Evaluation of anaesthetic services in selected Gauteng hospitals

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

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DECLARATION

I, Blaise Bayingana, declare that this Research Report is my own, unaided work. It is being submitted for the Degree of Master of Medicine in Anaesthesiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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(Signature of candidate)

18th day of June 2017 in Johannesburg.

DEDICATION

I dedicate this work to my lovely wife Linda whose sacrificial care and unconditional love made all this possible. To my wonderful son Ganza, you are simply amazing.

ABSTRACT

Anaesthesia is an important aspect of clinical medicine. The quality, safety, education and training in anaesthesia have an impact on the outcome of patient care. The overall aim of the study was to evaluate anaesthetic services in selected Gauteng hospitals.

This study was done in two parts. Part 1 evaluated the level of training of doctors administering anaesthesia, the range of procedures performed and the perception of training adequacy for the anaesthesia they administered. Part 2 of the study reviewed a total number of 585 procedures performed over a two week period in August 2015. Procedures performed and type of anaesthesia employed as well as the length of stay post the procedure were analysed.

The majority of doctors, 72.4%, administering anaesthesia had neither an anaesthetic postgraduate qualification nor any recognised resuscitation certificate such as ACLS or ATLS. Although 58.6 % of doctors felt that the training they had received was adequate for the type of surgical cases they were expected to anaesthetise, some junior doctors highlighted inadequate supervision.

The majority of procedures, 47.4%, were obstetrics caesarean sections, of which 96.0% were performed under spinal anaesthesia. There was no statistically significant difference in length of stay between obstetric patients who had either a general or spinal anaesthesia. Anaesthetic records were retrieved in 97.8% of the cases. Post-operative observations were recorded prior to discharge from the recovery room in 97.2% of patients. There were no anaesthetic related complications reported or noted during the two week study period.

The majority of doctors were not trained in anaesthesia, however no complications occurred during the study period. Furthermore, the majority of procedures done were obstetrics using spinal anaesthesia. This is in contrast to the Green-Thompson (1) study that found that the majority of obstetric cases were done under general anaesthesia. There was also a substantial improvement in record keeping.

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LIST OF ABBREVIATIONS

ACLS	Advanced Cardiovascular Life Support
ATLS	Advanced Trauma Life Support
ASA	American Society of Anaesthesiologists
CMSA	College of Medicine of South Africa
DA	Diploma in Anaesthetics
ESI	Elective sequence induction
FCA	Fellowship of the College of Anaesthetists
GA	General anaesthesia
GP	General practitioners
HPCSA	Health Professionals Council of South Africa
IQR	Interquartile range
LA	Local anaesthesia
MMed	Master of Medicine
NCCEMD	National Committee for Confidential Enquiries into Maternal Deaths
NCEPOD	National Confidential Enquiry into Patient Outcome and Death
PNB	Peripheral nerve block
RSI	Rapid sequence induction
RCA	Root cause analysis
SASA	South African Society of Anaesthesiologists
UK	United Kingdom
USA	United States of America

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

An overview of the study is presented in this chapter. This includes the study background, problem statement, aims and objectives, demarcation field of the study, ethical considerations, research methodology, significance of the study, study outline and a summary of the chapter.

1.2 Background

Anaesthesiology is a medical speciality concerned with the safety of the patient undergoing any surgical procedure. It is a high risk speciality as errors can lead to patient mortality and/or morbidity (2, 3).

Anaesthesia is given by doctors with different levels of qualifications. Glazebrook et al. (4) noted that some general practitioners (GP) in rural Australia provided anaesthesia with little or no formal training. This led to various doctors seeking more training in anaesthesia before going back to their rural communities. The authors reported that recruiting and retaining well qualified and experienced health care professionals in Australian rural areas poses a great challenge. Some anaesthetists highlighted that a lack of time and long distances to academic centres influenced their on-going education in anaesthesia. Thus quality of anaesthesia service rendered in the rural population can be negatively affected (4).

Similarly, in rural Canada, a study by Chiasson et al. (5) noted that anaesthesia was given by GPs with limited formal training in the field. GP anaesthetists provide a wide range of anaesthetic services and procedures. The authors highlighted that there is a shortage of anaesthetists in remote areas of Canada, with only 20% of these anaesthetists working full time. To alleviate problems caused by the shortage, GP anaesthetists fill in the gap (5). Both Australian and Canadian examples compare to the South African context where there are

insufficient specialist anaesthetists for the patient population with a ratio of less than 1:50 000, especially in rural areas (2, 6).

In the Saving Mothers report 2008 to 2010 (7), the editors noted that the number of anaesthetic related maternal deaths was on the rise despite all the measures taken previously to improve anaesthetic safety and quality, especially at the district level hospitals. Moodley et al. (7) attributed the lower level of training as one of the contributing factors causing mortality and/or morbidity. Lack of adequate supervision is also an important aspect contributing to maternal deaths (5).

The Health Professions Council of South Africa (HPCSA) increased the intern training time in anaesthesiology from two weeks to two months from 2005. This is with the view that some of those giving anaesthesia might have had training only during their internship (2). However, with the increase in anaesthetic related deaths (2.5% of all maternal deaths) as reported in the Saving Mothers interim report 2011 to 2012, the committee recommended an increase in intern anaesthetic training time to four months (7, 8).

Encouraging doctors to obtain postgraduate qualifications, such as obtaining a Diploma in Anaesthetics (DA), will also improve quality and safety in anaesthesia (9). A study done by Gordon et al. (9) reported that GP anaesthetists with a DA felt that it had been valuable in their practices. The majority of GP anaesthetists felt competent to carry out slightly more complicated cases such as geriatric and obstetric cases (9).

In the United Kingdom (UK), the pre-registration house officers rotate through anaesthesia for four months and this was deemed a short time. The recommendation made was to increase the house officers training time through a Department of Anaesthesiology (10).

High quality and safe anaesthesia is of paramount importance in ensuring a reduction in mortality and morbidity. The European guidelines for safety and quality practice established in 2007, advise anaesthetists to do a thorough pre-operative assessment as this will assist with preparation and planning for the case (3). There is no optimal method to measure the quality of care; hence guidelines can be used as a reference and general standard of care (11).

This research will be a follow up study 12 years after a critical evaluation of anaesthetic services in Gauteng hospitals, outside the greater Johannesburg area, was done by Green-Thompson (1). The researcher will evaluate if there has been any change in anaesthetic practice.

1.3 Problem statement

Anaesthesia is an important aspect of day to day clinical medicine, it is therefore imperative to deliver safe and quality anaesthesia (3). Green-Thompson (1) reported that, in 2002, 45% of anaesthetists in non-academic hospitals in Gauteng felt they were inadequately trained for the type of work they were expected to carry out. Subsequently intern anaesthetic training time has been increased from two weeks to two months from 2005 (2).

No follow-up evaluation of anaesthetic services in the selected hospitals included in the Green-Thompson (1) study could be identified. A follow up study in these hospitals is of importance, especially against the background of the Kusel et al. (12) 2014 study highlighting that 80% of interns felt confident administering general anaesthesia.

Since the completion of the Green-Thompson (1) study, Tembisa hospital, one of the hospitals that was included in his study was reclassified by the Department of Health as a tertiary hospital.

1.4 Aims

The aims of this two part study were:

Part 1

- to describe the level of training of doctors who provide anaesthesiology services at selected hospitals, in Gauteng and their perception of the adequacy of their training.

Part 2

- to describe the anaesthetic practice at the selected hospitals over a two week period.

1.5 Objectives

The aims of this study were achieved by the following objectives.

Part 1

- Describe the level of anaesthesiology training and postgraduate qualifications of doctors working in anaesthesiology departments at selected hospitals.
- Describe the range of surgical procedures for which the doctors are expected to perform anaesthesia.
- Describe their perceptions about the adequacy of their preparation for the level of service which they were expected to provide.

Part 2

- Describe the anaesthetic patient profile and the surgical procedures performed at the selected hospitals over a two week period.
- Evaluate the appropriateness of the anaesthetic service provided by describing anaesthetic choices and presence of anaesthetic records.
- Evaluate the outcomes of the anaesthetic delivery using length of hospital stay following the procedure.

1.6 Research assumptions

The following definitions were used in the study.

Anaesthetist: is any qualified doctor who administers anaesthesia to patients. This may be an intern, community service doctor, medical officer, registrar or consultant.

Intern: is a doctor who completed a university degree but is currently undergoing practical training prior to registration with the HPCSA as an independent practitioner (2).

Community service doctor: is a doctor who is completing his/her community service as prescribed by the HPCSA prior to being granted full registration for independent practice. This doctor has usually completed a two year internship which is acknowledged as an extended period of training following graduation with a medical degree (2).

Medical officer: is a qualified doctor practising in a department of anaesthesia under specialist supervision. Medical officers with more than 10 years of experience are career medical officers and are regarded as consultants (2).

Registrar: is a qualified doctor who is registered with the HPCSA as a trainee anaesthetist (2).

Consultant: is a doctor with a specialist qualification endorsed by the HPCSA after completing a four year training program in anaesthesia. The doctor should have obtained an FCA or MMed (Master of Medicine). This includes career medical officer.

Diploma in Anaesthetics (DA): is a postgraduate qualification offered by the (College of Medicine of South Africa) CMSA for doctors who have completed a minimum of six months training in anaesthesia at accredited health care facilities (2).

Master of Medicine (MMed): is a university awarded postgraduate degree in medicine which serves as a qualification that allows a doctor to register with the HPCSA as a specialist in anaesthesia.

Fellowship of the College of Anaesthetists (FCA): is a postgraduate professional qualification offered by the CMSA, enabling the doctor to register as a specialist in anaesthesiology.

Appropriate anaesthetic: Green-Thompson (1) defined appropriate anaesthetic as: **"**for the purposes of this study, as an acknowledged choice for that procedure. The definition does not suggest that the choice of anaesthetic technique is best practice for the procedure, only

that it is an acknowledged technique for that procedure" (1). In the study, the researcher used this definition to guide his judgement.

Length of stay: in this study, the length of hospital stay following the administration of an anaesthetic will be used. Length of stay has been used as a surrogate measurement for the outcome of anaesthesia (1).

Records: these include the anaesthetic records, theatre registers and the ward admission books.

Non-academic hospital: "is a hospital which is administered by a provincial Department of Health, but does not offer formal training for undergraduate and postgraduate doctors. This hospital may or may not be formally associated with a university. This category of hospitals includes both regional and district hospitals for this study" (1).

Selected hospitals: selected hospitals were all non-academic at the time of the initial study. Tembisa hospital has since become academic, however the other four hospitals remain non-academic hospitals.

District hospital: serves a population in a health district and supports primary health care. It is not affiliated to any teaching university but may receive support from a teaching institution (13).

Regional hospital: has specialists and may or may not be affiliated to a teaching university. It receives support from a teaching institution (13).

Tertiary hospital: provides specialist and sub-specialist services. It may provide training for health care services and is affiliated with a teaching university (13).

Major surgery: is any **s**urgical procedure which penetrates or exposes the body cavity and also potentially causes major fluid shifts or haemodynamic instability. This may also result in anatomical or physiological impairment or gross tissue dissection (14).

Minor surgery: is any surgical procedure which does not penetrate the body cavity, not cause a major fluid shift including minor tissue dissection (14).

Paediatric patient: is a patient below the age of 14 years. This is the cut off age used by study hospitals for administrative purposes.

The National Committee for Confidential Enquiries into Maternal Death report: will be referred to as "Saving Mothers".

1.7 Demarcation of study field

This study was conducted in Gauteng province. Initially, five hospitals were targeted however only four were included in the study. Pretoria West hospital was excluded as the theatres had not been functional in the preceding three and a half years. The following hospitals were included in the study:

- Tembisa Hospital - a provincial tertiary hospital affiliated to the University of Pretoria
- Kopanong Hospital - a district hospital with no university affiliation
- Sebokeng Hospital - a regional hospital with no university affiliation
- Heidelberg Hospital - a district hospital with no university affiliation.

1.8 Ethical considerations

Approval to conduct the study was obtained from the relevant authorities. In Part 1, anaesthetists were invited to participate and those who agreed were given an information letter and a questionnaire. Completing the questionnaire implied consent. Data collected from the hospital records omitted patient names or hospital numbers. The study was conducted in adherence to the principles of the Declaration of Helsinki (15) and the South African Good Clinical Practice Guidelines (16).

1.9 Research methodology

1.9.1 Study design

A prospective, contextual, descriptive research design was used in Part 1 of this study and a retrospective, contextual, descriptive research design was used in Part 2.

Part 1

1.9.2 Study population

The study population in this part was all doctors who gave anaesthesia in the selected hospitals.

1.9.3 Study sample

A convenience sampling method was used in this part of the study.

All doctors who administer anaesthesia in the five selected hospitals were invited to take part. The sample size was realised by the response rate. The inclusion and exclusion criteria for the study were defined.

1.9.4 Collection of data

In this part of the study, a questionnaire was used to collect data. This questionnaire was developed by a supervisor of this study, Green-Thompson (1) in 2001.

The researcher distributed questionnaires at the selected hospitals. The Head of the Department for each hospital was requested to assist with identification of anaesthetists and distribution of questionnaires.

Part 2

1.9.5 Study population

The study population in this part of the study consisted of all medical records of patients who underwent surgical procedures during the two week study period (1 to 15 August 2015) in the selected study hospitals.

1.9.6 Study sample

Consecutive, convenience sampling was used in this part study. The sample size was determined by the number of records available during the time period of the study. Inclusion and exclusion criteria were defined.

1.9.7 Collection of data

All data were collected from anaesthetic records, theatre registers and the ward admission books. This data was collected by the researcher and was entered directly onto a Microsoft® Excel spread sheet for analysis. No records were removed from hospital premises.

1.10 Data analysis

Descriptive and inferential statistics were used to analyse the data.

1.11 Significance of the study

In the 2008-2010 Saving Mothers Report (7), the anaesthetic related deaths continued to increase despite implementing recommendations to reduce maternal mortality. Inadequate level of training of doctors who administer anaesthesia was noted as being a possible contributory factor to the unacceptable and avoidable deaths of mothers. The training time for interns in anaesthesia was increased in 2005 and it is therefore important to re-evaluate the perceptions of anaesthetists regarding the adequacy of their training and the services at these hospitals. Kusel et al (12), in 2014, noted in their study of anaesthesia training for

interns at a metropolitan training complex in KwaZulu Natal that 80% of interns, had enough confidence intubating and administering general anaesthesia. However the authors concluded that the interns' confidence did not relate to their competence assessment.

The results from this study may contribute to the better understanding of anaesthetic service delivery in non-academic hospitals and to the pursuit of patient safety.

1.12 Validity and reliability of the study

Measures were taken to ensure the validity and reliability of this study.

1.13 Study outline

The study will be discussed as follows:

Chapter 1	Overview of the study
Chapter 2	Literature review
Chapter 3	Methodology
Chapter 4	Results and discussion
Chapter 5	Summary, limitations, recommendations and conclusion.

1.14 Summary

In this chapter a brief overview of the study was presented. The next chapter contains the literature review.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The safety of anaesthesiology has improved over the last couple of decades (3, 17). However, there are major differences in outcomes between the developed and the developing countries. This is partly due to poorly trained anaesthetists, inadequate resources and structural support. As a result of this gap, safe anaesthesia in the developing world remains a concern (18-20).

In this chapter, the literature review will look at factors that influence safety and quality in anaesthesia, including different review processes available and how these can assist in standardising and improving the quality of anaesthetic services.

2.2 Quality and safety in anaesthesia

According to Harteloh (21), there have been many debates regarding quality health care and a part of this debate is the definition of quality health care. Many definitions have been proposed but, the Institute of Medicine's (IOM) definition encompasses features of many of the definitions (22). The IOM defined quality of health care as: "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (22).

A working definition is required to evaluate quality in health care systems, without which the process of selecting interventions and developing new strategies towards improvement is impaired (23). A definition is considered to enable meaningful actions for quality improvement. The IOM (22) outlined six aims to ensure high quality care in a health care system. These aims are defined as following:

- safe – avoid causing injury to the patient
- efficient – one should not waste resources

- effective – provide services that are useful and based on scientific knowledge for the benefit of health care users
- timely – avoid delays and offer quick service to patients
- patient–centered – involve the patient in decision making process
- equitable – provide care that is fair and equal across the board, there should be no discrimination.

Anaesthesiology is a subsystem of the health care system and these same principals can be applied. Safety is an important principle, therefore quality and safety go hand in hand. Patient safety can be defined as "freedom from accidental injury" (24). The IOM further defines accidental injury as "the failure of a planned action to be completed as intended or use of a wrong plan to achieve an aim" (22, 24). A health care system seeks to prevent error and learn from errors which occur (25).

The WHO (World Health Organisation) safe surgery campaigns have often neglected the role of safe anaesthesia (26). In a health care setting, safety should be a priority for all users. There should not be any difference with regards to safety at any given time across all health care facilities (24). Uniformity is the key and regular mechanisms should be in place to ensure that the same standards are maintained, be it day or night time (24).

Wake Up Safe is a quality initiative improvement data registry initiated by the Society of Pediatric Anesthesia in the United States of America (USA) since 2008 (27). Wake Up Safe captures the serious adverse events that occur within 24 hours of anaesthesia resulting in death, life threatening and prolonged hospitalisation or disability (27).

Tjia et al. (27) reported on quality improvement in paediatric patients, using the Wake Up Safe data registry. Traditionally, focus was placed on the individual who committed the error whereas the quality improvement approach involves the analysis of serious adverse events by determining processes or systems that led to the events (27). The Root Cause Analysis identifies changes that should be implemented to avoid adverse events instead of focusing on individual errors. According to the authors, understanding the causes of adverse events can promote changes that will improve quality and safety in paediatric anaesthesia (27).

Another important aspect often over looked involves patient participation in the decision making process. As suggested by the IOM (22), improvement in safety and quality of health care services should include the patient's involvement in the management process. This includes not withholding any information related to treatment options, risks and potential undesirable outcomes (28).

According to McIntosh et al. (11) achieving a specific outcome is considered as evidence that quality care has been rendered. However, the process of achieving the specified outcome may be of more value since poor outcome may not be as a result of poor care all the time. The authors further suggest that this might be the case in anaesthesia, as many factors determining outcomes are outside anaesthetists' control. However, mortality and morbidity may be used by anaesthetists to evaluate the quality and safety of anaesthesia delivered to patients (11).

2.3 Mortality and morbidity

In a recent study by Bainbridge et al. (29) in 2012, the authors compared whether perioperative anaesthetic related mortality was greater in developed countries than in developing countries. They used a systematic review with meta-analysis methodology covering the period prior to the 1970s up to 2011. Country development status was assigned according to the United Nations Human Development Index, hence enabling the differentiation between developed and developing countries. Events considered in the study occurred intra-operatively and 24 to 48 hours postoperatively in the majority of studies included (29).

The results from the Bainbridge et al. (29) study showed that the total perioperative mortality progressively decreased over the decades from 10 603 to 4533 per million anaesthetic cases from the 1970s to 2000s ($p<0.0001$).

According to Bainbridge et al. (29) when analysed separately, both the developed and developing countries showed significant decline in perioperative mortality ($p<0.0001$). However, the reduction was higher in developed countries than developing countries

(p<0.0001). The authors attributed this difference to wealthier countries being able to increase health care investment in the technologies, techniques and training of health care personnel (29).

Thomas et al. (28) noted that the longest longitudinal study of anaesthetic related mortality in South Africa was undertaken at the University of Cape Town between 1956 and 1987. There was a decline in anaesthetic related mortality from 3.3 per 10 000 cases done between 1956 and 1965 period to less than 1 per 10 000 between 1977 to 1987 period (28).

According to Thomas et al. (28), this reduction is attributed to the following:

- improvement of patient monitoring
- establishing of recovery rooms
- advancement in anaesthetic training and expertise
- development of critical care units with multi-disciplinary medical teams
- development of drugs that are shorter acting, more predictable and have fewer toxic side effects
- better acute pain management with multimodal and regional technique approach
- improved clinical skills with vigilance
- development of subspecialties within anaesthesia.

In South Africa, the Saving Mothers report gives insight into the number of maternal deaths attributed to anaesthesia (30). In the 2008 to 2010 Saving Mothers Report (7), it was noted that the number of deaths due to anaesthesia had continued to increase. In comparison with the previous report there were 107 anaesthetic deaths reported during 2005 to 2007 period and 121 deaths in the 2008 to 2010 period. The 2011 to 2013 report however showed a decline in anaesthetic related maternal deaths with 105 cases recorded (31).

In the 2008 to 2010 Saving Mothers report (7) 79% of anaesthetic deaths resulted from complications of spinal anaesthesia, of which 35% were attributed to hypotension. General anaesthesia complications accounted for 17%, of which 9% were due to difficult or failed intubation. Of the total number of cases studied, 72% occurred at the district hospitals. Substandard management of patients and lack of appropriately trained staff were reported as the possible reason why the mortality rates were higher at level 1 hospitals (7).

Lundgren (32) reported in 2011 that the maternal death rate attributed to anaesthesia at Chris Hani Baragwanath Academic Hospital over a period of five years (2000 to 2004) was 4.0 per 10 000 cases. However, only 0.4 per 10 000 caesarean sections were considered to be anaesthetic contributory deaths (32).

Khan et al. (33) reviewed all deaths that occurred during the 1992 to 2003 period in a teaching hospital in Pakistan which is a developing country. All reported deaths were of patients who had anaesthesia within a 24 hour period. Overall, mortality rate was recorded as 3.14 per 10 000 cases of which 0.35 per 10 000 cases were anaesthetic related (33). These results are similar to Lundgren's (32) results from one of the tertiary hospitals in South Africa.

In a USA Closed Claim analysis study by Cheney et al. (19), the authors reported a decline in the proportion of claims for death or permanent brain damage from 44% between 1980 and 1989 to 31% between 1990 to 1994 ($p<0.05$). They noted that respiratory and cardiovascular events were some of the damaging events leading to death or permanent brain damage. The reason for the decline could not be determined from this database study (19).

2.4 Education and level of training

Quality and safe anaesthesia requires well trained and qualified anaesthetists. A study by Bharati et al. (18) in 2014 highlights that there is lack of adequate education in anaesthesia in most developing countries. An important issue noted by the authors is the non-availability of teaching staff. In turn, this further affects the training in the field of anaesthesia including registrars, medical students and anaesthetic support staff (18).

Furthermore, when some physicians do get training in anaesthesia abroad, they either do not return to their countries or find it hard to adjust to the poorer working conditions when they return to their developing countries (18). When some of the anaesthetists do return, it becomes increasingly difficult to impart their knowledge and train anaesthetists in such a resource strained environment (18).

The shortage of anaesthetic health care workers in low to middle income countries has been documented, especially in sub-Saharan Africa (34, 35). Dubowitz et al. (34) suggested the need to develop and support training programs for non-physician and physician anaesthetists in developing countries. The authors believe that appropriate context specific training curricula development should improve the quality of care and, in so doing, reduce the dependency of local services on outside support (34).

In Zambia, anaesthesiology is a sub-division of the Department of Surgery (36). A survey study done by Jochberger et al. (36) at the University Teaching Hospital in Lusaka highlighted the shortage of medically qualified and well-educated anaesthetists. The hospital is a referral health care facility, however, only five doctors are qualified anaesthetists. The authors report that eight anaesthetists are non-medically graduated physicians (also known as clinical associates in South Africa) who received training in a college for three years followed by two years in anaesthesia (36).

Jochberger et al. (36) found 16 000 annual surgical cases reportedly done, ranging from minor to major cases including cardiac surgery. No perioperative mortality and morbidity data were available. However, the authors in this study indicated that hypotension and poor airway management contributed to most anaesthetic complications in theatre (36).

According to Jochberger et al. (36) a major factor preventing the formation of an independent anaesthetic department was the lack of well trained and qualified anaesthetists. Hence the quality of training of medical students at the undergraduate level is affected, thus leading to few medical students showing interest in anaesthesia (36). Under such conditions competent quality patient care and training of more anaesthetists poses a major challenge (36).

The South African Society of Anaesthesiologists (SASA) 2013 guidelines (2) defined the scope of practice in anaesthesia by dividing them into two main groups of relevance as either independent or supervised practice. These are as follow.

- Interns: these are doctors in training after graduating from medical school and should receive a minimum of two months supervised training. They should administer anaesthesia only under supervision onsite.

- Community service doctors: the recommendation is to have had two months of supervised training, following which they may administer anaesthesia remotely but still under supervision.
- General practitioners: training given at undergraduate level is not sufficient to allow independent administration of anaesthesia. However, they can be expected to give anaesthesia in a dire emergency while organising the transfer of the patient to a more capable centre. Alternatively, the general practitioners should discuss such patients with a specialist anaesthesiologist.
- Diplomate anaesthetists: they are eligible for independent practice in healthy patients or those with systemic disease which is well controlled. Patients with more severe disease should only be anaesthetised under supervision or in consultation with a specialist in anaesthesia.
- Specialists in training (registrars): should administer anaesthesia under specialist supervision.
- Specialist anaesthetist (anaesthesiologists): can provide anaesthesia to ASA I-V classification patients independently.
- Clinical associates: SASA advises that they should not be trained to administer any form of anaesthesia but rather be taught how to recognise complications following the administration of regional anaesthesia.
- Anaesthetic assistants: they obtain technical university training and should assist anaesthetists to anaesthetise patients.

In 2005, Lamacraft et al. (37) did a study in the Free State province looking at the reasons for high maternal deaths reported in the Saving Mothers report 1999 to 2001 and 2001 to 2004. All level 1 and 2 hospitals were assessed with regard to training and experience of doctors administering obstetric anaesthesia using a questionnaire. A total of 148 doctors were noted to have given obstetric anaesthesia, however there was only a 69% response rate to the questionnaire. According to the authors, respondents comprised of interns (9.5%), community service doctors (24.7%), medical officers (47.6%), general practitioners (15.2%) and specialist anaesthetists (2.9%). Besides specialists with a postgraduate qualification, only one medical officer had a diploma in anaesthesia (37).

Lamacraft et al. (37) found that 59% of anaesthetic doctors had received training in anaesthesia for four weeks or less. Of these, 11% had never given a spinal or general anaesthetic before being appointed to their current posts. According to the authors, a significant number of doctors were comfortable with either spinal or general anaesthesia but not both. The study also noted that there was a lack of appropriate supervision, with 12.5% of interns administering anaesthesia unsupervised (37). The 2002 to 2004 Saving Mothers report (30), strongly recommended that anaesthetists be competent in administering both spinal and general anaesthesia.

Lamacraft et al. (37) recommended an increase in time of internship training in anaesthesiology in order to improve competence in anaesthesia of community service doctors. A further recommendation was to encourage doctors involved in giving anaesthesia to obtain a diploma in anaesthesia. In South Africa, many rural area hospitals depend on community service doctors to administer anaesthesia (12). Green-Thompson (1) similarly recommended that training should be improved at a district level in order to respond to the challenges faced by anaesthetists to improve safety.

Resuscitation courses such as ACLS can significantly improve the outcome during CPR (cardiopulmonary resuscitation) as reported by Sodhi et al. (38). There was a statistically significant difference between ACLS trained health care workers and those not ACLS trained, including shorter period to return of spontaneous circulation (38). Moretti et al. (39) similarly reported improved survival to hospital discharge and one year survival post cardiac arrest by ACLS trained health care workers.

2.5 Challenges in developing countries

Bharati et al. (18) stated that: “Anaesthesia services in developing countries are going through a phase of transition.” The authors highlighted the fact that there is a need for anaesthetists to shift from intraoperative management of patients to the perioperative management, including caring for patients in intensive care units and resuscitation in emergency departments. The authors further state that due to the high number of patients resources become scarce and costly to maintain. The lack of qualified and well trained

anaesthetists is still a challenge with non-physician trained anaesthetists filling the gaps in some instances (18, 33-35).

Most developing countries that were surveyed in a study by Dubowitz et al. (35) had ratios of less than one anaesthetic provider (physician or non-physician) per 100 000 population with the exception of Swaziland which had 1.41 anaesthetic providers per 100 000 people. The Democratic Republic of Congo had the lowest number of anaesthetic providers, reported as 0.02 per 100 000 population (35). This is in contrast to the USA with an estimate of one anaesthetic provider per 4000 people and the UK with approximately one anaesthetic provider per 5000 people (35).

According to Dubowitz et al. (35), countries such as Kenya and Uganda use trained anaesthetic officers and nurse anaesthetists to address this challenge. The training in most instances is for 18 months post high school, which qualifies them to perform basic anaesthetic procedures. Therefore, the quality of anaesthetic service provided is variable (35).

A report published in 2014 by Hendel et al. (26) noted that there are a lack of resources in developing countries. The authors reported that 66.3% of developing countries studied had oxygen available and 54.3% had electricity available at all times. The choices of drugs were also limited leaving anaesthetists with not many options (26).

In Zambia, the University Teaching Hospital lacked resources hence affecting the quality of anaesthesia service rendered (36). For instance, endotracheal tubes are re-used and decontaminated by soaking in 0.5% chlorine. The water supply is unreliable, available from 06:00 to 22:00. In addition there is also no generator available in the event of interruption to the power supply (36).

Another important aspect proving to be a challenge in developing countries according to Marchal et al. (20) is the imbalance in the health care work force. The term “brain drain” describes the loss of qualified personnel to other countries perceived to be better than the country of origin (20). This phenomenon can happen within the same country as well. For

instance migration of qualified personnel from rural to urban areas, from government to private institutions and from a clinical to a managerial position (20).

Pang et al. (40) reported that emigration of well-educated personnel is a major problem in developing countries and up to 23 000 professionals emigrate annually from Africa alone. They further stated that in South Africa, "a third to half of medical graduates emigrate to the developed countries". The authors highlighted that this further strains the already depleted health care system and widens the inequality gap, thus impacting on quality of service delivered. This comes at a great cost and loss to the affected country (40).

2.6 Hospital levels

In a 2012 South African Government Gazette report (13), the Minister of Health defined the different categories of public hospitals. Five different categories were defined as shown in Table 2.1.

Table 2.1 Categories of public hospitals in South Africa (13)

Categories of public hospitals	General description	Services offered	Specialised services offered	Number of beds	Training of health care workers
District Hospital	Support primary health care Serve a population within a district	Paediatric Internal medicine General surgery Family physician Obstetrics and gynaecology	Nil offered but receives support from a regional hospital	1) Small: >50 and <150 2) Medium: >150 and <300 3) Large: >300 and <600	Where practical
Regional hospital	Offers services to a defined regional drainage population Receive support from a tertiary hospital	Paediatric Internal medicine General surgery Family physician Obstetrics and gynaecology Trauma and emergency services Short term ventilation critical care unit	Provides at least one specialised service in: Anaesthesiology Orthopaedics, Psychiatry and Diagnostic radiation.	Between 200 and 800 beds	Where practical

Tertiary hospital	Receives referrals from regional hospital	Specialists level at services offered by regional hospital	Provides sub-speciality in one of the specialities offered *ICU	Between 400 and 800 beds	May provide training
Central hospital	Receives patients referred from more than 1 province	Offers specialities found at a regional hospital plus national referral services	Super specialised national referral units: for an example liver transplant	A maximum of 1200 beds	Must be attached to a medical school
Specialised hospital			Provides specialised services like tuberculosis and infectious diseases.	A maximum number of 600 beds	

*ICU= Intensive Care Unit

In order to improve quality service and accessibility to health care facilities, the Department of Health in South Africa categorised different level hospitals according to services rendered (13, 41). This is intended to facilitate the referral system and efficiency in the health care services (41).

Hensher et al. (41) defined the word “referral” as any process in which health care personnel, who lack skills and/or the facilities to manage certain clinical conditions, seek the assistance of health care providers who are better trained and equipped in managing these conditions. Referral hospitals also take into account resources and services offered by the different referring hospitals (41).

According to Hensher et al. (41), for a referral system to be effective there is a need for good communication, coordination and support among different level of health care facilities to improve patient care. This can be achieved by offering significant support to personnel at the lower level health care centres and frequent specialist advice concerning patient management (41).

In developing countries, tertiary hospitals affiliated to university medical schools, are regarded as teaching hospitals and serve as referral hospitals (41). Importantly, referral hospitals can play an important role in quality improvement through training of health care workers at lower level hospitals and monitoring the type of referrals received which may assist with improvement in the quality of service rendered (41).

Sanders et al. (42), in their reflection on the effectiveness of referral systems in Zimbabwe, reported that inappropriate patient referral to higher levels of care overwhelmed these levels unnecessarily. In a study reporting a similar experience in the Zambian health system, Atkinson et al. (43) interviewed patients and offered two main reasons for the possible failure of the prescribed referral systems. These are perceptions of superior quality of services and resources at the higher level referral hospital as well as access to appropriate medication. Patients may also be living closer to the referral facility (43).

Development of different hospital levels facilitates better management of resources and improvement in quality of health care services (41, 43). According to Hensher et al. (41) problems associated with failed referral systems can negatively impact the health care system. For instance, inappropriately referred patients only requiring primary health care treatment can cause longer than necessary waiting times and delay management of more complex urgent cases. Similarly, simple illnesses are treated at a higher cost unnecessarily and further strain the already scarce staff resources (41).

2.7 Review processes

According to Khan et al. (44), the critical incidents monitoring system was introduced to anaesthesia in 1978. This involved establishing an incident database with sufficient details, identifying mechanisms and contributory factors. The authors defined critical incidents as any preventable mishap arising from administration of anaesthesia. The use of critical incidents as a measure of quality has advantage in that new problems can be identified and enable development of preventable strategies, which can be useful to health care workers (44, 45).

In anaesthesia, the interpretation of critical incidents may vary according to an individual's understanding and may be influenced by the person's perception (45). For instance, what seems like minor event may not be reported yet these might provide invaluable information. In a similar manner, a major event might not be reported for fear of reprisal and identification of an individual (45). Incident reporting is widely used to identify medical errors in the health care system (24).

The Australian Incident Monitoring Study (AIMS) database in anaesthesia was established in 1988 with the aim of reporting incident cases for the purpose of learning, thus preventing similar incidents from occuring in the future (44). It provides a formal reporting system with less chances of victimisation (44).

According to Metzner et al. (46) "The ASA Closed Claims database was established in 1984, concerned with the aim of improving patient safety and prevention of injury". This initiative began after seeing a rise in lawsuit claims against anaesthetists. The authors noted that the aim was to evaluate anaesthetic adverse outcomes, identify the pattern of injuries recorded by insurance companies and recommend preventative measures in the future. Cases are reviewed by a team of anaesthesiologists and a detailed summary of the sequence of events for each case is provided (46, 47).

The idea and intention of establishing such a database is very valuable, there are however some advantages and limitations of such a registry (46).

Advantages would be:

- ability to examine and study a large collection of cases with adverse outcomes
- a cost effective method to obtain such a large data collection from different patients' files collected from different health care institutions
- data is kept at one central location and easily accessible
- data can be analysed as a large collection pool, as opposed to if data were collected from one centre only (46).

Limitations would be:

- unable to determine the incidence and risk of anaesthetic related adverse outcomes, as there is no numerator with a total number of adverse cases and no denominator with a total number of anaesthetic cases done
- different geographic variations in anaesthetic practices may have an impact on the type of adverse events seen at that particular location
- not all patients file for lawsuits, therefore some adverse events may go unreported (46).

In the UK, National Confidential Enquiry into Patient Outcome and Death (NCEPOD) was formed in 1988 to review and study perioperative critical events with the aim of improving anaesthetic services. The body prides itself on confidentiality and anonymity with regards to poor patient outcome and adverse events. This encourages more cases to be reported and facilitate establishment of policies with regards to improved patient safety (48).

Currently in South Africa, the only review committee similar to the NCEPOD is the National Committee for Confidential Enquiries into Maternal Deaths (NCCEMD), also known as the Saving Mothers report. This committee looks at maternal deaths and generates a report triennially, including anaesthetic related deaths. There is therefore a need for a body similar to the Australian AIMS database in South Africa to report and review all critical incidents related to anaesthesia (7, 30). This will give insight into the types of poor anaesthetic outcomes, therefore improvement of patient safety can be recommended. It is important to understand the causes of adverse events in order to promote and implement processes towards improvement of quality and patient safety (7, 30, 32, 37).

2.8 Anaesthetic records

In any medical profession, it is imperative to keep records of all patients' consultations. With regards to anaesthesia, all perioperative processes must be systematically documented and recorded (3, 49). The SASA practice guidelines recommend that an anaesthetist must at all times clearly record details of each anaesthetic done (2).

Raff et al. (49), in 2003, did an anaesthetic record keeping audit during a one week period, at one of the local Cape Town hospitals, the aim was to determine if there was an anaesthetic chart and whether it was filled in adequately. A total of 284 records were analysed and of these, only 29.9% were reported to have been complete and legible. Of the remaining records, 45% were deemed illegible or incomplete. During the intra operative period, 19.5% of charts did not have vital sign observations and a further 53% of the records were not clear. There was no preoperative assessment in 78.1% of cases (49).

The results above show a serious problem with record keeping practices, which is unacceptable practice. The SASA practice guidelines recommend that the anaesthetist should record all events during a surgical procedure when anaesthesia has been given (2). Inadequately or illegibly completed charts put the doctor administering anaesthesia at a disadvantage should medico-legal action occur in an unforeseen adverse event (49).

Lundgren (32) similarly reported poor anaesthetic record keeping at Charlotte Maxeke Johannesburg Academic Hospital (33%), mostly by registrars. This could possibly be due to lack of experience and ignorance. In a research report by Green-Thompson (1), only 5% of anaesthetic records were noted to have been filled in completely. In 77% of cases, there were no anaesthetic records found.

The record of any previous anaesthetic may be of value to the next anaesthetist, especially if complications had occurred in the previous operation. This will assist the doctor with better planning and could prevent similar complications from occurring.

2.9 Summary

This chapter reviews the quality, safety, education and training in anaesthesia and its impact on resultant morbidity and mortality using record keeping and review processes. The next chapter contains the research methodology.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

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

3.2 Problem statement

Anaesthesia is an important aspect of day to day clinical medicine, it is therefore imperative to deliver safe and quality anaesthesia (3) . Green-Thompson (1) reported that in 2002, 45% of anaesthetists in non-academic hospitals in Gauteng felt they were inadequately trained for the type of work they were expected to carry out. Subsequently intern anaesthetic training time has been increased from two weeks to two months in 2005 (2).

No follow-up evaluation of anaesthetic services in the selected hospitals included in Green-Thompson (1) study could be identified. It is therefore not known if the increased intern anaesthetic training time had contributed to change in anaesthetic service delivery. A follow up study in these hospitals is of importance, especially against the background of the Kusel et al. (12) 2014 study highlighting that 80% of interns felt confident administering general anaesthesia.

3.3 Aims

The aims of this two part study were:

Part 1

- to describe the level of training of doctors who provide anaesthesiology services at selected hospitals, in Gauteng and their perception of the adequacy of their training.

Part 2

- to describe the anaesthetic practice at the selected hospitals over a two week period.

3.4 Objectives

The aims of this study were achieved by the following objectives.

Part 1

- Describe the level of anaesthesiology training and postgraduate qualifications of doctors working in anaesthesiology departments at selected hospitals.
- Describe the range of surgical procedures for which the doctors are expected to perform anaesthesia.
- Describe their perceptions about the adequacy of their preparation for the level of service which they were expected to provide.

Part 2

- Describe the anaesthetic patient profile and the surgical procedures performed at the selected hospitals over a two week period.
- Evaluate the appropriateness of the anaesthetic service provided by describing anaesthetic choices and presence of anaesthetic records.
- Evaluate the outcomes of the anaesthetic delivery using length of hospital stay following the procedure.

3.5 Ethical considerations

Approval to conduct the study was obtained from the Graduate Studies Committee (Appendix 1) and the Human Research Ethics Committee (Medical) (Appendix 2) of the University of the Witwatersrand. Permission to conduct the study was obtained from the Gauteng Department of Health and relevant authorities from the selected hospitals (Appendix 3) as well.

Anaesthetists were invited to participate and those who agreed were given an information letter (Appendix 4) and a questionnaire (Appendix 5). Completion of the questionnaire implied consent. Participation was voluntary and no penalties were incurred for not participating.

Anonymity and confidentiality were maintained as no identifying information was requested on the questionnaire, completed questionnaires were returned in sealed envelopes and only the researcher and the supervisors had access to the raw data. When collecting data from the hospital records no patient names or hospital numbers were recorded. Data will be stored securely for six years after completion of study.

The study was conducted in adherence to the principles of the Declaration of Helsinki (15) and the South African Good Clinical Practice Guidelines (16).

3.6 Research methodology

3.6.1 Research design

A prospective, contextual, descriptive research design was used in Part 1 of this study and a retrospective, contextual, descriptive research design was used in Part 2.
A prospective study according to Brink et al. (50) "presumes data about a cause are first collected, and then the effect or outcome is measured." Part 1 of this study is prospective as data was collected at the time the study took place.

A retrospective study according to Brink et al. (50) is a study in which " the dependent variable is identified in the present and an attempt is made to determine the independent variable that occurred in the past." In this study data was collected from patients' records for anaesthetics that occurred from 1 to 15 August 2015.

A contextual study was defined by de Vos (51) as research done in a "small scale world." A small scale place can be a hospital ward, operating theatre or intensive care unit. This study is contextual because it took place in selected hospitals in Gauteng.

According to Brink (50), “a descriptive study is a research study in which phenomena are described or the relationship between variables is examined; no attempt is made to determine cause-and-effect relationships”. The study was conducted in two parts. In Part 1, the researcher used questionnaires to determine qualifications and level of training of anaesthetists at the selected hospitals. Part 2 reviewed patients’ records for a period of two weeks. The remaining methodology for Part 1 and Part 2 is discussed separately.

Part 1

3.6.1.1 Study population

The study population in this part of the study was all doctors who gave anaesthesia in the selected hospitals.

3.6.1.2 Study sample

Sample method

A convenience sampling method was used. Endacott et al. (52) defined convenience sampling as the use of readily accessible individuals in a study. This is used in descriptive research to get an estimation of a particular element of interest (52).

Sample size

All doctors administering anaesthesia in the selected hospitals were invited to take part. The sample size was realised by the response rate. A response rate of 60% was considered as acceptable, but a response rate of 80% was the target.

Inclusion and exclusion criteria

Inclusion criteria were:

- all doctors administering anaesthesia in these departments
- those consenting to take part.

The exclusion criterion in this study was doctors on annual and sick leave.

3.6.1.3 Collection of data

In this part of the study, a questionnaire was used to collect data. The questionnaire (Appendix 5) was used and developed previously by Green-Thompson (1).

The questionnaire requested information under the following headings:

- designation and years of experience in current designation
- qualifications
- practice.

The researcher distributed questionnaires at the selected hospitals. The Head of the Department for each hospital was requested to assist with identification of anaesthetists and distribution of questionnaires. The questionnaire had an information sheet attached. Participants were advised to return completed questionnaire, in the sealed envelope provided, to an identified contact staff member. The researcher collected the completed questionnaires and entered the data onto a Microsoft® Excel spread sheet.

Part 2

3.6.2 Study population

The study population in this part of the study consisted of all medical records of patients who underwent surgical procedures during the two week study period.

3.6.2.1 Study sample

Sample method

Consecutive, convenience sampling was used in this study. Endacott (52) describes convenience sampling as " the use of the most readily accessible individuals or units in a study" and consecutive sampling as " a version of convenient sampling where every available individual or event within an accessible population is chosen." All records for the two week study period were included.

Sample size

The sample size was determined by the number of records available for the time period of the study. A sample size similar to that of Green-Thompson's (1) was anticipated i.e. 514.

Inclusion and exclusion criteria

All surgical cases done under any type of anaesthesia within the two week period were included. The exclusion criteria were illegible or missing records.

3.6.3 Collection of data

All data were collected from anaesthetic records, theatre registers and the ward admission books. This data were collected by the researcher and entered directly onto a Microsoft® Excel spread sheet for analysis (Appendix 6). No records were removed from hospital premises.

3.7 Data analysis

Data were analysed using Statistica version 12. Descriptive and inferential statistics were used. Categorical variables were summarised using numbers and percentages. Continuous variables in this study were not normally distributed and were described using medians, interquartile ranges (IQR) and ranges. Comparisons were done using Wilcoxon-Mann-Whitney tests. A p value of <0.05 was considered statistically significant.

3.8 Validity and reliability of the study

Botma et al. (53) defined validity as "the degree to which a measurement represents a true value" and reliability as the "consistency of the measure achieved".
Validity and reliability were ensured in this study by:

- using an appropriate study design

- using a standard questionnaire for all participants and a standard Microsoft spreadsheet.
- where possible, the researcher was present at the site to answer any questions or queries regarding the study, otherwise contact details were included on the information sheet
- upon completion, participants anonymously returned completed forms in sealed envelopes
- only the researcher collected the retrospective data ensuring standardisation
- every eighth data entry was checked for accuracy.

3.9 Summary

In this chapter, the research methodology used in the study was described. In the next chapter the results are presented and discussed.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the results of both Part 1 and Part 2 of the study according to the objectives followed by discussion.

Part 1 of the study involved the administration of a questionnaire in the selected study hospitals. Of the 35 doctors available, 29 (82.9%) responded. In Part 2 of the study, a total number of 598 procedures were performed of which 585 cases (97.8%) were included. The 13 cases that were excluded either had missing anaesthetic charts or the charts were illegible.

Initially, five hospitals were targeted, however only four were included in the study. These were Heidelberg, Kopanong, Sebokeng and Tembisa. Pretoria West hospital was excluded on the basis that the theatres had not been functional in the preceding three and a half years. Heidelberg and Kopanong are district hospitals, while Sebokeng and Tembisa are regional and tertiary health care facilities respectively.

4.1 Results

Part 1

4.1.1 Demographics of participants

The majority of participants administering anaesthesia (n=21, 72.4%) were medical officers. There were 2 (6.9%) consultants, of whom one had a postgraduate qualification in anaesthesia and the other in family medicine. There were 3 (10.3%) interns and 3 (10.3%) community service doctors in the regional and tertiary hospitals. This is presented in Table 4.1.

Table 4.1 Designation of participants

Designation	Participants n (%)
Consultant	2 (6.9)
Medical officer	21 (72.4)
Community service	3 (10.3)
Intern	3 (10.3)

The majority of participants 18 (62.1%) had less than five year experience in anaesthesia. Only one doctor had more than 20 years of experience in anaesthesia. This is illustrated in Table 4.2.

Table 4.2 Anaesthetic experience

Years of anaesthetic experience	Participants n (%)
0 - 5	18 (62.1)
6 -10	5 (17.2)
11 - 15	3 (10.3)
16 - 20	2 (6.9)
>20	1 (3.4)

Objective: describe the level of anaesthesiology training and postgraduate qualifications of doctors working in the anaesthesiology departments at four selected hospitals

The majority of participants, 21 (72.4%), had no anaesthetic postgraduate qualification. Only 8 (27.6%) had obtained a DA, including one participant who had both a DA and a FCA qualification. Out of the 29 participants, 11 (38%) stated that they had obtained a postgraduate qualification, for example in family medicine or obstetrics. Of these, the majority 6 (54.5%) obtained their postgraduate qualification from an academic hospital.

The majority of participants 21 (72.4%) administering anaesthesia have neither an anaesthetic postgraduate qualification nor any recognised resuscitation certificate. The anaesthetic participant who had both FCA and DA postgraduate qualification had also obtained ACLS (Advanced Cardiovascular Life Support) and ATLS (Advanced Trauma Life Support) certificates. The highest postgraduate qualifications and resuscitation certificates are shown in Table 4.3.

Table 4.3 The highest postgraduate qualifications and resuscitation certificates

Highest postgraduate qualification	**ATLS n**	**ACLS n**	**ACLS + ATLS N**	**None n**	**Total n (%)**
FCA	0	0	1	0	1 (3.5)
DA	1	1	3	2	7 (24.1)
None	2	4	2	13	21 (72.4)
Total	3	5	6	15	29 (100)

Objective: describe the range of surgical procedures for which the doctors are expected to perform anaesthesia

District level hospitals had mainly minor procedures plus obstetric and gynaecological cases which were regarded as major surgeries. Both regional and tertiary hospitals covered major and minor general surgery, gynaecology, obstetrics, orthopaedics, paediatric and urology cases. However, neurosurgery was only done in Tembisa which is a tertiary hospital. There were no cardiothoracic or neonatal procedures performed at any of the hospitals. The ranges of surgical procedures the doctors are expected to perform are shown in Table 4.4.

Table 4.4 Surgical procedures per hospital

Type of surgery		Hospital			
		Heidelberg	Kopanong	Sebokeng	Tembisa
General surgery	Minor				
	Major				
Gynaecology	Minor				
	Major				
Obstetrics	Minor				
	Major				
Orthopaedics	Minor				
	Major				
Paediatrics	Minor				
	Major				
Urology					
Neurosurgery					
Cardiothoracics					
Neonates					

Green= Yes Red= No

Objective: describe the doctors' perceptions about the adequacy of their preparation for the level of service which they were expected to provide

Of the 27 doctors who responded to this question, 17 (58.6 %), felt that the training they had received was adequate for the type of surgical cases they were expected to anaesthetise, especially at higher level hospitals with consultants available. Three junior doctors who had trained at academic hospitals during their internship reported that the level of training was adequate, although they felt that their current level of supervision was inadequate.

Of the participants, 10 (34.6 %) stated that the level of training they had received was inadequate for the type of anaesthetic they were expected to perform. Reasons included were lack of formal training and supervision by more experienced anaesthetists or those who hold a postgraduate qualification in anaesthesia.

This is supported by the following comments from participants:

"*It would have been nice if we had more academic meetings and lectures".*

"Insufficient training at present, working mostly under supervision with plans of future postgraduate training".

"Require more training in anaesthesia, especially how to administer general anaesthesia".

Further questions regarding what methods participants would like to use and what methods they had used in the last year to improve their anaesthetic expertise were asked. Participants could choose more than one option.

Most participants, 14 (48.3%), had used refresher courses to enhance their anaesthetic knowledge in the last year and 15 (51.7%) would like to do a postgraduate course. Postgraduate courses and congresses were used by those with some form of anaesthetic postgraduate qualification. These are reported in Table 4.5.

Table 4.5 Methods to improve anaesthetic expertise

Methods used for improving anaesthesia expertise	**Preferred n (%)**	**Used in the last year n (%)**
Postgraduate course	15 (51.7)	4 (13.8)
Congress	5 (17.2)	4 (13.8)
Refresher course	22 (75.9)	14 (48.3)
Lectures	17 (58.6)	10 (34.5)
Other	0 (0)	0 (0)

Part 2

Objective: describe the anaesthetic patient profile and the surgical procedures performed at the selected hospitals over a two week period

4.1.2 Patient profile

Of the 585 patients presenting for surgery, there were 418 (71.5%) female patients and 167 (28.5%) male patients. The median (IQR) age was 28 (22-36) years. The age distribution is presented in Figure 4.1.

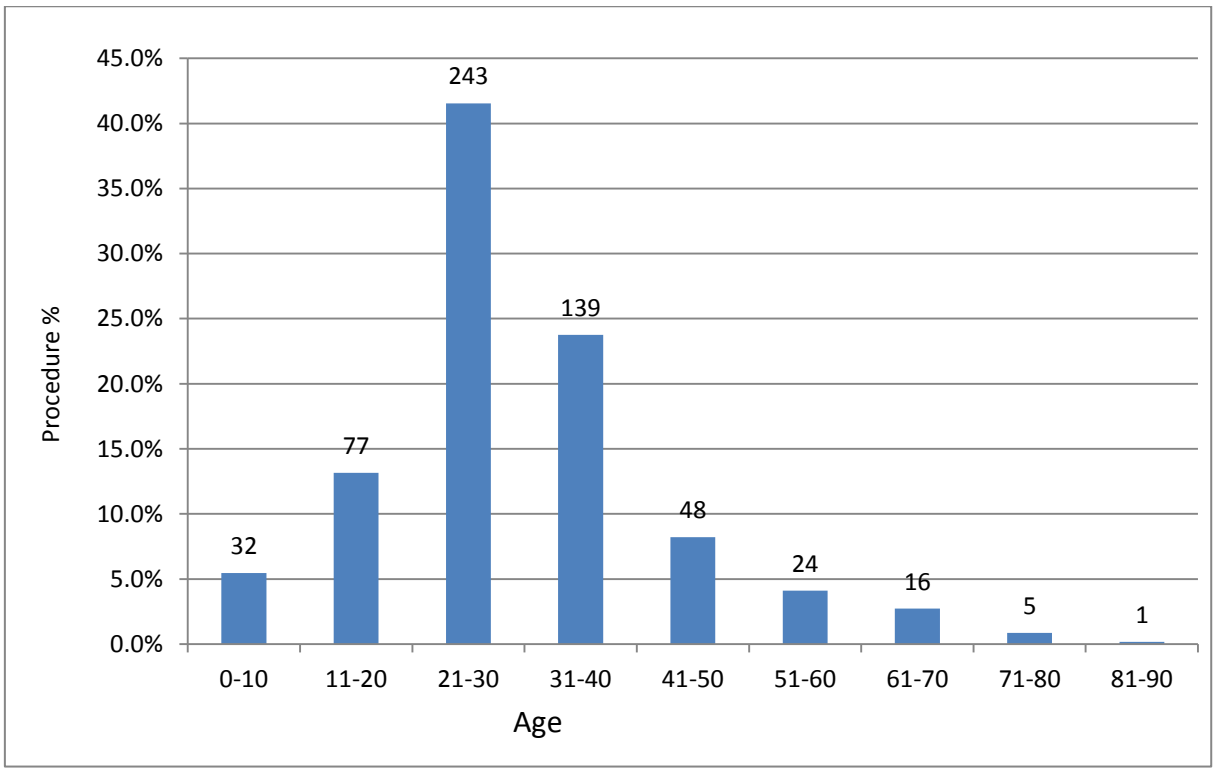


Figure 4.1 Age distribution of patients

Further analysis was done between major and minor surgery and patients' age. There was no statistically significant difference (p=0.1) between the ages of the patients presenting for major or minor surgery. The youngest patient, a 4 month old boy, had adenotonsillectomy at a tertiary hospital and the oldest patient, an 87 year old, had a below knee amputation.

4.1.3 Number of procedures performed per hospital

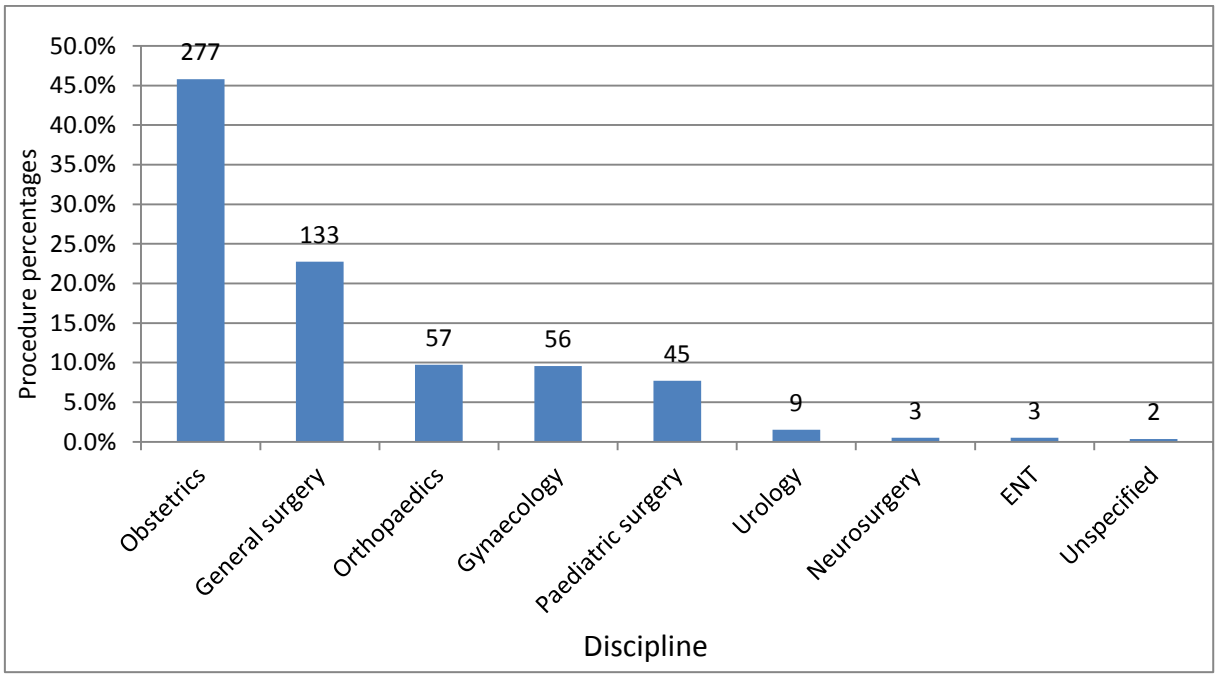
Table 4.6 shows the number of procedures done per hospital during the 2 week period. A total number of 585 procedures were included in the study. Tembisa, being a tertiary hospital, had the majority of cases, 48.7% (n=285), followed by Sebokeng, a regional hospital, with 214 (36.6%) procedures.

Table 4.6 Number of procedures performed per hospital

Hospital	Procedures performed n (%)
Heidelberg	41 (7)
Kopanong	45 (7.7)
Sebokeng	214 (36.6)
Tembisa	285 (48.7)

4.1.4 Type of surgical procedures and duration

There were 418 (71.5%) major surgical procedures done during the specified study period. The majority of procedures were obstetrics, 277 (47.4%), followed by general surgery with 133 (22.7%) procedures. The type of surgical procedures is shown in Figure 4.2.



ENT (Ear, Nose and Throat).

Figure 4.2 Type of procedures

The median (IQR) duration for the procedures was 50 (35-70) minutes. The median (IQR) time for major surgery was 55 (45-75) minutes and 30 (15-50) minutes for minor procedures. When further analysed, a statistically significant difference between duration of major and minor procedures (p= <0.0001) was found. The time range for major surgery was 10 - 360

minutes and 5 – 155 minutes of minor procedures. The duration of surgical procedures are shown in Table 4.7.

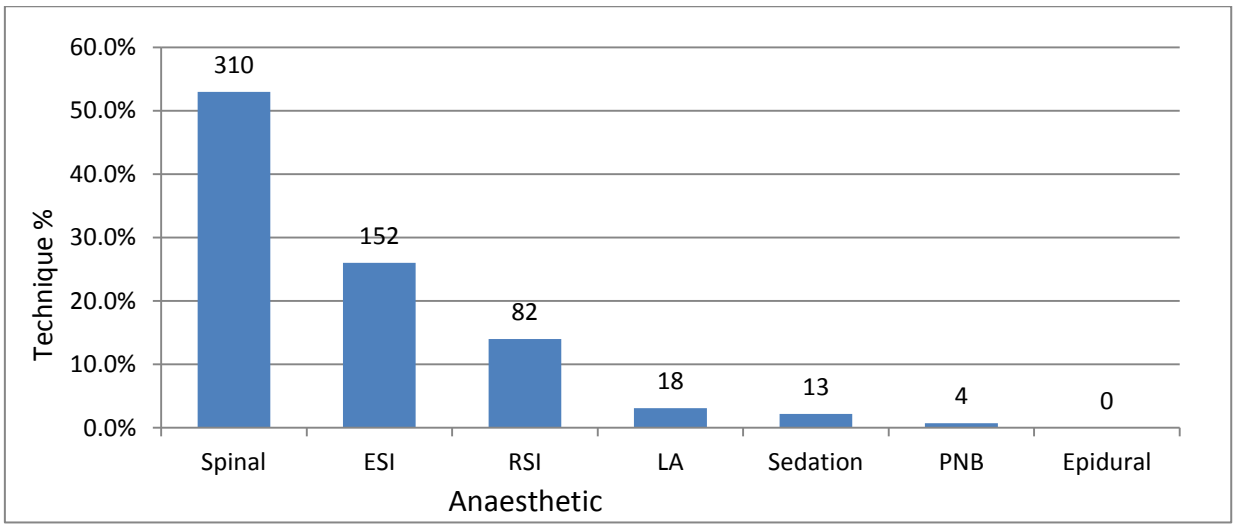
Table 4.7 Duration of surgical procedures

Minutes	Major procedure n (%)	Minor procedure n (%)
0-30	46 (11)	91 (54.8)
31-60	204 (48.9)	46 (27.7)
61-90	102 (24.5)	16 (9.6)
91-120	34 (8.2)	7 (4.2)
121-150	9 (2.2)	5 (3%)
151-180	10 (2.4)	1 (0.6)
>180	12 (2.9)	0 (0%)

Objective: evaluate the appropriateness of the anaesthetic services provided by describing anaesthetic choices and presence of anaesthetic records

4.1.5 Type of anaesthetic chosen

The total number of regional (spinal, LA (Local anaesthesia) and PNB (peripheral Nerve Block)) techniques performed was 332 (56.8%), of which 266 (85.0%) were obstetric procedures. A total number of 277 (47.4%) obstetric procedures were done in the two week period of data collection, 266 (96.0%) were done under spinal and the remaining 11 under GA including one case that was converted to GA post a failed spinal. This is presented In Figure 4.3. The type of anaesthetic used for each procedure was deemed appropriate by the researcher as described in the research assumption.



ESI (elective sequence induction), RSI (rapid sequence induction), LA (local anaesthesia), PNB (peripheral nerve block)

Figure 4.3 Anaesthetic technique used

4.1.6 Review of anaesthetic records

After identifying cases done during the two week period using theatre registers, files were retrieved and reviewed with the aim of checking whether there was an anaesthetic record or not. The majority of the cases, 572 (97.8%), had some type of anaesthetic record.

On review of anaesthetic records, it was found that most circumcisions had no formal record, however, anaesthetic notes were recorded in the file. All hospitals except Tembisa kept a duplicate of anaesthetic charts. Post-operative observations were recorded prior to discharge from the recovery room for 569 (97.2%) patients. These included blood pressure, oxygen saturation and pulse. Post-operative observations were recorded for all patients who had major surgical procedures.

Objective: evaluate the outcomes of the anaesthetic delivery using length of hospital stay following the procedure

4.1.7 Length of hospital stay

Length of stay was used as surrogate marker for anaesthetic related complications. However, no anaesthetic complications were reported or noted. The time spent in hospital

was related to the type of surgery. There were two deaths noted post trauma and both cases died in ICU.

The median (IQR) length of stay was 2 (2-3) days. For patients having major procedures, the median (IQR) length of stay in hospital was 3 (2-3) day whereas for patients having minor procedures it was 1 (1-2) day. Further analysis showed that there was a statistically significant difference (p = <0.001) with regards to the length of stay between major and minor procedures.

The majority of cases, 277 (47.4%), were obstetrics. The median length of hospital stay was 2 days. On further analysis, no significant statistical difference (*p* value 0.07) was found between length of hospital of stay for obstetric patients and type of anaesthetic received (regional or GA). No GA was performed for obstetric patients in the district hospitals.

4.2 Discussion

Although this was a follow up study, direct comparisons could not be made due to the change in status of one of the hospitals (Tembisa) and excluding the academic hospitals included in the Green-Thompson study (1) due to the scope of this study.

There is a major shortage of medically qualified anaesthetists in Sub-Saharan African countries, anaesthetic services are rendered largely by non-medically trained anaesthetists (26, 35). Particularly in South Africa, it was recently reported that there is shortage of anaesthetists (54). In our study all anaesthetic providers were medically trained doctors. In South Africa, no non-medically trained person such as a clinical associate or an anaesthetic assistant is permitted to administer anaesthesia (6). In our study the majority (72.4%) of doctors giving anaesthesia had neither a postgraduate qualification such as a DA or FCA nor any resuscitation certificates such as ACLS or ATLS.

Lamacraft et al. (37) reported that there were no specialists in level one and two hospitals available to administer anaesthesia in the Free State province. The majority of doctors

rendering anaesthetic services were medical officers. In Zambia, similar findings were reported, however majority of anaesthetic physicians were non-medically trained (36).

Green-Thompson (1) found that the majority of doctors administering anaesthesia at non-academic hospitals in Gauteng, outside the greater Johannesburg area were medical officers. In our research study, 72.4% of those who administered anaesthesia were medical officers. Anaesthesiology specialists represented 3.4% versus 5.6% reported by Green-Thompson (1). Although no data was available from the Green-Thompson study (1) with regards to interns, 10.3% of participants in our study were interns.

Lamacraft et al. (37) reported that besides two anaesthetic specialists, only one other doctor had a postgraduate qualification in anaesthesia. The authors also noted that only 50% of the doctors had other postgraduate qualifications, of these 43% had acquired resuscitation certificates. Green-Thompson (1) highlighted that 83.3% of the doctors in non-academic hospitals did not have a postgraduate qualification in anaesthesia, but 50% of had obtained resuscitation certificates. According to Lamacraft et al. (37) of the doctors who had more than five year experience, 47%, had no postgraduate training in anaesthesia neither did they have any resuscitation certificates.

Retaining of experienced doctors in South Africa, in particular in the public sector, becomes a challenge for various reasons. The lack of adequately trained anaesthetists in low to middle income countries could be attributed to them moving to countries with higher income and better equipment (20, 26).

Our study suggests that there seems to be an interest in obtaining postgraduate training in anaesthesia, with 51.7% of participants indicating a preference for postgraduate courses to enhance their anaesthetic knowledge and skills.

The 2011-2013 Saving Mothers report highlighted a slight decline in anaesthetic related maternal deaths. In a period of ten years, anaesthetic related deaths had decreased from 2.8% to 2.42% (31). In the UK, “Savings Lives, Improving Mothers’ Care” 2014 report, the authors also highlighted a declining trend in anaesthetic related maternal deaths within 40

years from 40 to four cases per triennium (55). In our study, no maternal deaths were reported.

Coetzee et al. (56) indicated that 22 to 32% of perioperative evaluation, problem recognition, diagnosis, and management of complications was poor. Lack of postgraduate training in anaesthesia, inadequate supervision and/or no basic resuscitation courses taken may possibly contribute to poor anaesthetic outcome. The 2011 to 2013 Saving Mothers report indicated that 47% of maternal deaths recorded were attributed to the lack of appropriately trained doctors involved in anaesthesia (31). Jochberger et al. (36) also reported that lack of recognition and adequate management of anaesthetic related complications contributed to morbidity and mortality . Inability to recognise complications in our health care setting due to inadequate training in anaesthesia and lack of resuscitation certification may compromise patient safety.

In our study, nearly half (47.4%) of the cases done during the two week period were obstetrics. Green-Thompson's (1) study reported that 23% of the cases were obstetric in nature. In a space of 13 years, the number of obstetric cases doubled. A possible explanation could be due to the increase in urban population as reported by Statistics South Africa (57).

According to Yeoh et al. (58) there is a rising trend world-wide in the number of caesarean sections being performed both in developed and developing countries. Our study confirms this rising trend among the selected hospitals. Our results showed that 96,0% of all caesarean sections were performed using spinal anaesthesia. The remaining cases were done under GA, with one failed spinal anaesthetic being converted to a GA. Green-Thompson (1) reported that the majority of caesarean sections (76.7%) were performed under GA. The rise in use of spinal anaesthesia for caesarean sections could be due to increasing recognition of potential complications with GA as opposed to spinal anaesthesia. However, adequate training is required to perform safe spinal anaesthesia. Yeoh et al. (58) also noted that there was an increase in the regional technique for caesarean sections. Algert et al. (59) as well recommended the use of spinal and/or epidural rather than GA due to the risk of failed intubation and aspiration.

4.3 Summary

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

CHAPTER 5

SUMMARY, LIMITATION, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The summary, limitations, recommendations and conclusion of the study are presented in this chapter.

5.2 Summary of the study

5.2.1 Aims

The aims of this two part study were:

Part 1

- to describe the level of training of doctors who provide anaesthesiology services at selected hospitals, in Gauteng and their perception of the adequacy of their training.

Part 2

- to describe the anaesthetic practice at the selected hospitals over a two week period.

5.2.2 Objectives

The aims of this study were achieved by the following objectives.

Part 1

- Describe the level of anaesthesiology training and postgraduate qualifications of doctors working in anaesthesiology departments at selected hospitals.
- Describe the range of surgical procedures for which the doctors are expected to perform anaesthesia.

- Describe their perceptions about the adequacy of their preparation for the level of service which they were expected to provide.

Part 2

- Describe the anaesthetic patient profile and the surgical procedures performed at the selected hospitals over a two week period.
- Evaluate the appropriateness of the anaesthetic service provided by describing anaesthetic choices and presence of anaesthetic records.
- Evaluate the outcomes of the anaesthetic delivery using length of hospital stay following the procedure.

5.2.3 Summary of methodology

A prospective, contextual, descriptive research design was used in Part 1 of this study. A questionnaire was distributed to all doctors who administered anaesthesia at the selected hospitals. Voluntary completion of the questionnaire implied consent in taking part in the study. Anonymity and confidentiality were ensured; completed questionnaires were returned in sealed envelopes and entered onto Microsoft Excel® spread sheet for analysis using Statistica version 12.

A retrospective, contextual, descriptive research design was used in Part 2 of this study. All medical records of patients who underwent surgical procedures during the two week study period (1 to 15 August 2015) in the selected study hospitals were retrieved and entered onto Microsoft® Excel spread sheet for analysis using Statistica version 12.

Descriptive and inferential statistics were used to analyse the data post consultation with a statistician.

5.3 Summary of results

Part 1

The majority of participants administering anaesthesia (n=21, 72.4%) were medical officers. The results also reveal that 18 (62.1%) participants had less than five years of experience in anaesthesia, only one participants had more than 20 years of experience in anaesthesia. The majority of participants 21 (72.4%) had neither an anaesthetic postgraduate qualification nor any recognised resuscitation certificate.

Furthermore, 17 (58.6 %) felt that the training they had received was adequate for the type of surgical cases they were expected to anaesthetise, although some junior doctors felt that the level of supervision was inadequate.

Part 2

A total number of 585 procedures were performed in the two week period study, of which the majority were obstetrics 277 (47.4%). Regional techniques, 332 (56.8%), were employed in the majority of cases. Of these, 266 (96.0%) were obstetric cases done under spinal anaesthesia and the remaining 11 under GA including one case that was converted to GA post a failed spinal.

Anaesthetic records were present 97.8% of the time and 97.2% of these had post-operative observations recorded prior to patients' discharge from the recovery room. There were no anaesthetic related complications reported or noted in the two week study period. The length of stay was appropriate for the type of surgical procedure done in all of the cases.

5.4 Limitations of the study

Some of the hospitals studied initially by Green-Thompson were not included due to limited time of the study. Pretoria West hospital had to be excluded as the theatres had not been functional during the data collection period.

In Part 1, questionnaire distribution and identification of participants was done by the Heads of Anaesthetic Departments of each of the selected study hospitals. A third party may not have similar interests in the study as the researcher.

Part 2 of the study had several limitations. Firstly, the consecutive sampling method was used in this study, due to the time constraints and travelling requirements between these hospitals which are wide apart as well as the study scope limitation. This method of sampling can be used in descriptive research to get an estimation of a particular element of interest (52).

Secondly, the results from the study were contextual to Gauteng province. This may not be generalisable to the rest of South Africa, however, data obtained can be used for improvement in the health care services. Furthermore, the duration due to the scope of the research of the study was limited to two weeks.

In a retrospective study, information available to the researcher depends on the accuracy of record keeping. The researcher did not analyse the anaesthetic records completion adequacy, only the presence and post-operative observations were reviewed.

5.5 Recommendations from the study

The majority of the doctors administering anaesthesia had neither any postgraduate qualification in anaesthesia nor any recognised resuscitation certificates. Some hospitals do not keep a copy of the anaesthetic chart. The following recommendations are suggested regarding clinical practice and further research.

5.5.1 Recommendations for clinical practice

- Doctors involved in administering anaesthesia could be encouraged to improve learning and training by acquiring postgraduate qualification in anaesthesia, for instance a DA.

- Doctors involved with anaesthesia could be encouraged to obtain recognised resuscitation certificates such as ACLS and ATLS.
- Encourage doctors and the Departments of Anaesthesia to keep anaesthetic records for all anaesthetics given.
- Improve anaesthetic supervision of junior doctors.

5.5.2 Recommendations for further research

- A similar study could be done over a longer period of time.
- A similar study could be done involving other hospitals from different provinces.
- Review of anaesthetic charts completion adequacy.

5.6 Conclusion

The majority of doctors administering anaesthesia had neither a postgraduate qualification in anaesthesia nor any recognised resuscitation certificates. The doctors felt that the training they had received was adequate for the type of surgical cases they were expected to anaesthetise, however, some junior doctors highlighted inadequate supervision.

The majority of procedures done were obstetric and were performed using spinal anaesthesia. This is in contrast to Green-Thompson (1) study that found that the majority of obstetric cases were done under GA. There was also a substantial improvement in record keeping.

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Appendix 1: Graduate Studies Committee letter

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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

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

11 January 2016
Person No: 0503682P
PAG

Dr B Bayingana
Unit 3
499 Fifth Street
Florida Glen Ext6
Johannesburg
1709
South Africa

Dear Dr Bayingana

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *Evaluation of anaesthetic services in selected Gauteng 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

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 2: Ethics clearance certificate

R14/49 Dr Blaise Bayingana

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150113

NAME: (Principal Investigator)	Dr Blaise Bayingana
DEPARTMENT:	Anaesthesiology Tembisa Hospital Kopanong Hospital Pretoria West Hospital Sebokeng Hospital and Heidelberg Hospital
PROJECT TITLE:	Evaluation of Anaesthetic Services in Selected Gauteng Hospitals
DATE CONSIDERED:	30/01/2015
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Juan Scribante et al
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	12/06/2015

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.

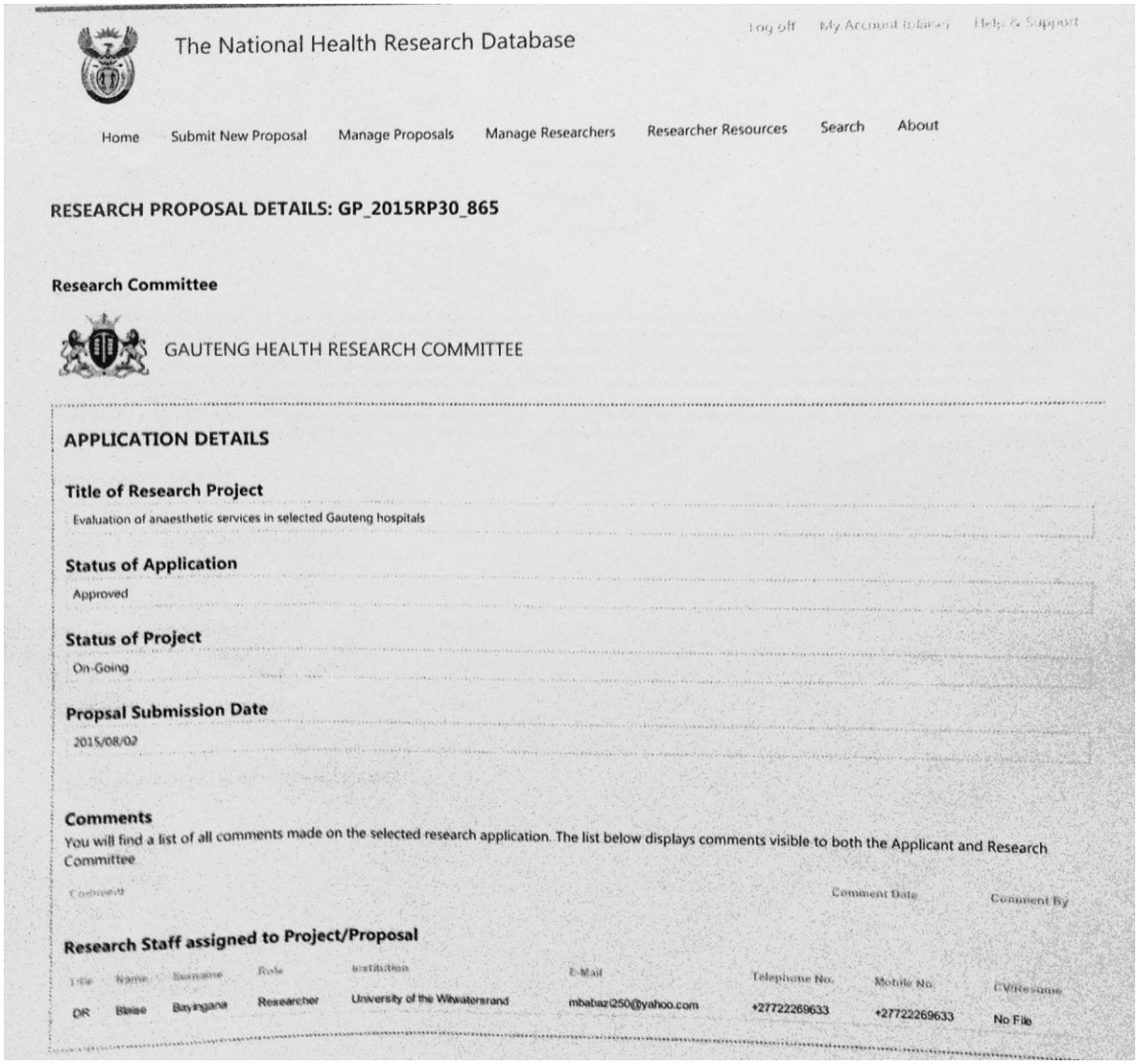
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to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

Principal Investigator Signature

Date 12/06/2015

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 3: Letters from relevant authorities



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RESEARCH PROPOSAL DETAILS: GP_2015RP30_865

Research Committee

GAUTENG HEALTH RESEARCH COMMITTEE

APPLICATION DETAILS

Title of Research Project

Evaluation of anaesthetic services in selected Gauteng hospitals

Status of Application

Approved

Status of Project

On-Going

Propsal Submission Date

2015/08/02

Comments

You will find a list of all comments made on the selected research application. The list below displays comments visible to both the Applicant and Research Committee

Comment	Comment Date	Comment By

Research Staff assigned to Project/Proposal

Title	Name	Surname	Role	Institution	E-Mail	Telephone No.	Mobile No.	CV/Resume
DR	Blaise	Bayingana	Researcher	University of the Witwatersrand	mbabazi250@yahoo.com	+27722269633	+27722269633	No File

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Enquiries : Ms Baale NE
Tel : [011] 923 2320
Fax : [011] 926 2719
E-Mail : Nkgopoleng.Baale@gauteng.gov.za

Tembisa Provincial Tertiary Hospital
Cnr Flint Mazibuko and Rev Namane
1632

SUBJECT: PERMISSION TO CONDUCT RESEARCH

Evaluation of anaesthetic services in selected Gauteng Hospital - Tembisa Provincial Tertiary Hospital.

Permission is hereby granted for the research to be conducted at Tembisa Provincial Tertiary Hospital. This approval is given on the condition that ethics clearance will be obtained from the training institution ethics committee.

Regards

Dr. D Pekane
Chief Executive Officer
Tembisa Provincial Tertiary Hospital

Date: 3/06/2015

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

HEIDELBERG HOSPITAL

Enquiries: Ms Yika
Tel: (016) 341-1207
Fax: (016) 349-5259
E-FAX: 0866547753
Email: Jobe.nomonde@gauteng.gpv.za

TO : **DR. B. BAYINGANA**
FROM : **DR. B.M MOALUSI**
SUBJECT : **PERMISSION TO CONDUCT RESEARCH ON ANAESTHESIOLOGY**
DATE : **13 MAY 2015**

Dear Dr. Bayingana

We have received your request and you are granted permission to come and conduct your research at our institution Heidelberg Hospital.

Regards

DR. M.B. MOALUSI
ACTING CHIEF EXECUTIVE OFFICER
DATE: 13.05.2015

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

PRETORIA WEST HOSPITAL
PRIVATE BAG X02, PRETORIA WEST, 0117

Telephone: (012) 380 1205
Fax: (012) 386 3720
Enquiries: Dr HM Mosoane/smdej

4 June 2015

Dr B Bayingana

Dear Dr Bayingana

REQUEST TO CONDUCT RESEARCH AT PRETORIA WEST HOSPITAL

Approval is hereby granted for you to conduct research titled: Evaluation of anaesthetic services in selected Gauteng hospitals at Pretoria West Hospital as requested.

Please communicate with the Family Physician, Dr CA Visser on telephone number: (012) 380 1340.

Regards

05/06/2015

CEO
PRETORIA WEST HOSPITAL

GAUTENG PROVINCE

KOPANONG HOSPITAL
Private Bag X031, Vereeniging, 1930

OFFICE OF THE CHIEF EXECUTIVE OFFICER

Enquiries : Mr. M.T. Nhlapo
Tel. No. : 016-4287160
Fax no: : 016-4281148

08 June 2015

TO WHOM IT MAY CONCERN

Approval to conduct research by Dr. B. Bayingana in anaesthetic department is subject to the following conditions:

1. Study should not disrupt the services of the unit.
2. The data collection form/sheet for record reviews being submitted should specify exact information extracted from patient's records.
3. Hard copy of the final report of the study and recommendations should be submitted to the CEO of Kopanong Hospital.
4. May need Provincial Research Office approval.

MR. M.T. NHLAPO
CEO

7 - 6 - 2015
DATE:

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Sebokeng Hospital
Clinical Manager
Private Bag X058
Vanderbijlpark
1938

Enquiries : Dr. N. A. Msibi
Tel: 016 930 3304
Email : Nomusa.Msibi@gauteng.gov.za

Department of Anesthesia
Sebokeng Hospital

13 May 2015

Dr. B. Bayingana
Department of Anesthesiology
University of Witwatersrand

PERMISSION TO CONDUCT RESEARCH AT SEBOKENG HOSPITAL

This is to advise you that permission has been granted for you to conduct research at our hospital.

Regards

Dr. P. Basajjasubi
HOD Anesthesia
Sebokeng Hospital

Appendix 4: Information letter

Dear colleagues,

Hello my name is Blaise Bayingana, I am a registrar in the Department of Anaesthesiology at the University of the Witwatersrand. I am currently registered for an MMED degree: **Evaluation of anaesthetic services in selected Gauteng hospitals.**

I would like to invite you to participate in this study by completing the questionnaire attached to this letter. The research proposal is a follow up study looking at the current anaesthetic practice in anaesthesiology following a critical evaluation of anaesthetic services in Gauteng, outside of the greater Johannesburg area in 2002.

Participation of this study is voluntary, anonymity and confidentiality will be maintained as no names or details identifying individuals will be required. The researcher and supervisors will be the only ones with access to the raw data. There are no consequences for not completing the questionnaire. I have provided return envelopes, upon completion kindly seal the envelopes and return it to the allocated contact person at your hospital or directly to me. Please return the questionnaire and envelope even if not completed.

Please feel free to contact me for further clarity or question you may have regarding the study.

This study may not benefit your department directly; however information obtained may contribute to recommendations which can improve the current practice in anaesthesiology.

I have obtained approval for the study from the Postgraduate Committee and the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, certificate number M150113. There will be no cost to your hospital.

Regards,

Blaise Bayingana

Email: mbabazi250@yahoo.com

Phone: +27-72-226-9633

Appendix 5: Questionnaire

1. Designation and years of experience in current designation

Consultant	
Medical Officer	
Community service Doctor	
Intern	

0-5 years	
6-10 years	
11-15 years	
>15 years	

2. Qualification

Have you completed one of the following?	ATLS	
	ACLS	

	Yes	No
Do you have any postgraduate qualifications in anaesthesia?		

If yes, please complete the following

DA		FCA		MMED	
Other		Please specify			

Where did you receive your postgraduate training?

Academic	
Non-academic	

	Years	Months
Cumulative time spend in training to date		

3. Practice

Do you administer anaesthesia?	

How long have you been involved in anaesthesia?

0-5 years	
6-10 years	
11-15 years	
16- 20 years	
>20 years	

Type of Surgery performed at your hospital

General- major		Paediatric surgery- general	
General- minor		Paediatric surgery- neonates	
Neurosurgery		Orthopaedic surgery- major	
Cardio thoracic surgery		Orthopaedic surgery- minor	
Obstetric surgery		ENT surgery	
Gynaecology surgery- major		Urology surgery	
Gynaecology surgery minor		Other- specify	

In your opinion, does your level of training in anaesthesia meet the requirements of what is expected in practice?

Yes		No	

Please explain your answer above

What methods would you use to improve your anaesthetic expertise?

Postgraduate course		Refresher course	
Congress		Lectures	
Other		Specify	

What methods did you use to improve your anaesthetic expertise in the last year?

Postgraduate course		Refresher course	
Congress		Lectures	
Other		Specify	

Thank you very much for your cooperation. Please place your completed questionnaire in the envelope provided, return the sealed envelope to you hospital contact person.

Appendix 6: Data collection sheet for Part Two of the study

Date										
Name										
Gender										
Age										
Hospital No										
Anaesthetic Doctor										
Procedure										
Type of anaesthetic										
Start time										
Stop time										
Duration (min)										
Anaesthetic record	Yes						No			
Details of anaesthetic	*RSI		**ESI		Spinal		Epidural		***PNB	
Date of operation										
Date of discharge										
Length of stay										
Post operation vital										
Comment										

*RSI: Rapid Sequence Induction

** ESI: Elective Sequence Induction

*** PNB: Peripheral Nerve Block