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Ngwenya, Makhosazana Busisiwe

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Anaesthetic nurses knowledge of commonly used drugs in four academic hospitals

Makhosazana Busisiwe Ngwenya

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Medicine in Anaesthesiology.

Johannesburg, 2016

Declaration

I, MakhosazanaBusisiwe Ngwenya declare that this research report is my own work. It is submitted for admission to the degree of Master of Medicine in Anaesthesiology in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree at this or any other University.

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Signed on this19thday of February, 2016 at Johanneburg

Abstract

Lack of pharmacology knowledge among nurses can result in adverse events and medical errors which can have serious consequences for the patient. The South African Society of Anaesthesiologists (SASA) states that a trained anaesthetic assistant is necessary for the safe and efficient conduct of anaesthesia. Literature worldwide have shown that pharmacology knowledge of nurses is lacking. Knowledge of anaesthetic drugs used in theatre by anaesthetic nurses in the four academic hospitals affiliated to the University of the Witwatersrand is not known.

The aim was of this study was to describe the knowledge of anaesthetic nurses working in four public academic hospitals in Johannesburg regarding selected drugs commonly administered during anaesthesia. The primary objectives of the study were to describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia and to describe the sources used by nurses to obtain knowledge of drugs. The secondary objectives were to correlate the level of knowledge with years of nursing experience and to compare the level of knowledge with the nurse's qualification.

The study was descriptive, prospective and contextual.Thirty-six nurses took part in the study. A self administred questionnaire, with a demographic and knowledge section, was used to collect data. It was found that anaesthetic nurses had inadequate knowledge as only 36% of the participants passed, achieving a score of ≥ 80%.The most common source of knowledge was obtained from clinical experience.A weak negative correlation was found between the level of knowledge and years of anaesthetic experience (r=-0.1850). There was no statistical significance between level of knowledge and nursing qualification (p=0.999).

It is of importance to note that the questionnaire was simple and practical, and if a more standardised questionnaire was used then an even lower pass rate would have been obtained. The study revealed that anaesthetic nurses lack adequate knowledge and are essentially functioning outside their scope of practice. The study highlights the need for an intervention to improve pharmacology knowledge of anaesthetic nurses in the Department of Anaesthesiology.

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Chapter 1: Overview of the study

1.1Introduction

In this chapter a background of the study, problem statement, aims and objectives, research assumptions, demarcation of study field, ethical considerations and research methodologyare discussed. The significance of the study, outline of the study and a summary are presented.

1.2 Background.

An anaesthesiologist working with an assistant such as an anaesthetic nurse experiences less mortality and morbidity than if the anaesthesiologist were to work alone(1).Three main categories of anaesthetic assistants have been described in the literature: the nurse anaesthetist, the anaesthetic nurse and the anaesthetic technicians. This study focused on the anaesthetic nurse.

International practice guidelines e.g. World Federation of Societies of Anaesthesiologists (WFSA), Association of Anaesthetists of Great Britain and Ireland (AAGBI), Australian and New Zealand College of Anaesthetists (ANZCA) and the Canadian Society of Anaesthesiologists (CAS) agree to the need for a trained and competent anaesthetic assistant. Some of the guidelines specify the anaesthetic assistant training requirements(2-5).

The South African Society of Anaesthesiologists (SASA) (6)guidelines state that “it is essential for the safe and efficient conduct of anaesthesia that a suitably trained and competent registered or enrolled nurse or anaesthetic technician be available to assist the anaesthesiologist”. The South African Theatre Nurses (SATS) (7) position statement also maintains that an anaesthetic nurse, either registered or enrolled, must be present during invasive surgical procedures. However, neither of these two societies explains what is meant by “suitably trained or competent”.

No international or national research determining anaesthetic nurses' knowledge of medication could be identified. However various studies (8-18) highlight deficient knowledge with regard to medication of nurses working in various disciplines, and this may also apply to anaesthetic nurses.

A study by Ndosi et al (8), in 2008 in the United Kingdom, concluded that nurses had inadequate knowledge of medication. In this study, only 25% of nurses had adequate knowledge regarding specific drugs. Regarding drug interactions and their mechanism of action, knowledge among nurseswas found to be poor. They also found that more experienced nurses had better knowledge.

Simonsen et al (9), in Norway, evaluated nurses' medication knowledge and the risk of drug errors. Their knowledge in drug management was considered low as only one out of four participants (25%) achieved a score above the lowest acceptable score. The authors concluded that poor knowledge of medication was a significant risk for medication errors.

A study by Kaborg(10),in Sweden, assessed nurses' ability to calculate medication doses. The results of the study highlighted that inappropriate dosages of medications were administeredby the nurses to the patients. The author emphasised that nurses' education did not prepare the majority of student nurses to perform medication dose calculations accurately.

Safe administration of medication by nurses depends not only on knowledge and skill with regards to the calculation of dosage, but also on an in-depth knowledge of pharmacology in order to examine the appropriateness of the medication prescribed and administered (10). Anaesthetic medication given during general anaesthesia and regional anaesthesia may have a host of side effects which can be associated with mortality and morbidity. Even though the anaesthetist is always present during the administration of a drug, the anaesthetic nurse should be able to anticipate any errors or adverse events.

In South Africa the anaesthetic nurse's practice is regulated by Regulation 2598: The Scope of Practice of Persons who are Registered or EnrolledNurse under the Nursing Act.

1.3 Problem statement

The safety of an anaesthetic has been shown to be improved when a trained assistant is present (6, 7). Both SASA and SATS state that a suitably trained and competent assistant for the anaesthetist is essential for the safe conduct of anaesthesia, and that this assistant be either a registered or enrolled nurse, or anaesthetic technician.

The anaesthetist and the anaesthetic nurse work as a team to provide safe anaesthesia to patients.The anaesthetist is also involved in the informal training of anaesthetic nurses. It is therefore essential for the anaesthetist to understand the level of knowledge of anaesthetic nurses e.g. their knowledge of commonly used drugs during anaesthesia. However, currently in the Department of Anaesthesiology at the University Witwatersrand (Wits) the anaesthetic nurses' knowledge of commonly used anaesthetic drugs is not known.

1.4 Aim and objectives

1.4.1 Aim

The aim of this study was to describe the knowledge of anaesthetic nursesworking in fourpublic academic hospitals in Johannesburg regarding selected drugs commonly administered during anaesthesia.

1.4.2Objectives

The primary objectives of this study were to:

- describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia
- describe the sources used by nurses to obtain knowledge of drugs.

The secondary objectives were to:

- correlate the level of knowledge with years of anaesthetic nursing experience
- compare the level of knowledge with the nurse's qualification.

1.5 Research assumptions

The following definitions were used in this study.

Anaesthetic nurse: a registered or enrolled nurse who assists the anaesthetist during anaesthesia (6).This nurse may not be a dedicated anaesthetic nurse but may have other duties in theatre e.g. a scrub nurse.

Anaesthetic technician: a person who assists the anaesthetist, but usually does not have medical experience (19).

Registered nurse: “is a person who is qualified and competent to independently practice comprehensive nursing in the manner and to the level prescribed and who is capable of assuming responsibility and accountability for such practice” (20).In this study any nurse with a three or four year nursing diploma or degree in nursing will be referred to as a registered nurse.

Enrolled nurse: also referred to as a staff nurse, “is a person educated to practice basic nursing in the manner and to the level prescribed”(20). In this study the term staff nurse will be used.

Anaesthetist:will include any medical officers, registrars, and anaesthesiologists who administers an anaesthetic.

Adequate knowledge: in this study a score of 80% and greater is regarded as adequate knowledge. This score is often used in knowledge studies(8, 13, 15, 18).

1.6 Demarcation of study field

This study was conducted in the theatres at four public academic hospitals in Johannesburg that are affiliated to the Department of Anaesthesiology at Wits.The hospitals are as follows:

Chris Hani Baragwanath Academic Hospital which is a central hospital comprising of 2888 beds, 25 theatres and on average 65000 cases are done annually.

Charlotte Maxeke Johannesburg Academic Hospital is also a central hospital which has 1200 beds, 25 theatres and on average 23000 cases is done annually.

Helen Joseph Hospital is a regional hospital with 500 beds, seven theatres and they do 6000 cases annually.

Rahima Moosa Mother and Child Hospital is a regional hospital with 338 beds, five theatres and they do 6600 cases annually.

1.7 Ethical considerations

Permission to conduct this study was received from the relevant authorities.

The study was conducted according to the ethical principles for medical research involving humans as outlined in the Declaration of Helsinki(21), and the South African Good Clinical Practice Guidelines(22).

1.8 Research methodology

1.8.1 Research design

A descriptive, prospective, contextual study design was used in this study.

1.8.2 Study population

All nurses assisting the anaesthetist with the administration of anaesthesia in the selected public academic hospitals.

1.8.3 Study sample

Sample statement and size

The sample size of 36 anaesthetic nurses was obtained in consultation with a biostatistician.

Sample method

A convenient sampling method was used.

Inclusion and exclusion criteria

The inclusion criteria were:

- all nurses who assisted the anaesthetist with the administration of the anaesthetic
- those who agreed to take part in the study.

The exclusion criteria were:

- those on leave or sick at the time of data collection
- blank questionnaires.

1.8.4 Data collection

Procedure

A questionnaire which was self administered comprising a demographic section and a knowledge section was used to collect data. The knowledge section had questions pertaining to each specific drug.

The questionnaire was distributed to the nurses in an envelope by the researcher. In an attempt to prevent data contamination the researcher tried to be present during completion of the questionnaire. However, it was not always possible as the anaesthetic nurse was sometimes busy at those times and the researcher had to return at a later stage.

1.8.5 Data analysis

Data was captured on aMicrosoft Office Excel®sheet,and analysed in consulation with a biostatistian using Statistica version 12. Descriptive and inferential statistics were used.

1.9 Significance of study

The safety of an anaesthetic has been shown to be improved when a trained assistant is present (6, 7). Both SASA and SATS say that a suitably trained and competent assistant for the anaesthetist is essential for the safe conduct of anaesthesia, and that this assistant be either a registered or enrolled nurse.

The anaesthetic nurses' knowledge of commonly used drugs is not known. Studies have shown that the knowledge of South African nurses in general is lacking (23). Should the anaesthetic nurses' knowledge regarding commonly used drugsbe found to be lacking, appropriate training programmes can be put into place. Appropriate training programmes may ensure that the anaesthetic nurse is more knowledgeable and thus improve patient safety.

1.10 Validity and reliability

Measures were taken to ensure the validity and reliability of this study. A detailed discussion will follow in Chapter 3.

1.11 Overview of the study

The chapters in this study include:

Chapter 1: Overview of the study

Chapter 2: Literature review

Chapter 3: Research methodology

Chapter 4: Results and discussion

Chapter 5: Studysummary, limitations, recommendations and conclusion.

1.12 Summary

An overview of the study was presented in this chapter. In the next chapter the literature review relevant to this study is discussed.

Chapter 2: Literature review

2.1Introduction

This chapter presents the categories of the anaesthetic assistants, the various societies position statements with regard to anaesthetic assistants and the training of anaesthetic nurses both internationally and locally. It describes the pharmacology of five commonly utilised drugs in theatre, and the literature regardingnursesknowledge of pharmacology.

2.2 Categories of anaesthetic assistants

There are three main categories of anaesthetic assistants that have been described in the literature: the nurse anaesthetist, the anaesthetic nurse and the anaesthetic technicians.

In the United States of America the nurse anaesthetist may provide anaesthesia to patients independently, or they may have some degree of supervision by a physician anaesthetist. This practice of anaesthesia by the nurse anaesthetist allows the physician anaesthetist to be able to manage many patients simultaneously (1).

Registered nurses or enrolled nurses who assist the anaesthetist in the provision of anaesthesia are known as anaesthetic nurses. They do not make independent decision regarding what type of anaesthetic will be provided and they also do not administer the anaesthetic independently (1, 2).

The anaesthetic technicians role is to manage and maintain the equipment used during anaesthesia. They are not directly involved in the administration of anaesthesia. They do not have any medical or nursing experience, however they are specifically trained to be anaesthetic assistants (1).

Although some of the discussion pertains to the anaesthetic assistant, the primary focus of this literature review will be on the general nurses' knowledge of pharmacology.

2.3 Professional societies position statements with regard to anaesthetic assistants

Some countries have their own guidelines and requirements for the anaesthetic assistant as noted by the individual country's professional society practice guidelines. International variations are governed by the health requirements and the terms of legislation of the country (5).

WFSA does not have a guideline in its own position statement regarding the anaesthetic assistant. WFSA utilises the standards drawn up by the International Task Force on Anaesthesia Safety which states that the anaesthetist must always have a trained assistant present (5).

The ASA (24)guidelines mainly focus on the anaesthesia care team, this comprises the nurse anaesthetist and not the anaesthetic nurse. They do not have the anaesthetic nurse at all, although the care team involves an anaesthetic technician

The CAS supports the role of anaesthetic assistants to administer technical support to enhance the efficiency of a safe anaesthesia. Individuals working as anaesthetic assistants are professionals e.g. registered nurseswho work under the direct supervision of an anaesthesiologist. Theirduties include "administration of prescribed pharmacological agents to the patient under the direct supervision of the attending anaesthesiologist, observing for side effects and efficacy of treatment during anaesthesia to ensure the patient responds appropriately"(2).

The AAGBI(19) guideline states that a suitably trained and proficient anaesthetic assistant is essential to assist the anaesthetist during the administration of an anaesthetic. An anaesthetic assistant is a registered professional nurse with additional training or an operating department practitioner (technician). Additionally the guidelines state that a third person should be available incase any unforeseen circumstances arise. The guidelines do not specifically mention if this third person should be a nurse or doctor.

The World Health Organisation (WHO) European Strategy for Continuing Education for Nurses and Midwives (25) guidelines state that the anaesthetist must be assisted by an anaesthetic nurse who has a specialist postgraduate anaesthetic nursing qualification. The anaesthetic nurse must have a well developed knowledge base and specialist skills during the three phases of anaesthesia, namely induction, maintenance, and reversal. However they recognise that this role is rather limiting, and theyhave therefore extended the role of the anaestheticnursetoinclude assisting the theatre nurses in preparing for surgery, and in the recovering of the patient.

ANZCA(3) guidelines statethat the “presence of a trained assistant for the anaesthetist during the conduct of anaesthesia is a major contributory factor to safe patient management”. The anaesthetic assistant is either a registered or an enrolled nurse, who has completed one or two years of full time employment. Depending on their qualification, this includes studying and working as trainee anaesthetic assistants in order to qualify as an anaesthetic nurse. The anaesthetic technician can also serve as an anaesthetic assistant and needs to complete three years of full time employment including studying and working as a trainee assistant, as they do not have previous medical experience.

SASA(6) guidelines mention that “it is essential for the safe and efficient conduct of anaesthesia that a suitably trained and competent registered or enrolled nurse or anaesthetic technician be available to assist the anaesthesiologist”. The SASA guidelines are in line with SATS(7) position statement. This mentions that an anaesthetic nurse, either registered or enrolled, be present during invasive surgical procedures. SATS discourages the deployment of unlicensed personnel in the theatre.

2.4 Training of anaesthetic nurses

Major advances in surgery and anaesthesia with regards to techniques and technology have made it possible to assist patients that would have previously died from serious illnesses or injuries. Monitoring equipment and ventilator support

have vastly improved in the field of anaesthetics. A well trained assistant for the anaesthetist is an important factor for safe patient management during anaesthesia. It is essential that they have the appropriate expertise in their field in order to provide support to the anaesthetist (26).The European, United Kingdom, Australian and New Zealand and South African training programmes will be discussed.

2.4.1 International training of anaesthetic nurses

The WHO European Strategy for Continuing Education for Nurses(25) and Midwives states that nurses have to successfully complete the specialist post-qualification education in anaesthetic nursing. This will supplement the initial generalist nursing education. This training will equip them with the ability and special skills necessary to meet the specific needs of patients undergoing surgery and anaesthesia. Before being admitted into the training programme, candidates need two years of clinical experience post qualifying as a nurse. The curriculum should ideally be completed on a full time basis. It comprises six theory and practice modules which take 40 weeks, each week being 30 hours in durationThe course is continuously being reviewed by an external audit to ensure that the quality and protocols are up to standard.

Before practicing asanaesthetic nurses the AAGBI (19) requires additional training from registered professional nurses. From 2002 the universities offer postgraduate modular theatre courses, most comprise three core and three optional modules which include anaesthesia. There are no standard competencies as the courses vary in length and content. The AAGBI insists upon nationally developed standards for the anaesthetic nurse. The universities maintain a high standard as there is some national guidance required for these programmes(19).

ANZCA(3) stipulates that before enrolling in the anaesthetic assistant training course a registered or enrolled nurse needs to be currently employed or recently employed in clinical practice. The anaesthetic training course is one year long for the registered nurse and two years long for the enrolled nurse. Reputable and reliable institutions are recommended for the implementation of this training

course. The anaesthetist's input is essential in the curriculum augmentation, preparation and delivery of lectures, as well as the management and evaluation of the trainees. The courses can be taken on a full-time or part-time basis, or a combination of both. In some cases it may include a distant learning programme. In order to complete the training programme 150 hours of lectures are required. A log book is mandatory to record any supervised practical experiences. Trainees need to satisfactorily complete assignments and internal assessments, in addition they need to show proficiency and successfully pass certain examinations (3).

2.4.2 South African training of anaesthetic nurses

The SASA practice guidelines (6) state that the anaesthetic nurse must be a "suitably trained and competent registered or enrolled nurse". There is currently no clarity on what constitutes a "suitably trained and competent" anaesthetic nurse.

SATS (7) does not specifically mention the anaesthetic nurse training in its position statement. It however states that peri-operative professional nurses should continuously update and upgrade their skills and knowledge. In addition it recognises that the skills must be provided by a reputable institution accredited by the South African Nursing Council (SANC).

SANC is theentrusted, statutory body that is in charge of the training of nurses in South Africa. Presently there is no anaesthetic nurse training course approved by SANC. The training of the anaesthetic nurse forms part of a postgraduate master degree or diploma in Operating Theatre Nursing Science (27). The curriculum for basic nurse training requires that anaesthetic nursing at both a theoretical and practical level be addressed, however this can vary between institutions.

It is stipulated that in order to achieve a postgraduate diploma in Operating Theatre Nursing Science, a registered nurse must complete a two year course under Medical and Surgical Nursing Science. The first year has a general focus,and it is done together with nurses from other specialities such as ICU. The second year is more focused and comprises the Operating Theatre Nursing Sciences and is inclusive of anaesthetic nurse training (27).The masters

programme can be by course work, that follows a similar outline as the post graduate diploma, or by research only. There is no SANC accredited postgraduate anaesthetic training for staff nurses.

Some private hospitals offer anaesthetic nursing courses within the hospital, as “in house” programmes. The courses are approximately six months long and different courses are offered for registered and enrolled nurses. It is also common practice for the anaesthesiologist to do “on the job” training of anaesthetic nurses. These courses are not certified by the SANC nor are they standardised, and thus are not formally recognised(28).

The competence and the lack of a nationally accredited training program is currently a major concern for SASA. They are investigating the possibility of developing a national training program for anaesthetic and recovery room nurses, and are actively starting to engage with SANC in this regard (28).

2.5 Regulation 2598: Scope of Practice of Registered and Enrolled Nurses

In South Africa the anaesthetic nurse’s practice is regulated by Regulation 2598: The Scope of Practice of Persons who are Registered or Enrolled under the Nursing Act, 2005 (Act No 33 of 2005)(20). With regard to medication the regulation states that a registered nurse is accountable for:

- “ (b) The execution of a programme of treatment or medication prescribed by a registered person for a patient;
- (c) The treatment and care of and the administration of medicine to a patient, including the monitoring of the patient's vital signs and of his reaction to disease conditions, trauma, stress, anxiety, medication and treatment” (20).

Scribante et al (23) interpreting the Scope of Practice for critical care nurses highlight that nurses should have an in-depth knowledge of the medicine that is

prescribed to a patient, how this medication is going to act in different patient groups, the indications, interactions and complications that might occur “if the registered person who prescribes the treatment or medication makes a mistake, and the CCN [critical care nurse] who executes the treatment or gives the prescribed medication does so without questioning the prescription, she and the registered person are both accountable for the wrong action.” This is also true for the registered anaesthetic nurse.

For the enrolled nurse the regulation states:

- “(b) caring for a patient, and executing a nursing care plan for a patient, including the monitoring and the observation of reactions to medication and treatment” (20)

“In principle this should state that the scope of practice of an enrolled nurses practice encompasses certain registered midwifeacts and procedures which have been planned and initiated by a registered nurse or and which arecarried out under her director indirect supervision as part of the nursing regimen. This would make it clear that the enrolled nurse may not carry out professional functions. It is important that registered nurses and registered midwives understand this, for they have to teach and prepare the enrolled nurse for her role and functions; prepare a nursing regimen (including nursing care plans); decide whether an enrolled nurse is functioning beyond her scope of practice supervise this practice; take responsibility for the delegated duties and be accountable for the fact that they allow enrolled nurses to act beyond their scope of practice, for allocating them functions beyond their knowledge and skill and for inadequate supervision” The anaesthetist and the registered nurse must understand the role and functions of an enrolled nurse and decide whether an enrolled nurse is functioning beyond her scope of practice and supervise this practice(29).

2.6Commonly used drugs

A brief discussion of commonly described anaesthetic drugs that is the focus of this study.

2.6.1. Suxamethonium chloride.

Suxamethonium chloride is a peripherally acting muscle relaxant and each 2 ml ampoule contains 100mg suxamethonium chloride. The usual dose is 1.5 mg/kg, usually a maximum of 150mg, the dosage is given as a direct intravenous bolus(30). It is a depolarizing neuromuscular blocking agent. Its initial effect is to depolarize the membrane in the same manner as acetylcholine, but for a longer period, which results in a brief period of firing manifested by muscular fasciculation's. The phase is followed by neuromuscular paralysis. (30)

Its main use is to obtain relaxation of the abdominal wall during surgery. Additionally it is used to facilitate laryngoscopy at intubation, oesophagoscopy in combination with general anaesthesia. It should be stored in the refrigerator(30)

It is contraindicated in patients:

- who have suffered burn injuries,
- those who exhibit myotonia and muscular rigidity,
- It is contraindicated in hyperkalaemia,
- who have atypical pseudocholinesterase,
- with penetrating wounds of the eye,
- who have had massive trauma. (30)

Suxamethonium chloride causes apnoea,which may be unusually prolonged in patients with atypical pseudocholinesterase and it may cause braycardias, and should be used with caution in cardiac patients (30).

2.6.2 Propofol.

Propofol is a sedative-hypnotic agent that is given intravenously for use in the induction and maintenance of anaesthesia or sedation. It is a milky white fluid, and as it contains no preservatives, an opened vial should be used within six hours.It comes in varying strengths, but the most common form is in 10 mg/ml concentration in a 20 ml vial. When used as an induction agent, 2-2.5 mg/kg is given as an intravenous dose(30).

It is not to be used in patients with allergies to eggs, egg products, soy bean or soy products. It should only be used by individuals trained in the administration of a general anaesthetic. Apnoea requiring ventilator support and hypotension also occurs during induction and maintenance of anaesthesia. In ICU patients, when used for sedation it has been associated with propofol infusion syndrome(30).

Drug Interactions

In patients who have received an intra-muscular or intravenous premedication especially a narcotic or sedative the induction dose of propofol may be reduced. These agents may increase the anaesthetic or sedative effects of propofol(30).

2.6.3. Adrenaline

Adrenaline is a sympathemimetic agent, it is a potent stimulator of both alpha and beta adrenergic receptors. A 1 ml ampoule contains 1mg of adrenaline (1:1000).Adrenaline is used for its sympathemimetic properties such as relief of bronchial spasm, acute allergy and for cardiovascular resuscitation (30).

Caution should be exercised in patients with cardiovascular disease such as ischaemic heart disease, hypertension, arteriosclerosis and aneurysm. Patients receiving monoamine oxidase inhibitors should not receive adrenaline. Central adverse effects include anxiety, restlessness, and confusion. Cardiac effects include palpitations, cardiac arrest, and a rapid pulse. Weakness and coldness of extremities is a known side effect and gangrene may follow infiltration into fingers and toes.

The following doses are important as they pertain to emergency situations:

- Bronchial spasm, give 0.1-0.5ml subcutaneously.
- For acute allergy, give 0.2-0.5ml subcutaneously or intramuscularly.
- In cardiovascular resuscitation 0.5-1mg(30).

2.6.4. Atropine

Atropine sulphate is a parasympatholytic agent with peripheral and central actions. It’s mechanism of action is by inhibiting the muscarinic actions of acetylcholine on

structures innervated by postganglionic cholinergic nerves and on smooth muscle. It is important to note that atropine comes as 0.5mg or 1mg in a 1 ml ampoule.

Atropine is used in many conditions for its parasympatholytic effects. It is used for bradycardia,to blunt the increased vagal tone caused by abdominal wall traction or by the ocular muscle. It is also as an antisialogogue. Atropine is also used for alleviation of the muscarinic side effects of anticholinesterase drugs used for the reversal of neuromuscular blockade.

It should not be used in patients closed angle glaucoma. Caution should be exercised in patients with prostatic enlargement or cardiac failure. Atropine is not to be used in patients with paralytic ileus(30).

Some of its side effects included dryness of mouth, thirst, dilation of pupils, tachycardia, constipation, and vomiting. Hypersensitivity reactions can result in conjunctivitis or skin rash

2.6.5 Rocuronium bromide

Rocuronium bromide is a nondepolarizing neuromuscular blocking agent with a fast to intermediate onset depending on the initial dose given. It acts by competing for cholinergic receptors at the motor end plate. This action is antagonized by acetycholinesterase inhibitors. It comes in a 5 ml vial ampoule which contains 50 mg of rocuronium. Rocuronium bromide is only administered as an intravenous dose. When it is used in tracheal intubation the dose is 0.6-1.2mg/kg, its other use is to provide relaxation of skeletal muscle during surgery(30).

It is not to be used in patients who have a hypersensitivity to rocuronium bromide or other neuromuscular blocking agents. It causes pure muscle paralysis with no effect on consciousness, therefore it should be used with adequate anashesia. Severe anaphylactic reactions can occur with rocuronium bromide. In patients with liver failure care should be taken as the drug depends on biliary excretion(30).

2.7 Studies of nurses' knowledge of drugs

Studies have been done to assess the pharmacology knowledge of nurses in general, these will be discussed below. No studies could be identified which looked specifically at the drug knowledge of the anaesthetic nurse. Studies assessing nurses' drug knowledge in South Africa also could not be identified. In the literature the is evidence that suggests nurses who are in charge of drug administration do not always have adequate knowledge to fulfil the duties of managing medication(8, 13, 15).

A study done by Boggs et al(13) assessed nurses' knowledge regarding three commonly used drugs. A secondary purpose was to determine if there were differences in specific drug knowledge amongst the nurses, and lastly to determine whether a relationship existed between knowledge and educational or experiential background. The nurses were given a 36 item multiple-choice examination, and the questions covered six different categories of pharmacology information such as clinical indication, side effects, drug interaction, mechanism of action dosage range, and pharmacokinetic parameters. The three drugs selected were Digoxin, Cephalexin and Meperidine. When the data was analysed a mean score of 46% was achieved. Based on a standard academic pass score of 70%, exam performance indicated an inadequate level of knowledge among nurses.

Further analysis of the data indicated a higher overall score on the examination when educational background was taken into account. When looking at the mechanism of action and clinical indication of the drug question between nurses who held a masters or baccalaureate and those who were licensed practical nurses p values of 0.0001 and 0.0047 respectively were obtained. A p-score of 0.004 overall was achieved which was statistically significant.The results revealed that with an increase in educational level drug knowledge tends to be higher. No significant differences were found between nurses with differing levels of experience in administering medication, as noted by years of nursing experience. Nurses in administration and management scored higher than nurses who were in positions that included administration of the medication regularly.(13)

Knowledge levels were highest 57.4% for clinical indication for a drug. A declining level of knowledge occurred for side effects, dosages, mechanism of action and pharmacokinetics with scores of 56.6%, 49.8%, 44.9%,and 34.4% respectively. Knowing how a particular drug exerts its effect, combined with an understanding of pathophysiology would enable the nurse to know when potential problems may arise from use of the drug (13).

A study by Ndosi et al(8) conducted in the United Kingdom specifically looked at nurses' knowledge of pharmacology of drugs they commonly administer. A secondary objective of this study was to determine if their pharmacology knowledge was related to their experience or educational background. Medication administration is an important aspect of nursing. To administer a drug is defined as the introduction of medicine either by external contact (by injection or orally) or by direct contact. The study method used was a non-experimental causal comparative and correlational design. The population comprised registered nurses and enrolled nurses selected from the surgical wards. They identified common drugs which are dispensed to the surgical wards, the four most common drugs where Lansoprazole, Codeine Phosphate, Diclofenac and Dalterparin. Requirements of nurses for the administration of medicines according to the Guidance for Administration of Medicines is, "nurses are expected to know the indications of use, normal dosage, side effects, precautions and contra-indications, method of administration, route and timing of the administration".

A questionnaire was distributed to the nurse's, it comprised questions which looked at nurses sources of pharmacology, educational background and pharmacology knowledge. Invitations were sent out to 98 people, however only 48 consented and thus took part in the study. Participants were given a score out of 10 for the questionnaire, furthermore participants were divided into junior nurses and senior nurses. The mean knowledge score was six, only 11% of nurses scored above eight which was regarded as adequate knowledge, 60% of nurses scored below seven. It was found that junior nurses had a significantly lower mean score of 5.3 in comparison to the senior staff whose mean score was 6.4 ($p=0.039$) statistically significant. The study also compared the nurses' working experience to pharmacology knowledge. The results revealed that greater working experience was proportional to better pharmacology knowledge. The result was

statistically significant. There were significant differences in the scores obtained by nurses in different grades. Nurses who had obtained a postgraduate qualification were found to have more knowledge than their counterparts.The majority of participants had an average score on questions relating to indicationsand side effects of drugs with a score of 72.6% and 79.8% respectively, but poor scores were achieved for questions on drug interactions and mechanism of action achieving a score of 22.6% and 28.6%. This study thus showed that regarding the knowledge of drugs they administer nurses had largely inadequate knowledge.(8).

Inadequate pharmacology knowledge could result in nurse's not making appropriate decisions when it comes to the administration of medication. This can result in drug errors due to incompatibilities of certain medication and may compromise patient safety in certain instances(8). It is thus imperative that nurse's have a sound pharmacology knowledge base in order to confidently and safely administer patient medication.

A study by Grandell-Niemi et al(15)conducted in 2005 looked at the pharmacological skills of Finnish nurses' and nursing students' and nurses' , the study revealed that they have some deficiencies in their pharmacological skills. A questionnaire was used to assess pharmacology self-rated and actual pharmacology knowledge. Both students and nurses rated their pharmacology knowledge as insufficient. The questionnaire included a question about basic pharmacology terms and 12 questions about pharmacology skills. The nurses scored an average of 80 % and the students scored an average of 75% for the pharmacology skills section. None of the students scored 100% and only 2% of nurses scored 100%. The study compared pharmacological skill and the nurses work experience, the results revealed that work experience of over 20 years was related to a better actual performance on the test (15).

Sodha et al(14) performed a study in the United Kingdom, looking at a group of community nurses pharmacology knowledge.Nurses were given five hypothetical case scenarios that dealt with medication management. A total of 110 community nurses responded to the questionnaire, 37 % were qualified as nurse prescribers at the clinics. All therespondents were registered nurses, 14 had a BSc and 93

had other qualificationssuch as a certificate or diplomas. Only 11% of the respondents felt that they were very confident in dealing with medication matters. Overall respondents did not perform well, 73% and 64% of community nurses declined to respond to scenarios 4 and 5 respectively. In case scenario 2 to 4 only 3% of respondents got full marks and over 50 % of respondents scored 0%. This was particularly worrying since some of the nurses prescribe treatment to patients in the community independently. This study revealed that nurse prescribers, although confident following specific training, still lack a necessary degree of pharmacological knowledge (14).

A study done by King(12) in the United Kingdom on the nurses' perception of their pharmacology educational needs showed that nurses had a limited understanding of pharmacology. In addition they the need for pharmacology knowledge in practice was recognized.(12). Ten qualified nurses from an emergency admission ward were invited to take part in an interview which was semi structured. Most respondents, 70 % had a limited understanding of pharmacology. When prompted to discuss the pharmacology of an anti-hypertensive, all respondents only gave an example of an anti-hypertensive and class of the group. However some candidates could not give the mechanism of action of the drug (12). Approximately 90% of the respondents felt that not enough time was spent on pharmacology in their preregistration courses. Thus improved pharmacology teaching may improve nurses' confidence in drug administration (12).

In a cross sectional study in Norway, the medication knowledge, certainty and risk of errors in health care was studied amongst nurses. Medication knowledge looked specifically at pharmacology knowledge, which included drug management and drug dose calculations. For each question participants indicated self-estimated certainty graded between zero and three. Risk of errors was estimated by combining knowledge and certainty for each question, a correct answer plus a high certainty scored resulted in a low risk error (9).

Nurses from two Norwegian hospitals were invited to participate in the survey, registered nurses with at least one year of work experience were included in the study. The nurses who participated in the study where from primary health care

establishments, from the department of surgery, internal medicine and psychiatry. They were given a multi-choice test in pharmacology. To cover all topics within each discipline questions were put together from actual tests for bachelor nursing students at college as well as other relevant questions. Variables such as age, gender, education and work experience were included. For this study, 64% was chosen as the lowest pass mark acceptable, for questions pertaining to drug management and drug dose calculations only a faultless test was acceptable. All participants gave written consent, and the data was analyzed using Chi-squared and Fishers exact test. In the end 203 nurses participated in the study, 89% of the participants scored 64% or more which was the lowest acceptable score in pharmacology. Twenty five % of the participants had a faultless test in drug management and 12 % had a faultless test in drug dose calculation.Essentially the study revealed that medical knowledge among nurses was insufficient and unsatisfactory, with a high risk for medical errors. Incorrect drug doses are imperative as erroneous calculations can result in serious effects. This has an important bearing as patient safety can be compromised (9).

A study was done in Sweden by Kapborg(10), to investigate if student nurses and registered nurses had adequate knowledge and skills in drug dosage and calculation. The test was given to 545 nurses who were enrolled in various supplementary nursing programmes. The test included questions on calculation of percentages, dosage calculations, transformation of units and times for giving intravenous medication and infusion (10). The study revealed a significant difference among nurses in different supplementary programmes, p value<0.01. Anaesthetic nursing and intensive care nursing scored higher in the tests compared to nurses in public health, midwifery and psychiatry. When comparing nurses experience and knowledge regarding drug calculations, a p-value of <0.01 was obtained, thus revealing that nurses with shorter experience had the highest scores ironically, in other words the test score was inversely related to the length of work experience. The poor performance of trained staff in calculating drug doses could be due to them forgetting the skills due to lack of recent practice. The study also revealed that the student nurse just about to graduate have insufficient competence when it comes to drug dosages(10).

A study by Yukselturk N et al(18) was conducted in Turkey, to assess the knowledge about anti-tuberculosis treatment among nurses at tuberculosis clinics. A questionnaire was handed out to 293 nurses. The questionnaire comprised 2 parts, one part had questions about nurse demographics and the other part had a knowledge test with true-false statements related to anti-TB treatment. Theknowledge test included 24 true-false statements which were related to anti-TB treatment. The majority of the nurses,77% of the nurses answered the statements correctly. The relatively high level of good knowledge was most likely due to purposeful sampling of the participants, as more than half of them had at least 5 years clinical experience. Also given the fact that the questionnaire was in the form of true or false each participant had a 50% chance of getting the correct answer. Therefore the knowledge score of nurses in this study could be regarded as moderate, which indicates that nurses have a lack of knowledge regarding TB medication. Interpretation of the results indicated that mean scores increase with length of clinical experience, age and clinical experience.Therefore better education level and longer work experience equated to better pharmacology knowledge of nurses.

A study was conducted in Holland by Sino et al(16) among Dutch home healthcare nurses on their perspectivesand knowledge of medication frequently used by older people. A total of 146 nurses participated in the study and a questionnaire was handed out. The questionnaire started with questions about demographics, and then the actual knowledge questions included drug interactions, side effects and contra-indications relating to the 10 most frequently dispensed drugs by the nurses. For total knowledge an average score of 76% was obtained, the averagescore for side effects was 77% and the average score for knowledge of contraindications was 73%. Approximately one-third of the nurses(30.1 %)achieved a scored of 80% and above which is regarded as adequate knowledge. These findings are in line with the literature which states that the nurses' pharmacology knowledge is inadequate. No linear relation was noted between the years of working experience andlevel of knowledge, r= 0.007 and p=0.318. No correlation was noted between the level of knowledge and educational level (Spearman r=0.108, P=0.194).

A study by Daouphars et al(17), looked at the oncology nurses knowledge of inpatient medication. A questionnaire was drawn up and presented to nurses in a French cancer centre. The questionnaire consisted of three parts, career history, which also included the nurses' self-evaluation of their knowledge about drugs. The second part looked at knowledge about drugs regarding patients specifically in their care.The final part looked at support tools that nurses could use for acquiring knowledge and the nurses were asked about their priorities. Ninety percent of nurses scored well on the indication,storage and dosage of drugs. However they scored poorly on the side effects, drug interactions and duration of intravenous infusion, as less than 50% scored correctly in these sections.

As can be seen from the above literature that nurses' pharmacology knowledge is lacking. The is no consensus to say that longer work experience is associated with better knowledge, although better qualification is associated with better pharmacology knowledge.

2.8 Summary

In this chapter a literature of the study was discussed. In the next chapter the research methodology will be discussed.

Chapter 3: Research methodology

3.1Introduction

This chapter includes the problem statement, aims and objectives, ethical considerations, research methodology, and validity and reliability of the study.

3.2 Problem statement.

The safety of an anaesthetic has been shown to be improved when a trained assistant is present (6, 7). Both SASA and SATS state that a suitably trained and competent assistant for the anaesthetist is essential for the safe conduct of anaesthesia, and that this assistant be either a registered or enrolled nurse, or anaesthetic technician.

The anaesthetist and the anaesthetic nurse work as a team to provide safe anaesthesia to patients. The anaesthetist is also involved in the informal training of anaesthetic nurses.It is therefore essential for the anaesthetist to understand the level of knowledge of anaesthetic nurses e.g. their knowledge of commonly used drugs during anaesthesia. However, currentlyin the Department of Anaesthesiology at Wits the anaesthetic nurses' knowledge of commonly used anaesthetic drugs is not known.

3.3 Aim and objectives

3.3.1 Aim

The aim of this study was to describe the knowledge of anaesthetic nurses working in four public academic hospitals in Johannesburg regarding selected drugs commonly administered during anaesthesia.

3.3.2 Objectives

The primary objectives of this study were to:

- describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia
- describe the sources used by nurses to obtain knowledge of drugs.

The secondary objectives were to:

- correlate the level of knowledge with years of anaesthetic nursing experience
- compare the level of knowledge with the nurse's qualification.

3.4 Ethical considerations

Permission to conduct this study was sought from the Human Research Ethics Committee (Medical) (Appendix 1) and the Post Graduate Committee, University of the Witwatersrand (Appendix 2). Once approval was obtained, consent to conduct the study was obtained from the Medical Advisory Committeeof Chris Hani Baragwanath Academic Hospital and the Chief Executive Officers of the other four public academic hospitals included in the study (Appendix 5, 6, 7 and 8). Verbal consent was requested from the respective theatre matrons.

Nurses were invited to take part in the study and an information letter was given to the anaesthetic nurses who agreed to take part in the study (Appendix 3). Consent was implied by returning the questionnaire. Anonymity was ensured by the questionnaires being unmarked and not requesting any identifying data. Confidentiality was ensured as the researcher and the supervisors were the only people having access to the raw data. A few nurses requested to be told their results. Their names and question numbers were therefore recorded but kept separately.

All data will be stored securely for 6 years following completion of this study.The data was obtained according to the ethical principles for medical research

involving humans as outlined in the Declaration of Helsinki (21), and the South African Good Clinical Practice Guidelines (22).

3.5 Research methodology

3.5.1 Research design

A descriptive, prospective, contextual study design was used in this study.
A descriptive study design may be used to develop theory, identify problems with current practice or to make judgements or determine what others are doing in a similar situation (31). Variables are not manipulated and there is no treatment or intervention (32). In this study the knowledge of anaesthetic nurses regarding five commonly used drugs in theatre will be described based on the results of the questionnaire.

A prospective study is one where data about a presumed study are first collected, and then the outcome is measured (31) as in this study.

De Vos (33)describes context as a “small scale world”, which can include clinics, hospital wards, or critical care units, amongst others. This study is contextual as it will be conducted in the context of the theatres of public academic hospitals.

3.5.2 Study population

All nurses assisting the anaesthetist with the administration of anaesthesia in the selected public academic hospitals formed the study population.

3.5.3 Study sample

Sample statement and size
The sample size of 36 anaesthetic nurses was obtained in consultation with a biostatistician, using the statistical programme nQuery Advisor ® 7.0. The number of participants expected to achieve a pass rate was used to calculate the sample size.

Sample method

Convenience sampling was used. In convenience sampling subjects are included in the study because they happened to be in the right place at the right time (31). Nurses who were available at the time of the study participated in the study.

Inclusion and exclusion criteria

The inclusion criteria were:

- all nurses who assisted the anaesthetist with the administration of the anaesthetic
- those who agreed to take part in the study.

The exclusion criteria were:

- those on leave or sick at the time of data collection
- blank questionnaires

3.5.4 Data collection

Questionnaire development

A self administered questionnaire (Appendix4) with a demographic section and a knowledge section was used to collect data. A questionnaire was developed following a review of the literature and in consultation with six experts with anaesthetic and nursing expertise who ensured face and content validity then gave their input as to the adequacy of the questionnaire. Four were senior anaesthetic consultants, one with a special interest in pharmacology, and two nurses with extensive experience in critical care nursing.

The following demographic data was collected:

- age
- nursing qualifications
- specific anaesthesia nursing training
- source of knowledge
- years worked as an anaesthetic nurse
- years worked as a nurse
- full or rotate duties as an anaesthetic nurse

Knowledge pertaining to the drugs:

- indication
- storage
- contraindication
- side- effects
- appearance
- dosages

Procedure

The anaesthetic nurses were approached during working hours and the purposeof study was explained to them. The nurse's were informed that their identity would be confidential, and that there would be no consequences to participating or declining to take part in the study. The nurses who agree to participate in the study were given an information letter (Appendix 3), and implied consent was obtained by nurses who completed the questionnaire.

The questionnaire was distributed to the nurses in an envelope by the researcher. In an attempt to prevent data contamination the researcher attempted to be present during completion of the questionnaire, however it was not always possible as the anaesthetic nurse was sometimes busy at those times and the researcher had to come back at a later stage.

3.5.5 Data analysis

Data was captured on a Microsoft Office Excel® spread sheet. This data was analysed using Statistica version 12. The data collected was analysed in consultation with a biostatistician. Analysis of the data helped to reduce and organize the results, it also allowed for interpretation of the results (32).

Descriptive and inferential statistics were used.Numbers, percentages, means and standard deviations were used to describe variables. The level of knowledge and years of experience was correlated using Pearson's Correlation Coefficient as these variables were normally distributed. Fisher's exact test was used to compare the nurses' knowledge and the level of qualification.

3.6 Validity and reliability.

Validity is the extent to which an instrument measures what it is supposed to measure.

The reliability of an instrument is the consistency with which the instrument measures the target attributes (34).

Validity and reliability of this study was ensured by:

- using an appropriate study design
- having anaesthetic experts giving face and content validity to the questionnaire
- the sample size was calculated in consultation with a biostatistician
- selection bias was minimised by inviting all anaesthetic nurses at the hospitals to take part in the study
- the researcher was the only data collector
- all questionnaires not completed were returned to the researcher in sealed unmarked envelopes
- the researcher was present during data collection in an attempt to prevent data contamination
- all data entered into excel was checked for accuracy.

3.7 Summary

This chapter described the research methodology.The results and discussion will be presented in the following chapter.

CHAPTER 4: Results and discussion

4.1 Introduction

The results of the study according to the objectives and the discussion are presented in this chapter.

The primary objectives of this study were to:

- describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia
- describe the sources used by nurses to obtain knowledge of drugs.

The secondary objectives were to:

- correlate the level of knowledge with years of anaesthetic nursing experience
- compare the level of knowledge with the nurse's qualification.

4.2 Sample realisation

A total number of 36 anaesthetic nurses participated in the study. There were 37 questionnaires that were handed to the nurses in sealed envelopes from 5 to 12 January 2015. Only one nurse did not return the envelope. The sample realisation was therefore 97.3%.

4.3 Results

The percentages were rounded off to 1 decimal place. Adequate knowledge was considered as a score of ≥ 80%.

4.3.1 Demographics

The mean number of years worked as an anaesthetic nurse was 4.4 (SD 2.4) years,with a range of 1 month to10 years. One participant did not fill in this

information. The mean years of general nursing experience was 7.6 (SD 5.5) years, witha range of 2 months to 24 years.

The age group, nursing qualifications, specific training in anaesthetic training, and allocation of participants are shown in Table 4.1. The majority of participants, 15 (41.7%) were in the age group 30-39 years, 28 (77.8%) were enrolled nurses ,6 (21%) had received specific anaesthesia training and 28 (77.8%) were full time anaesthetic nurses . The number of participants who did not complete a particular question is indicated in the table as missing data.

Table 4.1 Demographics of participants

Demographic	Number	Percentage
Age group		
• 20-29 years	7	19.4
• 30-39 years	15	41.7
• 40-49 years	8	22.2
• 50-59 years	4	11.1
• >60 years	1	2.8
• Missing data	1	2.8
Nursing qualifications		
• Masters degree	0	0
• Bachelorsdegree	0	0
• 4 year diploma	4	11.1
• 3 year diploma	2	5.5
• 1 year diploma in anaesthesia nursing	0	0
• Enrolled nurse	28	77.8
• Bridging course	2	5.5
Specific anaesthesia nursing training		
• Yes	6	16.7
• No	28	77.8
• Missing data	2	5.6
Allocation		
• Full time anaesthetic nurse	28	77.8
• Rotation	7	19.4
• Missing data	1	2.8

4.3.2 Primary objective: to describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia.

Of the participants only 13 (36.1%) achieved a score of ≥ 80%. The mean score achieved by the participants for the knowledge test was 73.6% (SD13.6). The minimum score was 27% and the maximum was 93%. The scores per question and per drug are shown in Table 4.2.

Table 4.2 Scores per question and per drug

Question no.	Question description	Correct n (%)	Incorrect n (%)	Overall %
	Knowledge of suxamethonium			73.1
8	Indication of suxamethonium	26 (72)	10 (28)	
9	Contraindication	17 (47)	19 (53)	
10	How stored	36 (100)	0 (0)	
	Knowledge of propofol			83.3
11	Indication of propofol	25 (69)	11 (31)	
12	Appearance	36 (100)	0 (0)	
13	Common side effect	28 (78)	8 (22)	
14	Statement regarding propofol	31 (86)	5 (14)	
	Knowledge of adrenaline			70.4
15	Dose in mg per ml of a vial	29 (81)	7 (19)	
16	Main indications of drug	29 (81)	7 (19)	
17	Side effects of adrenaline	18 (50)	18 (50)	
	Knowledge of atropine			61.1
18	Use of atropine	21 (58)	15 (42)	
19	Side effects of atropine	15 (42)	21 (58)	
20	Where it is stored	30 (83)	6 (17)	
	Knowledge of rocuronium			83.3
21	Indications for this drug	26 (72)	10 (28)	
22	Where it is stored	34 (94)	2 (6)	

4.3.2 Primary objective: to describe the sources used by nurses to obtain knowledge of drugs.

The most common source of knowledge of drugs was obtained from clinical experience. This option was indicated by 13 (36%) participants in this study. The sources used by participants are shown in Table 4.3.

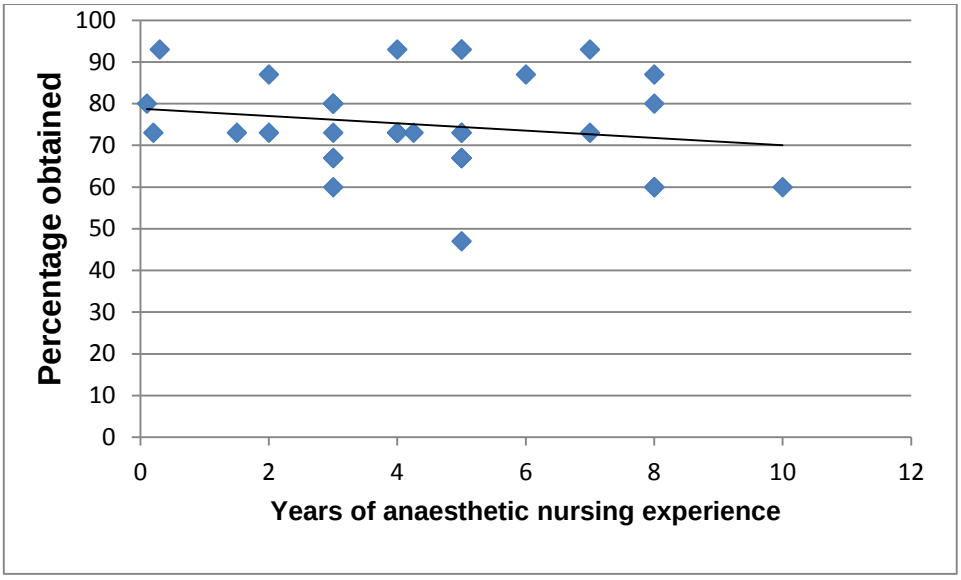
Nurses could choose more than 1 source of knowledge therefore the numbers would add up to more than the number of participants and percentages to more than 100%.

Table 4.3 Source of knowledge

Source of knowledge	Number	Percentage
Textbook	7	19
Nursing journals	3	8
Medical journals	0	0
Medical colleagues	5	17
Nursing colleagues	11	33
Clinical experience	13	36
Part of curriculum when training	5	14
“In house” training	7	19

4.3.3 Secondary objective: to correlate the level of knowledge with years of anaesthetic nursing experience.

Pearson’s correlation coefficient was used to correlate level of knowledge with years of anaesthetic experience (r=- 0.1850, p=0.287). This was not statistically significant. This is shown in Figure 4.1, number of people who completed this demographic was 35 participants. Some of the participants had the same years of anaesthetic nursing experience.



*p= 0.287

Figure 4.1 Correlation between level of knowledge and years of anaesthetic nursing experience.

4.3.4 Secondary objective: to compare the level of knowledge with the nurse's qualification.

A Fisher's exact test was used to compare the level of knowledge with the nurse's qualification. A p value of 0.999 was obtained. This was not statistically significant.Of the registered nurses 3, (38%) obtained a score of ≥ 80% and of the enrolled nurses 10 (36%) also achieved a pass mark.

Table 4.4 Level of knowledge compared with nursing qualification

	Registered nurse	**Enrolled nurse**
Pass	3 (8%)	10 (28%)
Fail	5 (14%)	18 (50%)

*p=0.999

4.4 Discussion

Drug knowledge among nurses is poor as a score of ≥80% was obtained by only 36.1% of the participants. The international literature on nurses' knowledge varies.(8-10, 12-18).Our results are in keeping with the results of Ndosi et al (8) whereby 26% of the nurses obtained a score of ≥80% which was regarded as adequate knowledge. In a study by Sino et al (16) 30% of the healthcare nurses achieved an adequate score. However, it must be kept in mind that our questionnaire was practical and did not require an indepth knowledge of pharmacology (due to the requirements of the postgraduate committee) and our nurses may have obtained an even lower pass rate if the questionnaire was aimed at a higher cognitive level.

However nurses level of knowledge with regard to drugs in our department is in contrast with the results of Yukselturk et al (18) where 77%of the participants obtained an adequate score. A possible reason was that their study had true and false questions thus a participant had a 50% chance of answering correctly. In our study participants had a 20% chance of answering correctly if they did not know the correct answeras the multiple choice type questions had five options to choose from.

Our study was specific to anaesthesia; no other studies could be found in this field. However, Daouphrs et al (17)assessed the pharmacology knowledge of oncology nurses, also a specialist field. In comparison, regarding the specific knowledge relating to the side effects of the drugs, our results showed a range from 42% for the drug atropine to 78% for the drug propofol which were consistent with the oncology nurses knowledge of 42%.

In our study 69% of the participants correctly identified the indication of propofol and 81% of participants correctly identified the indication for the drug adrenaline. This was in contrast to the oncology nurses (17) where 93% of the participants correctly identified the indication of a drug. In our study 83% correctly identified where the drug atropine is stored and 100%of participants correctly identifiedwhere suxamethonium is stored. This is in line with the oncology nurses knowledge regarding drug storage, as 96% of the nurse's scored correctly.

There was only a single question on the contraindication of a drug in our study, 47% of the participants scored correctly, however a higher score of 60% was obtained in the oncology nurses (17). These findings are consistent with findings in literature where nurses had a decreasing level of knowledge for the contraindication and side effects of a drug(8, 13, 17).

The most common source, 36% of knowledge of drugs was obtained from clinical experience in our study.It is interesting to note that for the oncology nurses in France 46% of the participants used the internet (17).

Although the correlation between drug knowledge and years of anaesthetic experience was not significant in our study, it was weakly negative meaning that increased years of experience did not result in increased knowledge.Similar findings were noted in a study by Sino et al(16)and in a study by Boggs et al(13), where there was no relation between experiential background and drug knowledge. Kapborg et al(10) showed an inverse relationship between nursing experience and nurses pharmacology knowledge,whereby nurses with longer experience actually performed worse than nurses with less experience. However in other studies a direct relationship was noted between work experience and knowledge. Ndosi et al(8) proved that longer work experience was associated with better knowledge, in this particular study participants had work experience of 9.6 - 16.2 years. These findings were also echoed by Yukselturk et al (18) whereby longer clinical experience of nurses working in Tuberculosis clinics was associated with better knowledge. Studies have shown that work experience ≥ 20 years has been associated with better knowledge(15).

There was no statistical significance when we compared the level of knowledge with the nurse's qualification. Thirty-eight percent of registered nurses passed the questionnaire compared to the 36% of the enrolled nurse. This was surprising as registered nurses have a higher level of education than the enrolled nurse. These findings are inconsistent with other studies(8, 15, 18)where a higher educational level was directly proportional to the knowledge of drugs. In a study by Ndosi et al (8)nurses with a post-graduate degree were more knowledgeable than their undergraduate counterparts. An explanation for this was that nurses with a post-graduate diploma or degree seem to be professionally mature and take

accountability for self-directed learning and improving their skills. Grandell-Niemi et al (15) had similar results in their study where nurseswho had completed upper secondary schooling had better knowledge than nurses who had only completed lower secondary schooling.

Enrolled nurses and registered nurses are bound by the regulations relating to the Scope of Practice of Persons who are Registered or Enrolled under the Nursing Act(20). The scope of practice require that nurses need to be knowledgeable of the treatment and administration of medicine to a patient, and the observation of his reaction to the medication, and only36.1% of the nurses had adequate knowledge. The question arises: Are nurses functioning outside their scope of practice. Poor knowledge compromises patient safety and care as the anaesthetic team cannot always work effectively in the interest of the patient. It is also important that anaesthetists are aware of the level of knowledge of other members of the team.This awareness highlights the importance for the need of a sound education and training programme which can equip the anaesthetic nurses with a good knowledge base.

4.5 Summary

The results of this study were presented and discussed in this chapter. In the following chapter the study summary, limitations, recommendations and conclusion are presented.

Chapter 5: Study summary,limitations,recommendations and conclusion

5.1 Introduction

In this chapter, a summary of the aims and objectives, research methods and results of the study will be presented. The limitations of the study will also be discussed and future recommendations regarding the pharmacology knowledge of anaesthetic nurses at Wits. A conclusion will also be presented.

5.2 Study summary

5.2.1 Aim

The aim of this study was to describe the knowledge of anaesthetic nurses working in four public academic hospitals in Johannesburg regarding selected drugs commonly administered during anaesthesia.

5.2.2 Objectives

The primary objectives of this study were to:

- describe the knowledge of anaesthetic nurses regarding five drugs commonly administered during anaesthesia
- describe the sources used by nurses to obtain knowledge of drugs.

The secondary objectives were to:

- correlate the level of knowledge with years of anaesthetic nursing experience
- compare the level of knowledge with the nurse's qualification.

5.2.3 Summary of methodology

This study was a prospective, contextual, descriptive study on a sample that consisted of anaesthetic nurses working in the Department of Anaesthesiology at Wits.

A sample of 36 nurses was estimated, this figure was estimated in consultation with a biostatistician. Anaesthetic nurses who were at work on the day the study was conducted and were willing to participate in the study were included in the study. In addition incomplete questionnaires were included. Blank questionnaires and nurses who were on leave at the time of data collection were excluded.

In order to prevent data contamination the researcher tried to be present during data collection. To ensure face and content validity the questionnaire was developed following a review of literature and in consultation with four anaesthetic and two nursing experts. Data was collected from 5-12 January 2015. Implied consent was obtained by nurses who returned the questionnaire. The data was captured on Microsoft Office Excel® spread sheet. The statistical programme Graphpad was used. Descriptive and inferential statistics were used. Pearson's correlation coefficient was used to correlate level of knowledge and years of anaesthetic experience, Fisher's exact test was used to compare the level of knowledge and the nurse's qualification.

5.2.4 Summary of results

Thirty six nurses took part in the study. It was found that anaesthetic nursesin the Department of Anaesthesiology at Wits have inadequate knowledge as only 36% of the nurses achieved a score ≥ 80% . Nurses had better knowledge regarding the storage of a drug 94% as compared to the side effect which showed a range from 42%-78%.

No correlation was noted between the level of knowledge and years of anaesthetic experience, (r= -0.185). There was no statistical significance between the level of knowledge and the nursing qualification, (p= 0.99).

5.3 Limitations

Due to the contextual nature of the study, generalisations cannot be made to other public hospitals or private hospitals in South Africa.

The study involved anaesthetic nurses that happened to be on duty when the questionnaire was distributed. It excluded other staff members and there was possibly an element of bias to the results.

Thirty-six percent of the nurses had adequate knowledge, this was higher than what was assumed based on a sample size of 36 nurses. It is of importance to note that the questionnaire was a practical questionnaire, the initial questionnaire looked at mechanism of action and had more questions pertaining to the contraindication of a drug. However these questions were deemed to be difficult by the expert panel and were thus removed from the questionnaire. Also there were more enrolled nurses than registered nurses in the study therefore this could have resulted in some bias with the interpretation of results.

5.4 Recommendations

Anaesthetic nurses should be aware of the fact that they are practising outside their Scope of Practice, and that they need to act within the Scope of Practice. The anaesthesiologist working with the anaesthetic nurse also needs to be aware that anaesthetic nurses are acting outside their Scope of Practice.

Anaesthetic nurses need to improve their level of knowledge. They need to utilise other sources of knowledge to improve their level of knowledge and experience e.g. nursing journals and textbooks.

Regular lectures should be provided to the anaesthetic nurse in order to improve pharmacology knowledge.

A standardised training programme needs to be put in place for training of anaesthetic nurses.

5.5 Conclusion

The drug knowledge of anaesthetic nurses at in the Department of Anaesthesiologyat Wits is not adequate, and the nurses are acting outside their Scope of Practice. This lack of knowledge may result in serious adverse events or medical errors which can compromise patient safety. There needs to be an adequate training programme implemented for the training of anaesthetic nurses

which will hopefully ensure that competent and trained nurses are available to assist the anaesthesiologist during the peri-operative stage of anaesthesia.

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Appendix 1

R14/49 Dr Makhosazana Busisiwe Ngwenya

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130303

NAME: (Principal Investigator)	Dr Makhosazana Busisiwe Ngwenya
DEPARTMENT:	Anaesthesiology Chris Hani Baragwanath Academic, Charlotte Maxeke Johannesburg Academic, Helen Joseph and Rahima Moosa Mother and Child Hospitals
PROJECT TITLE:	Anaesthetic Nurses Knowledge of Commonly used in Four Academic Hospitals
DATE CONSIDERED:	05/04/2013
DECISION:	Approved unconditionally
CONDITIONS:	Title change (23/11/2015)
SUPERVISOR:	Dr Juan Scribante
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	23/11/2015

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 a yearly progress report.**

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 2

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Private Bag 3 Wits. 2050
Fax: 02711 7172119
Tel: 02711 7172076

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

25 August 2015
Person No: 000530/M
TAA

Ms MB Ngwenya
208 Beaumonde Terrace
Lily Street
Berea
2198
South Africa

Dear Ms Ngwenya

Master of Medicine: Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of **Master of Medicine** has been approved:

From:	**Anaesthetic nurses knowledge of commonly used drugs in three academic hospitals**
To:	**Anaesthetic nurses knowledge of commonly used drugs in four academic hospitals**

Yours sincerely

Ms Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 3

Information Letter

Dear Colleague

Hello, my name is Makhosazana Ngwenya. I am a registrar in anaesthesia and currently doing my Masters Degree in Medicine at the University of the Witwatersrand. I am conducting a research study, and would like to invite you to participate in my study.

The purpose of my study is to assess the pharmacology knowledge of the anaesthetic nurse, specifically looking at five drugs used in theatre. It is hoped that the study will contribute towards the training programme and teaching curriculum of the anaesthetic nurses.

Should you agree to take part in the study, I will ask you to please complete a questionnaire. This should not take more than 20 minutes to complete. Permission will be obtained from the theatre matron for you to complete the questionnaire during your working hours and I will personally bring you the questionnaire. You will remain anonymous, as there will be no personal identifying information that you will reveal. Completed questionnaires will be placed in unmarked envelopes, sealed and returned to me or my assistants.

Only my supervisors and I will have access to the completed questionnaires, thereby maintaining confidentiality. The results will be reported in a general way, and no specific person or institution will be identified. Participation is voluntary, and you may withdraw from the study at any point and no questions will be asked. Results may be made available to you if you so wish.

I appreciate that you will not benefit directly from this study. However the results may provide clarity on the needs of the anaesthetic nurse with regard to pharmacology knowledge.

The Human Research Ethics Committee and the post graduate committee will be consulted to obtain approval for the study. Should you have any questions or queries please do not hesitate to contact me on 0713524376 or Professor Cleaton Jones, on 011 717 1234.

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

Yours Sincerely

Makhosazana Ngwenya

Appendix 4

Questionnaire

Section 1: DEMOGRAPHIC INFORMATION

1. **AGE**

<20 years	
20-29 years	
30-39 years	
40-49 years	
50-59 years	
>60 years	

2. **Nursing Qualification**

Msc Nursing	
Bsc Nursing	
4 year diploma in Nursing	
3 year diploma in Nursing	
1 year diploma in anaesthesia nursing	
Staff nurse/Enrolled nurse	
Other	

If “other” please specify

.....

3. **Have you had any specific training in anaesthesia nursing?**

Yes	No

4. **How have you acquired your knowledge regarding pharmacology in anaesthesia?**

Text books	
Nursing Journals	
Medical Journals	
Medical Colleagues	
Nursing Colleagues	
Clinical experience	
Part of curriculum when training	
“in house” training	
Other	

If other, please specify

.....

5. **How many years or months have you worked as an anaesthetic nurse?**

Years	
Months	

6. **For how many years have you worked as a nurse?.....**

7. **Are you a full time anaesthetic nurse or do you rotate duties?**

Full-time	Rotate duties

Section 2: Knowledge of pharmacology of selected drugs

Questionnaire

Please tick **one** answer.

Suxamethonium (scoline).

8. What is the indication of the drug suxamethonium?

A	induction agent	
B	analgesic agent	
C	sedation agent	
D	facilitate intubation	
E	I am not sure	

9. In what condition is the use of suxamethonium contraindicated?

A	Hypokalaemia	
B	Hyperkalaemia	
C	Hypernatraemia	
D	Hyponatraemia	
E	I am not sure	

10. How should suxamethonium be stored?

A	in a dark container	
B	in a fridge	
C	on a shelve	
D	locked away with opioids	
E	I am not sure	

11. Regarding the drug suxamethonium, which one answer is the most correct?

A	analgesia must be given before	
B	patient has received a fluid bolus	
C	ventilator support is available	
D	reversal agent is available before administering drug	
E	I am not sure	

Propofol

12. What is the main indication of this drug in anaesthesia?

A	reversal agent	
B	analgesic agent	
C	muscle relaxation	
D	induction agent	
E	I am not sure	

13. What does propofol look like?

A	clear fluid in a clear glass bottle	
B	milky white fluid in a clear glass bottle	
C	milky white fluid in a dark bottle	
D	white powder in a clear glass bottle	
E	I am not sure	

14. Which one of following is the correct statement?

A	can be used only in children	
B	can be used only in adults	
C	should be used within 6 hours after opening the vial	
D	can be used more than 6 hours after opening the vial	
E	I am not sure	

Adrenaline

15. What dose in mg per ml is in a vial of adrenaline?

A	0.1mg	
B	10mg	
C	1mg	
D	20mg	
E	I am not sure	

16. What are the main indications of adrenaline?

A	CPR, induction of anaesthesia, analgesia intra-operatively	
B	CPR, as an anxiolytic, treatment of anaphylaxis	
C	CPR, treatment of anaphylaxis, to improve blood pressure	
D	induction of anaesthesia, analgesia, treatment of anaphylaxis	
E	I am not sure	

17. What are some of the side effects of adrenaline?

A	may cause gangrene of digits, hypotension, loss of consciousness, tachycardia	
B	arrhythmias, may cause gangrene of digits, hypertension, tachycardia	
C	hypotension, bradycardia, arrhythmias, gangrene of digits	
D	arrhythmias, gangrene of digits, hypertension and bradycardia	
E	I am not sure	

Atropine.

18. What is atropine used for?

A	treatment of tachycardia	
B	treatment of bradycardia	
C	induction agent	
D	Analgesia	
E	I am not sure	

19. What are some of the side effects of atropine?

A	bradycardia, constricted pupils, dry mouth	
B	tachycardia, dilated pupils, increased secretions	
C	bradycardia, dilated pupils, constipation	
D	tachycardia, dilated pupils, dry mouth	
E	I am not sure	

20) Where is atropine stored?

A	in the fridge	
B	on a shelf	
C	dark cupboard	
D	locked away	
E	I am not sure	

Rocuronium

21. What are the indications for this drug?

A	analgesia, relaxation of skeletal muscle	
B	sedation, induction agent	
C	facilitation of intubation, induction agent	
D	skeletal muscle relaxation, facilitation of intubation	
E	I am not sure	

22. Where should rocuronium be stored?

A	locked away	
B	on a shelf	
C	in the fridge	
D	dark cupboard	
E	I am not sure	

Appendix 5

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 04 July 2014

TITLE OF PROJECT: Anaesthetic nurses' knowledge of commonly used drugs in three academic hospitals

UNIVERSITY: Witwatersrand

Principal Investigator: MB Ngwenya

Department: Anaesthesiology

Supervisor (If relevant): J Scribante

Permission Head Department (where research conducted): Yes

Date of start of proposed study: July 2014
Date of completion of data collection: Dec 2015

he Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 04 July 2014

.....
Approved/Not Approved
Hospital Management
Date: 08/07/14

Appendix 6

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Mrs. L.Se
Office of the Director: Clinical Services
Tell: (011): 488-3365
Fax: (011): 488-3753
16th August 2014

Dr. M.B. Ngwenya
Registrar – Anaesthesiology
CMJAH

Dear Dr. Ngwenya

RE: "Anaesthetic nurses knowledge of commonly used drugs in three academic hospitals"

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

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

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

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

Supported / ~~not supported~~

Dr. M.I. Mofokeng
Director: Clinical Services
DATE: 16/9/2014

Approved / not approved

Ms. G. Bogoshi
Chief Executive Officer
DATE: 20/09/2014

Appendix 7

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

PERMISION FOR RESEARCH

DATE: 09 JULY 2014

NAME OF RESEARCH WORKER: DR M.B. NGWENYA

CONTACT DETAILS OF RESEARCH (INCLUDE ALTERNATE RESEARCHER):

Tel 071 3524376

e-mail- knqwenya@yahoo.com

TITLE OF RESEARCH PROJECT Angesthetic nurses knowledge of commonly used drugs in three academic hospitals

OBJECTIVES OF STUDY (Briefly or include a protocol): Protocol included

METHODOLOGY (Briefly or include a protocol): Protocol

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: None

(iii) APPROVAL OF HEAD OF DEPARTMENT: Yes

(iv) APPROVAL BY ETHICS COMMITTEE OF UNIVERSITY: Yes

SUPERINTENDENT PERMISION

Signature: [signature] Date: 11/7/2014

SUBJECT TO ANY RESTRICTIONS: See above

Helen Joseph Hospital
Perth Road
Tel: 011 489 1011

Private Bag X47
Auckland Park
2006

Appendix 8

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

RAHIMA MOOSA MOTHER AND CHILD HOSPITAL

RAHIMA MOOSA MOTHER AND CHILD HOSPITAL

Enquiries : Dr Edward Hank
Tel : (011) 470 9030/1
Fax : (011) 477 4117
Email : Edward.Hank@gauteng.gov.za

Department of Anaesthesiology
Faculty of Health Sciences
University of the Witwatersrand

Dear Dr Ngwenya,

RE: ANAESTHETIC NURSES KNOWLEDGE OF COMMONLY USED DRUGS IN FOUR ACADEMIC HOSPITALS.

We are aware of the research that you conducted at Rahima Moosa Mother and Child Hospital looking at the Anaesthetic nurses knowledge of commonly used drugs in four academic hospitals.

We fully approve of your research that was conducted at the hospital

Permission is granted to use the results of your findings in your MMed research.

Yours sincerely,

DR EDWARD HANK
Clinical Manager
2015:09:28

ADDRESS: Cnr. FUEL & OUDSTHOORN STREET CORONATIONVILLE 2093 / PRIVATE BAG X20 NEWCLARE 2112 JHB