



DSPACE

<https://dspace.org/>

An analysis of theatre utilization at Sekororo District Hospital

Ramodise, Kgaugelo Betrets

2014-02-26

<http://hdl.handle.net10539/13954>

AN ANALYSIS OF THEATRE UTILIZATION AT SEKORORO DISTRICT HOSPITAL

KGAUGELO BETRETS RAMODISE

A research report submitted to the Faculty of Health Sciences, University of the
Witwatersrand, in partial fulfilment of the requirements for the degree of Master of
Public Health in the field of Hospital Management

May, 2013

DECLARATION

I, Kgaugelo Betrets Ramodise, declare that this research report is my own work. It is being submitted for the degree of Master of Public Health in the field of Hospital Management at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or any examination at this or any other University.

A handwritten signature in black ink, appearing to read 'Kgaugelo Betrets Ramodise', written over a horizontal line.

Johannesburg

DEDICATION

This research is dedicated to my family; my wife Bellah, Mamoraka and Dimpho, for the endless love, support and motivation during the whole process.

ACKNOWLEDGEMENT

Sincere thanks are extended to all my colleagues at Sekororo District Hospital, who contributed to the successful completion of this study. The assistance of the following people deserves a special acknowledgement:

- Dr Leegail Adonis, my supervisor for this research project for her continual advice, guidance and inspiration to this study.
- Dr Debashis Basu for support and guidance throughout this research project.
- The Head of Department of Health- Limpopo Department of Health for allowing me to conduct the investigation for the study.
- Ms Magdeline Mphelane for capturing the data.
- The staff of maternity and operating theatre for helping with data collection.

ABSTRACT

BACKGROUND – District hospitals provides level of care services that are part of the basic service package for district hospitals. Services applicable to district hospitals' operating theatres include performance of elective and emergency surgical procedures. A study was conducted at Sekororo district hospital to evaluate the functioning of the operating theatre system.

AIM: To describe the profile of patients, theatre down time and theatre throughput efficiencies at the district hospital for the period 1 April 2009 – 31 March 2011.

METHODOLOGY: This was a cross sectional study based on a retrospective record review. The study setting was Sekororo District Hospital Operating Theatre. The population included records of all operations performed in the theatre during the study period. Theatre utilization was calculated as well as patient throughput to assess the internal operational efficiencies. The throughput of elective and emergency cases were compared.

RESULTS: A total of 702 cases were performed during the study period. The majority of cases performed in the operating theatre were maternity cases (caesarean sections). Maternity cases accounted for 602 cases. The most common indication for caesarean sections (CS) is Cephalo-pelvic Disproportion (CPD) (49.2%). For the maternity cases, the majority were emergency cases (84.33%), and 15.67% elective cases. Theatre utilization for this period was 3% (3.6% for 2009/10 and 3.2% for 2010/11). There was a statistically significant difference ($p < 0.01$) between the average throughput for emergency and elective cases – 25 minutes for emergency cases (confidence interval 20-35 minutes) versus 62.5 minutes for elective cases (confidence interval 38.75 – 78.75 minutes).

CONCLUSION: The theatre utilization rate is extremely low for this study period. Patient throughput is much more efficient for emergency cases. Further studies are required to determine resource allocation to the operating theatre that resulted in the low theatre utilization.

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT	iv
ABSTRACT.....	v
TABLE OF CONTENTS.....	vi
LIST OF FIGURES	ix
GLOSSARY OF TERMS.....	xi
LIST OF ABBREVIATIONS	xiv
CHAPTER 1.....	1
INTRODUCTION	1
1.1 BACKGROUND	1
1.2 STATEMENT OF THE PROBLEM	2
1.3 JUSTIFICATION FOR THE STUDY	2
1.4 RESEARCH QUESTION	3
1.5 STUDY OBJECTIVES	3
1.5.1 MAIN OBJECTIVE	3
1.5.2 SPECIFIC OBJECTIVES	3
1.6 SUBSEQUENT CHAPTERS.....	4
CHAPTER 2.....	5
LITERATURE REVIEW	5
2.1 INTRODUCTION	5
2.2 MANAGEMENT AND CONTROL OF OPERATING THEATRE	5
2.3 PLANNING AND ORGANIZATION OF THEATRE	8
2.4 OPERATING THEATRE UTILIZATION	10
2.5 OPERATING THEATRE TURN-AROUND TIME	13
CHAPTER 3.....	15
METHODOLOGY.....	15
3.1 STUDY DESIGN.....	15
3.2 STUDY SETTING	15

3.3	STUDY SCOPE	16
3.4	STUDY PERIOD	16
3.5	STUDY POPULATION AND SAMPLING.....	16
3.6	DATA MANAGEMENT.....	16
3.6.1	VARIABLES	16
3.6.2	DATA COLLECTION.....	18
3.6.3	DATA ANALYSIS	19
3.7	PILOT STUDY	20
3.8	ETHICAL CONSIDERATIONS	20
CHAPTER 4.....		21
RESULTS		21
4.1	DEMOGRAPHIC PROFILE	21
4.1.1	AGE.....	21
4.1.2	GENDER.....	21
4.1.3	TYPES OF OPERATIONS	21
4.2	OPERATING PROCEDURES	22
4.2.1	MATERNITY CASES	22
4.2.2	TYPE OF MATERNITY PROCEDURES	23
4.2.3	TYPE OF OTHER PROCEDURES	23
4.3	OPERATIVE INDICATIONS	24
4.3.1	CAESAREAN SECTIONS.....	24
4.3.2	OTHER MATERNITY PROCEDURES.....	25
4.4	TURN-AROUND TIME.....	25
4.4.1	CAESAREAN SECTION	26
4.4.2	OTHER MATERNITY PROCEDURES.....	27
4.4.3	OTHER PROCEDURES	29
4.4.4	COMPARISON OF DIFFERENT PROCEDURES	30
4.4.5	COMPARISON BETWEEN TWO YEARS.....	31
4.4.6	THEATRE UTILIZATION RATE	31
CHAPTER 5.....		33
DISCUSSION.....		33

5.1	INTRODUCTION	33
5.2	OPERATING PROCEDURES	33
5.3	DEMOGRAPHIC PROFILE OF PATIENTS	34
5.4	CLINICAL PROFILE OF PATIENTS	34
5.5	TURN-AROUND TIME.....	35
CHAPTER 6.....		39
CONCLUSIONS AND RECOMMENDATIONS		39
6.1	CONCLUSIONS RELATED TO THE AIMS OF THE STUDY	39
6.1.1	DESCRIPTION OF THE PROFILE OF PATIENTS	39
6.2	LIMITATIONS OF THE STUDY	39
6.3	RECOMMENDATIONS.....	40
6.3.1	HIGH TOTAL TIME SPENT IN THEATRE	40
6.3.2	LOW UTILIZATION RATE.....	40
6.3.3	FUTURE RESEARCH.....	41
6.4	SUMMARY AND CONCLUSIONS.....	41
APPENDICES.....		1
APPENDIX A: ETHICS CLEARANCE CERTIFICATE		1
APPENDIX B: LETTERS OF APPROVAL		3
APPENDIX C: DATA COLLECTION INSTRUMENTS		6

LIST OF FIGURES

Figure 3.1 Theatre turn-around flow chart.....19

Figure 4.1 Type other procedure.....24

LIST OF TABLES

Table 3.1 Population in five sub-districts.....	15
Table 3.2 Objective and study variables	17
Table 4.1 Demographic profile and types of operations performed at Sekororo hospital, Limpopo, 2009-2011.....	22
Table 4.2 Operating procedures performed at Sekororo hospital, Limpopo, 2009-2011.....	23
Table 4.3 Operating procedures by operative indications performed at Sekororo hospital, Limpopo, 2009-2011.....	25
Table 4.4 Interval between Theatre arrival to Operating Room arrival times for CS.....	26
Table 4.5 Interval between Theatre Operating Room arrival to departure for CS.	27
Table 4.6 Total Operating Theatre Time for CS.....	27
Table 4.7 Interval between Theatre arrival to Operating Room arrival for Other Maternity procedures.	28
Table 4.8 Interval between Theatre Operating Room arrival to departure for Other Maternity procedures.	28
Table 4.9 Total Time spent for Other Maternity procedures.....	28
Table 4.10 Interval between Theatre arrival to Operating Room arrival for Other procedures.....	29
Table 4.11 Time interval between OR arrival and departure for Other procedures.	29
Table 4.12 Total Time spent for Other procedures.	30
Table 4.13 Analysis of Total Time spent in Operating Theatre.	30
Table 4.14 Analysis of Total Time spent in Operating Theatre	31
Table 4.15 Theatre utilization rate.....	32
Table 5.1 Comparative analysis of Total Time spent in Operating Theatre.	37

GLOSSARY OF TERMS

Analysis	A detail study or examination of something in order to understand more about it (Oxford Advanced Learner's Dictionary, 2004).
Anti-Partum Haemorrhage	Bleeding from the birth canal after the 24th week of pregnancy. It can occur at any time until the second stage of labour is complete (Webster's New World Medical Dictionary, 2008).
Assessment	An opinion or a judgement about something that has been thought about very carefully (Oxford Advanced Learner's Dictionary, 2004).
Breech	The condition in which the baby is in longitudinal lie. Birth in which the buttocks presents before the head (Webster's New World Medical Dictionary, 2008).
Bi-lateral tubal ligation	A surgical procedure for sterilization in which a woman's fallopian tubes are clamped and blocked, or severed and sealed, either method of which prevents eggs from reaching the uterus for fertilization (Webster's New World Medical Dictionary, 2008).
Caesarean sections	A surgical procedure in which one or more incisions are made through a mother's abdomen (laparotomy) and uterus (hysterectomy) to deliver one or more babies, or, rarely, to remove a dead foetus. A Caesarean section is usually performed when a vaginal delivery would put the baby's or mother's life or health at risk, although in recent times it has also been performed upon request for childbirths that could otherwise have been natural(Webster's New World Medical Dictionary, 2008).
Caesarean section rate	Proportion of caesarean sections to total number of deliveries within a time period in a health facility.
Cephalo-pelvic Disproportion	Cephalo-pelvic disproportion exists when the capacity of the pelvis is inadequate to allow the foetus to negotiate the birth canal. This may be due to a small pelvis, a non-gynecoid pelvic formation, a large foetus, or a combination of these factors (Webster's New World Medical Dictionary, 2008).
Dilation and curettage	The dilation (widening/opening) of the cervix and surgical removal of part of the lining of the uterus and/or contents of the uterus by scraping and scooping (curettage). It is a therapeutic gynaecological procedure as well as a rarely used method of first trimester abortion (Webster's New World Medical Dictionary, 2008).
District Hospital	Services provided are level 1 care. Level one care entails that care is provided by General Practitioners, Medical Officers and Primary Health Care Nurses. The hospitals

	have between 30 and 400 beds. The hospitals do not employ permanent specialists, but specialists are required to do training visits.
Elective surgery	A surgery carried out at a time convenient to client and surgeon (Segen's Medical Dictionary, 2011). An elective procedure is planned in advance, rather than one that's done in an emergency situation and can be significant and potentially life-saving operations. Elective surgeries go on a waiting list to be scheduled according to their urgency.
Eclampsia	Hypertensive disorder of pregnancy and toxemia of pregnancy. It is an acute and life-threatening complication of pregnancy, is characterized by the appearance of tonic-clonic seizures, usually in a patient who has developed pre-eclampsia (Webster's New World Medical Dictionary, 2008).
Emergency operation	A surgical procedure that cannot be delayed, for which there is no alternative therapy or surgeon, and a delay could result in death or permanent impairment of health (Segen's Medical Dictionary, 2011). Open fracture of skull, some gunshot and stab wounds, extensive burns, urinary obstruction, intestinal obstruction, ruptured appendix, twisted ovarian cyst, ruptured fallopian tube are some of the examples of emergency operations.
Failed induction	The non-achievement of remission in a patient in whom it is otherwise expected (Webster's New World Medical Dictionary, 2008).
Foetal Distress	The presence of signs in a pregnant woman before or during childbirth that suggest that the foetus may not be well (Webster's New World Medical Dictionary, 2008).
Occipito Posterior	This is the most common malposition. The head is usually incompletely flexed and the occipito frontal diameter presents (Webster's New World Medical Dictionary, 2008).
Placenta Previa	An obstetric complication in which the placenta is attached to the uterine wall close to or covering the cervix. It is a leading cause of anti-partum haemorrhage (Webster's New World Medical Dictionary, 2008).
Pregnancy Induced Hypertension	The development of new arterial hypertension in a pregnant woman after 20 weeks gestation without the presence of protein in the urine (Webster's New World Medical Dictionary, 2008).
Transverse lie	A shoulder presentation refers to a malpresentation at childbirth where the baby is in a transverse lie (its vertebral column is perpendicular to that of the mother), thus the leading part is an arm, shoulder, or the trunk

	(Webster's New World Medical Dictionary, 2008).
Level 1 care	Services which are within the skill base of a general medical practitioner and do not require the intervention of a specialist. Includes simple surgery requiring a general anaesthetic (DOH, 2006).
Operating time	The difference between the time when a patient enters the operating theatre room and he/she leaves the operating room.
Operating Theatre	A room in which a registered medical practitioner or dentist carries out operations (Government Notice No.R.434 of 19 March 1993).
Recovery room	Section of an operating theatre-unit specially set aside and fully equipped, for the immediate post-operative recovery, resuscitation, nursing and special care of patients until such time as such patients are considered to have recovered sufficiently to be safely removed from the aforementioned section (Government Notice No.R.434 of 19 March 1993).
Theatre down-time	Theatre down-time is the amount of time theatres are closed down or are non-functional.
Theatre utilization rate	Proportion of actual operating time to total operating theatre time available in a facility. (The percentage of available working hours that a theatre is used during the normal working day. The percentage of total hours a theatre is used).

LIST OF ABBREVIATIONS

APH	Ante-partum Haemorrhage
BTL	Bi-Lateral Tubal ligation
CS	Caesarean Section
CPD	Cephalo-pelvic Disproportion
D and C	Dilation and Curetage
DHS	District Health Systems
DHIS	District Health Information System
HIS	Hospital Information System
IQR	Inter-Quartile Range
PIH	Pregnancy Induced Hypertension
PP	Placenta Previa
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

The purpose of this study was to describe the profile of patients, theatre utilization and patient throughput at Sekororo District Hospital for the period 1 April 2009 – 31 March 2010 and then 1 April 2010 – 31 March 2011. The Hospital is situated in Maruleng sub-district of Mopani District, in Limpopo Province. This introductory chapter will cover the background to the study, statement of the problem, its aims and objectives and an outline of subsequent chapters.

1.1 BACKGROUND

According to the World Health Organization's (WHO) functional definition of district hospitals, they should provide diagnostic, treatment, care, counselling, and rehabilitation services (Department of Health, 2002). Performance of theatre operations is part of the functions of a district hospital as part of its role of providing first level hospital care (Health Systems Trust, 1998). Services that are applicable to operating theatres in the norms and standards of the District hospital service package, are outlined as follows (Department of Health, 2002):

- Each district hospital has an operating theatre, with an uninterrupted power supply, which is functional 100% of the time,
- All minor elective surgical procedures are performed locally,
- Waiting times for elective surgery are monitored, with 95% of such procedures performed within three months of such a need arising,
- No preventable anaesthetic deaths occur during elective surgery,

Hospitals (both public and private) should produce suitable services of the highest quality at the lowest costs without compromising the quality of services (Guinet and Chaabane, 2003). Complicated theatre operations should be referred to higher levels of care. The performance of operations is part of this District hospital service package, and it requires that there be constant

monitoring of the theatre utilization. The Health Systems Trust (1998) further explained that the exact basket of services will depend on the demographic and epidemiological profile of the district, resources available and its proximity to the regional hospital. Any district hospital should offer these basic services.

1.2 STATEMENT OF THE PROBLEM

Optimum operating theatre utilization at Sekororo District Hospital is a challenge. This Hospital is performing both elective and emergency surgical procedures, although the majority of procedures are emergency surgical procedures. Monthly review of the Hospital Information System (HIS) indicates that average operating theatre utilization rate is 9.5%, as compared to 15% standard norm, which implies massive under-utilization of the operating theatre. The 9.5% means that there is theatre down time of 90.5%, which means that there is a lot of wasted time.

Operating theatre utilization rate is the proportion of actual operating time to total operating theatre time available in a facility (Department of Health, 2002). Therefore, there was a need to analyse the data systematically which included analysis of the number and types of operations, profile of patients, and theatre down-time associated with theatre operations. The purpose of the study was to systematically analyse the data and provide information to the hospital management in order to improve operating theatre utilization in the hospital.

1.3 JUSTIFICATION FOR THE STUDY

Recently, this Hospital has been experiencing an increase in the emergency operations. Some data is collected on the utilization of operating theatre. The hospital management does not know the actual theatre utilization. A study has not been conducted to assess operating theatre utilization at Sekororo District Hospital. A systematic study needs to be conducted to understand the actual

operating theatre utilization. The study is important because the Hospital provides emergency surgery for minor conditions such as skin grafts, tubal ligations and for serious conditions such as caesarean sections, for which travel to a regional hospital would likely be fatal, and minor and common major elective surgery (Department of Health, 2002). The study was feasible because it focused on analysing operating theatre utilization in the hospital.

1.4 RESEARCH QUESTION

What was the theatre utilization rate and patient throughput at Sekororo District hospital?

1.5 STUDY OBJECTIVES

1.5.1 MAIN OBJECTIVE

To describe the profile of patients and theatre utilization at the district hospital for the period 1 April 2009 – 31 March 2010 then 1 April 2010 – 31 March 2011.

1.5.2 SPECIFIC OBJECTIVES

1. To describe the profile of patients who underwent surgery at the theatre for the study period:
 - Demographic profile (age, gender).
 - Clinical profile (indication, type and complications).
2. To describe the types of operations performed during the study period, and to compare elective and emergency operations.
3. To describe theatre turn-around time during the study period.

1.6 SUBSEQUENT CHAPTERS

So far, the background to the research has been discussed. Then, research question and objectives were defined in this first chapter. A brief outline of following chapters is described below.

Chapter Two: Literature Review: The purpose of the literature review is to review pertinent literature and to discuss theatre utilization concepts with particular reference to theatre utilization in hospitals in South Africa and elsewhere.

Chapter Three: Research Methodology: The chapter describes the research methodology, study design, setting and scope and data management techniques used in this study.

Chapter Four: Presentation of Results: This chapter deals with an analysis of the data collected for this study relating to its aims and objectives.

Chapter Five: Discussion: The findings from the review of the literature are incorporated in this chapter with the results obtained from the analysis in order to address the aims and objectives of the study.

Chapter Six: Conclusions and Recommendations: This constitutes the last chapter of the report and derives conclusions from the research related to the objectives of this study, makes recommendations and advocates areas for future research in the field of theatre utilization in a district hospital setting.

CHAPTER 2

LITERATURE REVIEW

In this chapter, relevant literatures into aspects that influence operating theatre utilization; namely, management and control of operating theatre, planning and organization of theatre, theatre utilization, and operation theatre turn-around time are discussed. In addition to published literature, information from various unpublished sources is also reviewed.

2.1 INTRODUCTION

Public health hospitals are expected to measure and ensure that their operating theatre functions in an effective and efficient manner. In order to describe and determine the operation theatre efficiency and effectiveness, hospital management needs to analyse various aspects that impact on the functioning of operations theatre. These aspects have been identified as management and control of operating theatre, planning and organization of theatre, theatre utilization, and operation theatre down-time.

2.2 MANAGEMENT AND CONTROL OF OPERATING THEATRE

The discussion on the management and control of operations theatre should entail controlling how resources are allocated, utilized, monitored and evaluated. Theatre operations control should cover flow of patients, supplies to theatre, and pre-planning for staffing (Chakravarthy, 2005). Operations theatres in hospitals should be organised in a manner that they are able to provide efficient, organised and cost effective services. The hospital management should continually appraise them. Where gaps are identified, service improvement plans should be developed to address inefficiencies. This is supported by Chakravarty (2005), who argued that theatres should promote high standard of asepsis, high utilization rates, comfortable treatment of patients, and efficient function of the

entire operating department. In order to determine this, relevant data needs to be collected. Hospital managers must ensure that routine data are collected and analysed to quantify the management and control of operating theatres. Proper management and control requires availability of data. This hospital's operating theatre information system is mainly paper-based, and some of it is captured and analysed on the District Health Information System (DHIS) (Department of Health, 2002).

A study done in the United Kingdom in 2008 highlighted that hospital theatres represents a significant expense and the efficient use of this costly resource is therefore economically desirable (Faiz, Tekkis, Mcquire, Papagrigoriadis, Rennie, and Leather, 2008). The operation theatre of a hospital represents an area of considerable expenditure in a hospital budget and requires maximal utilization to ensure optimum cost-benefit (Vinukondaiah, Ananthakrishman and Ravishankar, 2000). This is done through analysing records, describing and determining the number and types of operations, describing profile of patients, and the turn-around time for theatre operations.

The management of theatres is concerned with planning and organisation of theatre activities, ensuring availability of resources, theatre management information, measurement and monitoring of utilization (Northern Ireland Audit Office, 2003). This includes scheduling of patients and turn-around times which affects patient waiting lists. Adonis (2006) explains that waiting lists require an in-depth understanding of factors that affect and influence the demand for surgical services and the rate of supply. The management structure of the operations theatre provides for an operational manager. The manager is responsibility for the day-to-day management of the theatre. The operational manager's role should cover monitoring of theatre utilization, operating lists, patient waiting times, cancellations, types of operations, staffing scheduling and materials supplied to the operating theatre. To be able to carry-out these responsibilities, management requires basic information about the operating theatre. These are

basic tenets of information management which are timely, relevant and accurate that assists in operating theatre planning (Williams, 2002).

The argument for the need for management and control of theatres is that theatres requires both human and materials resources for them to operate. This is informed by the fact that hospitals budgets are not unlimited. Operating theatres are equally competing with other service areas when budget allocations are made in a hospital. Operations theatres represent an area of considerable expenditure in a hospital budget (Vinukondaiah, et al., 2000; Van Houdenhoven, Hans, Klein, Wullink, and Kazemeir, 2007). When resources are allocated adequately utilization of theatre can be influenced positively. Significant management benefits will follow from high theatre utilization, including reduced patient cancellations when there is adequate monitoring and evaluation (Delaney, Davis and Tamblyn, 2010).

It is the responsibility of the theatre manager to manage and control utilization of human and materials resources, and monitoring and evaluation of all theatre activities. The provision of different public health services relies on the efficient use of operating theatres (Lobelo, 2010). The efficient use of operating theatres also ensures optimum cost-benefit for the hospital and to clear waiting lists (Deane et al., 2010). The hospital management has to be concerned about the efficient use of these resources, including the time it takes patients waiting for operations.

According to Chakravarty (2005) a considerable portion of the money spent on health care delivery is related to surgical services. This supports the need for maximum utilization of existing resources. An effective management and control system of theatre will ensure that patients' lives are not endangered and that human resources are utilized appropriately. The researcher would like to analyse how the theatre operations are managed. This study forms part of an initial assessment of overall theatre utilization, without an in-depth analysis of how the

theatre is managed. Further studies to evaluate resource allocation and theatre turnaround time would provide further insight on how theatre utilization could be maximized. The intention is that this first research will lead to an impetus for further studies in order to facilitate an improvement in operations theatre management and resource utilization.

2.3 PLANNING AND ORGANIZATION OF THEATRE

Planning for the operation theatre is very critical for the hospital. The operating theatre's operational manager is responsible for scheduling and delegation of nurses working in the operating theatre. The Clinical manager takes responsibility for allocation of doctors to perform various operations. The planning will assist the hospital in determining the hours that are not utilized in the operating theatre, and how resources have been allocated to that service point. The benefit of planning is to improve throughput without compromising quality of services. Given that operating theatre represents an item of considerable expenditure in a hospital (O' Donnell, 1976; Van Houdenhoven et al., 2007), it becomes critical to have adequate planning. A well planned and better functioning operating theatre gives multiple returns to the management in terms of success of surgical procedures, time saved, and more utilization of high cost equipments (Chakravarthy, 2005). Adequate planning also maximizes the utilization of theatre staff, for both medical and non-medical staff.

Another critical aspect of planning is scheduling of operations in a manner that does not lead to disruption of services. Bookings for elective operations are made and staffs are allocated for those operations. Williams (2002) stated that scheduling of operations and operating theatres includes identifying the procedures that require to be performed, and creating a timetable of when those procedures are going to be carried out. According to Orchard, Ellams, and McWhinnie (2010) management should put in systems to ensure that most productive aspect of any surgical list is the time spent on actual operating.

Inefficient or inaccurate scheduling of operating theatre time often results in delays of surgery or cancellations which affects both patients and the hospital (Jonnalagadda, Walrond, Hariharan, Walrond, and Prasad, 2005). Its effect on the hospital can include issues of operational costs. The hospital management should look at ways to contain costs without sacrificing the quality of operating theatre services. It is critical to note that both emergency and elective procedures are performed at this hospital. Emergency procedures are performed to save lives. This is supported by Greenall (2008) who stated that timely surgical interventions for patients improves productivity and quality of services provided. The hospital holds monthly budget review meetings to discuss and review budgets and expenditure for all the costs centres. The operating theatre is also a cost centre with its own allocated budget to cover the theatre based costs.

Planning processes for theatre operations are informed by the number of operations, time to be allocated for each operation, and patient waiting time for the procedure. It also includes ensuring adequate staffing for efficient operations of the operations theatre. This will assist the management to deal with factors that leads to disruption of operations. Chakravarty (2005) explains that careful planning and organising of an operating theatre leads to resource optimisation in terms of human resources, money, materials, and time allocated for theatre operations.

The daily activities of the operating theatre must be scheduled in order to synchronise various human resources and available supplies (Guinet and Chaabane, 2003). Guinet and Chaabane (2003) further argue that accurate operating times are not easy to predict because they depend on the surgeon expertise and patient pathology. These will influence the length of operations and frequency of cancellations. Cancellations and delays in operations affect the efficiency of the operating theatre. Surgeon and pathology factors can only be included in the planning phase by skilled planners who have in-depth knowledge of the staff and the patients.

Efficiency can be determined if there is available data of all operations that takes place in the hospital's operating theatre. Adonis (2006) explains that another area of efficiency creation lies in the appropriate management of waiting lists, and that long waiting lists are often considered the metaphor for inefficiency. On the day of the operation, it is expected that the patient will receive an anaesthetic and surgical procedure in the operating room and next is woken up in the recovery room before returning to the respective ward (Guinet and Chaabane, 2003). Understanding this process will benefit the management of patient waiting lists.

In order to provide the services package outlined by the DOH the theatre uses several human and material resources. Utilization of staff needs to be pre-planned and that staffing levels must match clinical activity (Chakravarthy, 2005) so the theatre manager knows who will be available for the operations. Planning should result in optimal utilization of both material and human resources. Adequate planning can be directly linked to the operations theatre management and control.

2.4 OPERATING THEATRE UTILIZATION

The hospital's operating theatre consists of two operating rooms and a recovery room. The operation of theatre is guided by the hospital services package. The hospital is performing both elective and emergency operations as per the services package for district hospitals (Department of Health, 2002). District hospitals are expected to measure operating theatre utilization on a monthly basis. This is done through capturing and analysis of data via the District Health Information System (DHIS). The raw data is collected and captured in the theatre register. The data will then be analysed to determine operating theatre utilization rate. Operating theatre utilization is an efficiency indicator which monitors the activities of the health system. Utilization should be used as a principal marker of theatre performance in the hospital (Faiz et al., 2008). Operating theatre

utilization is typically considered as an absolute measure that can be used to resolve the perceived efficiency problems in healthcare (Van Houdenhoven et al., 2007). It measures the percentage of total hours a theatre is used in order to determine the available capacity. In the study conducted at Johannesburg Hospital, it was noted that none of the information generated by the theatre information system at the time indicated at what level theatres were being utilized (Adonis, 2006).

Hospital managers need to observe and measure theatre utilization to improve efficiency and effectiveness. Theatre efficiency is defined as maximising theatre utilization, minimising over-running, and minimising cancellations (Pandit, Stubbs and Pandit, 2010). The achievement of efficiency requires the theatre to utilize its allocated resources adequately. The critical element of optimum utilization of theatre is efficiency. Orchard et al., (2010) explains that methods of assessing theatre efficiency includes recording the number of sessions scheduled, number of sessions used, late starts, early or late finishes and number of cases per session. The theatre uses the collected data to measure theatre utilization. The average operating theatre utilization rate in the hospital is 9.5%, as compared to 15% standard norm set by the national department of health.

Operating theatres forms part of a common utilization point of some of the major clinical departments comprising the healthcare system (Adonis, 2006). Hospital managers should be concerned with maximising utilization as part of optimal healthcare delivery which Chakravarthy, (2005) intimated that it can ensure appropriate cost-benefit to the hospital. In terms of the district hospital service package, the hospital management team should find ways in which the hospital-based resources can be optimally harnessed to strengthen the District Health Systems (DHS) (Department of Health, 2002). If operating theatre is not effectively utilized, these hospital resources are largely wasted, and it significantly impacts on the patient care (Jonnalagadda et al, 2005). Therefore, this implies that those resources are wasted because they could have been

allocated and utilised in other costs centres in the hospital.

Despite wide spread use of utilization rates in the public hospital setting there has been little research to date investigating its validity as a performance (Faiz et al., 2008) indicator. No research has been undertaken in this hospital to determine utilization of theatre in order to establish its efficiency. The Department utilizes theatre utilization rate indicator as a measure of monitoring usage of theatre on a monthly a basis. Operating theatre utilization rate is commonly used as an indicator to measure efficient use of hospital resources such as the operating rooms (Van Houdenhoven et al, 2007). It is also argued that higher levels of staffing and expenditure are needed to increase theatre utilization (Haiart, Paul, and Griffiths, 1990). Even though utilization rate is not an indicator of efficient use of resources as outlined by Faiz et al, (2008) it is still an important measure of use.

The hospital needs to understand the factors that affects theatre utilization, and put in measures to address them. Appreciation of the common reasons for cancellations of surgeries will improve operating theatre utilization (Jonnalagadda et al., 2005). Measures taken to improve utilization should take into account factors that impede on the achievement of maximum theatre utilization.

Improving theatre utilization is a key performance target in terms of ensuring that there is timely surgical interventions for patients, reduced length of stay, increased activity and income and improved productivity and value for money from the services provided (Greenall, 2008). Clinical benefits includes improved patient outcomes, enhanced patient and surgical team satisfaction (Deane et al., 2010). Improving utilization requires special attention to resources that are needed to help in the improvement. If this is not done it may lead to under-utilization, which might in turn leads to in-efficiencies.

Under-utilization of operating theatres can be attributed to poor working practises amongst surgeons (Haiart et al., 1990). Hospital management needs to closely monitor allocation for theatre sessions, staffing and scheduling for procedures. Theatre management must ensure that unplanned but predictable workload will be managed in planned and predictable fashion (Deane et al., 2010). Planning for operations need to take into account factors that may impact on scheduled operations from taking place. This is relevant to this hospital because majority of its operations are emergency maternity cases.

2.5 OPERATING THEATRE TURN-AROUND TIME

Theatre utilization as a measure of efficiency and effectiveness can be utilised to determine operating theatre down-time. This will be determined by calculating theatre utilization rate which is derived from the theatre turn-around time. The hospital does not operate a 24-hour service due to the low number of operations performed. It allocates staff during day, and others are put on stand-by for any emergency operations. In order to determine patient throughput, it will be critical to describe operating theatre turn-around time. In order to determine the patient throughput after performance of each operation, operating theatre turn-around time will be calculated. Operating theatre turn-around time will be calculated as the sum of the following time periods:

- 1 = Time Patient Arrives at Operating Theatre
- 2 = Time arrived in the Operating Room
- 3 = Time left the Operating Room
- 4 = Total Operating Theatre Time

Table 2.1 below, Adonis (2006) present results of a study conducted at Johannesburg hospital on the average turn-around for elective procedures conducted which showed that on average patients spent 220 minutes in theatre.

Table 2.1 Average theatre turn-around time for elective procedures at Johannesburg Hospital

Activities	Minutes
Time taken to arrive in theatre reception	26 min
Time taken waiting to be anaesthetised	67 min
Waiting times before operation starts after being anaesthetised	13 min
Average time for operations	52 min
Time taken to arrive in recovery room	4 min
Time from departing and back to recovery room	35 min
Time between being anaesthetised end of cutting time	73 min
Average time spent in theatre	220 minutes

Source (Adonis, 2006)

In Table 2.1 above, the average time each patient spends in operating theatre is described. Orchard et al. (2010) explained that intra-operative pathways are divided into three segments which are measured in minutes; “Anaesthetic Time”, “In Theatre Preparation Time” and “True Operating Time”. This will assist in determining the amount of time that the operating theatre stands unused (Orchard et al., 2010).

CHAPTER 3

METHODOLOGY

The methodology for this study was selected on the basis of its aims and objectives. In this chapter the following were discussed: study design, study setting, study scope, study period, and research tools.

3.1 STUDY DESIGN

This was a cross-sectional study based on a retrospective record review conducted at a district hospital in Limpopo Province.

3.2 STUDY SETTING

The study setting was the operating theatre of Sekororo District Hospital. The hospital is situated in the Maruleng municipality, which is a sub-district of Mopani District in Limpopo province.

Mopani District

The District contains five local municipalities (outlined in Table 3.1).

Table 3.1 Population in five sub-districts

Local municipality	Population
Maruleng	98 550
Greater Tzaneen	375 588
Greater Giyani	237 436
Greater Letaba	220 126
Ba-Phalaborwa	131 081

Sekororo District Hospital

This Hospital is situated in Maruleng Sub-district of Mopani District, in Limpopo Province. The Hospital has 132 beds. The Hospital has five medical doctors and the theatre is staffed by 14 nurses and 2 cleaners and administrative clerk. The hospital has one operating theatre with two operating rooms. Elective and emergency surgical procedures are performed in the theatre.

3.3 STUDY SCOPE

The study involved retrospective record review from the operating theatre of Sekororo District Hospital.

3.4 STUDY PERIOD

The study period was two years 1 April 2009 to 31 March 2011. Comparisons were done between the two years (1 April 2009 to 31 March 2010 and 1 April 2010 to 31 March 2011) for the different variables used in this study.

3.5 STUDY POPULATION AND SAMPLING

The population of this study included seven hundred and two (702) patients who were operated during the study period. No sampling was done because all the operations that were performed in the theatre during this period were included in the study.

3.6 DATA MANAGEMENT

3.6.1 VARIABLES

Following variables were measured during the study (Table 3.2):

Table 3.2 Objective and study variables

Objectives	Variables	Type of variable
Objective 1 To describe the types of operations performed during the study period	Emergency Or Elective Type of Surgery: -Gynaecological -Orthopaedic -Circumcision -Amputation -Laparotomy -Cauterization	Categorical
Objective 2 To describe the profile of patients who underwent surgery at the theatre for the study period.	Demographic profile Age Gender Clinical profile Indication Type Complications. -Surgical Indication -Surgical Type -Name of complication	Continuous Categorical Categorical Categorical Categorical
Objective 3 To determine theatre turn-around time between performance of operations.	Time theatre not in operation	Continuous

Operating theatre turn-around time was calculated, as the sum of the following time periods:

- 1 = Time Patient Arrives at Operating Theatre
- 2 = Time arrived in the Operating Room
- 3 = Time departed the Operating Room and theatre
- 4 = Total Operating Theatre Time

The above calculations are unformed by internal factors. The calculation of Operating theatre turn-around time, will assist in determining operating theatre

utilization rate. Adonis (2006) calculated theatre utilization using following formula:

$$\frac{\text{Operating time}}{\text{Available theatre hours 8 a.m. - 5 p.m.}} \times 100$$

These calculations for theatre utilization are focussing on external factors. Available working hours are based on weekday working of 8 a.m. to 5 p.m. The theatre utilization rate will be determined as follows:

$$\frac{\text{Total theatre hours used}}{\text{Total available theatre hours}} \times 100$$

However, in this hospital there is one theatre which is used 24 hours for elective and emergency cases. While elective cases were performed during working hours (8 AM to 5 PM during week days, the theatre is open for emergency cases rest of the time. If there was an emergency case during working hours, elective cases were put on hold. Therefore a modified formula was used to calculate theatre utilization:

$$\frac{\text{Operating time}}{\text{Available theatre hours (24 hours per days X 365 days)}} \times 100$$

3.6.2 DATA COLLECTION

For Objectives 1 and 2

Data for this study was routinely collected for the DHIS. Data from the DHIS was be extracted using the MS Excel based data collection tool. These tools were designed for this study. Additional data was collected from the theatre register (Appendix C).

For Objective 3

In order to determine the theatre down time, the flow chart below was utilised;

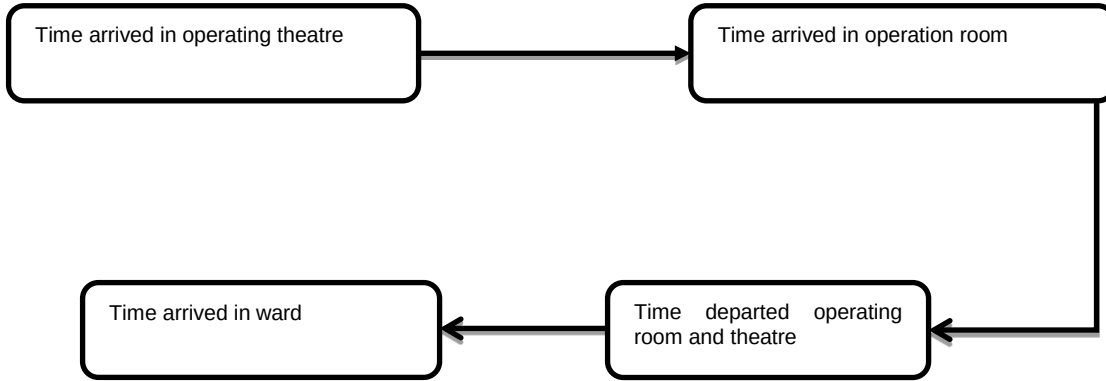


Figure 3.1 Theatre turn-around flow chart

As the Hospital does not have any recovery room, the patients are observed inside the Operating room and then taken from the operating room to the Ward.

3.6.3 DATA ANALYSIS

All data was captured with MS Excel software. Subsequently, data was exported to EPI-Info software version 3.4.1 for analysis. The following descriptive statistics were calculated:

- Continuous variables (age, operating times): Continuous variables with normal distributions: mean and standard deviation. Median and inter-quartile range are used other (skewed) continuous variables to look at measures of dispersion.
- Categorical variables (gender, type of procedure): proportion and range (average turn-around time).

For comparison between emergency and elective surgery (types of operations performed), the following analytical statistics will be used:

- Categorical variables: Mann Whitney's test, Fisher's Exact test and Chi-square test
- Continuous variables: t test

In addition, comparisons were also done between the two years (1 April 2009 to 31 March 2010 and 1 April 2010 to 31 March 2011).

The statistical significance was calculated at the 95% confidence level.

3.7 PILOT STUDY

No pilot study was done as the data used for this study was routinely collected.

3.8 ETHICAL CONSIDERATIONS

The project was approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (Appendix A). A permission to conduct research was sought and obtained from the Department of Health and Social Development of Limpopo province and Sekororo District Hospital (Appendix B). Confidentiality and anonymity has been maintained all the time for collection, capturing, analysis and reporting of the information by a unique study number that will not identify the patient by name or hospital number. Patients' name and hospitals number have not been recorded during any processes of collection, capturing, and reporting of the information. The data was stored in a password protected computer to limit the access only to the study researcher and to ensure data security.

CHAPTER 4

RESULTS

The results obtained from the analysis of data were described in this chapter.

4.1 DEMOGRAPHIC PROFILE

The study population consisted of seven hundred and two patients (n=702) who were operated in the theatre during a two-year study period. Table 4.1 below describes the study population.

4.1.1 AGE

The median age of the patients was 23 years, and the inter-quartile range was 12 – 29.3 in 2009/10. The median age of the patients was 25 years, and the inter-quartile range was 22 – 29.3 in 2010/11 (Table 4.1).

4.1.2 GENDER

There was a huge difference between males and females, with females having the highest numbers. 74.7% (607) of patients were females and 25.3% (95) of patients were males in 2009/10, and 99.7% of patients were females and only 0.3% of patients were males in 2010/11. The reasons for the lower number of cases like circumcision were not performed in 2010, hence the lower number of males (Table 4.1).

4.1.3 TYPES OF OPERATIONS

During the study period, the hospital performed both elective and emergency operations during the period. In terms of elective cases, there were 105 in 2009/10 and 5 in 2010/11, whereas 267 in 2009 and 325 emergency cases were

performed in 2009/10 and 2010/11 respectively (Table 4.1). For the entire study period emergency cases were (592, 84.33%) more than elective (110, 15.67%) procedures in the two year study period.

Table 4.1 Demographic profile and types of operations performed at Sekororo hospital, Limpopo, 2009-2011.

Variable	Year	
	2009/10 (N=372)	2010/11 (N=330)
Age (years) Median (IQR)	23 (12)	25 (22-29)
Gender		
Female	278 (74.7%)	329 (99.7%)
Male	94 (25.3%)	1 (0.3%)
Types of operations		
Electives	105 (28.2%)	5 (1.5%)
Emergency	275 (71.8%)	325 (98.5%)

4.2 OPERATING PROCEDURES

4.2.1 MATERNITY CASES

Maternity cases were the most common procedures for the operating theatre in this Hospital. There were 609 (86.20%) maternity cases operated out of 702 cases during the study period. The maternity cases performed in operating theatre were more than other cases (97) for both years (74.50% and 99.40%) respectively. There were significantly more maternity cases performed during the year 2010/2011 (Fisher's Exact test, $P < 0.001$) (Table 4.2).

Table 4.2 Operating procedures performed at Sekororo hospital, Limpopo, 2009-2011.

Variable	Year	
	2009/10 (N=372)	2010/11 (N=330)
Operating procedures		
Maternity	277 (74.50%)	328 (99.40%)
Others	95 (25.50%)	2 (0.60%)
Types of maternity		
CS	271 (97.8%)	320 (97.6%)
Other types	6 (2.2%)	8 (2.4%)
Other operating procedures		
Circumcision	91 (93.8%)	-
Non-circumcision	4 (4.2%)	2 (100%)

4.2.2 TYPE OF MATERNITY PROCEDURES

Most of maternity procedures were Caesarean sections (CS). CS made up 97.7% of all maternity procedures performed during the study period. Other types of maternity cases performed during this period included; Bi-lateral tubal ligation (BTL), Removal of placenta, Dilation and curettage (D and C), Laparatomy, Secondary suturing and Cauterization. There were no significant differences between the two years in terms of the types of maternity cases performed (Fisher's Exact test, $P=0.60$) (Table 4.2).

4.2.3 TYPE OF OTHER PROCEDURES

During the study period the other procedures that were performed totalled 97. Circumcision made up 91 (93.8%) of all other procedures performed during the study period. Other types of cases performed during this period included;

amputation, hydrocelectomy, laparotomy, skin graft and cauterization. These procedures are outlined in Figure 4.1 below

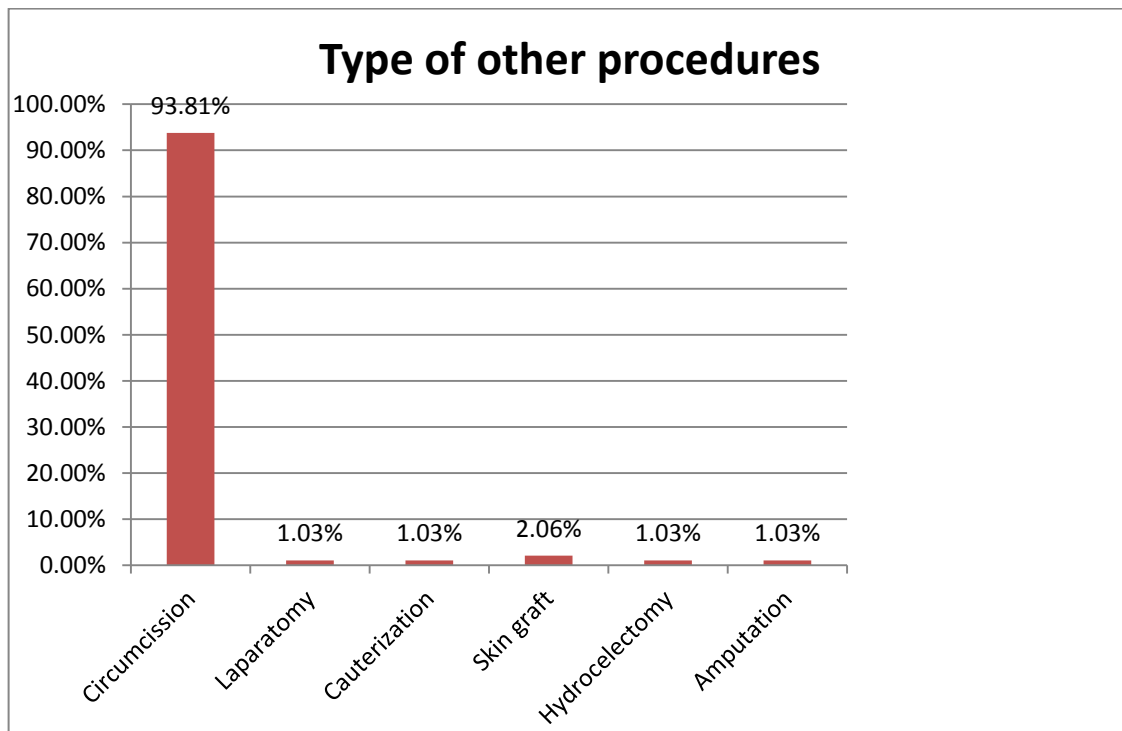


Figure 4.1 Type other procedure

4.3 OPERATIVE INDICATIONS

4.3.1 CAESAREAN SECTIONS

The most common maternal-related indication was CPD 291 (49.2%), previous CS (66, 11.1%), poor progress (30, 5.1%) and APH (17, 2.9%). In relation to the foetal cases, the following common cases were noted; foetal distress (52, 8.8%), breech (40, 6.8%) and big baby (17, 2.9%) (Table 4.3).

Table 4.3 Operating procedures by operative indications performed at Sekororo hospital, Limpopo, 2009-2011.

Operating procedure	Procedure	Operative Indication	N (%)
Maternity (CS)			
	Maternal-related	CPD	291 (49.2)
		Previous CS	66 (11.1%)
		Poor progress	30 (5.1%)
		APH	17 (2.9%)
	Fetal-related	Fetal distress	52 (8.8%)
		Breech	40 (6.8%)
		Big baby	17 (2.9%)
		Other	79 (13.2)
Other Maternity procedures			
	Laparotomy	Ectopic pregnancy	7 (50.0%)
	D and C	Missed abortion	2 (14.3%)
	BLT	Multi-parity	2 (14.2%)
	Other	Other	3 (21.5%)
Other operating procedures			
	Circumcision	Circumcision	91 (93.8%)
	Other	Other	6 (6.2%)

4.3.2 OTHER MATERNITY PROCEDURES

There were other indications for maternity procedures in addition to main indication which is CS, the half of these indications were laparotomy for ectopic pregnancy (50%). The other indications were multi-parity (14.2%), and Dilation and Curettage (D and C) (14.3%). Other cases operated in the theatre accounted for 97; the majority of these operations were circumcisions (93.8%) (Table 4.3).

4.4 TURN-AROUND TIME

Theatre turn-around time was measured in 2010. Following time intervals were measured: (i) the time for theatre arrival to operating room (OR) arrival, (ii) theatre OR arrival to departure and (iii) total time. The information was presented

according to type of procedures namely: (i) Caesarean section (ii) Other maternity procedures and (iii) Other procedures. The turn-around time at the operating theatre is presented Tables 4.4 – 4.14, and this also includes total times spent per different category of operations.

4.4.1 CAESAREAN SECTION

The subjects studied spent the following times in the operating theatre:

- Between Theatre arrival to OR arrival: (Median: 15 min)
- Between Theatre OR arrival to departure: (Median: 35 min)
- Total time: (Median: 50 min)
- They have spent significantly more time between theatre OR arrival to left (Median 35 min). This means more time was spent in the actual operation.

THEATRE ARRIVAL TO OR ARRIVAL

Theatre Arrival to OR Arrival is presented in Table 4.4 and the total median is 15 minutes and inter-quartile range (IQR) is 10 - 20 minutes. There is no significant differences between the median of elective and emergency cases (Mann Whitney's test, $p=0.79$).

Table 4.4 Interval between Theatre arrival to Operating Room arrival times for CS.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	15 (10-20)	16 (10-20)	15 (10-20)
Minimum	0	5	0
Maximum	90	25	90

THEATRE OR ARRIVAL TO DEPARTURE

Theatre OR Arrival to left is presented in Table 4.5 and the total median is 35 minutes. There is no significant differences between the median of elective and emergency cases (Mann Whitney's test, $p=0.56$).

Table 4.5 Interval between Theatre Operating Room arrival to departure for CS.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	35 (30-44)	35 (27-45)	35 (30-44)
Minimum	3	6	3
Maximum	258	90	258

TOTAL TIME

The time spent in the operating theatre during the study period is described in the Table 4.6. Total time: (Median: 50 min) and IQR 44 - 61 minutes. The time spent during the system is normally distributed therefore is described by the median and inter-quartile range.

Table 4.6 Total Operating Theatre Time for CS.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	50 (44-61)	50 (42-66)	50 (44-61)
Minimum	10	16	10
Maximum	283	95	283

4.4.2 OTHER MATERNITY PROCEDURES

TIME OF ARRIVAL AT THEATRE TO OR ARRIVAL

Theatre Arrival to OR Arrival is presented in Table 4.7. The median for emergency procedures was 14 minutes. The theatre arrival to OR arrival ranges

from 5 – 20 minutes. The elective cases were not analysed because very few electives cases were performed.

Table 4.7 Interval between Theatre arrival to Operating Room arrival for Other Maternity procedures.

Time interval (in min)	Emergency only
Median (Inter-quartile range)	14 (5-20)
Minimum	0
Maximum	25

THEATRE OR ARRIVAL TO DEPARTURE

Theatre OR Arrival to left time is presented in Table 4.8 below. The median was 36 minutes. The time spent is for both elective and emergency procedures. It can be noted that the data is not normally distributed because it is a multi-modal distribution. The range of the time in the OR ranged between 4 and 60 minutes.

Table 4.8 Interval between Theatre Operating Room arrival to departure for Other Maternity procedures.

Time interval (in min)	Emergency only
Median (Inter-quartile range)	36 (30-50)
Minimum	5
Maximum	60

TOTAL TIME

The time spent in the operating theatre during the study period is described in the Table 4.9. The time spent in the system is not normally distributed and it is described by the median (50 min) and inter-quartile range (35 – 65 min).

Table 4.9 Total Time spent for Other Maternity procedures.

Time interval (in min)	Emergency only
Median (Inter-quartile range)	50 (35-65)
Minimum	5
Maximum	75

4.4.3 OTHER PROCEDURES

THEATRE ARRIVAL TO OR ARRIVAL

Theatre arrival to OR arrival is presented in Table 4.10. The total median was 5 minutes for both elective and emergency procedures. There is a significant difference between the median of elective (5 min) and emergency (23 min) cases (Mann Whitney's test, $p < 0.01$) which implies that more time (theatre arrival to OR arrival time) is required for emergency cases than electives.

Table 4.10 Interval between Theatre arrival to Operating Room arrival for Other procedures.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	5 (5-10)	5 (5-10)	23 (11-34)
Minimum	0	0	0
Maximum	305	305	90

THEATRE OR ARRIVAL TO DEPARTURE

Time interval between Theatre OR arrival to departure is presented in Table 4.11. On average, both elective and emergency patients spent 20 minutes in the operating theatre room. There is no statistical difference between elective and emergency patients in terms of time spent in operating theatre room arrival to left (Mann Whitney's test, $p = 0.11$).

Table 4.11 Time interval between OR arrival and departure for Other procedures.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	20 (15-27)	20 (15-25)	43 (10-60)
Minimum	0	5	0
Maximum	65	56	65

TOTAL TIME

The time spent in the operating theatre during the study period is described in the Table 4.12. There is significant differences between the median of total time spent for elective (25 min) and emergency cases (63 min) (Mann Whitney's test, $p < 0.01$). The time spent during the system is not normally distributed therefore described by median and inter-quartile range.

Table 4.12 Total Time spent for Other procedures.

Time interval (in min)	Total	Elective	Emergency
Median (Inter-quartile range)	26 (20-35)	25 (20-35)	63 (39-79)
Minimum	10	10	35
Maximum	310	310	80

4.4.4 COMPARISON OF DIFFERENT PROCEDURES

A comparative analysis was done for time spent among different procedures in Table 4.13 below.

Table 4.13 Analysis of Total Time spent in Operating Theatre.

Time between	Total#	Elective#	Emergency#	p value
CS				
Theatre arrival to OR arrival	15 (10-20)	16(10-20)	15(10-20)	0.79
OR arrival to departure	35 (30-44)	35(27-44)	35(30-44)	0.56
Total time	50 (44-61)	50(42-66)	50(44-61)	0.77
Other maternity procedure				
Theatre arrival to OR arrival	14 (5-20)	-	-	
OR arrival to departure	36 (30-50)	-	-	
Total time	50 (35-65)	-	-	
Other procedure				
Theatre arrival to OR arrival	5 (5-10)	5(5-10)	22.5(11-34)	<0.01*
OR arrival to departure	20 (15-27)	20(15-25)	42.5(10-60)	0.11
Total time	25.5 (20-35)	25(20-35)	62.5(39-79)	<0.01*

#Median and IQR

*Statistically significant

Although, there were no significant differences in turn-around time for CS, the time interval between Theatre arrival and OR arrival for emergency cases for other procedures was significantly longer than elective cases (Mann Whitney's test, $p < 0.01$). It shows that patients undergoing emergency procedures took longer time in comparison to those undergoing elective procedures in the operating theatre. As a result of that, total turn-around time for other procedures were significantly longer than elective cases (Mann Whitney's test, $p < 0.01$).

4.4.5 COMPARISON BETWEEN TWO YEARS

Comparison is done between two years (Table 4.14). Although there was no significant changes in interval between Theatre arrival to OR arrival, the interval between OR arrival and departure increased significantly in 2010/11 (Mann Whitney's test, $p < 0.01$). As a result of that, the total time was also significantly increased in 2010/11 (Mann Whitney's test, $p < 0.05$).

Table 4.14 Analysis of Total Time spent in Operating Theatre

Time between	Total#	2009/10#	2010/11#	p value
Theatre arrival to OR arrival	15 (10-20)	13(8-20)	14(10-18)	0.14
OR arrival to departure	35 (30-44)	33(25-41)	35(30-43)	<0.01*
Total time	50 (44-61)	50(35-66)	50(42-60)	<0.05*

#Median and IQR

*Statistically significant

4.4.6 THEATRE UTILIZATION RATE

Theatre utilization was calculated based on following formula:

$$\frac{\text{Operating time}}{\text{Available theatre hours (24 hours per days X 365 days)}} \times 100$$

The theatre was utilised for longer period in 2009/10 (317 hours) in comparison to 2010/11 (286 hours). There were a total of 8760 available hours for the operating theatre for each of the study periods (2009/10 and 2010/11). The theatre utilization rate is illustrated in Table 4.15 below.

Table 4.15 Theatre utilization rate

Time between	Total	2009/10	2010/11
Theatre utilised	603 hours	317 hours	286 hours
Total time available	17520 hours	8760 hours	8760 hours
Theatre utilization rate	3%	3.6%	3.2%

Table 4.15 above indicates that theatre utilization rate has been declining, 3.6% in 2009/10, compared to 3.2% 2010/11. The actual theatre utilization for the two year study period is 3%.

CHAPTER 5

DISCUSSION

In this chapter, the results obtained from the analysis of the data is discussed and compared with those from other published studies.

5.1 INTRODUCTION

The purpose of this study was to describe the profile of patients and theatre down time and theatre throughput efficiencies at Sekororo District Hospital. This study was done in order to describe the profile of patients who underwent surgery at the theatre, the types of operations performed, and to compare the efficient theatre management of elective and emergency operations. No study had been conducted at the level of a district hospital in the Mopani District to look at the profile of patients and theatre down time.

5.2 OPERATING PROCEDURES

There were few number of operations performed in 2010 as compared to 2009. In the view of theatre manager it is highly likely that the reduction is associated with the no performance of circumcision operations being conducted in 2010. It is assumed that if circumcisions were performed in that year of the study period, it might have led to an increase in the number of operations.

The hospital performed both elective and emergency operations. In terms of categories operations, the emergency cases were (592, 84.33%) and elective cases were (110, 15.67%) of all cases. The majority of cases were maternity procedures for both years (74.50% and 99.40%) respectively. There were 609 (86.20%) maternity cases operated out of the total 702 cases. A total of 97 other procedures were performed. This means that maternity cases were significantly higher than other cases during the study period (Fischer's exact test, $P < 0.001$).

The hospital performed both emergency and elective maternity procedures, with the majority of those cases being emergency operations, 572 and 19 CS operations respectively. There were other emergency procedures that were operated which were appendectomy, hydrocele and gangrene. The performance of emergency procedures is meant to save lives. For all categories of operations, the proportion of emergency operations is more in comparison to elective cases.

5.3 DEMOGRAPHIC PROFILE OF PATIENTS

The median age of the patients was 25 years and the majority (86.46%) were females. The reason behind the high number of females is because the majority of operations were caesarean sections.

During the study period, one maternal complication was the reason for transfer to higher level of care. In terms of foetal outcomes, there were four deaths. The lower rate of maternal complications shows that the hospitals is able to provide quality services and saves the lives of both mothers and babies, as well as managing the referral of patients adequately.

5.4 CLINICAL PROFILE OF PATIENTS

The indications for CS were both maternal and foetal (Table 4.3). In a study by Lobelo (2010) focussed on CPD, it raised the probability that women in the area have narrower pelvis resulting in CS performed in first pregnancy followed by repeat CS in subsequent pregnancies. Scott, Karlam, Gibbs, and Honey (2003) stated that the possible causes of CPD may include large baby, abnormal foetal positions, small pelvis and abnormally shaped pelvis.

According to Geidam, Audu, Kawuwa, et al (2009) the leading maternal indications were CPD (15.5%) as compared to other indications at Maiduguri teaching hospital in Nigeria. In a study done in private practice patients in South

Africa, Naidoo and Moodley (2009) CPD was indicated for 25.7% and 8.3% emergency and elective cases respectively. In comparison the CPD was indicated for 49.2% cases in this study. Therefore, there is a particular need for a follow up study to examine the increase in the number of CPD related indications for CS in this hospital. The study should also establish the actual causes of CPD for the CS cases performed in this hospital. The required research need to be implemented in the context of an integrated cross sectional plan to understand the underlying causes of CPD with the intention of reducing them. However, the reduction should not result in an increase in maternal and infant mortality.

The CS operations that took place were both emergencies and electives. The emergency and electives operations accounted for 96.8% and 3.2% respectively. The proportion of cases in each category shows that there were more emergency cases than elective CS cases. This proportion of cases is supported by the fact that the policy of Department of Health is that serious conditions such as caesarean sections, for which travel to a regional hospital would likely be fatal should be performed at district hospitals (Department of Health, 2002). The increased number of emergency CS operations could be attributed to indications for CS and need to save both mothers and babies. The lower number of negative maternal and foetal outcomes can be ascribed to the skills of both medical practitioners and advanced midwives in the hospital.

5.5 TURN-AROUND TIME

The determining of patient turn-around time is a measure utilised to determine theatre utilization in the operating theatre. This was done because there was no available data on theatre down-time or non-functionality of the theatre. According to Van Houdenhoven et al., (2007) operating theatre utilization rate is commonly used as an indicator to measure efficient use of hospital resources such as the operating rooms.

The subjects undergoing CS spent a significant amount of time in the system for both elective (median 50 minutes) and emergency (median 50 minutes) procedures (Table 4.6 and Table 4.13). The Mann Whitney's test ($p=0.79$) shows that there is no statistical difference in the time spent in the operating systems for subjects undergoing CS procedures.

The total median time was 5 minutes for both elective and emergency procedures. The theatre arrival to OR arrival time showed that there was a significant difference between the median of elective (5 min) and emergency (23 min) cases (Mann Whitney's test, $p < 0.01$). This implies that more time (between theatre arrival to OR arrival time) was required for emergency cases than electives. The reasons behind the difference might be that operating theatre needs more time to prepare for emergency procedures because they were not always ready for operations.

The total theatre time (median) for other maternity procedures is 50 minutes. There was no significant difference between the total time for CS and other maternity procedures (median 50 min). However, the situation was not similar when comparing with other procedures because there was a difference between the total time for both CS and other maternity procedures and other procedures (median 25.5 min). The difference in the total time spent could be attributed to the nature and scope of operation and experience of the surgeon performing the operations.

There were no major differences between the median of elective and emergency cases. The similarity in terms of times spent for all categories of maternity cases shows that different surgeons were spending on average equal times when operating patients. The reasons for efficiencies in theatre operations can be noticed in the outcomes of maternal outcomes of the operations. Table 5.1 presents a comparative analysis of the total theatre time spent in the operating theatre between this study and the study by Lobelo (2010).

Table 5.1 Comparative analysis of Total Time spent in Operating Theatre.

This study				Lobelo (2010)		
Time between	Total	Elective	Emergency	Total	Elective	Emergency
Theatre arrival to OR arrival	15(10-20)	16(10-20)	15(10-20)	36(20-59)	40(30-95)	35(20-57)
OR arrival to departure	35(30-44)	35(27-44)	35(30-44)	10(5-15)	10(5-15)	10((5-15)
Total time	50(44-61)	50(42-66)	50(44-61)	46(15-59)	50(30-95)	45(20-57)

#Median and IQR

It can be noted that there is no significance difference between the median time for both elective and emergency procedures for both studies.

The 330 operations in 2010 translated into an average of 27.5 operations per month (Table 4.14). Total time spent in the operating theatre was 50 minutes per patient per day. The operating theatre allocates 8 hours (480 minutes) per day for operations, and theatre down-time is 430 minutes. The 372 operations in 2009/10 translated into an average of 31 operations per month in comparison to 27 cases per month in 2010/11 (total 330). Because of that, the theatre was utilised for longer period in 2009/10 (317 hours) in comparison to 2010/11 (286 hours). It is difficult to calculate real utilization of theatre segregating between working hours and after hours, as there is no dedicated emergency theatre in the hospital. However, the low utilization rate found in the study showed the theatre could be utilised more such as leasing it to private providers.

The study showed that, although the number cases decreased in 2010/11 in comparison to 2009/10, the total time spent per case increased in 2010/11 showing probably a decrease in efficiency. This might be due to nature of cases performed in 2010/11 that are more complicated than 2009/10. For example, 91 circumcisions were only performed in 2009/10. These are simple procedures and take less time in comparison to other procedures such as CS.

The hospital recorded a lower theatre utilization rate during the two year study period. The hours utilised for the operating theatre were 317 and 286 hours respectively for the two year study period. This was out of a total of 8760 available hours for each year of the study period.

The actual utilization rate (3.6% in 2009/10 and 3.2% in 2010/11) is lower than the Departmental set target of 15%. This points to a lack of maximization of theatre utilization because the available capacity that is not fully utilised. Van Houdenhoven and others (2007) stated that operating theatre utilization is typically considered as an absolute measure that can be used to resolve the perceived efficiency problems in healthcare and it is also a principal marker of theatre performance in the hospital (Faiz et al., 2008). The hospital management needs to review this situation to ensure that resources are adequately allocated based on the performance of the operating theatre. The intention is ensure that available capacity is optimally utilised. This should be done without compromising the quality of services provided at the Hospital's operating theatre.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the results obtained from this study were assessed in relation to the aims and objectives of the study, so that appropriate conclusions can be drawn. The limitations of the study are listed. Based on the findings of the study, appropriate recommendations and suggestions for future research are included.

6.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY

This was a cross-sectional study that looked at the profile of patients and theatre down time at the operating theatre of Sekororo District Hospital, a district hospital in the rural Mopani district in the Limpopo Province during the two-year study period.

6.1.1 DESCRIPTION OF THE PROFILE OF PATIENTS

The majority of patients were females as opposed to males. The procedures underwent were, both emergency and elective procedures. Female patients had more emergency procedures than males. The reason behind the high number of females is because the majority of operations were caesarean sections and other maternal related procedures. There was a decrease in number of elective procedures in the last year of study period. The operative outcome for both elective and emergency procedures did not yield any differences.

6.2 LIMITATIONS OF THE STUDY

The following limitations were experienced in conducting this study:

- (a) The study was conducted in one rural district hospital; therefore the findings of this study may not be generalizable to other district hospital.

- (b) The study was a cross-sectional, therefore the bottlenecks could not be identified in the system which impacts on the performance of more emergency procedures.
- (c) Major limitation for the study was incomplete operating theatre records. The operating theatre register does not make provision for recording all required data elements that will enable the researcher to conduct a thorough study.
- (d) Theatre utilization was calculated on a 24 hour basis as there is no dedicated Emergency theatre in the Hospital.

6.3 RECOMMENDATIONS

The recommendations made based on the findings of the study.

6.3.1 HIGH TOTAL TIME SPENT IN THEATRE

This project is the first systematic study to be done at the Sekororo District Hospital. This study identified the areas where the patients spent more time in the operating theatre. The hospital management need to further investigate factors contributing to this turn-around time in order to improve efficiency.

6.3.2 LOW UTILIZATION RATE

It further highlighted that there was a decline in the theatre utilization, which implies the theatre is not used efficiently. This would assist the Hospital management to develop measures to improve operating theatre utilization.

The results of the study will be disseminated to the Mopani District and Provincial Office of Limpopo Department of Health and the management of hospital, staff in the operating theatre and maternity ward.

6.3.3 FUTURE RESEARCH

There is a particular need for a follow up study to examine the increase in the number of CPD related indications for CS in this hospital. The required research recommendations need to be implemented in the context of an integrated cross sectional plan to understand the underlying causes of CPD with intention of reducing them.

Based on findings of this study, the researcher would like to suggest following future studies:

- (a) There is a need to conduct a prospective study in order to understand the association between types of procedures and theatre turnaround.
- (b) A qualitative method, where participants can be engaged in the form of interviews can be conducted.
- (c) Therefore in order to determine resource utilization, cost analysis and skills-mix of the operating theatre needs to be performed.

6.4 SUMMARY AND CONCLUSIONS

This study was cross-sectional record review. It was first of its kind to be done in this Hospital and the Health District. The study described the types of operations performed during the study period, profile of patients who underwent surgery at the theatre for the study period, and determined theatre down time after performance of operations. The study population was 702 operations performed which consisted of elective and emergency operations.

The results of the study would assist the Hospital Management to develop appropriate measures to improve operating theatre utilization and efficiency.

REFERENCES

- Adonis, L.F. (2006). *Evaluation of the Johannesburg hospital operating theatre*. Research Report. Johannesburg: University of Witswatersrand
- Chakravarthy, M. D. (2005). *A Study of Planning and Functioning of The Operation Theatres in Father Muller Medical College Hospital*.
- Deane, S.A., MacLellan, D.G., Meredith, G.L., and Cregan, P.C. (2010). Making sense of emergency surgery in New South Wales: a position statement. *ANZ.J.Surg.*, Vol. 80, No. 3, pp 139-144. Available from: PM:20575914
- Delaney, C.L., Davis, N., and Tamblyn, P. (2010). Audit of the utilization of time in an orthopaedic trauma theatre. *ANZ.J.Surg.*, Vol. 80, No. 4, pp 217-222. Available from: PM:20575946
- Department of Health. (2002). *A District Hospital Service Package for South Africa*. <http://www.doh.gov.za/list.php?type=Reports> [Accessed January 2012]
- Faiz, O., Tekkis, P., Mcquire, A., Papagrigoriadis, S., Rennie, J., and Leather, A. (2008). Is theatre utilization a valid performance indicator for NHS operating theatres? *BMC Health Services Research*, Vol. 8, No. 28. Available from: <http://www.biomedcentral.com/pubmed/18237411> [Accessed on 9 April 2011]
- Geidam, A. D., Audu, B. M., Kawuwa, B. M., and Obed, J. Y. (2009). Rising trend and indications of caesarean section at the university of Maiduguri teaching hospital, Nigeria. , *Ann Afr Med*, Vol. 8, No. 2, pp 127-132. Available from: <http://www.annalsafrmed.org/text.asp?2009/8/2/127/56242> [Accessed on 9 April 2011]

Government Notice. (1993). *Regulations Governing Private hospitals and unattached Operating Theatre units*. No.R.434 of 19 March 1993.

Greenall, M. (2008). *Theatre Utilization*. Oxford Radcliffe Hospitals NHS Trust. <http://www.oxfordradcliffe.nhs.uk/aboutus/trustboard/tbdocs08/november/0811minutes080918.pdf> [Accessed on 08 January 2012]

Guinet, A. and Chaabane, S. (2003). Operating theatre planning. *Int J Production Economics*, Vol. 85, pp 69-81. Available from: <http://www.elsevier.com/locate/dsw> [Accessed on 11 May 2011]

Haiart, D.C., Paul, A.B., and Griffiths, J.M. (1990). An audit of the usage of operating theatre time in a peripheral teaching surgical unit. *Postgrad.Med J*, Vol. 66, No. 778, pp 612-615. Available from: PM:2217029 <http://www.ncbi.nlm.nih.gov/pubmed/2217029> [Accessed on 9 April 2011]

Health Systems Trust. (1998). *The role of the District Hospital in the DHS*. <http://www.hst.org.za/sites/default/files/kwiksk9.pdf> [Accessed on 23 February 2011]

Hornby, A.S. (2004). *Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. London: Oxford University Press

Jonnalagadda, R., Walrond, E.R., Hariharan, S., Walrond, M., and Prasad, C. (2005). Evaluation of the reasons for cancellations and delays of surgical procedures in a developing country. *Int J Clin Pract*, Vol. 59, No. 6, pp 716-720

Lobelo, M.E. (2010). Utilization of operating theatres at General De La Rey hospital in the North West province. Research Report. Johannesburg: University of Witwatersrand

Naidoo, P.R, and Moodley, J. (2009). Rising rates of Caesarean sections: an audit of Caesarean sections in a specialist private practice. *SA Fam Pract*. Vol. 51, no.3 pp. 254- 258.

Northern Ireland Audit Office. (2003). *The use of Operating Theatre in Northern Ireland in Health and Personal Social services*.

http://www.niauditoffice.gov.uk/index/publications/report_archive_home/report_archive_2003/the_use_of_operating_theatres.pdf [Accessed on 1 June 2011]

O' Donnell, D.J. (1976). Theatre utilization analysis. *Med J Aust.*, Vol. 2, No. 17, pp 650-651. Available from: PM:994981

<http://www.ncbi.nlm.nih.gov/pubmed/994981> [Accessed on 1 June 2011]

Orchard, M., Ellams, J., and McWhinnie, D. (2010). What Do We Mean by "Theatre Utilization"? *The Journal of One Day Surgery*. Vol. 20., No. 1, pp 4-6

Pandit, J. J., Stubbs, D., and Pandit, M. (2010). Measuring the quantitative performance of surgical operating lists: theoretical modelling of 'productive potential' and 'efficiency'. *Anaesthesia*, Vol 65, No. 1, pp 84-85.

Scott, J.R., Karlam, B.V., Gibbs, R.S., and Honey, A.F. (2003). *Danforth's Obstetrics and Gynecology*. Lippincott Williams. 9th eds.

Segen's Medical Dictionary. (2011). *Concise Dictionary of Modern Medicine*. <http://medical-dictionary.thefreedictionary.com/Emergency+Surgery> [Accessed on 1 June 2011]

Van Houdenhoven, M., Hans, E.W., Klein, J., Wullink, G., and Kazemeir, G. (2007). Norm Utilization for Scarce Hospital Resources: Evidence from Operating Rooms in a Dutch University Hospital. *J Med Syst* Vol 31, pp 231-236.

<http://www.ncbi.nlm.nih.gov/pubmed/17685146>

Vinukondaiah, K., Ananthakrishnan, N., and Ravishankar, M. (2000). Audit of operation theatre utilization in general surgery. *Natl.Med.J.India*, Vol 13, No 3, pp 118-121 available from: PM:11558108

<http://www.ncbi.nlm.nih.gov/pubmed/994981>

Webster's New World Medical Dictionary. (2008). 3rd edition. Wiley Publishing

Williamson, D. (2002). *A Review of Managing Operating Theatres in the National Health Services*. <http://www.duncanwil.co.uk/pdfs/opth.pdf>

APPENDICES

APPENDIX A: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

R14/49 Kgaugelo B Ramodise

CLEARANCE CERTIFICATE

M110953

PROJECT

An Analysis of Theatre Utilization at Sekoro
District Hospital

INVESTIGATORS

Kgaugelo B Ramodise

DEPARTMENT

School of Public Health

DATE CONSIDERED

30/09/2011

DECISION OF THE COMMITTEE*

Approved unconditionally

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

DATE 16/01/2012

CHAIRPERSON 
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr Leegail Adonis

DECLARATION OF INVESTIGATOR(S)

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

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX B: LETTERS OF APPROVAL



Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011)717-2075/6

Reference: Ms Salamina Segole
E-mail: Salamina.segole@wits.ac.za
26 September 2011
Person No: 0010583G
PAG

Mr KB Ramodise
3 Constantia Gardens
Wilhelmina Street & Van Vuuren
Constantia Kloof
1709
South Africa

Dear Mr Ramodise

Master of Public Health (Hospital Management): Approval of Title

We have pleasure in advising that your proposal entitled "*An analysis of theatre utilization at Sekororo District Hospital*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

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

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH & SOCIAL DEVELOPMENT

Enquiries: Selamolela Donald

Ref: 4/2/2

30 March 2011
Ramodise K B
Department of Health
Mopani District
Sekororo Hospital

Greetings,

Request for permission to conduct study within the departmental facilities

1. Your letter dated 1st March 2011 herein refers
2. Kindly note that the department can only grant permission for your study upon the receipt of Ethical Clearance Certificate from your institution
3. The Ethical Clearance Certificate will enable the Provincial Health Research Committee to process your request
4. Kindly obtain and furnish the department with the certificate for the speedy processing of your request
5. Hope you find the above to be in order

Kindest regards,

Senior Manager: Monitoring and Evaluation

APPENDIX C: DATA COLLECTION INSTRUMENTS

TOOL 1: PATIENT PROFILE AND DIAGNOSIS

[illegible]

TOOL 2: PATIENT TURN AROUND TIME

[illegible]