

Knowledge of post-operative airway emergencies in recovery room nurses in selected hospitals

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of

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Declaration

I, Julia McCallum, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in the branch of Anaesthesiology in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signed: _____

Signed at: University of the Witwatersrand

On: _____ day of _____ 2015

Abstract

Background

Recovery room nurses are required to have knowledge, skills and competency to recognise and safely manage post-operative airway emergencies in adult patients.

Aim

The aim of this study was to describe the level of knowledge of post-operative airway emergencies in recovery room nurses working at Chris Hani Baragwanath Academic Hospital (CHBAH), Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Helen Joseph Hospital (HJH).

Method

A prospective, contextual and descriptive research design, involving a self-administered questionnaire was used. The questionnaire consisted of two sections: demographic data and knowledge based questioned, Convenience sampling was used. The sample population was formed by all recovery room nurses on duty at a given time, who voluntarily elected to participate.

Results

Descriptive statistics were used. The overall mean score obtained by the 24 participants was 46.2% (SD 21.7%) which is 23.8% below the competency score of 70%. The range of scores attained by participants was 8-75% with only five participants (20.8%) achieving a score $\geq 70\%$.

Conclusion

Recovery room nurses working at CHBAH, CMJAH and HJH did not have the necessary knowledge and competency required to safely provide quality nursing care to post-operative patients. The majority of participants failed to achieve a set competency score, representing adequate knowledge. As the study was contextual, the results could not be generalised.

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List of Abbreviations

AAGBI	Association of Anaesthesiologists of Great Britain and Ireland
ACLS	Advanced Cardiac Life Support
ANZCA	Australia and New Zealand College of Anaesthesiologists
ARDS	Acute Respiratory Distress Syndrome
ASPAN	American Society of Peri-anaesthesia Nursing
BKAT	Basic knowledge assessment tool
BLS	Basic life support
CCN	Critical care nurses
CHBAH	Chris Hani Baragwanath Academic Hospital
CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
CPAP	continuous positive airway pressure
CPR	Cardiopulmonary resuscitation
ESA	European Society of Anaesthesiologists
HJH	Helen Joseph Hospital
ICU	Intensive Care Unit
NAP4	National Audit Project
PACU	Post-anaesthetic care unit
PEEP	Positive end expiratory pressure
RRN	Recovery room nurse
SANC	South African Nursing Council
SASA	South African Society of Anaesthesiologists
SATS	South African Theatre Nurse Organisation
USA	United States of America
WFSA	Federation of Societies of Anaesthesiologists
WHO	World Health Organisation

Chapter 1: Overview of the study

1.1 Introduction

In this chapter an overview of the study is given. This includes the background, problem statement, aim and objectives, research assumptions, demarcation of the study field, ethical considerations, research methodology, significance of the study, validity and reliability, and a project outline.

1.2 Background

The post-anaesthetic care unit, known in South Africa commonly as the recovery room, is considered to be a vital service. The purpose of a recovery room is to provide care for a patient until they can be safely discharged, awake, to a ward or home, in a stable condition. Alternatively they may need to be transferred to a critical care unit/intensive care unit if further close monitoring is required (1). If adequate standards of care are not provided within the recovery room, serious life-threatening complications can occur. For this reason, the nurses, in whom patient care is entrusted, need to have the appropriate knowledge to identify and manage such complications before they impose danger.

The recovery room should be under the medical direction of an anaesthesiologist, and be “staffed by nurses who have expertise in airway management and advanced cardiac life support as well as problems commonly encountered in surgical patients” (1). A well-run and appropriately staffed recovery room will influence post-operative patient care and outcomes. Scribante and Perrie (2) pose the question “Who is looking after your patient in the recovery room?” and “Who should be looking after your patient?”.

The South African Society of Anaesthesiologists (SASA) guidelines state that the nursing staff working in recovery rooms must be appropriately trained and competent. They stipulate that “a registered or enrolled nurse trained and competent in recovery room care must be present at all times”. Furthermore, these guidelines state that it is the institution’s responsibility to ensure appointed staff in recovery rooms fulfil these requirements. (3)

Currently, the South African Theatre Nurse Organisation (SATS) only addresses the role of the peri-operative nurse during anaesthetic care, and staffing instructions in theatre. They do not make mention of the recovery room nurse. (4)

Internationally, guidelines are equally vague regarding the role of a recovery room nurse. The World Federation of Societies of Anaesthesiologists (WFSA) (5), European Society of Anaesthesiologists (ESA) (6) American Society of Peri-anaesthesia Nursing (ASPAN) (7) and Australia and New Zealand College of Anaesthesiologists (ANZCA) (8) all make mention of competency and adequate training, but fail to elaborate further or define these terms. Current guidelines are non-specific and no clear definition of “competency” and “adequately trained” exists. This allows for a wide range of practice and interpretation which may not be safe for patients during this critical time.

Airway management has been described as the cornerstone of effective post-anaesthetic management, and maintenance of the airway is vital, as the patient’s life depends on it (9). Securing an adequate airway and ventilation, although seemingly basic, is fundamental to anaesthesia and is vitally important in daily practice (10). The National Audit Project (NAP4) (9) into major complications of airway management in the United Kingdom from 1 September 2008 until 31 August 2009 highlighted the incidence of airway complications during emergence and recovery from anaesthesia. This audit set out to answer questions regarding types of airway devices used during anaesthesia, occurrence of major airway complications, their frequencies and consequences. The findings of the project were as follows:

- poor airway assessment, poor planning and failure to plan for failure contributed to poor airway outcomes;
- supraglottic airway devices were used inappropriately, predisposing patients to aspiration, failed intubation and loss of airway;
- aspiration was the single commonest cause of death in anaesthesia events;

- one third of events occurred during emergence or recovery, and obstruction was the commonest cause in these events. Post-obstructive pulmonary oedema was described in 10% of reports.

Complications relating to airway management can be anticipated and possibly avoided if patients “at risk” are identified and an appropriate plan of management is established.

The primary objectives in airway management in anaesthesia are two-fold: to maintain airway patency and ensure appropriate passage of gases; and to avoid aspiration (10). Peri-operative patients require a significant amount of care. A foundation of this care is airway management, which can be affected by a number of factors post-operatively (10). Knowledge and understanding of respiratory physiology is required to understand how various factors affect the patient’s airway and ability to breathe adequately. Clinical observations and mandatory monitoring of vital signs and respiratory function are essential to the safe conduct of anaesthesia. This should be continued into the post-anaesthetic period until the patient has fully recovered from anaesthesia. (9) It is essential that adequate standards of care are maintained in order to prevent serious complications, and to improve awareness and understanding of factors influencing patients’ ability to maintain a patent airway and spontaneous ventilation. (11) “Control of these factors facilitates good airway management and a successful recovery”. (9)

Hypoxia is the most common cause of airway-related deaths and represents the final common pathway for airway complications (12). Ineffective airway management will rapidly lead to hypoxaemia, which in turn can deteriorate into organ failure and ultimately death (9). Deaths and significant morbidity result from airway complications in the peri-anaesthesia period with most contributing factors being well-described and avoidable (13).

There is a paucity of studies relating to post-anaesthesia staffing practices and fewer studies still that explore recovery room nurses’ or peri-anaesthesia nurses’ knowledge. Studies have been conducted that explore the occurrence of respiratory complications in the recovery room and the relationship between these complications and possible patient, surgical and anaesthetic risk factors (14). A

study conducted in England by Stephens et al (15) revealed that nurses were “competent to care for an unconscious patient so long as an emergency did not arise”. This study also concludes that recovery room nurses are not sufficiently aware of particular complications that may arise in the immediate post-operative period and how these could be prevented. (15)

Van Huyssteen and Botha (16) conducted a study in private hospitals in Northern Gauteng to determine the knowledge of recovery room nurses regarding airway emergencies. They concluded that “nurses working in recovery rooms of five hospitals in Northern Gauteng, South Africa, did not have the necessary knowledge and competence needed to render quality nursing care to post-operative patients”.

No other South African studies of recovery room nurses knowledge could be identified.

1.3 Problem statement

Hospitals in the public sector in Gauteng serve a vast population, providing an extensive service, and performing a large number of anaesthetics annually. Recovery rooms in this sector are staffed by nurses with varying qualifications, level of experience and competence (2). In a study conducted in private hospitals in Northern Gauteng regarding post-operative airway emergencies, nurses achieved a mean score of 43% when the competency score required was 70% (16). This lack of knowledge may impact on patient safety. There is currently no information regarding the level of knowledge of recovery room nurses in the public hospitals on post-operative airway emergencies and management, specifically the hospitals affiliated to the University of the Witwatersrand (Wits).

1.4 Aim and objectives

1.4.1 Aim

The aim of this study was to describe the level of knowledge of post-operative airway emergencies in recovery room nurses working at Chris Hani Baragwanath

Academic Hospital (CHBAH), Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Helen Joseph Hospital (HJH).

1.4.2 Objectives

The primary objectives of this study were to:

- describe the recovery room nurses' knowledge regarding post-operative airway emergencies;
- correlate knowledge with years of recovery room nursing experience.

The secondary objective of this study was to compare the level of knowledge with the level of qualification.

1.5 Research assumptions

The following definitions were used in this study.

Enrolled nurse: is a person educated to practice basic nursing to a level and in a manner prescribed (17).

Registered nurse: is a professional nurse who is qualified and competent to practice independent and comprehensive nursing in the manner and to the level prescribed, and is also capable of assuming responsibility and accountability for such practice (17).

Specialist nurse: is a registered nurse who has further training in a specific field of expertise or interest (17). The specialist nurses relevant to this study will be theatre nurses, trauma nurses and ICU nurses, as they are all involved in airway management of patients and should therefore have good knowledge of the topic.

Staff nurse: During this study staff nurses and enrolled nurses will all be referred to as enrolled nurses and presently function under the supervision of a registered nurse

Recovery room nurse: Any nurse, registered with the South African Nursing Council (SANC) involved in the care of recovery of a patient post-anaesthesia, regardless of the type of anaesthetic performed or the nurses' educational profile. Recovery room nurses include both staff nurses and registered nurses and will be referred to as "the nurse" throughout the document.

Knowledge: In this study, knowledge refers to the medical knowledge that a recovery room nurse possesses regarding standard practices, guidelines and protocols. Adequate knowledge in this study was a score of 70% or more.

Post-operative airway emergencies: are post-anaesthetic related complications that originate in the respiratory system which may affect oxygenation and/or airflow (ventilation) within the airway passages and/or lungs.

Recovery room: is a critical care environment with high-activity, where post-operative patients recover immediately following surgical/anaesthetic procedures. The term recovery room is used in standard practice in South Africa, whilst the term post-anaesthetic care unit (PACU) is used commonly in the United States of America (USA).

1.6 Demarcation of the study

This study was conducted in the recovery rooms at three public academic hospitals in Johannesburg. The hospitals were as follows:

- Chris Hani Baragwanath Academic Hospital (CHBAH)
- Charlotte Maxeke Johannesburg Academic Hospital (CMJAH)
- Helen Joseph Hospital (HJH)

CHBAH, in Soweto, is the third largest hospital in the world with 3 200 beds and over 6 000 members of staff. The hospital is a central academic hospital, serving the community of Soweto and receives countrywide referrals. CMJAH is based in Parktown with a capacity of 1088 beds. It is also a central academic hospital. HJH is a 485 bed, regional academic hospital. All three hospitals are affiliated with the University of the Witwatersrand Health Sciences Faculty.

1.7 Ethical consideration

Approval to conduct this study was obtained from the relevant authorities.

Recovery room nurses in the selected hospitals were given an information letter (Appendix 1) to explain the aim of the research, and implied consent to participate in the study was obtained through the voluntary completion and return of the questionnaire (Appendix 2).

Anonymity and confidentiality was ensured. At the end of the data collection period, nurses were provided with an answer memo sheet, which they could read and keep, to identify gaps in their knowledge.

This study was conducted in accordance with the Declaration of Helsinki (18) and the South African Good Clinical Practice Guidelines (19).

1.8 Research methodology

1.8.1 Research design

This study was a prospective, contextual, descriptive study.

1.8.2 Study population

The study population consisted of nurses working in the recovery rooms at CHBAH, CMJAH and HJH at the time the study was conducted.

1.8.3 Study sample

Sample size

Acceptable knowledge was evaluated as a score of at least 70% for the questionnaire. A knowledge score of 50% was assumed, and adequate knowledge was assumed if an increase of at least 20% over this status quo was found. A

standard deviation of 21% was used (16). A sample of 14 nurses has 90% power to detect this increase of 20% when testing at the 0.05 level of significance. The sample size was however realised by the response rate.

Sampling method

Convenience sampling was used to select the recovery room nurses involved in the study. All nurses on duty at the time of data collection were invited to participate in the study.

1.8.4 Inclusion and exclusion criteria

The following inclusion and exclusion criteria were used.

All nurses on duty in the recovery room at the time of data collection were included in the study.

All nurses who declined to participate in the study were excluded from the study. All nursing students were excluded from the study.

1.8.5 Data collection

Data were collected in the form of a self-administered questionnaire (Appendix 2) that was based on a questionnaire developed by Van Huyssteen and Botha (16). This questionnaire was reviewed by two senior specialists in the University of the Witwatersrand Anaesthesiology department. Questions were re-worded for clarity, whilst the format and content of other questions were simplified.

The data was collected from each hospital on allocated shifts during July and August 2014 convenient to the researcher and recovery rooms involved.

Completion of the questionnaires took place in the recovery rooms of the three hospitals involved. All recovery room staff on duty were invited to participate. Those who elected to participate were provided with an information letter (Appendix 1).

Questionnaires were distributed in an unsealed envelope. After completion, these questionnaires were placed in an unmarked envelope and sealed before being returned to the researcher.

All complete and incomplete questionnaires were returned to the researcher. An unanswered question was regarded as incorrect.

1.8.6 Data analysis

Microsoft Excel 2007 was used to capture data collected. GraphPad InStat was used to analyse data from the descriptive study. Data were analysed using descriptive statistics.

1.9 Significance of the study

Peri-operative patients require vigilant nursing care. It has been suggested that recovery room care represents the weak link in the peri-anaesthetic nursing period (20). Airway management is a cornerstone of safe recovery room care. A previous study in private hospitals in Northern Gauteng, has shown that this knowledge is lacking (16). Little is known regarding the knowledge of recovery room nurses in public hospitals.

If knowledge of recovery room nurses is found to be lacking, appropriate educational programmes may be instituted. These programs can be used to establish defined guidelines to ensure recovery room nurses are adequately trained and competent in post-anaesthesia care, and ensure patient safety in the recovery room.

1.10 Validity and reliability

Validity and reliability of this study was ensured.

1.11 Project outline

The report will be discussed as follows:

Chapter One	Overview
Chapter Two	Literature review
Chapter Three	Methodology
Chapter Four	Results and discussions
Chapter Five	Summary, limitations, recommendations and conclusion

1.12 Summary

In this chapter an overview of the study was given. This included the background, problem statement, aim and objectives, research assumptions, demarcation of the study field, ethical considerations, research methodology, significance of the study, validity and reliability, and a project outline. The literature review will now be covered in chapter two.

Chapter 2: Chapter 2: Literature review

2.1 Introduction

In this chapter, the following will be discussed: patient safety guidelines, the history and importance of the recovery room, current practice guidelines, recovery room nurse responsibilities, general airway management principles, the knowledge of recovery room nurses regarding airway management, current South African recovery room nursing profile, and the importance of acquiring and maintaining knowledge.

2.2 Patient safety guidelines

The World Alliance for Patient Safety, established in 2004, identified research as a priority area as it is a fundamental component in the establishment of safer healthcare. They noted that in order to achieve success with this goal, greater knowledge about what is required, and improved usage of current knowledge is necessary. The World Health Organisation (WHO) Patient Safety regulations emphasise the importance of communication in the sharing of knowledge, as a lack of communication has been shown to impact negatively on patient care. They state that “Communication, transfer of knowledge and handovers between providers remain central to optimizing patient safety”. (21)

In 2009, the WHO identified and compiled a list of 50 global priority areas for patient safety, with the intention of focusing on critical areas pivotal in improving the safety of patient care. This list has been further refined to a shortlist of six issues that are most relevant to developing countries such as South Africa. One of these six core issues is adequate competencies and skills reflected by appropriate knowledge and transfer of knowledge between individuals. A major challenge for healthcare systems in developing countries is the inadequate numbers and distribution of skills of qualified healthcare providers as well as lack of knowledge about safe practices. A shortage in numbers of staff caring for patients impacts on the ability to provide safe care and contributes to fatigue and increased stress levels in staff, which can further contribute to an increased frequency of adverse events and poor patient outcomes. (21)

“Anaesthesia is regarded as one of the leading specialties in healthcare in terms of safety” (22). It is said that in an organisation one is only as strong as one’s weakest link. “In the practice of anaesthesia in South Africa, this weakest link is often the recovery rooms” (20). For this reason, the care yielded in the recovery room, ultimately part of the anaesthesiologists’ responsibility, needs special attention.

2.3 History and importance of the recovery room

Historically, the concept of a recovery room was not always part of hospital planning (23). As knowledge regarding anaesthesia has improved and a deeper understanding of post-operative care requirements has developed, the importance of recovery rooms has become more recognised. Post-anaesthetic nursing care, a specialised and intense service, is well recognised as essential in optimising outcomes for patients undergoing modern anaesthesia and surgical techniques (24).

General anaesthetic techniques can be traced back for over 150 years, whilst the widespread establishment of recovery areas began after World War II (24). Over time, recovery rooms have been improved with better staffing ratios, equipment and spaces. As the number and complexity of surgical procedures have increased, immediate post-operative care has evolved from a short period of observation in an area within close proximity to operating theatres, to a more prolonged and active period of monitoring and intervention in an area specifically designed for such a purpose (25).

Barone et al (24) refer to a study conducted in 1947 that was published in the Journal of the American Medical Association, which, not only demonstrated the advantages of a recovery room, but also that the establishment of recovery areas was documented to save lives. It reviewed all patient deaths occurring within 24 hours of induction of anaesthesia over an 11 year period, identified all contributing factors in the mortality and whether the fatality was preventable. Three of the top ten contributing factors in post-anaesthetic deaths identified in this study, namely poor oxygenation, respiratory obstruction and laryngospasm, were airway related and are still leading contributing factors in modern days (24).

A recovery room is a dynamic, rapidly changing environment, with a high turnover of patients in an “at risk” state (22). Those in charge of recovery rooms need to be committed to creating and sustaining a work culture of safety thereby ensuring the delivery of optimal care and achievement of optimal results will be kept as a primary objective (26).

2.4 Current practice guidelines

Internationally and nationally, numerous associations or expert panels exist that outline various guidelines regarding recovery rooms. For the most part, the focus of these guidelines is on the appropriate staffing ratios, required and recommends equipment, recovery room layout, discharge criteria and various other protocols (3, 5, 6). They all make mention of the role of the recovery room nurse and that they should be competent and adequately trained in peri-anaesthesia care with knowledge in their special field of care.

Some studies (27, 28) emphasise the importance of recovery room staff being trained in current basic life support (BLS) and advanced cardiac life support (ACLS) protocols. The Association of Anaesthesiologists of Great Britain and Ireland (AAGBI) (27) state that at least one member of staff in the recovery room at all times should be ACLS certified. If the recovery room receives paediatric patients, there should always be a nurse on duty who has the appropriate paediatric life support qualification.

The Royal College of Anaesthesiologists recommends that at least one member of the recovery room staff present at any time should be certified as an advanced life support provider (29).

This is reiterated in a document published in 1996 by ASPAN exploring the need and opportunity for development of the advanced practice nurse in the peri-anaesthetic setting. In this document, ASPAN recommended certain requirements necessary for nurses wishing to fulfil the position of peri-anaesthetic nurse, which included BLS and ACLS certification. (28)

Of concern, is that these guidelines fail to clarify the term competence and what this encompasses, or to provide academic requirements that recovery room nurses need to achieve in order to acquire the necessary knowledge.

WFSA adopted an International Standard for Safe Practice of Anaesthesia in 1992, and revisions were ratified in 2008 and 2010. These standards, recommended for anaesthesia professionals worldwide, state that for post-anaesthetic care “all patients should be observed and monitored in a manner appropriate to the state of their nervous system function, vital signs, and medical condition with emphasis on the adequacy of oxygenation, ventilation, circulation and temperature”. (5)

The AAGBI guidelines (27) state that when the anaesthesiologist delegates care or treatment of a patient to a person, they must be satisfied that that person has the qualifications, experience, knowledge and skills to provide the required care or treatment. The anaesthesiologist’s role is to pass on enough information about the treatment they desire or need for their patient, as ultimately patient management is still their responsibility (30). According to the AAGBI recommendations, a patient in the recovery room should be observed on a one-to-one basis by an anaesthesiologist, recovery room nurse or other properly trained member of staff, who should monitor them closely so that they may identify and interpret clinical signs relating to the patients’ condition timeously to avoid complications (25).

ASPAN defines Standards of Peri-anaesthesia Nursing Practice to help guide post-anaesthesia care (7). Krenzischek et al (26) take it further, saying “peri-anaesthesia nurses have an ethical and moral obligation to provide safe, quality care to patients. Safety must be the fundamental core value in everyday practice”. Internationally and nationally, the standards of nursing practice do not clearly outline what is deemed as safe patient care.

The SASA guidelines state that the nursing staff working in recovery rooms must be appropriately trained and competent. They stipulate that “a registered or enrolled nurse trained and competent in recovery room care must be present at all times”. Furthermore, these guidelines point out that it is the institution’s

responsibility to ensure appointed staff in the recovery rooms fulfil these requirements. (3)

SATS' states that every patient has the right to the highest standard of care, based on the patient's needs, which is in line with the Constitution of South Africa and Human Rights Charter (4). SATS position statement outlines the need for all peri-operative nursing staff to continuously update and improve their skills and knowledge, which should be provided by a nursing school or organisation recognised by the SANC. Furthermore, they encourage the establishment of a safe and comfortable working environment where nursing staff make use of critical thinking, good communication and nursing judgement in their delivery of direct and indirect care (4).

In these above mentioned guidelines, they do not define what constitutes safe care or competency and they do not stipulate minimum education requirements necessary to become a peri-operative nurse.

2.5 Responsibilities of the recovery room nurse

The recovery room nurse is involved in care of patients from handover to discharge. Ultimately, the person looking after the patient should be competent and appropriately trained to deal with problems faced within a recovery room. Knowledge about prevention and proper treatment of post-operative complications contributes to competency.

2.5.1 Handover from theatre

Handover is defined as the process of communicating and conveying patient information and responsibility from one healthcare professional to another, aiming to ensure continuity of care (31). The transfer of information during a handover is essential to a patient's well-being and safe management during the recovery period (32). Information exchanged between anaesthesiologist and recovery room nurse aims to ensure a complete sharing of vital information relevant to that patient's care. If such information was omitted, it could potentially impact negatively on the outcomes. "Incomplete, or poor-quality handovers have been implicated as a

source of adverse events” (32). In order for the recovery room nurses to holistically care for their patients during the critical recovery period, and apply their knowledge relating to post-operative care, they require all aspects of information to be shared in an appropriate manner (31). Thereafter, if they have any concerns or queries, they should raise these with the anaesthesiologist before they accept handover of the patient thereby implying responsibility of care (33). Currently, there is minimal to no formalisation of the handover process through specific guidelines or documentation (22, 34).

Communication errors between professionals have been seen as a leading cause of death in a retrospective study (35). Deficient handovers can cause a breakdown in communication resulting in inappropriate or inadequate treatment and potential harm to the patient (32).

2.5.2 General responsibilities

“The scope of practice and definitions for PACU nursing staffing are diverse, multi-faceted, and capture many variables that influence patient care outcomes” (36).

According to the AAGBI (25), recovery room nurses should have the following core skills and knowledge in order to care for their patients:

- assessment of vital signs and initiation of management to improve any abnormalities detected;
- competency in all aspects of basic life support;
- address patients comfort needs including emotional support and re-orientation post general anaesthesia;
- charting and documentation
 - assessment of fluid balance and management of intravenous fluid therapy;
 - administration of appropriate drugs by all appropriate routes including, but not limited to, anti-emetics and analgesic, which should be guided by local protocols;

- early detection of changing clinical conditions and appropriately directed management.

Each patient must be kept under continuous clinical observation with data recording physiological parameters, clinical observations and medication administered, being regularly measured and recorded at the relevant time (6).

2.5.3 Discharge

A patient's discharge from the recovery room to either the ward or home is the responsibility of the anaesthesiologist, but the use of strict discharge criteria enables this responsibility to be delegated to recovery room staff (25). Recovery room nurses are responsible for monitoring vital signs and clinical assessment of the patient, whilst in the recovery room (5). Drawing on their knowledge and relevant clinical findings, they should be alerted early to any abnormal parameters or concerning change in condition that may require them to call the anaesthesiologist for help (33). If they are satisfied that the patient is clinically stable and well, based on their knowledge of complications associated with anaesthesia and general patient care, they can safely discharge the patient from the recovery room (27).

Hegarty et al (33) conclude that those in charge of recovery rooms, be it the anaesthesiologist or nursing manager, need to utilise the clinical experience of their recovery room nursing staff to determine the most appropriate discharge criteria for their individual unit, thereby implying nursing staff working in the recovery room need to have adequate clinical experience in order to undertake this role.

Patients' readiness for discharge from a recovery room needs to be "approached in a structured but simple and clear manner that meets international standards of appropriate nursing, medical and anaesthesia patient care" (33). In order to safely return a patient to the ward, the recovery room nurse requires confidence in her clinical judgement which in turn displays competence in her core skills (25).

2.6 Airway management

2.6.1 Scope of practice of recovery room nurses in South Africa

Nurses working in South Africa are governed by a framework of professional and ethical responsibilities defined by the Regulations relating to the scope of practice (Nursing Act 1978 Government notice R2598 as amended) (Scope of Practice) (37) and rules relating to the Rules setting out the Acts and Omissions (government notice no R387 as amended) (38). Accountability is core to professional nursing practice (39) requiring, at the very least, ability, which includes knowledge, skills and values essential in decision making regarding specific issues (40). It is the nurses' responsibility to ensure they have the necessary knowledge in their speciality that they may ensure adequate patient safety, and to ensure no action or omission in their practice impacts negatively on patient care. (41).

Speciality nursing, including recovery room nursing, presents extended practices to nurses, placing expectations that such qualified nurses are capable to function at a level more advanced than 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" (39).

In order to adequately manage an airway, knowledge of anatomy and physiology is needed. This also includes knowledge of oxygen concentration, pulse oximetry, tidal volume, hypoxia and expired carbon dioxide. Knowledge of cardiac anatomy and physiology including heart rate and blood pressure is also essential as well as pharmacology related to anaesthesia and analgesia (30). The role of the recovery room nurse in airway management is primarily to maintain oxygenation (37, 42). In order to achieve this, the recovery room nurse needs to be able to assess an airway and identify any risk factors that may pose a risk to maintenance of airway patency, difficult intubation or difficult bag-mask ventilation (30). They should have knowledge regarding basic airway manoeuvres and appropriate patient positioning as well as common equipment and monitors used in airway management. Furthermore they should be aware of the indications for use of this equipment,

including the appropriate and necessary use of suctioning. Knowledge regarding oxygenation and ventilation and the clinical detection of any inadequacies is also imperative. (9)

Communication is vital to safe patient care and assuring positive patient outcomes. The accurate communication of safe and unsafe practices will improve quality of care and prevent potential harm. (26)

Guidelines for the scope of practice for both registered and enrolled nurses are provided by SANC (37). As discussed, many of the roles and responsibilities overlap. Whilst a registered nurse is expected to have deeper insight into the performance of daily tasks and more advanced ability to formulate a treatment plan, an enrolled nurse is expected to conduct acts and procedures which have been planned and initiated by a registered nurse, and perform these tasks under her direct or indirect supervision. Enrolled nurses may not carry out professional functions. (39) However, the reality of current practices is that registered nurses are being replaced by staff nurses to do the same job within the recovery room, often without the required supervision of a registered nurse. Therefore enrolled nurses' knowledge and skills should be equivalent to that of a registered nurse to ensure safe management of post-operative patients.

2.6.2 Routine management

Most patients in the recovery room will require little to no respiratory support. The recovery room nurses' role is to monitor such patients and observe for any clinical changes in their condition. They should be nursed in a semi-fowlers position, and placed on 40% face mask oxygen (14). In the event that a semi-conscious patient starts vomiting, they should rapidly be placed in the recovery position (left lateral position) to prevent aspiration of any gastric contents (43). The recovery room nurse needs to be vigilant for such an event and should ensure suction is readily available and in good working order. Suction can be used to clear an airway of vomitus and secretions (14). This can be done in the upper airway using a Yankeur suction, ideally under direct vision, taking care not to use excessive force or stimulation as this may lead to trauma and oedema, which in turn can precipitate irritation of the vocal cords leading to laryngospasm (9).

Commonly, semi-conscious patients may display signs of soft tissue/upper airway obstruction (10). In such cases, appropriate positioning of the head, and basic airway manoeuvres are often adequate to improve patency and stimulate the patient to awaken thereby managing the problem (9). The recovery room nurse needs to understand how to maintain a clear, patent airway including these basic airway manoeuvres (i.e. head tilt, chin lift, jaw thrust) (30).

2.6.3 Emergency management

Respiratory complications in the post-anaesthetic period remains one of the most important areas of concern in terms of morbidity and increased mortality (14). Patients decreased rousability in the recovery room, along with the predisposition for upper airway obstruction, increased secretions and potentially inadequate oxygenation and ventilation, contribute to their inability to adequately and appropriately respond to asphyxia and hypercapnia (10). “The most common adverse respiratory complications occurring post-operatively are airway obstruction, hypoxia, hypoventilation and pulmonary aspiration of gastric contents” (43). For this reason, four common causes of airway obstruction will be discussed, namely upper airway (soft tissue) obstruction, laryngospasm, laryngeal oedema and bronchospasm; followed by pulmonary aspiration and non-cardiogenic pulmonary oedema which leads to hypoxia and hypoventilation.

Upper airway obstruction

Upper airway obstruction during natural sleep, sedation and general anaesthesia is common (43). It is caused by a loss of muscle tone present in airway musculature, and the head and neck, brought on by decreased awareness or consciousness, which is compounded by depression of airway muscle activity by pharmacological agents. (10). Usually, the tongue falls back, in a patient who is unable to protect his or her airway, against the posterior pharynx thus preventing air flow into the trachea (43).

Risk factors for upper airway obstruction include a history of obstructive sleep apnoea, decreased level of consciousness, anatomical abnormalities (e.g. short neck, cleft lip, small chin, various clinical syndromes) and obesity (44).

Clinical features of airway obstruction are audible snoring, decreased or lack of chest movement, decreased misting of the oxygen facemask and ultimately apnoea and oxygen desaturation (43).

Principles of management include stimulating the patient to rouse them, performing appropriate airway manoeuvres which are a jaw thrust, head tilt and chin lift simultaneously, and/or insertion of oral or nasal airway to prevent the tongue from falling backwards and occluding the airway passages, until the patient is awake and alert enough to protect their own airway (1, 43). Essentially, this situation can usually be avoided if the patient is awake prior to extubation and little sedation is still in circulation post-extubation (43).

Laryngospasm

Laryngospasm, a potentially life-threatening complication that can, and often does occur during the post-operative period, is an emergency situation which must be promptly recognised and actively treated appropriately. Without this, the patients' airway may occlude leading to respiratory arrest and potentially cardiac arrest (45). Recovery room nurses require knowledge regarding its clinical features and emergency management, that they may remain ever vigilant to its presentation.

Laryngospasm is the involuntary forceful spasm of the laryngeal musculature caused by sensory stimulation of the superior laryngeal nerve leading to closure of the vocal cords and partial or complete airway obstruction. Laryngospasm tends to be more common in paediatric patients, but potential triggers in all patients include extubation, particularly if a patient is only lightly anaesthetised, presence of fluids or secretions at the vocal cords, current or recent upper respiratory tract infection or exposure to secondary tobacco smoke. (44) Clinical features are stridor, restlessness, tachycardia, tachypnoea, oxygen desaturation (46).

Most cases of laryngospasm can be effectively treated by nursing the patient in a semi-fowlers position with 100% facemask oxygen, forceful forward jaw thrust movement and gentle positive pressure ventilation via bag-valve mask and removal of any stimulus (e.g. suctioning of secretions). Intravenous Lignocaine (1-1.5 mg/kg) can also be administered (44). If these are ineffective and hypoxia

develops, succinylcholine and re-intubation may be required to break the spasm and improve oxygenation and ventilation (43).

Laryngeal oedema

Laryngeal or tracheal oedema may become obvious post-extubation when the oedematous mucosa encroaches on the airway lumen, increasing airway resistance and work of breathing. If the oedema is severe causing significant airway obstruction, minute ventilation will be decreased and hypoxia usually ensues. (43)

Risk factors for the development of laryngeal oedema are patients with airway trauma, surgical factors (facial reconstruction, oral and/or neck surgery), paediatric patients, prolonged surgery, difficult intubation or those who required multiple intubation attempts and excessive movement of an endotracheal tube (46). Patients with these risk factors benefit from preventative doses of dexamethasone intra-operatively which reduces the risk of laryngeal oedema and stridor by up to 40% (43).

Usually, laryngeal oedema presents within one hour post-extubation and may continue to worsen over time potentially requiring re-intubation to maintain airway patency (46). Presentation is similar to laryngospasm namely inspiratory stridor, harsh sounding cough, restlessness, tachypnoea and tachycardia, and oxygen desaturation (43).

Management principles parallel those of laryngospasm: nurse in semi-fowlers position and provide 100% facemask oxygen. Furthermore, laryngeal oedema may be reduced by the use of adrenaline saline nebulisation and intravascular steroids. Re-intubation is not usually required. (43)

Bronchospasm

Bronchospasm tends to occur more often in asthmatic patients, but is not limited to this patient population (46). Pain, emotional stress, or stimulation can precipitate bronchospasm as well as drugs associated with histamine release (morphine, atracurium, pethidine) (44).

Clinically, a patient usually has an audible expiratory wheeze, tachypnoea and tachycardia (46). They may become restless, and worsen, developing an inspiratory component wheeze. A “silent chest” signifies absent air entry associated with hypoxia and hypercapnia (47) and is a sign of extreme severity.

Management principles include 100% oxygen, nebulisation with a combination solution containing atrovent, berotec and saline, and intravenous steroids (hydrocortisone 1.5-2 mg/kg) (46). Severe cases may require intravenous ketamine and/or magnesium sulphate. If the bronchospasm fails to respond adequately, and the work of breathing is excessive, patients may require re-intubation and ventilation with inspiratory pressures higher than normal, until such time as the spasm has broken and airway pressures have returned to normal. (46, 47)

Aspiration

Aspiration of gastric contents is possible during induction of anaesthesia, intubation and laryngoscopy, and both peri- and post-extubation where the patients’ natural airway protective mechanisms are violated (43, 44). The risk of aspiration is higher in patients’ extubated prematurely but can even occur in conscious patients when airway reflexes are still depressed in the immediate post-operative period.

Patients with altered airway reflexes (e.g. drug and/or alcohol intoxication, encephalopathy, general anaesthesia, neuromuscular disease) or abnormal and distorted pharyngeal or oesophageal anatomy (e.g. pregnancy, large hiatus hernia, obesity) are at increased risk for pulmonary aspiration (44). Other risk factors for aspiration include full stomach, under-inflated endotracheal cuff and use of supraglottic airway devices in inappropriately starved patients (43).

Aspiration may occur in patients without any witnessed vomiting. Clinical suspicion should be aroused in patients who are tachypnoeic and tachycardic, hypoxic and who have decreased or added breath sounds (e.g. wheezing) on auscultation. A chest x-ray and arterial blood gas should be done for further evaluation. (44)

Patients who are adequately awake should be at a lower risk of developing aspiration, in the event that vomiting may occur. Adequate level of consciousness, implying the ability to protect one's airway, can be demonstrated by gagging or coughing on the endotracheal tube, and the ability to perform and sustain a head lift. Since aspiration risk is not entirely eliminated by consciousness, patients at higher risk of aspiration should ideally be nursed in the lateral position provided no contra-indications are present. (43) Patients where regurgitation is suspected should immediately be placed in the head-down position, that gastric contents may drain spontaneously out of the mouth as opposed to down the trachea, followed by thorough suctioning of the pharynx and ideally the trachea.

Patients who become hypoxic often require re-intubation and positive pressure ventilation with positive end expiratory pressure (PEEP) or continuous positive airway pressure (CPAP). (44)

Non-cardiogenic pulmonary oedema

Pulmonary oedema results from transudation of fluid from the pulmonary capillaries into the interstitial spaces either as a result of an increase in net hydrostatic pressure across the capillaries (cardiogenic pulmonary oedema) or an increase in the permeability of the alveolar-capillary membrane (non-cardiogenic pulmonary oedema) (47). Thereafter, this fluid moves into the alveoli.

Non-cardiogenic pulmonary oedema, often seen with acute lung injuries and associated with trauma, sepsis and pulmonary aspiration, is referred to as acute respiratory distress syndrome (ARDS) in its most severe presentation (47).

ARDS is most commonly associated with extensive polytrauma patients and sepsis, and usually presents as severe dyspnoea and laboured respiration, hypoxia and hypoxaemia with fine crackles bilaterally on auscultation (46, 47).

Patients presenting with non-cardiogenic oedema are on a spectrum of severity. They are usually acutely and severely distressed, all require oxygen via facemask and many require respiratory support usually either CPAP via fitted face mask, or intubation and mechanical ventilation with inspiratory pressures greater than normal accepted values. Treatment includes diuretic therapy in certain cases, and

should also be directed at any reversible causes such as sepsis. Early ICU consultation for severe cases is recommended for ongoing ventilator support and possibly vasopressor support. (47)

2.7 Knowledge of recovery room nurses in airway management

Studies exploring critical care nurses' (CCN) knowledge can be related to all specialised nurses, which would include recovery room nurses.

Toth et al (42) conducted a study to assess the level of knowledge of CCNs using a basic knowledge assessment tool (BKAT) in nurses working in the USA compared with nurses from other countries. Basic knowledge, the minimum information required for entry into specialised nursing such as critical care, is required to provide safe nursing care. Although this basic knowledge does not guarantee safe practices, safe practice in specialised nursing care such as critical care or recovery rooms cannot occur without this basic knowledge. Participants in the study obtained a score of between 0 and 100 points for the BKAT test. Nurses from the USA scores ranged from 46 to 100 points with a mean of 85.8 points, with scores for nurses from other countries ranging from 35 to 98 points with a mean of 81.7 points. From this study, it was concluded that basic knowledge of CCNs in various countries appears to be very similar with no difference identified between the English-speaking countries of Canada, USA and Australia. (42) South Africa was not included in the study. The BKAT-5 measures knowledge in areas of critical care nursing practice including cardiovascular, monitoring, pulmonary, neurology, endocrine, renal, gastrointestinal, parenteral, infection control, hypothermia, haemofiltration and burns. There is no specific subsection relating to airway emergencies.

Higginson et al (48) highlighted the importance for all nurses working outside a traditional intensive care unit (ICU) to have core critical care skills, specifically relating to airway assessment and management. They emphasise the lack of standardised national guidelines which should outline and define "core" critical skills requirements, as well as a paucity of definitive respiratory assessment models to guide nurses in the conduct of patient respiratory assessment. Practical

skills cannot be attained without the necessary knowledge surrounding the skill and underlying anatomy and physiology related.

Van Huyssteen and Botha (16) conducted a study to identify recovery room nurses knowledge regarding post-operative airway emergencies in adults in private hospitals in South Africa using a survey with a structured questionnaire with two sections. Section one established biographical data which was used to describe the research population and section two consisted of questions intended to measure knowledge of recovery room nurses regarding post-operative airway emergencies in adult patients. The questionnaire was formulated and presented to a panel of experts in the field of study, who came to a consensus that the minimum mark required should be 70%. This essentially represented a competency indicator, and translates into participants needing to achieve a score of at least 70% to be deemed knowledgeable in the field. The mean score achieved by the participants was 43% with a range of 0 to 75%. Only one participant attained a mean score above the competency indicator. (16)

In this study, questions on six specific post-operative airway emergencies covered four main themes, namely the anatomical and/or physiological changes associated with the airway emergency, risk factors, clinical features, management and general knowledge. Recovery room nurses attained a mean score of 68% about the anatomical and/or physiological changes associated with the specified post-operative airway emergencies in adults, representing fair knowledge in this field. However for the remaining three themes, the results were poor: a mean score of 39% was attained regarding the management of post-operative airway emergencies, a mean of 34% was achieved where participants needed to identify clinical presentation and finally a mean score of only 32% was achieved for the fourth theme, namely general knowledge of risk factors for post-operative airway emergencies in adults. What is more concerning is that participants, who had additional qualifications, did worse on the questionnaire than those that had only basic nursing training. No correlation between years of experience and level of knowledge was demonstrated. (16)

2.8 South African recovery room nurses profile

Vimlati et al (6) acknowledge that the skill mix of nursing staff often varies. In their study, they recommend that a recovery room should have specially trained nurses, including anaesthesia or intensive care nurses (6).

South African recovery rooms are being staffed by nurses with varying qualifications including registered nurses, theatre nurses, enrolled nurses and nurses with some specialised training either in ICU or anaesthetic care (16). There are currently no set guidelines or requirements stating who is adequately trained to safely care for patients in the recovery room. Studies aimed at assessing the knowledge of recovery room nurses are limited.

Scribante and Perrie (2) conducted a pilot study in August 2011 in the recovery rooms of six hospitals, three private and three academic, to explore briefly the demographic and education profiles of the recovery room nurses, and to relate these to nursing knowledge and safe nursing care rendered. A total of 49 nurses were involved in the study, 47 females and two males. The experience of the nurses ranged from one month to 35 years, with an average of 8.6 years. Eleven of the nurses had more than 20 years of experience. Professional nurses numbered 28 (57.1%) and enrolled nurses 21 (42.9%). Of the 28 professional nurses, 9 (32%) had no post-graduate training. Post-graduate training ranged in the remaining 19 nurses between the following: 5 (17.9%) nurses had management and operating room technique, 4 (14.3%) had critical care and 3 (10.7%) had education. Some nurses had more than one qualification with the six-month anaesthetic nurse qualification being held by 10 (35.7%) of the professional nurses and by 1 (4.8%) of the enrolled nurses. This course is not an official SANC post-graduate qualification. (2) As such, no official anaesthetic nursing courses currently exist in South Africa.

2.9 Importance of acquiring and maintaining knowledge

“Core skills and education of recovery staff must be maintained as a programme of continuing professional development” (37). Regular updates in teaching programmes and recovery room protocols, invested in the education and training

of recovery room staff, helps maintain the satisfactory standard of care required for safe post-anaesthesia recovery room nursing (6).

Education is a key requirement for building the foundation of safety culture (26). O'Brien et al (49) discovered unpublished data that supported the fact that a gap in the knowledge and skills of nurses working in the recovery room presented a risk to patient safety. To overcome this, they recommended that both didactic and practical components should be included in educational programs to achieve optimal skills development.

Scribante et al (50) conducted a qualitative study to formulate and describe guidelines for competency requirements of registered CCNs. They concluded that CCNs have varying degrees of competency which should be seen as a continuum ranging from novice, advanced beginner, competent CCN, proficient CCN and expert CCN. Over time, a nurse's knowledge and competency improves, usually with rapid growth and development initially through education and training. If development is not maintained, the expert CCN regresses and a decline in competency and knowledge occur. This understanding of competency and the importance of ongoing educational programs in CCNs can be applied to other specialised nursing fields such as recovery room nurses. (50)

To ensure a high standard of care in the recovery room, and appropriate decision making by the staff working there, an investment in education and training of recovery room nurses is vital (33).

SANC Scope of practice (37) and rules relating to Acts and Omissions (38) emphasise that nurses are responsible for ensuring they have the knowledge required for their specific speciality and that up-to-date knowledge through continuous professional development is essential in order to achieve this. Searle (39) outlines that a nurse is responsible for the development and maintenance of her knowledge and skills, and the application of this knowledge and competency in decisions regarding ability to act in a specific situation. Muller (41) supports this and states that nurses are expected to maintain their knowledge and skills as circumstances demand.

2.10 Summary

In this chapter safety guidelines were discussed, followed by the history and importance of the recovery room. Thereafter, current practice guidelines, recovery room nurse responsibilities and general airway management principles were explored. The knowledge of recovery room nurses regarding airway management and the current South African recovery room nursing profile were then discussed followed lastly by the importance of acquiring and maintaining knowledge. Chapter three will follow, and discusses research methodology.

Chapter 3: Research methodology

3.1 Introduction

In this chapter the problem statement, aim and objectives from chapter 1 will be repeated to ensure consistency. Thereafter the research methodology will be discussed. It will include the research design, study population and sample, inclusion and exclusion criteria, data collection and the approach to data analysis. The ethical considerations and validity and reliability are also discussed.

3.2 Problem statement

Hospitals in the public sector in Gauteng serve a vast population, providing an extensive service, and performing a large number of anaesthetics annually. Recovery rooms in this sector are staffed by nurses with varying qualifications, level of experience and competence (2). In a study conducted in private hospitals in Northern Gauteng regarding post-operative airway emergencies, nurses achieved a mean score of 43% when the competency score required was 70% (16). This lack of knowledge may impact on patient safety. There is currently no information regarding the level of knowledge of recovery room nurses in the public hospitals on post-operative airway emergencies and management, specifically the hospitals affiliated to Wits.

3.3 Aim and objectives

3.3.1 Aim

The aim of this study was to describe the level of knowledge of post-operative airway emergencies in recovery room nurses working at Chris Hani Baragwanath Academic Hospital (CHBAH), Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Helen Joseph Hospital (HJH).

3.3.2 Objectives

The primary objectives of this study were to:

- describe the recovery room nurses' knowledge regarding post-operative airway emergencies;
- correlate knowledge with years of recovery room nursing experience.

The secondary objective of this study was to compare the level of knowledge with the level of qualification.

3.4 Ethical considerations

Approval to conduct this study was received from the Human Research Ethics Committee (Medical) (Appendix 3) and the Post-graduate Committee of the University of the Witwatersrand (Appendix 4).

Once these were obtained, permission to conduct the study at the involved hospitals was received from the Chief Executive Officer at each CHBAH, CMJAH and HJH respectively (Appendix 5).

The theatre nursing managers at the various theatres were informed of the study.

Recovery room nurses in the selected hospitals were invited to participate in the study. Those who agreed to participate were given an information letter (Appendix 1) to explain the aim of the research, and implied consent to participate in the study was obtained through the voluntary completion and return of the questionnaire (Appendix 2).

Anonymous questionnaires were distributed to participants in an unsealed envelope. Each questionnaire was numbered before distribution and represented participant number and not identification of the participant. After completion, these questionnaires were placed in the unmarked envelope and sealed, and placed in an unmarked box. Confidentiality was ensured as only the researcher and supervisors had access to the raw data. Raw data will be stored securely for six years following completion of the study.

At the end of the data collection period, nurses were provided with an answer memo sheet, which they could read and keep, to identify gaps in their knowledge.

This study was conducted in accordance with the Declaration of Helsinki (18) and the South African Good Clinical Practice Guidelines (19).

3.5 Research methodology

3.5.1 Research design

Burns and Grove (51) describe a research design as the blueprint for a study. According to Brink (52) a research design determines the methods by which the researcher obtains subjects, collects data, analyses data and interprets results.

This study was a prospective, contextual, descriptive study.

A prospective study is one in which a select population is followed over time, to observe an outcome (52). This study used a questionnaire therefore variables were collected at the time the study took place.

De Vos (53) describes context as a “small-scale world” which can be clinics, hospital wards or critical care units, amongst others. This study was contextual as it was conducted in the context of recovery rooms of public academic hospitals.

Brink (52) states that a descriptive study is used to gain more information in a particular field or population without attempting to establishing a causal link. This study was descriptive as it aimed to gather more information regarding recovery room nurses’ knowledge of post-operative airway emergencies, as information in this field is currently limited.

This study was a form of survey where knowledge was measured using a measuring instrument in the form of a questionnaire.

3.5.2 Study population

The study population consisted of nurses working in the recovery rooms, employed at CHBAH, CMJAH and HJH at the time the study was conducted.

3.5.3 Study sample

Sample size

Acceptable knowledge was evaluated as a score of at least 70% for the questionnaire. A knowledge score of 50% was assumed, and adequate knowledge was assumed if an increase of at least 20% over this status quo was found. A standard deviation of 21% was used (16). A sample of 14 nurses has 90% power to detect this increase of 20% when testing at the 0.05 level of significance. The sample size was however realised by the response rate.

Sampling method

Convenience sampling involves the choice of readily available participants for the study (52). Convenience sampling was used in this study. All nurses on duty in the recovery room at the time of data collection were invited to participate in the study.

3.5.4 Inclusion and exclusion criteria

The following inclusion and exclusion criteria were used.

All nurses, registered and enrolled, on duty in the recovery room at the time of data collection were included in the study.

All nurses who declined to participate in the study were excluded from the study.
All nursing students were excluded from the study.

3.5.5 Data collection

Data were collected in the form of a self-administered questionnaire (Appendix 2) that was based on a questionnaire developed by Van Huyssteen and Botha (16). Permission was gained from the authors to use their question in any form required. According to the article, development of the questionnaire and compilation of questions was preceded by an intensive literature review. This was to ensure validity and reliability of the research instrument. Experts, including an anaesthesiologist, a trauma nurse, two CCNs and a lecturer operating in theatre techniques reviewed the questionnaire for content validity, and to obtain their

opinions about the minimum mark (competency score). Consensus opinion was 70% meaning that a participant had to attain a score of $\geq 70\%$ to be considered as knowledgeable in this field. In this study, the questionnaire was further reviewed by two senior specialist anaesthesiologists. Questions were re-worded to avoid ambiguity and the format and content of some questions was adjusted for clarity.

The questionnaire consists of two sections. Section one obtains demographical data from participants, which was used to describe the research population, and compared with the level of knowledge. Section two consists of questions measuring the knowledge base of recovery room nurses regarding post-operative airway emergencies in adult patients. Any unanswered questions were scored incorrect.

The researcher visited the respective recovery rooms and obtained assent from the theatre nurse manager to conduct the study.

The data were collected from each hospital on allocated shifts during July and August 2014 convenient to the researcher and recovery rooms involved.

Recovery room nurses in the selected hospitals were invited to participate in the study. Those who agreed to participate were given an information letter (Appendix 1) to explain the aim of the research, and implied consent to participate in the study was obtained through the voluntary completion and return of the questionnaire (Appendix 2).

Anonymous questionnaires were distributed to participants. Each questionnaire was numbered before distribution and represented participant number and not identification of the participant. This was used to calculate a response rate.

Questionnaires were distributed in an unsealed envelope. After completion, these questionnaires were placed in the unmarked envelope and sealed, and placed in an unmarked box. The researcher distributed the questionnaires personally, and was present during completion of the questionnaires to prevent contamination of data. All complete and incomplete questionnaires were returned to the researcher. An unanswered question was regarded as incorrect.

At the end of the data collection period, nurses were provided with an answer memo sheet, which they could read and keep to identify gaps in their knowledge.

3.5.6 Data analysis

Microsoft Excel 2007 was used to capture data collected. GraphPad InStat was used to analyse data from the descriptive study. Descriptive statistics were used. Data were summarised using frequencies, percentages, means, standard deviations, and ranges. A Spearman's rank test was performed to correlate years of experience with average score. A p-value of < 0.05 was considered statistically significant.

3.6 Validity and reliability

Validity refers to the accuracy of a measuring technique or instrument to perform the intended measurement (52).

Reliability is concerned with the consistency with which a measuring technique produces the same results for a variable or idea (52).

Validity and reliability of this study was ensured by the following measures.

- The sample size was calculated with assistance from a biostatistician.
- The researcher was the only data collector.
- The same data collection method, namely a standard questionnaire, was used at all sites.
- The questionnaire was developed by Van Huyssteen and Botha (16) following a literature review and content validation by an expert panel. The questionnaire was modified with the assistance of two senior anaesthesiologists.
- All questionnaires, whether completed or not, were collected in sealed, unmarked envelopes to prevent data contamination.
- Data analysis was performed in conjunction with a biostatistician.

- Selection bias was minimised as all recovery room nurses were approached to participate in this study.

3.7 Summary

In this chapter the research methodology was discussed. It included the research design, study population and sample, inclusion and exclusion criteria, data collection and the approach to data analysis. The ethical considerations and validity and reliability were also discussed. Results and discussion of results will follow in chapter four.

Chapter 4: Results and discussion

4.1 Introduction

This chapter contains the results and the discussion of the data captured. The results are presented as per the research objectives which are repeated below.

The primary objectives of this study were to:

- describe the recovery room nurses' knowledge regarding post-operative airway emergencies;
- correlate knowledge with years of recovery room nursing experience.

The secondary objective of this study was to compare the level of knowledge with the level of qualification.

4.2 Background to data analysis

Data were collected at all three hospitals during July and August 2014. Adequate knowledge was defined as a score $\geq 70\%$ (competency score). Numbers are rounded off to one decimal place. Missing data is excluded from that particular statistical analysis.

Van Huyssteen and Botha (16) conducted a study in 2004 in 5 private hospitals in Northern Gauteng, which aimed to determine the knowledge of recovery room nurses regarding post-operative airway emergencies. Twenty-one nurses participated in the study. Considering the similar questions asked in both Van Huyssteen and Botha's study, and this study, the differences in results are identified and discussed, although no statistical comparison is made, due to the small sample sizes. This study used the same questionnaire as that used in Van Huyssteen and Botha's study, however, some questions were re-worded for clarity, and the format of other questions was simplified.

4.3 Results

4.3.1 Sample realisation

All nurses working in the recovery room were invited to participate. The number of nurses available during the periods of sampling were 38. Of these, 24 participants completed and returned questionnaires, and 14 declined. The number of nurses from each hospital is summarised in Table 4.1. The combined response rate was calculated as 63.2%.

Table 4.1: Response rate at each hospital

Hospital	RRN invited (n)	RRN participating n (%)	RRN declining n (%)
CHBAH	12	10 (83.3%)	2 (16.7%)
CMJAH	16	6 (37.5%)	10 (62.5%)
HJH	10	8 (80.0%)	2 (20.0%)

4.3.2 Section 1: Demographic data

Table 4.2 summarises the demographical data of participants. Sixteen participants (66.7%) had a basic nursing qualification, either registered or enrolled nurse, with experience in either intensive care or the recovery room, whilst 7 (29.1%) participants had additional training above a basic nursing qualification. One participant (4.2%) did not answer. Seventeen nurses (70.8%) had <7 years of recovery room nursing experience, whilst six (25%) had ≥ 7 years' experience. Twenty-three (95.8%) nurses were permanent staff with only one participant (4.2%) being part-time.

Table 4.2: Demographical data

Level of qualification	Number of participants (n)	Percentage (%)
Intensive care experience	1	4.2%
Recovery room experience	15	62.5%
Anaesthesia/recovery room course	2	8.3%
Diploma in Intensive Care Nursing	2	8.3%
Diploma in Operating Room Technique	3	12.5%
Master's in intensive care	0	0%
No answer	1	4.2%
Years of recovery room experience		
< 1 year	5	20.8%
1-2 years	4	16.7%
3-6 years	8	33.3%
7-9 years	2	8.3%
> 10 years	4	16.7%
No answer	1	4.2%
Appointment status		
Permanent staff	23	95.8%
Part-time staff	1	4.2%
Agency staff	0	0%

4.3.3 Section 2 Knowledge base

This section assessed the knowledge of participants concerning post-operative airway emergencies in adults in the recovery room. Questions were structured to cover six specific post-operative airway emergencies (upper airway obstruction, laryngospasm, laryngeal oedema, bronchospasm, aspiration and non-cardiogenic pulmonary oedema) and divided between four themes (anatomical/physiological

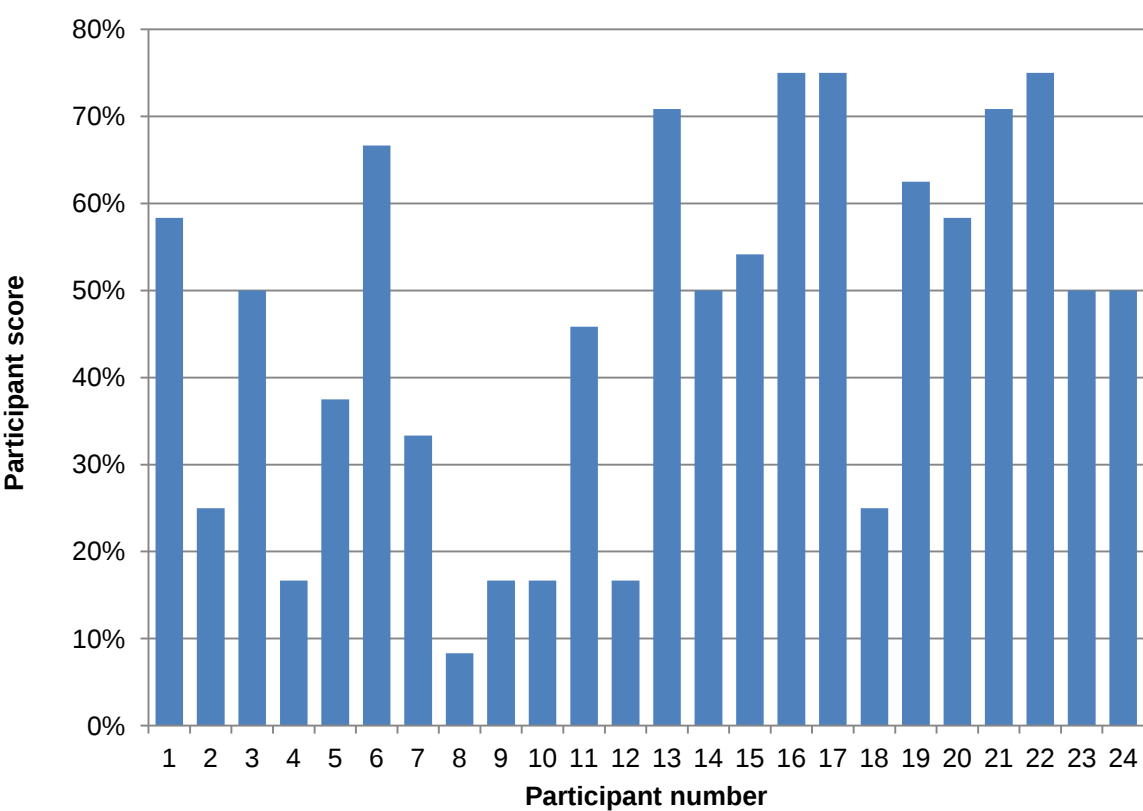
changes associated with the airway emergency, clinical signs, treatment and general knowledge).

Primary objective 1: Describe the recovery room nurses knowledge regarding post-operative airway emergencies

Scores attained by each participant for the questionnaire

The score obtained by each participant for Section Two was calculated, and is illustrated per participant in Figure 4.1. The overall mean score achieved by the 24 participants was 46.2% (SD 21.7%). Scores ranged from 8-75%. Only five participants attained a mean score $\geq 70\%$.

Figure 4.1: Bar graph showing scores attained by participants



Scores attained for each airway emergency

Table 4.3 summarises the mean scores attained for each of the six airway emergencies.

Table 4.3: Mean scores attained for each airway emergency

Airway emergency	Mean scores (SD)	Range
Soft tissue obstruction	50.0% (32.1%)	0-100%
Laryngospasm	42.7% (29.9%)	0-100%
Laryngeal oedema	35.4% (23.2%)	0-75%
Bronchospasm	47.9% (26.5%)	0-100%
Aspiration	52.1% (23.2%)	0-75%
Non-cardiogenic pulmonary oedema	49.0% (27.1%)	0-100%

Scores attained for different themes

The six different airway emergencies were subdivided into four themes. Questions were collectively addressed according to these themes and analysed, calculating mean scores for each theme. These results are expressed in Table 4.4.

Table 4.4: Mean scores attained for each theme

Theme	Mean scores (SD)	Range
Anatomical/physiological changes	64.6% (38.2%)	0-100%
Clinical signs	24.3% (23.6%)	0-66.7%
Treatment	29.9% (32.6%)	0-100%
General knowledge	66.0% (27.6%)	0-100%

Primary objective 2: Correlate knowledge with years of recovery room nursing experience

Average scores were calculated for participants according to years of recovery room experience, which are set out in Table 4.5.

Table 4.5: Knowledge score per years of recovery room experience

Years of recovery room experience	Number of participants (n)	Average score for group (%)
< 1 year	5	40.0%
1-2 years	4	36.5%
3-6 years	8	45.3%
7-9 years	2	62.5%
> 10 years	4	55.2%
No answer	1	54.2%

A Spearman's rank test was performed ($r = 0.3$, $p = 0.1$). No correlation between years of recovery room experience and knowledge level was shown.

Secondary objective: Compare the level of knowledge with the level of qualification

Participants were grouped according to their level of qualifications. The number of participants per group, and averages scored by these groups were calculated.

These finding are displayed in Table 4.6.

Table 4.6: Level of qualification and knowledge level of participants

Level of qualification	Number of participants (n)	Average score for group (%)
Intensive care experience	1	58.3%
Recovery room experience	15	43.1%
Anaesthesia/recovery room course	2	43.8%
Diploma in Intensive Care Nursing	2	37.5%
Diploma in Operating Room Technique	3	62.5%
Master's in intensive care	0	0%
No answer	1	54.2%

Table 4.7 shows scores for recovery room nurses, either registered or enrolled nurses, who only have their basic nursing qualification and those who have any additional qualifications. One participant did not answer this question and is excluded from this analysis.

Table 4.7: Level of knowledge and additional qualification

	Number of participants (n)	Mean score (%)
Basic qualification	16	44.0%
Additional qualification	7	50.0%

Table 4.8 compares the number of participants with basic qualifications and those with additional qualifications who attained the competency score set.

There was no statistically significant difference ($p = 0.999$) between nurses with only a basic nursing qualification and those with additional nursing qualifications and achieving a score of $\geq 70\%$.

Table 4.8: Comparison between participants with basic qualification and participants with additional qualifications attaining competency score

	Basic qualification	Additional qualification
Mean score $\geq$ 70%	4	1
Mean score < 70%	12	6

P value = 0.999

4.4 Discussion

In South Africa, the practice of nurses is regulated by the Scope of Practice SANC Regulation R2598 as amended (37), and rules relating to the Acts and Omissions SANC Regulation R387 as amended (38), which defines professional and ethical responsibilities. According to these two regulations nurses working in the recovery rooms must be competent in recovery room care. Without the necessary knowledge, nurses cannot be deemed competent. The applicable clauses from the Scope of Practice, pertinent to the recovery room nurse and airway emergencies include:

- “g) The facilitation of body mechanics and the prevention of bodily deformities in the execution of the nursing regimen
- h) The supervision and maintenance of a supply of oxygen
- j) The supervision over fluid, electrolyte and acid base balance of a patient
- k) The facilitation of the maintenance of bodily regulatory mechanisms and functions in a patient “. (37)

This Scope of Practice governs the responsibilities of registered nurses. Considering enrolled nurses are working in the recovery room under the supervision of a registered nurse, and in some cases as a substitute for a registered nurse, they too should be governed by this Scope of Practice in the recovery room to ensure patient safety.

This study shows that recovery room nurses knowledge regarding post-operative airway emergencies is inadequate and thus they do not adhere with the governing regulations.

The SASA guidelines (3) specify that the anaesthesiologist remains accountable for ongoing patient care in the recovery room until discharge. In practice, the anaesthesiologist entrusts patient care to the recovery room nurse, who should be competent, not knowing if they have adequate knowledge. The responsibility of ensuring that staff appointed to the recovery room are trained and competent, lies with the institution. Without an adequate level of knowledge, recovery room nurses may not be competent in caring for patients. Anaesthesiologists need to be informed of this lack of knowledge as it influences safe practices and patient care, for which they are ultimately responsible.

The twenty-four participants' total average score of 46.2% (SD21.7%) is 23.8% below the competency score of 70%. It can therefore be concluded that the level of knowledge of participants regarding post-operative airway emergencies in adults is far below acceptable and safe levels. The range of average percentages attained by participants was 8-75%, with only five recovery room nurses achieving a percentage above the competency score. A score of 70% should be a minimum achieved by every recovery room nurse to be considered to have adequate knowledge.

Identifying and quantifying knowledge in recovery room nurses is essential in the delivery of safe care to patients post-anaesthesia. No international studies could be found that have set out to quantify this knowledge. Only one South African study (16) conducted in the recovery room nursing population group could be found. Van Huyssteen and Botha's study was conducted in private hospitals in Northern Gauteng in 2004, thus reflects recovery room nurses knowledge in this sector; whilst this study was conducted in 2014 in public hospitals in Gauteng, representing knowledge of recovery room nurses in this sector. The differences in results between the two studies will now be discussed. For comparison, percentages are shown with no decimal places, as Van Huyssteen and Botha's did not use decimal places. It must be noted that the study population in this Van Huyssteen and Botha's study consisted of registered nurses working in the

recovery room; whilst in our study the study population consisted of all nurses, registered and enrolled, working in the recovery room.

Mean scores attained for questions on soft tissue obstruction were 50% and 43% in the public and private sector respectively. Questions answered on laryngospasm scored a mean of 43% in the public sector and 33% in the private sector, whilst those on laryngeal oedema scored 35% and 19% for public and private sectors respectively. Participants in the public sector attained a mean score of 48% for bronchospasm versus 51% by participants in the private sector. Mean scores attained for questions on aspiration were 52% and 59% in the public and private sector respectively. Participants in the public sector attained a mean score of 49% for questions on non-cardiogenic pulmonary oedema versus 44% by participants in the private sector.

Mean scores attained for questions on anatomical/physiological changes were 65% and 68% for the study conducted in the public and private sector respectively. Questions answered on clinical signs scored a mean of 24% in the public sector and 34% in the private sector, whilst those questions on treatment of airway emergencies scored 30% and 39% for public and private sectors respectively. Participants in the public sector attained a mean score of 66% for general knowledge on airway emergencies versus 32% with participants in the private sector.

It is evident that both groups of participants' level of knowledge is inadequate and mean scores are far below the competency scores. In Van Huyssteen and Botha's study (16), 4.7% (n=1) of participants and in this current study 20.8% (n=5) achieved scores $\geq 70\%$, thus considered to have adequate knowledge. There is no notable change in knowledge levels over the 10 year period these studies were conducted. The mean score in Van Huyssteen and Botha's (16) study was 43% in 2004, versus 46% in this study in 2014. Nursing staff frequently work in both the public and private sectors during the same time period but on different shifts (moonlighting). Thus the population profile in the two sectors is unlikely to be different and therefore knowledge levels are comparable.

Other knowledge studies (54-57) have been conducted in specialised nursing areas, predominantly amongst CCNs. Scores attained in these studies in other specialised nursing groups have repeatedly shown that knowledge is inadequate. Mean scores have all fallen below the competency indicators set, as discussed below.

A study conducted on the impact of the South African Nursing Council Regulation, Regulation R.212, on the training of theatre nurses in the northern area of the Eastern Cape in South Africa (54) revealed that the majority of participants involved in this study (85.4%) indicated they never had the opportunity to be trained, thus enabling them to manage emergencies. Furthermore participants rated themselves for tasks specified in the study, and 51.2% of them regarded themselves as not competent. This included performing cardiopulmonary resuscitation (CPR). The majority of participants (92.7%) believed that, with revised training in accordance with the regulations previously listed, they would eventually be able to handle emergencies better and would be enabled to provide quality and holistic care.

Perrie et al (55) conducted a study to assess the knowledge of critical care nurses working in selected ICUs in respect of pain management, glycaemic control and weaning from mechanical ventilation. The results of this study showed that the knowledge of both the ICU-trained and non-ICU-trained nurses was found to be lacking with an overall mean score of 47.56% (SD 11.61). The ICU-trained participants attained 50.11% (SD 11.96) and non-ICU-trained 45.01% (SD 10.75). A poor relationship was found between level of knowledge and years of ICU experience.

Another study, assessing CCNs' knowledge regarding central venous and pulmonary artery catheters monitoring (56), showed inadequate level of knowledge, with nurses attaining an average score of 56%. Although this score is higher than that attained in this current study, it was also below the set competency indicator for the study.

Windsor (57) conducted a study to determine the knowledge of CCNs regarding ventilator waveforms, in which 111 participants achieved a mean score of 40.3%,.

This fell 19.7% below the set competency score of 60%. Only 15 participants attained a score $\geq 60\%$. This study re-iterates findings of an inadequate level of knowledge in specialised nursing groups.

Considering the Scope of Practice (37) which highlighted the need for safe practice, adequate knowledge and competency skills; and these studies in critical care nurses, the overall results present a bleak picture for South African specialised nurses. The level of knowledge the recovery room nurses and other specialised nurses' possess is far below acceptable and, as such, the question arises as to whether they are adequately equipped to deliver safe care to patients.

According to Huysamen (58), an acceptable response rate range is between 37% and 65%. The response rate of 63.2% is thus acceptable. Response rates varied at the three hospitals. CHBAH response rate was 83.3%, CMJAH 37.5% and HJH 80.0%. Recovery room nurses at CMJAH are not dedicated recovery room staff after 16:00 on weekdays. After hours, the scrub sister, assisting the surgeon in the operating theatre, will then be the recovery sister for that patient. Many nurses in the recovery room at CMJAH were reluctant to participate thus the respondent rate is significantly lower than that of the other two hospitals. Refusal to participate may be due to nurses lacking confidence in their knowledge specifically of recovery room care since their area of practice is operating room technique.

4.5 Conclusion

Nurses working in recovery rooms in CHBAH, CMJAH and HJH did not have the necessary knowledge and competency required to safely provide quality nursing care to post-operative patients. Participants failed to achieve a competency score, representing adequate knowledge, in questions regarding six specific post-operative airway emergencies in adults over four different themes.

4.6 Summary

This chapter dealt with the statistical analysis and discussion of results, according to the objectives of the study. In the next chapter the summary, limitations, recommendations and conclusion are discussed.

Chapter 5: Summary, limitations, recommendations and conclusion

5.1 Introduction

In this chapter a summary, limitations, recommendations and conclusion of the study are given.

5.2 Study summary

5.2.1 Aim of the study

The aim of this study was to describe the level of knowledge of post-operative airway emergencies in recovery room nurses working at CHBAH, CMJAH and HJH.

5.2.2 Objectives of the study

The primary objectives of this study were to:

- describe the recovery room nurses' knowledge regarding post-operative airway emergencies;
- correlate knowledge with years of recovery room nursing experience.

The secondary objective of this study was to compare the level of knowledge with the level of qualification.

5.2.3 Summary of the methodology used in the study

The design of the study was prospective, contextual and descriptive. Convenience sampling was used in this study. All nurses on duty in the recovery room, employed at CHBAH, CMJAH and HJH, at the time of data collection were invited to participate in the study. The sample size was realised by the response rate.

This study was a form of survey where knowledge was measured using a measuring instrument in the form of a questionnaire.

Data were collected using a self-administered questionnaire, based on a questionnaire developed by Van Huyssteen and Botha (16). The questionnaire was further reviewed by two senior specialist anaesthesiologists in the Department of Anaesthesiology at Wits. Some questions were re-worded to avoid ambiguity and the format and content of others were adjusted for clarity.

The questionnaire consisted of two sections. Section one obtained demographical data from participants, which was used to describe the research sample, and compared with the level of knowledge. Section two consisted of questions measuring the knowledge of recovery room nurses regarding post-operative airway emergencies in adult patients. These questionnaires covered six airway emergency topics and four airway themes. Anonymous questionnaires were distributed to participants and all complete and incomplete questionnaires were returned to the researcher for data analysis. Descriptive statistics were used.

5.2.4 Main findings of the study

Demographic data

The overall response rate of recovery room nurses was 63.2%. Sixteen participants (66.7%) had basic nursing qualifications, whilst seven (29.1%) had additional qualifications. One participant (4.2%) did not answer this question.

Seventeen participants (70.8%) had < 7 years of recovery room nursing experience, six participants (25%) had ≥ 7 years, and one participant (4.2%) did not answer this question. Twenty-three participants (95.8%) were permanent staff members and only one participant (4.2%) was a part-time staff member.

Knowledge base

The overall mean score obtained by the 24 participants was 46.2% (SD 21.7%) which is 23.8% below the competency score of 70%. The range of scores attained by participants was 8-75% with only five participants (20.8%) achieving a score ≥ 70%.

The respective scores attained for the six airway emergencies were 50% (SD 32.1%) for soft tissue obstruction, 42.7% (SD 29.9%) for laryngospasm, 35.4% (SD 23.2%) for laryngeal oedema, 47.9% (SD 26.5%) for bronchospasm, 52.1% (SD 23.2%) for aspiration and 49.0% (SD 27.1%) for non-cardiogenic pulmonary oedema. Scores for questions on the airway themes were 64.6% (SD 38.2%) for anatomical/physiological changes, 24.3% (SD 23.6%) for clinical signs, 29.9% (SD 32.6%) for treatment and 66.0% (SD 27.6%) for general knowledge relating to the airway emergencies.

The number of years of recovery room experience and the level of qualification had no impact on the level of knowledge. The six participants with < 7 years of recovery room nursing experience attained a mean score of 57.6% with only four achieving score $\geq 70\%$, whereas 17 participants with ≥ 7 years of recovery room nursing experience achieved a mean score of 41.7% and only one of these participants attained a score $\geq 70\%$. The 16 participants with basic nursing qualifications attained a mean score of 44%, with only four participants achieving a score $\geq 70\%$, whilst the seven participants with further qualifications attained a mean score of 50% and only one of these participants achieved a score $\geq 70\%$. Since this was a secondary objective a sample size was not calculated to enable adequate power for further inferential statistical analysis.

When examining the level of knowledge of recovery room nurses in the public and private sectors, the results were similar. A study conducted in the private sector by Van Huyssteen and Botha (16) revealed a mean score of 43% (SD 20.8%) which was 27% below the competency score. This was similar to the mean score of 46.2% (SD 21.7%) attained in this study conducted in the public sector. In Van Huyssteen and Botha's study, only one participant attained a score $\geq 70\%$ versus the five who scored $\geq 70\%$ in this study conducted in the public sector.

5.3 Limitations

The results of this study need to be examined in light of certain limitations. This study was contextual, as the research was only conducted in selected Gauteng public hospitals. Its scope was thus restricted to a certain population which could limit the generalisation of the results. The sample size was not calculated to

ensure the secondary objectives were adequately powered; and the results should therefore be interpreted with caution.

Convenient sampling was used which may lead to over- or under-representation of knowledge levels in the study population.

All nursing staff on duty at the time of data collection were invited to participate. This included both registered and enrolled nurses. No distinction between the population groups were made in the questionnaire, thus the level of knowledge of each group could not be individually analysed. Differences in the groups level of knowledge may exist, which could not be distinguished.

Recovery room nurses were invited to participate in the study. These prospective participants knew the aim of the study. There was the possibility that some potential participants may have felt their lack of knowledge did not provide them with the confidence to complete the questionnaire and thus declined to participate. Therefore the actual average percentage of the study population might be even lower than that achieved in this study. This may also be a factor in the response rate, particularly for those nurses whose area of practice is operating room technique and not recovery room care, but who recover patients after hours. Furthermore, nurses who have been involved for a prolonged period of time in the operating room, assisting the surgeon or anaesthesiologist, may have been reluctant to dedicate the time necessary to complete the questionnaire and therefore declined.

Certain questions in the questionnaire were omitted by some participants. The omitted questions were mostly structured as one unique format. Despite efforts to improve clarity, with an example answered question provided as guidelines, it appears the format of this type of question may have been ambiguous or unclear. Alternatively, participants may have omitted these questions as they lacked the knowledge necessary to answer.

Although anonymity and confidentiality were assured, questions may have been omitted by participants who were fearful of the consequences if their lack of knowledge become evident.

The researcher was present during data collection to prevent contamination of the data. Despite this, participants may have discussed questions and answers together, and shared information.

5.4 Recommendations

5.4.1 Nursing education

Adequate and appropriate post-graduate education and training needs to be implemented for all nurses caring for patients in the recovery room. Regular in-service training programmes will be beneficial in orientating new recovery room staff, as well as refreshing knowledge of those already working in the unit. These should focus on critical aspects of recovery room care, including knowledge and skills necessary to recognise and manage post-operative airway emergencies. SASA is currently in the process of reviewing requirements for recovery room and anaesthetic nurses' accreditations. Results from this study could be used to guide the content of these courses thereby providing focus for teaching programs. It is advisable that SASA be made aware of the results of this study that the results may be considered.

Numerous short courses, with formal and informal content, currently exist; however these courses are not regulated. Examples of these informal courses are those run by academic departments at the University of Cape Town Anaesthesiology Department, University of Witwatersrand Anaesthesiology Department and Netcare Hospital group programs. No standardised programs or content for these courses is available. Currently there are no SANC accredited post-graduate courses for recovery room nurses. Set guidelines clearly defining requirements, knowledge and competency necessary for recovery room nurses needs to be established and regulated by the SANC and SASA, with the establishment of relevant, standardised and regulated courses. Post-graduate courses for recovery room nurses should include compulsory courses in advanced cardiac life support.

5.4.2 Nursing administration

Nursing staff employed in the recovery rooms need to be carefully considered and evaluated to ensure they have achieved the relevant qualifications, skill and expertise necessary.

5.4.3 Clinical practice

Considering the SASA guidelines (3) stating the nursing staff working in recovery rooms must be “appropriately trained and competent” (3), anaesthesiologists should be made aware of the level of knowledge of recovery room nurses, in whom patient care is entrusted. These guidelines stipulate that “a registered or enrolled nurse trained and competent in recovery room care must be present at all times”. Furthermore, they highlight that it is the institutions responsibility to ensure appointed staff in recovery rooms fulfil these requirements. According to the SASA guidelines, the anaesthesiologist remains accountable for patient care in the recovery room. (3) Without their knowledge of the competency of the nurses caring for patients during the recovery period, anaesthesiologists cannot safely and knowingly handover patient care to recovery room nurses.

Updated information and protocols, as well as current research findings of new technologies, need to be incorporated into teaching programs in the recovery room, on a continuous basis.

5.4.4 Further research

The following are suggested topics of research.

- Evaluate the effectiveness of the teaching programs by repeating this study after the implementation of in-service training.
- Extend the study to larger groups of recovery room nurses in different provinces to further quantify the level of knowledge. This will also enable further analysis of the level of knowledge compared with the level of qualifications.

- Ascertain, from recovery room nurses, the perception of their knowledge of post-operative airway emergencies in adults, compared with their actual level of knowledge. The perception is that they have adequate knowledge, when the study has shown it to be below acceptable levels.

5.5 Conclusion

Recovery room nurses working at CHBAH, CMJAH and HJH did not have the necessary knowledge and competency required to safely provide quality nursing care to post-operative patients. The majority of participants failed to achieve a set competency score, representing adequate knowledge. There was no statistical significance between level of knowledge and qualification or level of knowledge and years of recovery room experience. No difference was established in knowledge levels of recovery room nurses in the public versus private sectors.

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Appendix 1: Information Cover Letter for Questionnaires

Dear Colleague,

Hello, my name is Julia Wallis and I am a registrar in anaesthesiology and currently studying for my Master's Degree in Medicine at the University of the Witwatersrand. I am conducting a research study, and would like to invite you to participate.

The purpose of this study is to describe the level of knowledge of recovery room nurses regarding post-operative airway emergencies in adults. This study will hopefully contribute to clinical practice and education of recovery room nursing staff if necessary.

Should you agree to participate in my study, I will ask you to complete a written questionnaire. This should not take you longer than 25-30 minutes to complete. I will obtain permission from your theatre nursing manager for you to complete the questionnaire during "on duty" time, and I will bring you the questionnaire personally.

You will remain anonymous as the questionnaires will not ask for identifying information from you and will not be marked for identification in any way. Completed questionnaires will be placed in sealed unmarked envelopes which I will collect from you personally.

Confidentiality will be ensured as only my supervisors and I will have access to the completed questionnaires, and results of my study will be reported in general terms with no identifying information noted. Your participation in the study is voluntary. You may choose not to participate, or to withdraw from the study at any time with no repercussions. Results of the study will be made available to you, if you so wish.

I realise that you will not benefit directly from participation in this study. However, I hope the results from the study will help to clarify educational needs of nurses working in recovery rooms regarding post-operative airway emergencies. Once all the data has been collected, I will make the answers to the questions available to you.

This study has been approved by the Human Research Ethics Committee and the Post-graduate committee of the University of Witwatersrand and your healthcare institution.

Should you require more information, or wish to contact me regarding this study, please do not hesitate to call me on 082 389 7075 or the chairman of the Human Research Ethics Committee, Professor Cleaton-Jones on 011 717 1234.

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

Yours sincerely

Julia Wallis

Appendix 2: Questionnaire

The questionnaire contains 25 questions in three different formats, as shown in the examples below. Please read these examples carefully before completing the questionnaire.

Question format 1

Read each item below and **circle the letter** of the correct response(s). More than one response may be applicable.

1	Your level of qualification/experience in recovery room nursing is:	
	Intensive care experience	A
	Recovery room experience	B
	Diploma in Intensive Care Nursing	C
	Diploma in Theatre Technique	D
	Master's degree in critical care	E

Question format 2

Read each item and write the correct symbol from column A next to the applicable question number of column B. Each question number has only one correct answer.

	A Symbol/ Disorder	B System involved	Question Number	Give correct symbol from A
A	Diabetes Insipidus	Respiratory system	1	B
B	Asthma	Digestive system	2	D
C	Diabetes Mellitus	Neurological system	3	A
D	Crohn's Disease	Endocrinological system	4	C

Question format 3

With regards to each of the following questions, choose the correct combination of answers and mark with an X in the applicable box.

Which of the following statements are true with reference to Diabetes Mellitus?

- A. Patients experience breathing problems
- B. Fasting blood glucose levels exceed 6.2mmol/L
- C. Symptoms of increased urine output, increased fluid intake, fruity-smelling urine and general tiredness often occur
- D. Delayed wound healing

No	
1	A, B, C
2	B, C, D
3	A, C, D
4	A, B, C, D

POST-ANAESTHESIA CARE NURSES' KNOWLEDGE REGARDING POST-OPERATIVE AIRWAY EMERGENCIES IN ADULTS QUESTIONNAIRE

SECTION ONE – DEMOGRAPHICAL DATA

Read each item and circle the letter of the correct response(s). More than one response may be applicable.

1.	Your level of qualification:	
	Intensive care experience	A
	Recovery room experience	B
	Diploma in Intensive Care Nursing	C
	Diploma in Theatre Technique	D
	Master's degree in critical care	E
	Anaesthesia/Recovery room course	F

2.	As a staff member, you have been working in the recovery room for:	
	Less than one year	A
	One to two years	B
	Three to six years	C
	Seven to nine years	D
	Ten years or more	E

3.	As a staff member, you are:	
	A permanent staff member	A
	A part-time staff member	B
	An agency (or session) worker	C
	A student (Intensive care)	D
	A student (Theatre technique)	E

SECTION TWO – KNOWLEDGE BASE

Match the airway emergency in column II most accurately described in column I with the corresponding letter (A-F). Each question has only one correct answer.

№	I Description of anatomical and/or physiological disorder	ANSWER	II Airway emergency	
4	Passage of regurgitated gastric contents or other foreign material into the trachea and down to the smaller air units		A	Soft tissue obstruction
5	Characterised by spasmodic contractions of the bronchial tubes		B	Laryngeal oedema
6	Pharynx is blocked and air cannot flow in or out; tongue common cause		C	Laryngospasm
7	Increased total lung water, commonly caused by an upper airway obstruction		D	Bronchospasm
8	Swelling of the laryngeal tissue; extubation is common cause		E	Noncardiogenic pulmonary oedema
9	Reflex contractions of the pharyngeal muscles with spasms of the vocal cords		F	Aspiration

№	I Clinical sign	ANSWER	II Airway emergency	
10	Stridor, retractions, hoarseness and croup-like cough, restlessness		A	Soft tissue obstruction
11	Respiratory distress, tachypnoea, production of frothy sputum, rales and rhonchi sounds on auscultation, desaturation with hypercarbia		B	Laryngeal oedema
12	Tachypnoea and hypoxaemia, wheezing, coughing, dyspnoea, hypotension, apnoea and bradycardia		C	Laryngospasm
13	Dyspnoea, hypoxia, hypoventilation, absence of breath sounds, hypercarbia		D	Bronchospasm
14	Snoring, respiratory work load, tachycardia, decreased oxygen saturation level		E	Noncardiogenic pulmonary oedema
15	Wheezing, noisy shallow respirations, chest retractions, use of accessory muscles, dyspnoea, hypertension and tachycardia		F	Aspiration

№	I Clinical sign	ANSWER	II Airway emergency	
16	Removing any possible irritants or drugs; initialising of bronchodilators		A	Soft tissue obstruction
17	Hyperextension of head, positive pressure ventilation instituted with ambu bag, mask and oxygen; removal/reversal of stimulus		B	Laryngeal oedema
18	Placing patient in upright position, use of cool, humidified oxygen, inhalation of adrenaline-solution		C	Laryngospasm
19	Lowering of patient's head, if possible, positioning on side, CPAP and supplemental oxygen		D	Bronchospasm
20	Maintenance of an unobstructed airway and supplemental oxygen to correct hypoxaemia, CPAP or re-intubation and mechanical ventilation		E	Noncardiogenic pulmonary oedema
21	Wheezing, noisy shallow respirations, chest retractions, use of accessory muscles, dyspnoea, hypertension and tachycardia		F	Aspiration

With regards to the following questions (question 22-27), mark with an X in the applicable box.

Question 22

Which of the following statements are true with reference to soft tissue obstruction?

- A. Patients who undergo spinal anaesthesia are at high risk of soft tissue airway obstruction.
- B. The tongue can be relaxed due to general anaesthesia, narcotics and muscle relaxants administered during surgery, causing a post-operative soft tissue airway obstruction.
- C. Soft tissue airway obstruction never occurs in the recovery room.
- D. Patients displaying signs of soft tissue airway obstruction can be left unattended as it will resolve spontaneously.

No	
1	A & C
2	B
3	A, C & D
4	D

Question 23

Which of the following statements are true with reference to laryngeal oedema?

- A. Laryngeal oedema presents with slow quiet breathing, good chest movement and air entry, a calm and comfortable patient who saturates well on room air.
- B. The usual onset of presentation is delayed – over 24 hours post-operative and thus is never seen in the recovery room.
- C. Patients with laryngeal oedema should be given adrenaline intravenously (IV), and steroids nebulisation routinely.
- D. Patients with laryngeal oedema should be given steroids intravenously (IV), and adrenaline nebulisation routinely.

No	
1	A, B & C
2	C
3	D & B
4	D

Question 24

Which of the following statements are true with reference to laryngospasm?

- A. Common risk factors for the development of laryngospasm include secretions, vomitus or bleeding in the airway, upper respiratory tract infection, and airway manipulation under "light anaesthesia".
- B. Children never develop laryngospasm.
- C. The most appropriate management for laryngospasm is to immediately paralyse the patient and re-intubate them as soon as possible.
- D. Recognition and diagnosis of laryngospasm is only possible once the patient is cyanosed (blue).

No	
1	C
2	A
3	B & D
4	B, C & D

Question 25

Which of the following statements are true with reference to bronchospasm?

- A. Bronchospasm only occurs in asthmatic patients.
- B. Bronchospasm can be triggered by certain drugs such as morphine, as well as allergic reactions.
- C. Patients with bronchospasm will be breathing slowly and quietly, talking calmly in full-sentences.
- D. Management of bronchospasm includes nebulisation.

No	
1	A
2	B & D
3	B
4	A, C & D

Question 26

Which of the following statements are true with reference to noncardiogenic pulmonary oedema?

- A. Non-cardiogenic pulmonary oedema requires oxygen therapy with or without ventilatory support and treatment directed at the cause.
- B. Patients in pulmonary oedema present with shortness of breath with laboured breathing, hypoxia and hypoxaemia.
- C. Non-cardiogenic pulmonary oedema is always mild and self limiting.
- D. A patient in pulmonary oedema will always have a “silent chest” on auscultation.

No	
1	C
2	B & D
3	A & B
4	D

Question 27

Which of the following statements are true with reference to aspiration?

- A. Aspiration of foreign material can occur in the operating theatre, recovery room or during transfer from the operating theatre to recovery room.
- B. To prevent aspiration in a patient who is actively vomiting, lie them flat on their back (supine) with an oxygen mask on their face.
- C. Patients at highest risk for aspiration are starved patients who undergo neuraxial (i.e. spinal/epidural) procedures only.
- D. Aspiration pneumonia will develop only if a patient is vomiting blood.

No	
1	A
2	B & D
3	D & C
4	B

Appendix 3: Ethics Approval



HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130302

NAME: Dr Julia Wallis et al
(Principal Investigator)

DEPARTMENT: Department of Anaesthesiology
Chris Hani Baragwanath Academic Hospital

PROJECT TITLE: Knowledge of postoperative airway
emergencies in recovery room nurses in
selected public hospitals

DATE CONSIDERED: 05/04/2013

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Dr Helen Perrie

APPROVED BY:

Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 05/03/2014

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

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. I agree to submit

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 4: Post-graduate Committee Approval



Faculty of Health Sciences
Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172040

Reference: Ms Thokozile Nhlapo
E-mail: thokozile.nhlapo@wits.ac.za

14 February 2014
Person No: 778466
PAG

Dr J Wallis
Flat A4 St Johns Wood
15 - 2nd Street
Killarney
219
South Africa

Dear Dr Wallis

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *Knowledge of postoperative airway emergencies in recovery room nurses in selected hospitals* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Sandra Benn'.

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 5: Letters of permission from CHBAH, CMJAH and HJH



CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

IN THE OFFICE OF THE CEO

Enquiries: Ms. Thabile Ndlovu

Tel : (011) 933- 9145

Fax: (011) 938-1005

Email: Thabile.Ndlovu2@gauteng.gov.za

To : Dr. Julia Wallis
(M1130302)

From : Dr. Sandile Mfenyana
CEO: CHBA hospital

Date : 18 July 2014

Re : Knowledge of Postoperative Airway emergencies in Recovery Room Nurse in Selected Public Hospitals

Your application to request permission to conduct the knowledge Of Postoperative Airway Emergencies in Recovery Room Nurses in Selected Public Hospitals at Chris Hani Baragwanath Academic Hospital is approved by the CEO: Dr. Sandile Mfenyana

Hoping that the Institution (CHBAH) will meet the requirements of the study concerned.

Wishing you well in your future endeavors

Regards,

DR. SCB Mfenyana 2014.07.18
CEO: CHBA Hospital



GAUTENG PROVINCE

HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Ms. G. Ngwenya
Office of the Nursing Director
Tel: (011) 488-4558
Fax: (011) 488-3786
10th June 2014

Dr. Julia Wallis
Department of Anaesthesiology
University of Witwatersrand

Dear Dr. Julia Wallis

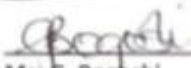
RE: "Knowledge of postoperative airway emergencies in recovery room nurses in selected public hospitals"

Please note that permission to conduct the above mentioned study is provisional approved. Your study can only commence once ethics approval is obtained. Please forward a copy of your ethics clearance certificate as soon as the study is approved by the ethics committee for the CEO's office to give you the final approval to conduct the study.

Supported / not supported


Ms. M.M Pule
Nursing Director
DATE: 10/06/2014

Approved / not approved


Ms. G. Bogoshi
Chief Executive Officer
DATE: 11/6/2014





health and
social development
Department: Health and Social Development
GAUTENG PROVINCE

PERMISION FOR RESEARCH

DATE: 27/5/2014

NAME OF RESEARCH WORKER: DR JULIA WALLIS

CONTACT DETAILS OF RESEARCH (INCLUDE ALTERNATE RESEARCHER):

082 389 7075

julzwally@gmail.com

TITLE OF RESEARCH PROJECT Knowledge of post operative airway emergencies in recovery room nurses in selected public hospitals

OBJECTIVES OF STUDY (Briefly or include a protocol): Describe level of knowledge of post operative airway emergencies and management in recovery room nurses and correlate this knowledge with years of nursing experience and years of recovery room nursing experience

METHODOLOGY (Briefly or include a protocol): Self administered questionnaires that are anonymous

THE APPROVAL BY THE SUPERINTENDENT IS STRICTLY ON THE BASIS OF THE FOLLOWING:

- (i) CONFIDENTIALITY OF PATIENTS MAINTAINED: Yes
- (ii) NO COSTS TO THE HOSPITAL: No costs
- (iii) APPROVAL OF HEAD OF DEPARTMENT: Yes
- (iv) APPROVAL BY ETHICS COMMITTEE OF UNIVERSITY: Yes

SUPERINTENDENT PERMISSION

Signature: [Signature] Date: 28/5/2014

SUBJECT TO ANY RESTRICTIONS: Financial Impact on hospital

Helen Joseph Hospital
Perth Road
Tel: 011 489 1011

Private Bag X47
Auckland Park
2006