval of protocol entitled Knowledge of Intensive Care Nurses with Regard to the Implementation of Protocol-based Care in Public and Private Health Care Institutions

I should like to advise you that the protocol and title that you have submitted for the degree of Master Of Science In Nursing (Part-Time) have been approved by the Postgraduate Committee at its recent meeting. Please remember that any amendment to this title has to be endorsed by your Head of Department and formally approved by the Postgraduate Committee.

Ms. S Schmollgruber has/have been appointed as your supervisor/s. Please maintain regular contact with your supervisor who must be kept advised of your progress.

Please note that approval by the Postgraduate Committee is always given subject to permission from the relevant Ethics Committee, and a copy of your clearance certificate should be lodged with the Faculty Office as soon as possible, if this has not already been done.

Yours sincerely

S Benn (Mrs)
Faculty Registrar
Faculty of Health Sciences

Telephone 717-2075/2076

Copies - Head of Department____Supervisor/s

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Perrie

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M050837**
PROJECT	Knowledge of Intensive Care Nurses with Regard to the Implementation of Protocol Based Care in Public and Private Health.....
INVESTIG ATORS	Ms H Perrie
DEPARTMENT	Nursing Education
DATE CONSIDERED	05.08.26
DECISION OF THE COMMITTEE*	Approved subject to researcher being more realistic about the time it will take to complete the questionnaire

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 05.09.07 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Mrs S Schmollgruber

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

H C PERRIE 11.11.05.

14 Shaw Road
Blairgowrie
Randburg
2194

20 November 2005

Deputy Director General
Gauteng Department of Health
Private Bag X085
Marshalltown
2107

Attention: Dr A Rahman

Re: Permission to conduct research at Johannesburg, Helen Joseph and Chris Hani Baragwanath Hospitals

Dear Dr Rahman

My name is Helen Perrie, I am a student registered for a Master of Science (Nursing) degree at the Faculty of Health Sciences, University of the Witwatersrand. As part of the course requirement, I am expected to conduct clinical research under supervision. The title of my proposed research is: "*Knowledge of Intensive Care Nurses with regard to the Implementation of Protocol-based Care in Public and Private Health Care Institutions*".

I would like to conduct this study as evidence-based nursing care is being introduced into the intensive care units more and more frequently by means of protocols. These protocols are excellent guides for inexperienced nurses and those new in the area and have been proven to improve patient outcome and decrease costs associated with intensive care. With the shortage of intensive care nurses, the lack of experienced intensive care nurses and the large number of agency staff used, protocols can potentially be of benefit to both the patient and the intensive care unit nursing staff. The purpose of my study is to describe and compare the knowledge levels of ICU nurses with respect to the implementation of protocol-based care in terms of pain, weaning and glycaemic control. The study will cover both ICU registered and non-ICU registered nurses with varying degrees of experience working in the intensive care units of public and private health care institutions. The study will also make recommendations for clinical practice and education of intensive care nurses.

With your permission I will ask the participants to complete a questionnaire, which will be in the form of vignettes (case studies), which simulate real life situations encountered in ICU. I will obtain permission from the unit manager prior to asking the participants to complete the questionnaire. No individual units will be identified and no names or identifying details will be required of the participants.

I hereby apply for permission to undertake research at Johannesburg, Helen Joseph and Chris Hani Baragwanath Hospitals Adult Intensive Care Units. The proposed study and its procedures have been approved by the Committee for Research On Human Subjects of the University of the Witwatersrand. The clearance certificate number is M050837

There will be no financial implications for these hospitals or the Gauteng Provincial Department of Health. All costs will be covered by myself. A copy of the final report will be made available to you should you request this.

Should you require any additional information please contact me at 011 488 4397 or 073 169 1895.

Yours faithfully,

H. Perrie

Helen Perrie (Registered ICU Nurse and MSc (Nursing) candidate); Research Assistant, Department of Anaesthesiology, University of the Witwatersrand.

Private bag X39, Johannesburg 2000, South Africa
Tel: +27 (0) 11 488 4911, Fax: +27 (0) 11 643 1612
www.johannesburghospital.org

Gauteng Department of Health

Enquiries: Ms. M. Motjelele
(011): 488-3785
(011) 488-3753

15 February 2005

Department of Nursing Education
Faculty of Health Science
7 York Road
Parktown
2193

For attention: Ms. H. Perrie

RE: PERMISSION TO CONDUCT KNOWLEDGE OF INTENSIVE CARE NURSES WITH REGARD TO THE IMPLEMENTATION OF PROTOCOL-BASED CARE IN PUBLIC AND PRIVATE HEALTH CARE INSTITUTION RESEARCH AT JOHANNESBURG HOSPITAL

Permission is hereby granted to conduct research at Johannesburg Hospital provided:

1. The Gauteng Department of health will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

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

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

I wish you success in your studies.

Yours sincerely

DR. M. MAZIZI

CHRIS HANI
BARAGWANATH HOSPITAL

DR. A.W. MANNING
CLINICAL DIRECTOR

Caring is our Mission

PO BERTSHAM
2013
TEL: 933-8146
FAX: 938-8161
EMAIL amanning@mweb.co.za

April 18, 2006

Dear Ms. Helen Perrie

You are hereby granted permission to conduct research entitled "Knowledge of Intensive Care Nurses with regard to the implementation of Protocol Based care in public and private health care institutions" in the ICU areas of the Chris Hani-Baragwanath Hospital. I acknowledge receipt of documents confirming ethics approval and approval from the acting Head of Health: Gauteng.

Yours truly

Dr. A.W. Manning

approved
acting CEO
29/03/06

14 Shaw Road
Blairgowrie
Randburg
2194

12 February 2006

Acting CEO
Helen Joseph Hospital
Private Bag
Auckland Park
2006

Re: Permission to conduct research at Helen Joseph Hospital

To whom it may concern

My name is Helen Perrie, I am a student registered for a Master of Science (Nursing) degree at the Faculty of Health Sciences, University of the Witwatersrand. As part of the course requirement, I am expected to conduct clinical research under supervision. The title of my proposed research is: *"Knowledge of Intensive Care Nurses with regard to the Implementation of Protocol-based Care in Public and Private Health Care Institutions"*.

I would like to conduct this study as evidence-based nursing care is being introduced into the intensive care units more and more frequently by means of protocols. These protocols are excellent guides for inexperienced nurses and those new in the area and have been proven to improve patient outcome and decrease costs associated with intensive care. With the shortage of intensive care nurses, the lack of experienced intensive care nurses and the large number of agency staff used, protocols can potentially be of benefit to both the patient and the intensive care unit nursing staff. The purpose of my study is to describe and compare the knowledge levels of ICU nurses with respect to the implementation of protocol-based care in terms of pain, weaning and glycaemic control. The study will cover both ICU registered and non-ICU registered nurses with varying degrees of experience working in the intensive care units of public and private health care institutions. The study will also make recommendations for clinical practice and education of intensive care nurses.

With your permission I will ask the participants to complete a questionnaire, which will be in the form of vignettes (case studies), which simulate real life situations encountered in ICU. I will obtain permission from the unit manager prior to asking the participants to complete the questionnaire. No individual units will be identified and no names or identifying details will be required of the participants.

I hereby apply for permission to undertake research at Helen Joseph Hospitals Adult Intensive Care Units. The proposed study and its procedures have been approved by the Committee for Research on Human Subjects of the University of the Witwatersrand. A copy of the clearance certificate is attached. Permission has been obtained from the Deputy Director General of the Gauteng Department of Health, Dr A Rahman, a copy of which is also attached.

PERMISSION TO CONDUCT RESEARCH IN PRIVATE SECTOR HOSPITALS

Permission to conduct research was obtained from the Research Administrator of the private hospitals in this study. It was a requirement to contact the hospitals concerned to obtain permission from both the Hospital Manager and the Nursing Manager. The necessary permission from all parties was obtained.

It was a requirement of these hospitals that the researcher sign a confidentiality agreement whereby the names of the hospitals and personnel involved would not be disclosed. The documentation of the confidentiality agreement was reviewed and approved by the candidates supervisor and the Head of the Nursing Department and is in the possession of the researcher. Should it be necessary for examiners to have sight of these documents, the researcher would approach the hospitals concerned for such permission.