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ASSESSMENT OF LABORATORY TESTING PATTERNS AND COSTS IN PRIMARY HEALTH CARE FACILITIES SEKHUKHUNE DISTRICT, LIMPOPO PROVINCE, 2010

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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

NOVEMBER 2016

DECLARATION

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

Johannesburg 22/11/2016

DEDICATION

This research is dedicated to my family, my husband Ramphelane and my two sons Katlego and Koketšo for their unconditional love, undivided support and motivation throughout my studies.

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Sincere thanks are extended to all my colleagues in the Sekhukhune Health District, who contributed to the successful completion of this study.

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ABSTRACT

BACKGROUND: Laboratories provide the bulk of available diagnostic techniques and are indispensable in delivery of health care. Correct types of tests ordered per level of care are very important. Appropriate laboratory testing is critical for the early detection and diagnosis of disease at primary health care level. However, laboratory tests remain a significant cost driver in many health care institutions in the Limpopo Province. Sekhukhune district, as one of five districts in the province, is no exception and is experiencing high laboratory expenditure.

AIM: The aim of this study was to review laboratory testing patterns and costs in all primary health care facilities within the Sekhukhune District, Limpopo Province for the period 1 January to 31 December 2010. This information would enable the district to determine an appropriate laboratory budget and monitor future expenditure.

OBJECTIVES: The objectives of this study were: a) to determine the *number* of laboratory tests done in primary health care facilities, b) to determine the *types* of laboratory tests done in primary health care facilities in the Sekhukhune District and c) to determine the *costs* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010

METHODOLOGY: This was a cross sectional study. The setting of the study was the Sekhukhune Health District, one of five districts in the Limpopo Province. The District has three community health centres, eighty-four primary health care clinics and twenty seven mobile clinics. Data on the number, type and cost of each test was extracted from the National Health Laboratory Services (NHLS) electronic database. The study commenced after obtaining approval from relevant authorities.

RESULTS: The total number of tests done in the study period was 10254 of which 1969 (20%) were performed in CHC's, 8239 (80%) in clinics and 46 in mobile clinics. The majority of the tests done were appropriate for the level of care. TB was the most common test performed. The reason for this is that Greater Tubatse and Fetakgomo sub districts are mining areas and case findings in these areas is intensified. Glucose tests and pregnancy tests are the least frequently tests performed and the indication or rationale may be that Point of Care testing for diabetes and pregnancy were introduced in facilities.

Therefore, these tests were necessary for the diagnosis and care of the clients that visited the public health facilities for their health care. The majority of tests ordered were relevant to the level of care and were for diagnostic purposes.

CONCLUSION: This study was first of its kind to be done in this health district. The study described the types and costs of laboratory tests performed during the study period, per facility type and sub district for the study period. There were issues identified that could improve laboratory utilisation within the district such as the need to establish NHLS committees at sub district level to monitor and strengthen service provision as well expenditure. The results of the study will assist the District Management to develop appropriate measures to improve laboratory testing patterns and efficiency.

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GLOSSARY OF TERMS

Category B municipalities	These are municipalities, which are mainly rural with communal tenure and with, at most, one or two small towns in their area. (COGTA, 2009)
Cost containment	A process of maintaining organizational costs within a specified budget restraining expenditure to meet organizational or project financial target (Friedman, 2007)
Cost-effective	Bringing the best possible profits or advantages for the lowest possible costs (Hornby, 2004)
Cost-saving	An action that will result in fulfilment of the objectives of a purchase, at a cost lower than the historical cost or the projected cost (Friedman, 2007)
District hospital	These are hospitals with a package of services that provide trauma and emergency care, in-patient care, out-patient visits and paediatric and obstetric care. A limited number of regional hospital services can also be provided by the larger district hospitals to improve access and to facilitate easy reference to regional hospital. The services are provided by family physicians, general practitioners, and clinical nurse practitioners. These hospitals only employ specialists in the form of family physicians, paediatricians, obstetrician/gynaecologists, and general surgery (National Department of Health, 2011).
Goods and Services	The most basic products of an economic system that consist of tangible consumable items and tasks performed by individuals. (Friedman, 2007)
High-value intervention	An intervention that prevents a substantial amount of morbidity and/or mortality and is cost-effective.

Health care providers	This refers to both nurses and doctors.
Laboratory tests	All tests done in the laboratory by National Health Laboratory Services.
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 general anaesthetics (National Department of Health, 2006).
Level 2 care	Services which at some time during the intervention are beyond the normal scope of a generalist and required the input of a registered specialist (National Department of Health, 2006).
Level 3 care	Services which at some time during the intervention are beyond the normal scope of a specialist and required the input of a registered sub-specialist (National Department of Health, 2006).
Primary Health Care	A set of prescribed services, generally falling within the skill base of a professional nurse, technician, mid-level worker, counsellor, community health worker, midwife and emergency medical practitioner. These services may be first point of contact or for follow-up care (National Department of Health, 2006).
Regional hospitals	These are hospitals that render services at a general specialist level, receive referrals from district hospitals and provide specialist services to a number of district hospitals. They also serve as a platform for training of health workers and researchers. Most of the care provided will require the expertise of teams led by experienced specialists. These are facilities that provide care requiring the intervention of general practitioners as well as specialists and be staffed permanently in at least five of the following eight basic specialties: surgery, medicine, orthopaedics, paediatrics, obstetrics and gynaecology, psychiatry, diagnostic radiology and anaesthetics. (National Department of Health, 2011).

Specialized Hospitals	There are wide a range of possible specialties that could be focused in a hospital, the two most common being TB and Psychiatry, but they also include spinal injuries, maternity, heart, infectious diseases and so on. These units may also provide either acute, sub-acute or chronic care or all of those levels of care (National Department of Health, 2006).
Standard Charts of Accounts	A system of accounting records developed by every organization to be compatible with its particular financial structure, and in agreement with the amount of detail required in its financial statements. It consists of a list of ledger account names and numbers showing classifications and sub-classifications, and serves as an index to locate a given account within the ledger. (Friedman, 2007)
Tertiary hospital	These are hospitals that render specialist and sub-specialist care to a number of regional hospitals. They also serve as a platform for training of health workers and researchers. Most care provided will require the expertise of teams led by specialists. The areas of specialty include cardiology, cardiothoracic surgery, craniofacial surgery, diagnostic radiology, endocrinology, geriatrics, haematology, human genetics, infectious diseases, general surgery, orthopaedics, general medicine, paediatrics, obstetrics & gynaecology, radiology and anaesthetics. (National Department of Health, 2011).

LIST OF ABBREVIATIONS

ART	Anti-Retroviral Treatment
ASLM	African Society for Laboratory Medicine
CE	Continued Education
CHC	Community Health Centre
CT scan	Computerized tomography scan
DHB	District Health Barometer
DHS	District Health System
DHIS	District Health Information System
DoH	Department of Health
GFATM	Global Fund to Fight AIDS, Tuberculosis, and Malaria
HB	Haemoglobin
HIV	Human Immunodeficiency Virus
HOD	Head of Department
HST	Health Systems Trust
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh - an international health research institution located in Dhaka
IHR	International Health Regulations
LDHSD	Limpopo Department Health and Social Development
LFT	Liver Function Test
MRI	Magnetic resonance imaging
NCD	Non Communicable Disease
NDoH	National Department of Health
NHLS	National Health Laboratory Service
NHS	National Health System
PCR	Polymerase Chain Reaction
PDE	Patient Day Equivalent
PEPFAR	The United States President's Emergency Plan for AIDS Relief

PHC	Primary Health Care
POCT	Point Of Care Testing
RFT	Renal Function Test
RPR	Rapid Plasma Reagin
SCOA	Standard Charts of Accounts
TB	Tuberculosis
TFT	Thyroid Function Test
UNHCR	United Nations High Commissioner for Refugees
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

The purpose of this study was to describe and cost the pathology laboratory tests done at primary health care level in Sekhukhune district. This introductory chapter will, therefore, provide some background to the study. A review of the international and national literature on the importance of laboratory tests is presented and has informed the study objectives and the methodology used.

Diagnostic services include all medically-based services that can assist a clinician to make a diagnosis in a patient or prevent diseases in populations. Diagnostic services include both imaging (X-rays, CT scans and MRI) and pathology services. Pathology laboratory services, the focus of this research project, refer essentially to the analysis of blood or other body fluids and tissues.

1.1. BACKGROUND

The provision of affordable access to quality laboratory services is key to the effective treatment and prevention of diseases (Roscigno, 2011). Laboratory services can be instrumental in confirming a diagnosis, providing insights as to how to manage a condition or preventing a disease. Laboratory services ensure that patients are diagnosed earlier and faster and treated more effectively. This contributes to increasing chances of survival, and reduces transmission of diseases in the community. The World Health Organization (WHO) advocates for basic laboratory services to support clinical and public health activities at primary health care level and states that basic laboratory tests may assist in better diagnosis and management of six out of ten of the most common diseases and conditions seen in outpatients presenting to health centres and primary level hospitals. (WHO, 1979). However, very little has been done to implement this in African countries even after 40 years (Carter, Lema, Wangai, et al, 2012).

Delegates at a consensus meeting on *Clinical Laboratory Testing Harmonization and Standardization for Africa* held in Maputo, Mozambique, in 2008 agreed that laboratory services play a pivotal role in the diagnosis of diseases in health facilities and proposed a reorganization of laboratory services to assure the provision of quality assured laboratory services as part of a greater framework of health system strengthening within resource limited settings in Africa (WHO, 2008)

Limpopo Province is one of nine provinces in South Africa. The province shares international borders with Zimbabwe to the north, Botswana to the west and Mozambique to the east. Limpopo Province is also bordered by Mpumalanga Province on the south-eastern side and Gauteng in the south. The population of Limpopo Province was 5.7 million in 2011. The majority of the population is young with 58.1% below the age of 25 years and 10.5% being children under five years. (Statistics South Africa, 2011)

The Province is divided into five district municipalities. Sekhukhune district municipality, the most deprived municipality, with 20.8% of the provincial population and is further divided into five local municipalities – Greater Tubatse, Makhuduthamaga, Elias Motswaledi, Ephraim Mogale and Fetakgomo (Health Systems Trust, 2012).

The Limpopo Provincial Government Department of Health, based in Polokwane, is responsible for the delivery of health care services in the province. Hospital services are provided in forty public sector hospitals across the province.

As part of the district health system, there are five health districts in the province, with boundaries that are co-terminous with the municipality boundaries. Primary health care services are managed by a district management team in each district and, in Sekhukhune, are provided in five district hospitals, three community health centres, 85 clinics and 27 mobile clinic points.

The expenditure per capita on primary health care was R997 in Sekhukhune health district in 2010 / 2011. This is less than the provincial average of R1 189 per person and

the R1 610 per person spent in the Waterberg health district (Health Systems Trust, 2012).

The district provides primary health care services in these facilities and refers patients requiring higher levels of care to one of two regional hospitals in the district or to Polokwane/Mankweng Hospital Complex, which is a tertiary hospital and is approximately 100 km away. Although there are no private hospitals within the district, there are a number of general practitioners who operate from their surgeries across the district.

Primary health care services in the district are free and are provided in line with a national core package of primary health care services. The first PHC Package of Services was published in 2000 and is in the process of being revised. The national core package articulates a comprehensive package of preventive and curative services to be delivered and includes evidence based treatment guidelines and algorithms, as well as an essential drug list. (National Department of Health, 2000a).

In order to ensure the availability of good diagnostic facilities to support preventive and curative care to all citizens of this country, these guidelines and algorithms also include laboratory testing guidelines for specific diseases and conditions and these have been developed over the years. Guidelines exist for the management of diabetes (National Department of Health, 2012a), dyslipidaemia (South African Medical Association and Lipid and Atherosclerosis Society of Southern Africa Working Group, 2000), and hypertension (National Department of Health, 2012b). These guidelines also articulate the need for good record keeping of all laboratory requests and require facilities to put in place systems to ensure that a laboratory specimen register is kept updated and missing results are followed up.

All PHC facilities in the district are staffed by qualified professional nurses, some of whom will have primary health care training, who render these primary health care services to communities. In addition, doctors and allied health professionals (such as physiotherapy and occupational therapy), who are employed by hospitals within the district, support

clinics and CHC's through outreach programs designed to ensure coverage by visiting them once a week.

All health facilities within the district have access to clinical laboratory testing services. Laboratory services are rendered by the National Health Laboratory Services (NHLS). The NHLS is a public health laboratory service and was established in 2001 by merging the South African Institute for Medical Research (SAIMR), the National Centre for Occupational Health, the National Institute for Virology and various provincial health department and university-run pathology laboratories. (National Health Laboratory Services, 2001). NHLS is now the largest diagnostic pathology service in South Africa and has the responsibility of supporting the national and provincial health departments in the delivery of healthcare. The NHLS provides laboratory and related public health services to over 80% of the population through a national network of laboratories. Services are rendered in satellite laboratories, which are attached to hospitals. In Sekhukhune District NHLS laboratories are found in each of the five district and two regional hospitals.

1.2. LITERATURE REVIEW

1.2.1 THE VALUE OF LABORATORY TESTS

The appropriate use of laboratory tests is necessary for optimal patient care. Nearly every practicing physician relies on laboratory services in order to make an informed diagnosis, (Wians, 2009), and the utilisation of laboratory tests had steadily increased in the past several decades (Sharma and Salzmann, 2007).

More information is needed on how clinicians working in PHC units utilise laboratory tests for patient management, and which tests are most useful for diagnosing and managing patients in different geographical areas. Garner, Kiani, Supachutikul (1997) raised the question about the possible impact of conducting sophisticated tests in primary health care setting. They proposed that the effectiveness of a test would depend on the tests

actually resulting in altered decision making, changing the timing or type of treatment, and thus producing a better outcome. (Carter, Lema, Wangai, et al (2012)

Axt-Adam, Wouden, and Van der Does (1993) indicated that there are various reasons why physicians order laboratory tests. They highlighted issues like fear of failing to notice something important (defensive medicine), fear of being criticized by supervisors for neglecting a test and not being able to cope with the uncertainties related to diagnosis.

1.2.2 THE NEED FOR STRONG LABORATORY SERVICES

Medical and public health laboratory services are a critical component of a country's national health system, as they are central in disease diagnosis, prevention, and surveillance, treatment, and outbreak investigations. However, laboratory services and systems in resource-poor countries have often been neglected. Funding for laboratory investigations often does not take into consideration the burden of disease and population served by facilities (Nkengasong, 2009).

A need to strengthen laboratory services has been identified – especially to meet the goals of several major global health programs, such as Global Fund to Fight AIDS, Tuberculosis, and Malaria (GFATM); the United States President's Emergency Plan for AIDS Relief (PEPFAR); the Millennium Development Goals; and the International Health Regulations (IHR). The IHR require all countries to have the capacity to assess, detect, and report to the World Health Organization (WHO) any potential public health risk. (Nkengasong, 2009).

Nkengasong (2009) has indicated that the three pillars for disease prevention, control, and patient management include public health, clinical medicine, and laboratory medicine. However, laboratory medicine in most developing countries is the most neglected pillar – despite its importance for clinical decision-making and for disease surveillance and control. Quality laboratory services and systems constitute the foundation for strengthening health systems, as the primary goal of laboratory medicine

is to provide information that is critical to assist medical decision making for the best health care.

1.2.3 COSTS OF LABORATORY SERVICES

Mepham, Bertel, and Chisuwo (2009) have demonstrated that laboratory services are crucial but an expensive component of health systems in developing countries. The effective utilization of laboratory services requires the correct selection and ordering of tests as well as specimen collection in developing countries. Controlling the costs of laboratory services therefore requires the monitoring of these three components.

1.1.1. LABORATORY SERVICES IN SOUTH AFRICA

South Africa has a public healthcare system that provides free primary healthcare (PHC) at the point of use; however, many constraints relating to the definition of geographic boundaries and governance responsibilities have affected the equitable delivery of PHC services (Coovadia, Jewkes, Barron, et al, 2009).

Stanfliet, King and Pillay (2009) indicated that evidence has highlighted that between 3 and 4 % of patients attending primary health care require a blood test. They also said studies have shown that there is compelling evidence of significant misuse and poor utilisation of many laboratory tests, which results in an economic burden and other problems, such as the further investigation of patients with false-positive results. This situation is exacerbated by patients having high expectations that blood tests are performed and have little understanding of the limitations of testing. The development of guidelines as part of a structured process is emphasized to consistently deliver the best practice of care to patients because patients have high expectations of having their blood tested.

1.2.4 FACTORS INFLUENCING COST OF LABORATORY SERVICES

A review of the literature has identified a number of factors that influence the costs of laboratory services.

Health financing method

Danzon, Manning Jr, and Marquis (1984) found that the method of financing medical care significantly affects the volume of laboratory testing. Related to the number of patient contacts with the medical care system rather than through the number of tests used per patient contact. They also cited the growth of insurance coverage as a factor in the growth of laboratory tests done and lack of incentives for the effective use of laboratory tests for patients and physicians.

Prevalence of co-morbid conditions

Nkengasong (2009) has found that, with an increase in the burden of disease, and South Africa is no exception, there is often an increase in both number and cost of laboratory tests.

Patients with co-morbid conditions are much more likely to need laboratory tests and an increase in the prevalence of many chronic conditions has resulted in a disproportionate increase in number of tests ordered, thereby increasing costs (Marc, et al, 2002).

Inappropriate use of tests

The inappropriate ordering of tests also increases the cost of laboratory services. A number of studies have found that some tests were unnecessarily ordered more than once or not utilized at all. In a study done in Malawi, Mepham et al (2009) found that 25% of the commonly ordered tests were not utilized at all. Beckmann et al (2010) found high levels of unnecessary ordering of tests for antenatal patients in Brussels.

Lack of adherence with guidelines and protocols is often associated with increase in number of tests requested (Marc, et al, 2002). Failure to adhere to guidelines is often

due to lack of knowledge, which gives rise to inappropriate use and incorrect diagnosis, resulting in high expenditure on laboratory services (Marc, Van der Lei, Mosseveld, et al, 2002). Displaying the charges for diagnostic tests on the laboratory request form may significantly reduce both the number and cost of tests ordered, and by doing so bring about considerable cost savings. (Ellemdin, Rheeder, Soma, 2011)

Wians stated in his study that there is a major misconception among clinicians about the superiority of laboratory tests over history taking and physical examination and this may also result in the inappropriate use of laboratory tests (Wians, 2009).

In the United States, it was discovered that tests were conducted for various reasons other than to support clinical decision making. In some cases, the tests were linked to overzealous documentation by doctors, education of junior doctors and doctors fearing medico-legal problems. This has led to unnecessary costs carried by the hospital, which do not necessarily improve decision making or improve clinical outcomes for the patients. (Bradley, Wertman, Stuart, et al, 1980)

1.2.5 MANAGEMENT OF COST OF LABORATORY TESTS

The literature identified a number of available strategies to reduce laboratory costs. However, the budget allocated for laboratory services is often insufficient to start with (Nkengasong, 2009). Funding for laboratory investigations is in many countries not taking the burden of disease and population served by facilities into consideration (WHO, 2008).

Marc, et al (2002) developed guidelines to assist doctors in improved clinical decision making while keeping costs down, hence saving government's money. Standardization of clinical practices helped with ensuring appropriateness of blood tests and contribution to lower costs. This was complimented with regular checking of the compliance with these guidelines for their effective implementation.

The effective utilization of laboratory services depends on correct selection and ordering of tests and specimen collection (Mepham, et al, 2009). Wians (2009) emphasized the importance of understanding the principles for the rational selecting and ordering of laboratory test(s) on a specific patient and this is heightened in the current age of managed care, medical necessity, and outcome-oriented medicine. He indicated that days of a "shotgun approach" to ordering laboratory tests has, of necessity, been replaced by a "rifle" (or targeted) approach based on an understanding of the test's diagnostic performance and the major "legitimate" reasons for ordering a laboratory test. Such an understanding is critical to good laboratory practice and patient outcomes.

Proper physical examination and history taking is an important aspect in patient management, as is reliance on laboratory tests. This is because the tests are more costly compared to history taking and clinical examination. It is widely accepted that the judicious use of laboratory tests, coupled with thoughtful interpretation of the results of these tests, can contribute significantly to diagnostic decision making, patient management and contribute to lower downstream health care costs (Wians, 2009).

Laboratory tests and cost can be reduced by emphasis and provision of primary health care services through uptake of preventative care. Tollman, Doherty, and Mulligan, (2006) indicated that community-based health interventions could reduce the use of emergency and other services in hospitals, improve the control of routine illnesses, and improve patients' perception of their own health. This would often result in improved patient satisfaction, reduced use of laboratory tests, increased patient compliance with treatment, and better recognition of patients' behavioural problems.

Ellemdin (2010) documented several modifiable factors, which could assist in bringing laboratory costs down, such as providing cost information to clinicians to make them aware of the cost of tests ordered, the provision of incentives to cautious spenders, encouraging clinicians to seek a second opinion to reduce the possibility of under diagnosis and introduction of feedback sessions. He also concluded that it is the

responsibility of clinicians to ensure that all the tests requested are appropriate. This can assist in ensuring responsibility of all health care providers.

1.3. STATEMENT OF THE PROBLEM

Sekhukhune district, like other districts within the province is experiencing high laboratory expenditure. For example, Table 1.1 provides a summary of the 2010 / 2011 goods and services budget and expenditure. Laboratory services are the third highest cost driver after human resources and pharmaceutical costs. (Limpopo Department of Health and Social Development, 2010).

Table 1.1. Limpopo Department of Health and Social Development budget for 2010/11

	Allocation	**Expenditure**
Goods and Services – Total	R4,300,000	R5,555,130
Laboratory tests	R325,000	R408, 200

Although district management was aware of the total expenditure on laboratory services, no information was available on the numbers of tests done, the types of tests done, and the costs of each of the tests.

1.4. JUSTIFICATION FOR THE STUDY

An analysis of laboratory testing would assist district management in determining an appropriate laboratory budget for the future and provide some baseline information in order to analyse future over and under expenditure on laboratory services.

1.5. STUDY OBJECTIVES

1.5.1 AIM OF THE STUDY

The aim of the study was to undertake a descriptive analysis of laboratory tests done in Sekhukhune District between the 1st January and 31st December 2010 in order to provide district management with information to inform future decision making about laboratory services.

1.5.2 SPECIFIC OBJECTIVES

1. To determine the *number* of laboratory tests done in primary health care facilities in the district.
2. To determine the *types* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010
3. To determine the *costs* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010

1.6. SUBSEQUENT CHAPTERS

Chapter 1 has described the background to the study and relevant literature has been discussed. The aims and objectives of the study have been articulated. A brief outline of future chapters is presented.

Chapter Two: Research Methodology. The study design, study setting and data management techniques used in this study are described.

Chapter Three: Presentation of Results: The findings of this study are presented.

Chapter Four: Discussion. The findings of the study are discussed, in the light of the aims, objectives and literature review.

Chapter Five: Conclusions and Recommendations: This last chapter derives conclusions from the research related to the objectives of this study, makes recommendations and advocates areas for future research in the field of assessment of laboratory testing patterns and costs in a district setting.

CHAPTER 2
METHODOLOGY

The methodology for this study was informed by aims, objectives and literature review. In this chapter the following are discussed: study setting, scope, study design, data collection tools and an overview of the data analysis done.

2.1 STUDY DESIGN

This study was a cross-sectional study. A retrospective review of data from the National Health Laboratory Services (NHLS) electronic database was done.

2.2 STUDY SETTING

The setting of the study was the Sekhukhune District, one of the five districts in the Limpopo Province. The District covers an area of 13,264 square kilometres and has a population of about 1,076,840 (Statistics South Africa, 2011). The district is surrounded by Capricorn on the northern side, Waterberg on the north-western side, Mopani on the eastern. Sekhukhune is bordered by Ehlanzeni to the south-east and Nkangala to the south, which are districts from Mpumalanga Province. The population in each sub-district is given in Table 2.1 and the number of health facilities is given in Table 2.2

Table 2.1 Population in five sub-districts

Local municipality	Population 2011
Greater Tubatse	335 676
Makhuduthamaga	274 358
Elias Motswaledi	249 363
Ephraim Mogale.	123 648
Fetakgomo	93,795
Total	1076840

Source: Statistics South Africa, 2011

Table 2.2 Number of facilities per sub-district.

Name of Sub District	Clinics	Community Health Centre
Greater Tubatse	22	1
Makhuduthamaga	21	0
Elias Motswaledi	16	1
Ephraim Mogale.	12	0
Fetakgomo	14	1
Total	**85**	**3**

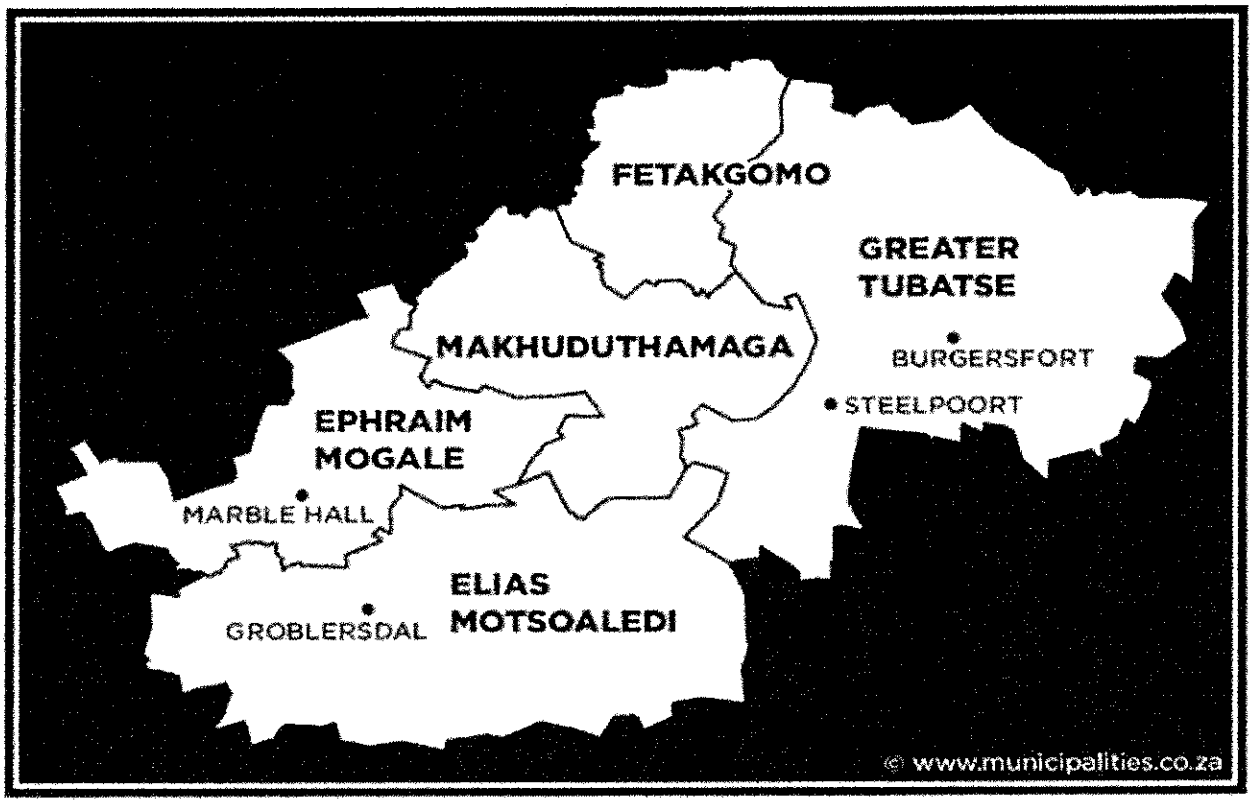


Figure 2.1 Sekhukhune District

Sekhukhune was selected for this study as the researcher was a primary health care manager in the district.

Fetakgomo Local Municipality

Fetakgomo is a local municipality within the Sekhukhune District Municipality. It is the smallest of the five local municipalities. The population size is 93 795. Almost the entire population (99, 4%) are black African (Statistics South Africa, 2011)

Makhuduthamaga Local Municipality

It comprises a land area of approximately 2,096 km². It is made up of 189 settlements with a population of 274,358 people and 65,217 households, which amounts to more than 24% of the district (Statistics South Africa, 2011)

Elias Motswaledi Local Municipality

The municipality is the third smallest of the five (5) local municipalities in Sekhukhune District (3,713 km^2), constituting 27.7% of the district. Land ownership is mostly traditional and the municipality is predominantly rural with about sixty-two settlements, most of which are villages. The majority of the population (249,363) was African black (97.9%). (Statistics South Africa, 2011)

Greater Tubatse Local Municipality

Geographically the municipality is the biggest of the five (5) local municipalities in Sekhukhune district (4,602 km^2), constituting 34.3% of the District. Land ownership is mostly traditional and the municipality is predominantly rural with about 166 settlements, most of which are villages. The municipality has a population of 335,676. (Statistics South Africa, 2011)

Ephraim Mogale Local Municipality

The municipality is the second smallest of the five local municipalities in the district (2,011 km^2), constituting 14.4% of the District. The municipality has 16 wards with a population size of 123 648. The majority of them are black Africans (97.8%), and fewer whites (1.6%) with other population groups making up the remaining 0,6%. (Statistics South Africa, 2011)

2.3 STUDY SCOPE

The study was based on retrospective review of records from NHLS database. The district routinely receives reports from NHLS about the tests performed in the health facilities, aggregated to a sub-district level. The study analysed this data. No primary data was collected.

2.4 STUDY PERIOD

The study period was one year from 01 January, 2010 until 31 December 2010.

2.5 STUDY POPULATION AND SAMPLING

The study population was all PHC facilities in Sekhukhune District of Limpopo Province. The total number of laboratory tests from the database during this period was 10,254.

One hundred and eighty eight tests were from clinics outside the boundaries of the Limpopo Province and were excluded from the study.

2.6 DATA MANAGEMENT

2.6.1 DATA COLLECTION

Data was collected from Thusano portal, the NHLS electronic database, for one year period (01 January, 2010 until 31 December 2010). The type of test done, the name of the facility, date of the test and the cost of each test were the only data extracted from the database.

The information was then exported into Microsoft excel.

Data was then checked for quality. Outliers with regard to number of tests were identified e.g. months where there were no tests reflected, were verified with facility managers.

The data was then exported to EPI Info version 3.4.1 software for analysis

2.6.2 VARIABLES

The variables for this study are listed in Table 2.3.

Table 2.3 Objective and study variables

Objectives	Variables collected	Type of variable
Objective 1 To determine the *number* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010	- Name of facility - Test done	Categorical
Objective 2 To determine the *types* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010	- Type of test - Facility type - Date of test	Categorical
Objective 3 To determine the *costs* of laboratory tests done in primary health care facilities in the Sekhukhune District between the 1st January and 31st December 2010	Cost of test - Costs on tests per sub district	Continuous

The costs used in this study were those provided by NHLS.

The tests were then grouped into a number of categories. (Table 2.4).

Table 2.4 Groups of Laboratory tests done in facilities and expenditure per test

Groups	Test Types	Unit cost
Glucose	Glucose – A,	R25.27
Liver function Test	Alanine Aminotransferase (ALT) ,	R38.22
	Bilirubin Direct Automated	R22.38
	Bilirubin Total - A	R29.68
	Alanine Transaminase – A,	R38.22
	Potassium - A	R25.52
	Lactate Dehydrogenase Total - A	R38.22
	Aspartate Transaminase - A	R38.22
	Glutamyl Trans peptidase – A	R38.22
	Partial Thromboplastin Time (PTT)	R44.07
	Prothrombin Index Manual (PI)	R39.79
	Phosphatase Alkaline – A	R36.42
	Protein Total - A	R21.93
	Albumin – A	R33.84
Renal Function Test	Urine Bacterial Inhibition,	R27.50
	Urine Microscopy	R35.51
	Creatinine - Automated	R25.52
	Uric Acid Automated	R26.87
	Chloride - A	R18.21
	Sodium - A	R25.52
	Profile Discrete Analyser U & E	R71.72
	Urea - A	R25.52
Pregnancy Test	Human Chorionic Gonadotropin (HCG)	R70.68
Blood group	ABO Group Rh	R28.78
	Indirect Coombs Test	R29.12

Groups	Test Types	Unit cost
	Rhesus Only	R28.78
Other Haematology	Full Blood Count including Platelet	R48.30
	Haemoglobin only	R15.03
	Platelet Count - Manual	R17.99
Cytology	Exfoliative Cytology (Gynae) 1st Smear,	R69.22
	Exfoliative Cytology (General)	R129.67
Serology	Rubella IGM Elisa,	R102.75
	Measles IGM (Elisa)	101.73
	Culture Aerobic	R46.09
Microscopy	Bilharzia Microscopic	R35.87
	Urine Culture	R46.09
	Urine Screening Tests	R10.68
RPR	RPR Quantitative Slide	R26.42
	RPR Slide Test	R16.53
Human-Immunodeficiency Virus (HIV)	Viable Cell Count	R10.01
	CD4 Panleukogated (PLG),	R60.28
	Polymerase Chain Reaction (PCR)	R348.21
	HIV Rapid Screen Test	R37.10
	HIV ELISA	R49.28
	Viral Load	R318.00
	Erythrocyte Sedimentation Rate (ESR)	R23.60
Tuberculosis (TB)	Micro TB Misc. flour	R31.27
	Bacterium MGIT Bottle	R25.86
	Radiometric Mycobacterium Antibiotic Sensitivity	R167.16
	Radiometric Mycobacterium Culture TB	R75.26
	Radiometric Mycobacterium TB Differentiation (NAP)	R96.35

Groups	Test Types	Unit cost
	Radiometric Mycobacterium Culture TB No Growth	R75.26

2.6.3 DATA ANALYSIS

The data was collected from the Thusano portal, the NHLS tests database. The data was transferred on to an MS excel spread sheet, was filtered and categorised according to the selected variables. Data were grouped into type, month, facility type, sub-district and cost. They were reported in number and percentages.

2.7 PILOT STUDY

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

2.8 ETHICAL CONSIDERATIONS

The project was approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (Appendix A). Permission to conduct the research was sought from the Head of Department, Department of Health and Social Development Limpopo Province (Appendix B).

No personal information on patients was extracted from the Thusano database. Patient confidentiality and anonymity was therefore maintained.

CHAPTER 3
FINDINGS

The findings of the study are presented in this chapter. They are presented by objective. The total number of laboratory tests done during the study period, according to the database, was 10,254. One hundred and eighty eight tests were from clinics outside the boundaries of the Limpopo Province and were therefore excluded from the study. The final sample size was therefore 10,066 tests

There were no tests at all from one sub-district - Makhuduthamaga. Twenty five percent of the Sekhukhune population live in this sub-district, which also contains 25% of primary health care facilities. As it is not likely that no tests were done, the results for this sub-district are likely to have been included in the hospital results.

3.1 NUMBER OF TESTS DONE

3.1.1 NUMBER OF TESTS DONE PER SUB-DISTRICT

The number of tests performed per sub-district is provided in Table 3.1.

Table 3.1 Total tests done per sub district

Sub district	Elias Motswaledi	Ephraim Mogale	Fetakgomo	Greater Tubatse	Total
Number of tests	2,631	1,482	2,891	3,062	10,066
Percentage	26.13	14.72	28.72	30.41	100

Table 3.2 provides details on the number of tests done, per sub-district and per type of facility. Over 80% of tests were ordered in the clinics.

Table 3.2 Total tests per facility type and per sub district

Facility type	Elias Motswaledi	Ephraim Mogale	Fetakgomo	Greater Tubatse	Total N %
CHC's (n = 3)	463	-	590	916	1,969 (19.6%)
Clinics (n = 85)	2,168	1,482	2,301	2,147	8,097 (80.4%)
Tests done	2,631	1,482	2,891	3,063	10,066 (100%)

Table 3.3 highlights that, although Fetakgomo only has 8.7% of the population in the district, 28.72 5% of tests were done in that sub-district.

Table 3.3 Total tests performed and population size by sub district

Sub district	Total tests done	Population	Percentage of population	Tests per population	Percentage of tests
Elias Motswaledi	2631	249, 363	23.15	0.01	26.13
Ephraim Mogale	1482	123, 648	11.48	0.01	14.72
Fetakgomo	2891	93,795	8.7	0.03	28.72
Greater Tubatse	3062	335, 676	31.17	0.009	30.41
Makhuduthamaga	0	274, 358	25.47	0	0
Total	10,066	1,076,840	100	0.009	100

3.1.2 LABORATORY TESTS PERFORMED BY MONTH

Figure 3.1 shows that, with the exception of January, there was very little variation in the number of tests done each month in either the clinics or the CHC's.

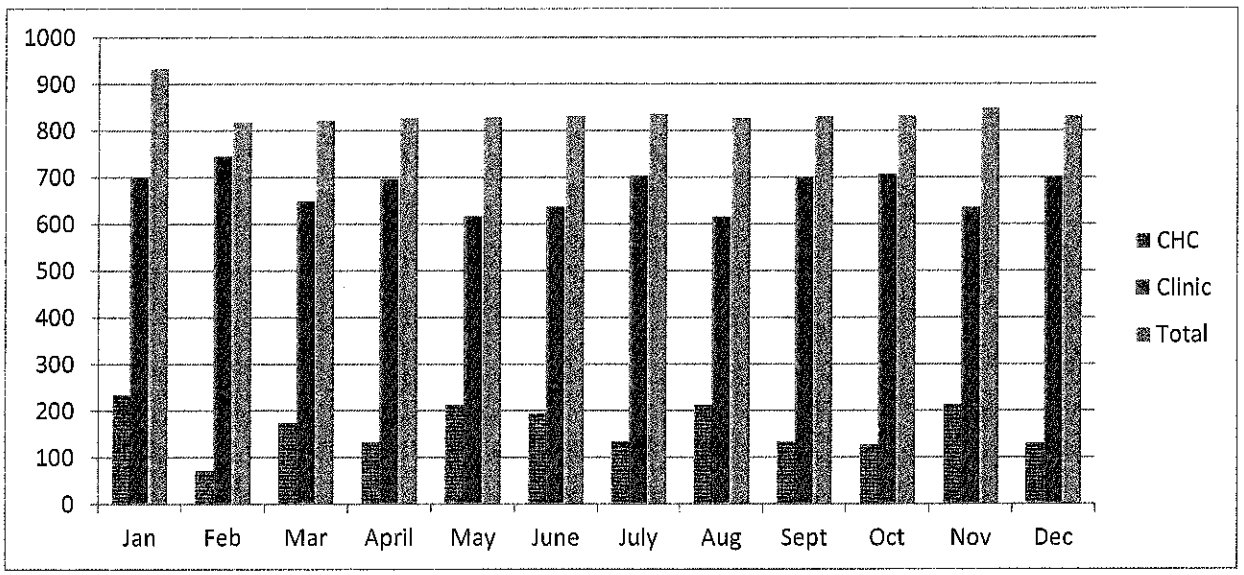


Figure 3.1 Number of tests done per month

The Figure 3.2 below provide details of the tests done per month, in each sub district. The variation, month to month, is much less in Fetakgomo.

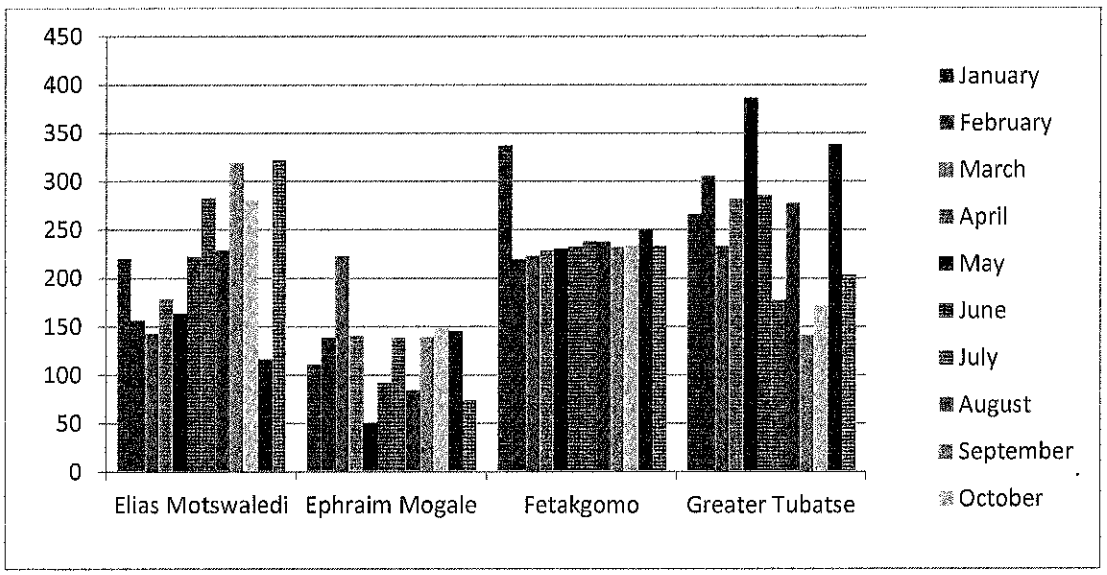


Figure 3.2 Number of tests done per month per sub-district

3.2 TYPES OF LABORATORY TESTS DONE

The total number tests performed per category is described below (Table 3.4).

Table 3.4 Total tests performed per category

Type of tests	Total number	Percentage %
Tuberculosis (TB)	2201	21.8
Blood group	1777	17.6
Cytology	1658	16.4
Other Haematology	1424	14.3
RPR	1344	13.3
Urine Microscopy	422	4.1
Human-Immunodeficiency Virus (HIV)	413	4.1
Liver function Test	368	3.6
Renal function tests	255	2.5
Serology	93	0.9
Pregnancy Test	72	0.7
Glucose	39	0.3
Total	**10066**	**100**

Table 3.5 shows that there were differences in the type of tests ordered in each of the sub-districts. Although the most common test performed in three districts was tests for TB, the most common blood test performed in Elias Motswaledi was blood group.

Table 3.5. Tests done per category, per sub-district

Type of tests	Elias Motswaledi	%	Rank	Ephraim Mogale	%	Rank	Fetakgomo	%	Rank	Greater Tubatse	%	Rank	Total	%	Rank
Glucose	6	0%	10	2	0%	11	23	1%	12	8	0%	12	39	0%	12
Liver Function test	46	2%	9	6	0%	9	193	7%	7	123	4%	6	368	4%	7
Renal Function test	59	2%	8	49	3%	7	106	4%	10	41	1%	9	255	3%	9
Pregnancy test	24	1%	11	43	3%	8	2	14%	4	3	0%	10	72	1%	11
Blood group	620	24 %	1	294	20%	2	413	14%	5	450	15%	4	1777	18%	2
Other Haematology	291	11%	5	279	19%	3	496	17%	3	458	15%	3	1424	14%	4
Cytology tests	561	21%	2	195	13%	4	503	17%	2	399	13%	5	1681	17%	3
Serology	4	0%	12	0	0%	12	89	3%	11	0	0%	11	93	1%	10
Urine microscopy	89	3%	7	78	5%	6	140	5%	9	115	4%	8	422	4%	8
RPR	325	12%	4	158	11%	5	353	12%	6	508	17%	2	1344	13%	5
HIV	92	3%	6	43	3%	9	153	5%	8	125	4%	7	413	4%	6
TB	514	20%	3	335	23%	1	518	18%	1	834	27%	1	2201	22%	1
TOTAL	2631	100		1482	100		2891	100		3061	100		10,066	100	

Table 3.6 Total tests per category by facility type

Type of tests	CHC's		Clinics		Total
	Number	Rank	Number	Rank	
Glucose	17	11	22	11	39
Liver function test	284	3	84	9	368
Renal Function test	136	7	119	8	255
Pregnancy Test	-	12	72	10	72
Blood group	234	5	1543	2	1777
Other Haematology	163	6	1261	4	1424
Cytology	374	1	1284	3	1658
Serology	86	8	7	12	93
Urine Microscopy	46	10	376	6	422
RPR	258	4	1086	5	1344
HIV	55	9	358	7	413
TB	316	2	1885	1	2201
Total	1969		8097		10066

Table 3.7 shows that, over 50% of all glucose tests were done in one district (Fetakgomo)

Table 3.7 Percentage of tests done in each category per sub-district

Type of tests	Elias Motswaledi	%	Ephraim Mogale	%	Fetakgomo	%	Greater Tubatse	%	Total
Glucose	6	15%	2	5%	23	59%	8	21%	39
Liver Function test	46	13%	6	2%	193	52%	123	33%	368
Renal Function test	59	23%	49	19%	106	42%	41	16%	255
Pregnancy test	24	33%	43	60%	2	3%	3	4%	72
Blood group	620	35%	294	17%	413	23%	450	25%	1777
Other Haematology	291	20%	279	20%	496	35%	458	32%	1424
Cytology tests	561	33%	195	12%	593	35%	399	24%	1681
Serology	4	4%	0	0%	89	96%	0	0%	93
Urine microscopy	89	21%	78	18%	140	33%	115	27%	422
RPR	325	24%	158	12%	353	26%	508	38%	1344
HIV	92	22%	43	10%	153	37%	125	30%	413
TB	514	23%	335	15%	518	24%	834	38%	2201
TOTAL	2631	26%	1482	15%	2891	29%	3062	30%	10,066

The Table 3.8 shows the category of tests according to type of facility (clinic or CHCs).

Table 3.8 Total tests per category by facility type

Type of tests	CHC's		Clinics		Total
	Number	Percentage	Number	Percentage	
Glucose	17	43.6%	22	56.4%	39
Liver function test	284	77.2%	84	22.8%	368
Renal Function test	136	53.3%	119	46.7%	255
Pregnancy Test	0	0.0%	72	100.0%	72
Blood group	234	13.2%	1543	86.8%	1777
Other Haematology	163	11.4%	1261	88.6%	1424
Cytology	374	22.6%	1284	77.4%	1658
Serology	86	92.5%	7	7.5%	93
Urine Microscopy	46	10.9%	376	89.1%	422
RPR	258	19.2%	1086	80.8%	1344
HIV	55	13.3%	358	86.7%	413
TB	316	14.4%	1885	85.6%	2201
Total	**1969**		**8097**		**10066**

It shows that:

- Over 50% of glucose tests were done in clinics
- Over 70% of the LFT were ordered in the CHC
- All pregnancy tests were done in the clinics
- Almost all serology tests were done in CHC's

3.3 COST OF LABORATORY TESTS

The total cost of laboratory tests performed was R401, 756.12 (Table 3.9).

3.3.1 COSTS OF LABORATORY TESTS PER SUB-DISTRICT

Table 3.9 characterises the total costs for tests done per sub district. It displays that tests (30%) were ordered from Greater Tubatse Sub-district and more money was spent (31%) as compared to the other sub-districts. Fetakgomo was the second highest and Ephraim Mogale the lowest.

Table 3.9 Total tests per category by facility type

Sub district	Elias Motswaledi	Ephraim Mogale	Fetakgomo	Greater Tubatse	Total
Total costs (ZAR)	110,007.03	55,379.77	112,492.62	123,876.70	401,756.12
Percentage	27	14	28	31	100
Number of tests performed	2631	1482	2891	3062	10066
Percentage	26%	15%	29%	30%	100%

The results revealed that the average laboratory cost per patient per annum is highest at Elias Motswaledi Sub-district (R44.11).

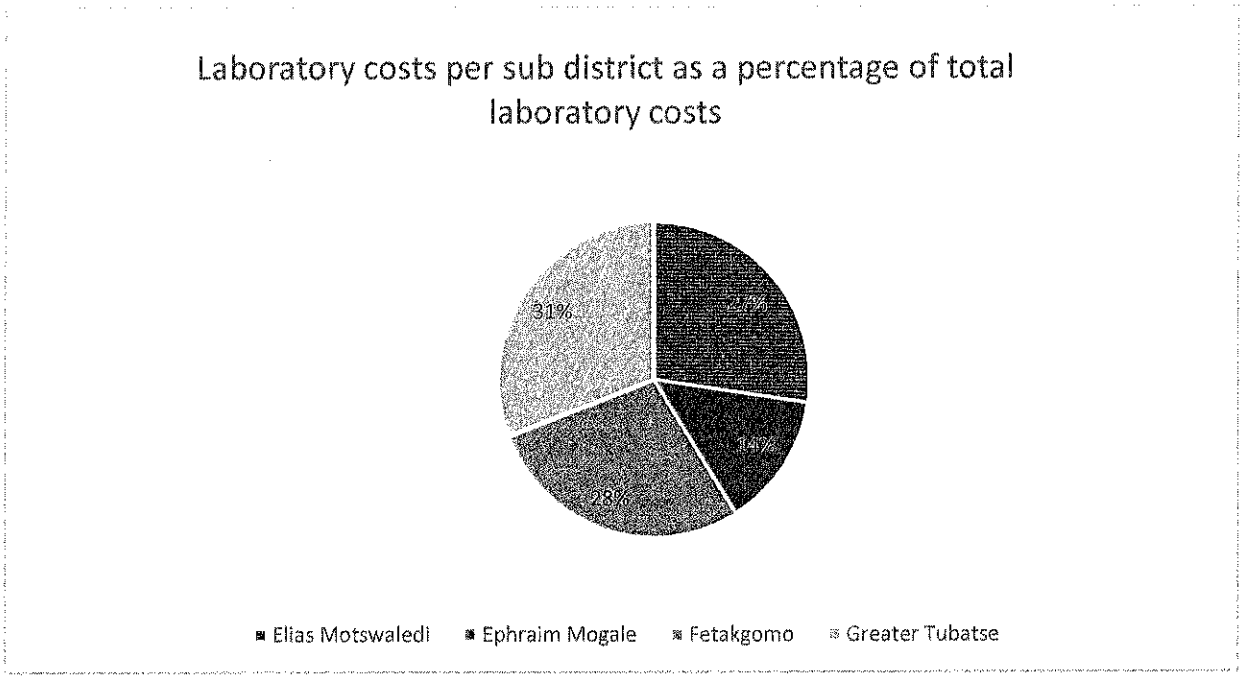


Figure 3.3 Laboratory costs per sub-district as a percentage of total laboratory costs

Figure 3.3 above displays the laboratory costs per sub-district as a percentage of total laboratory costs

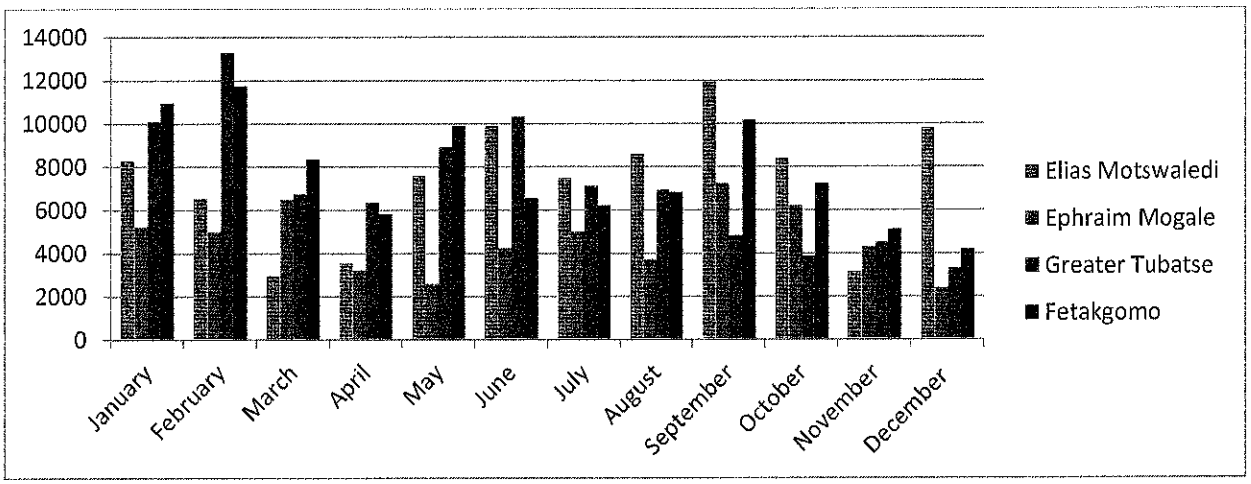


Figure 3.4 Cost per sub district per month

Figure 3.4 shows the costs per sub-district per month. Ephraim Mogale experienced lowest costs of all the sub districts in January, February, April, May, June, July, August and December whereas Elias Motswaledi experienced the lowest costs in March and November. On the other hand, Fetakgomo had the highest costs in January, March and May.

3.3.2 COSTS OF LABORATORY TESTS PER FACILITY TYPE

Table 3.10 lists costs per facility type.

Table 3.10 Total costs per facility type

Facility type	CHC's	Clinics	Total
Costs of all tests done(ZAR)	75, 888.89	325 867.23	401,756.12
Percentage	18.5	81.5	100
No of tests	1969	8097	10066

The mean laboratory cost per patient who visited CHC was R38.54 per test as compared to R41.03 in a clinic. This could be attributed to the fact that there are only three CHC in the district as compared to the number of clinics.

3.3.3 TOTAL COSTS PER TYPE OF TEST

Table 3.11 below demonstrates total costs per type of test. Cytology testing is a leading cost-driver followed by TB, HIV tests then blood grouping. It is followed by pregnancy testing and renal function tests.

Table 3.11. Total costs per type of test

Type of tests	Total Number of Tests	Total Cost ZAR	Percentage of total cost
Cytology	1658	108,391.97	26.9%
TB	2201	80,504.75	20.%
HIV	413	73,426.94	18.2%
Blood group	1777	50,205.39	12.4%
Other Haematology tests	1424	24,376.14	6.0%
RPR	1344	23,042.31	5.7%
Urine Microscopy	422	18,688.36	4.6%
Liver Function Test	368	10,184.90	2.5%
Serology	93	4,161.27	1.0%
Pregnancy Tests	72	3,853.53	0.9%
Renal Function Test	255	3,192.54	0.8%
Glucose	39	1728.01	0.4%
TOTAL	**10,066**	**401,756.12**	**100%**

3.3.4 TOTAL PERCENTAGE COST PER TESTS TYPE

Figure 3.5 depicts percentage costs per test type and revealed that cytology testing as the test that incurred the highest cost followed by tests for TB and glucose testing the lowest cost.

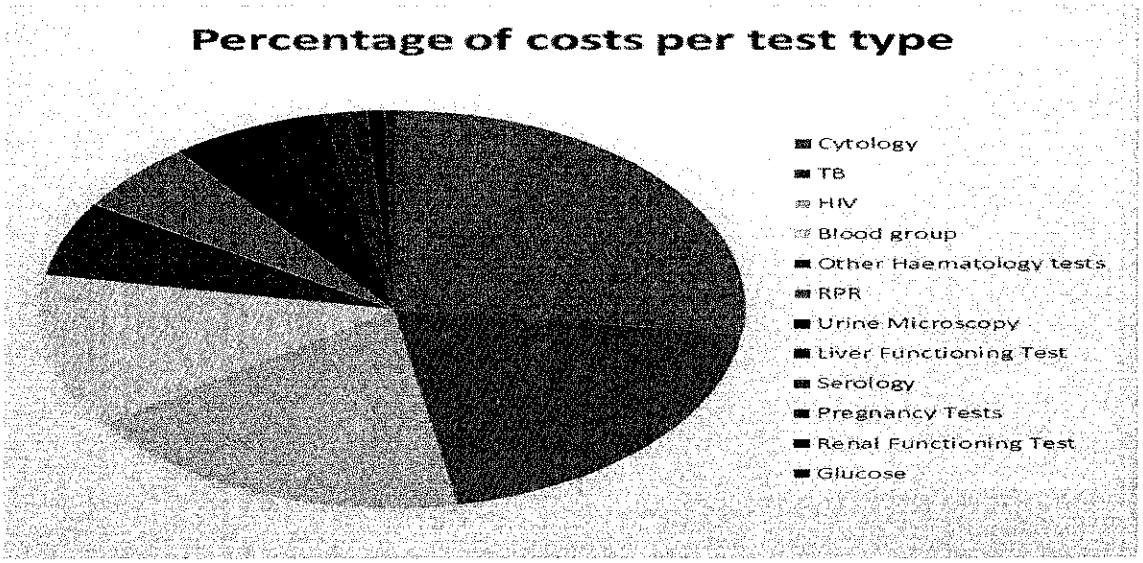


Figure 3.5. Percentage cost per test type

3.3.5 COSTS PER TYPE OF LABORATORY TESTS PER SUB-DISTRICT

The total costs of laboratory tests per sub-district and per category of test are given in Table 3.12.

Table 3.12. Total costs per type of test and sub-district

Type of tests	Elias Motswaledi R	Ephraim Mogale R	Fetakgomo R	Greater Tubatse R	Total R
Cytology	34,276.95	16,390.15	36,028.88	21,695.99	108,391.97
TB	17,563.25	11,847.38	21,911.94	29,182,18	80,504.75
HIV	17,369.43	6,646.49	31,242.24	18,168.78	73,426.94
Blood group	17,065.24	9,347.22	13,522.03	10,270.90	50,205.39
Other Haematology tests	3,893.83	3,435.75	8,675.98	8,370.58	24,376.14
RPR	5,806.07	3,075.6	6,012.31	8,148.33	23,042.31
Urine Microscopy	4,291.1	2,251.73	6,595.15	5,550.38	18,688.36
Liver Functioning Test	919.31	129.68	6,026.82	3,109.09	10,184.90
Serology	814.16	0	3,347.11	0	4,161.27
Pregnancy Tests	970.1	2,580.5	127.5	175.43	3,853.53
Renal Functioning Test	890.1	569.19	1370.15	363.1	3,192.54
Glucose	330.96	101.34	891.93	403.78	1,728.01
TOTAL	**104,190.50**	**56,275.03**	**13,5852.00**	**105,438.54**	**401,756.11**

Table 3.12 illustrates the total costs per type of test by sub-district and shows Fetakgomo as the sub district that incurred the highest costs in cytology and HIV tests followed by Elias Motswaledi sub district also for cytology testing and Greater Tubatse sub district for TB tests.

3.3.6 COSTS PER TYPE OF LABORATORY TESTS ACCORDING TO FACILITY TYPE

The table below (Table 3.13) illustrates the total costs per test type for the whole district.

Table 3.13 Cost per type of tests per facility type

Type of tests	CHC's		Clinics		Total	
	No of tests done	Total cost R	No of tests done	Total cost R	No of tests done	Total costs R'
Glucose	17	902.66	22	825.35	39	1,728.01
Liver function tests	284	7,088.23	82	3,096.67	366	10,184.90
Renal Function tests	136	1,442.35	119	1,750.19	255	3,192.54
Pregnancy Test	0	0	74	3,853.53	74	3,853.53
Blood group	397	13,060.53	1543	37144.86	3201	50,205.39
Other Haematology	163	3,451.00	1261	20,925.14	1424	24,376.14
Cytology	374	15,681.43	1284	92,710.54	1658	108,391.97
Serology	86	3, 146.01	7	1,015.26	93	4,161.27
Urine Microscopy	46	1,257.31	376	17,431.05	422	18,688.36
RPR	258	4,491.92	1086	18,550.39	1344	23,042.31
HIV	55	11,216.90	358	62, 210.04	413	73,426.94
TB	316	14,150.55	1885	66354.20	2201	80,504.75
TOTAL	**1969**	**75,888.90**	**8097**	**325867.22**	**10066**	**401,756.12**

CHAPTER 4
DISCUSSION

In this chapter, the findings of the study are discussed, in the light of available literature and the objectives of the study. The purpose of this study was to describe the profile of tests done and associated costs in PHC facilities of Sekhukhune district, Limpopo Province. This project is the first systematic study of laboratory costs to be done in the Sekhukhune District.

4.1 NUMBER OF TESTS DONE

There was no record of any tests being done in Makhuduthamaga Sub-district for the period under review, which is a limitation. Twenty four percent of the population in Sekhukhune District live in this sub-district. It is possible that, if tests were performed in that year, they might have been sent to the nearest hospital in the sub district. However, there is a great need for district management to verify if indeed there are no tests performed in this sub-district as accurate and reliable diagnosis is the cornerstone of disease management and control.

Over 30% of all tests done were in Greater Tubatse and 28% of tests were done in Fetakgomo Sub-district. The number of tests done in Fetakgomo Sub-district was higher than might be expected as this Sub-district has fewer primary care facilities (n=15) and the lowest population (93,795) as compared to Greater Tubatse (population= 335,676, number of facilities = 23). Over 23 tests per 1,000 population were performed in Fetakgomo as compared to 11.98 per 1,000 population in Ephraim Mogale Sub district. This would require further exploration to review the practice of ordering tests in these two sub-districts.

Stanfliet, King, and Pillay (2009) have stated that between 3 and 4% of patients have blood tests when they attend a primary health care facility.

Although this study did not explore the reasons for this higher than expected number of blood tests, possible explanations might be that the population in this sub-district made more frequent visits to the facilities in the sub district, the burden of disease is higher or there are more doctors visiting and ordered a lot of tests. The other reason may be due to the fact that Fetakgomo sub district has mines that were recently discovered and this may have led to an increase in the number of migrant workers to the area.

The fewest number of tests were done in Ephraim Mogale sub-district which is expected as this sub-district has the fewest number of facilities (n= 12) and has no community health centre.

The numbers of tests done did not vary much from month to month. Some of the variation might be due to migrant population. The farming and mining industries in some of the sub-districts use seasonal workers.

4.2 TYPE OF TESTS DONE

With some slight variation the five most frequent tests performed in all districts are for TB, blood group, syphilis (RPR), other haematology tests and cervical smears (cytology)

Laboratory tests for the diagnosis of tuberculosis are the most frequently done test, in three of the four sub-districts and the most frequently done test overall with 20% of all tests done for this disease. This might be due to high prevalence of TB in in this district.

Sekhukhune District has a lot of farms and mines and the majority of these farm workers and miners reside in informal dwellings. Informal dwellings are usually overcrowded. Overcrowding predisposes patients to TB therefore one would expect large number of TB tests done in these areas.

The most frequent test performed was a sputum test for tuberculosis in three districts, with the exception of Ephraim Mogale sub district. This sub district is a farming area and

the community is highly mobile and the majority are seasonal workers. Dr A Motswaledi, the Minister of Health, announced on the 25th March 2010 that South Africa is carrying 17 % of the global HIV burden, and one out of every 100 South Africans has TB (Department of Health, 2010). As a result of this and other research reports, on the 11th of March 2010, the Cabinet announced that the country was to launch a massive HCT campaign. This announcement precipitated the high TB case finding rates within the district wherein 79% of new Pulmonary Tuberculosis (PTB) was reported and 59% smear positive cases.

Overall, 18% of all tests done were to ascertain blood group. This test is done for all women attending an antenatal clinic for the first time. These tests are very important and include Rh status determination. Rhesus (Rh) factor is an inherited trait that refers to a specific protein found on the surface of red blood cells. As pregnancy needs special care, it is very important that all pregnant women be checked if they are Rh negative and their baby's father is Rh positive (American College of Obstetricians and Gynecologists, 2006). More tests for Blood Group were done in Elias Motswaledi sub-district (24% of total tests). This might be due to good clinical practice in the clinics situated in this sub-district.

RPR is the fifth most common test performed in the district. This is a convenient, reliable, cost effective test to use which is used to detect syphilis in all pregnant women. Syphilis is a major cause of adverse pregnancy outcomes and also an important cofactor for HIV acquisition and transmission in the developing world. The test is important and is supported by recent studies conducted in sub Saharan countries have indicated that syphilis screening and treatment program using the RPR test is a very cost effective intervention and provides good value for investment. (Levin, et al., 2007)

Cytology tests are essentially cervical smears and one would expect these to be high numbers in terms of National Cervical Cancer Screening Policy (National Department of Health, 200b). These tests are indicated for all sexually active women and women at risk of developing cervical cancer. Ephraim Mogale sub-district did the fewest tests across all the categories within the district. This was expected because it is the sub district with fewest number of clinics and has no CHC.

Very few serology tests were ordered (only 0.9% of all tests done) and this is likely to be due to the fact that these tests are generally ordered by doctors and there are no full time doctors in PHC facilities. Some facilities do have visiting doctors and therefore they would only order these blood tests, when a doctor is present.

Surprisingly, few pregnancy tests were done (only 0.7% of all tests). There are no pregnancy tests done in the CHC's and this is likely to be due to the fact that on site pregnancy testing kits were gradually introduced in PHC facilities at the time of this study.

Only 0.3% of all tests done were for blood glucose. At PHC level, urine is tested for glucose and there is some point of care testing. Glucose testing is done infrequently in the facilities and this is expected as Point of Care Testing (POCT) is largely done instead. Point of care testing, which is referred to as near patient, bedside testing, which could lead to earlier clinical decisions for patients. Many of the early "diagnostic tests" were first done at the bedside—for example, urine and blood glucose testing. Over the past few years, analytical systems have been developed that enable a wide range of tests to be done quickly and simply without the need for sophisticated laboratory equipment. The key objective of point of care testing is to generate a result quickly so that appropriate treatment can be implemented, leading to an improved clinical or economic outcome (Price, 2001).

It was expected that HIV testing would be the more frequently performed test as the Minister launched the HCT campaign wherein all patients were encouraged to do the test. HIV tests only accounted for 4.1% of all tests done. This may reflect the poor quality of counselling received, so, patients were not willing to test. On the other hand it might be that most tests done were negative. Blood for HIV is only sent to the laboratory for confirmation if the initial point of care test is positive so it is also possible of the tests done very few were in fact positive.

Liver and renal function tests accounted for 3.6% and 2.5% respectively of the overall tests done within the district. CHCs did a higher number of these tests, which is expected as there are doctors visiting CHC on weekly basis.

The profile of tests performed in the study revealed that all tests performed were relevant to the delivery of level 1 care within the district. They were all for diagnostic and preventative purposes and to assist and ensure that health professionals arrive at the correct decisions on the nature of the diseases and correct treatment to curb these diseases from complicating or spreading, thus improving quality of life for communities.

4.3 COSTS OF TESTS

The total cost of laboratory tests was R401, 756.12

Cytology testing was a leading cost-driver as over 26% of all costs were due to cytology tests – namely pap smears. This expenditure is however worthy because timeous health intervention is cost-saving when the intervention is done early. It is effective and costs less in the long run than the cost of not intervening, such as the cost of screening all legible women above the age of 20 in a given population to rule out cervical cancer in its early stage is more cost effective than detecting it late. The cost of treating the disease is very high because it will involve chemotherapy which is expensive. This is therefore regarded as a high-value, cost-effective and cost – saving way of treating clients.

TB tests accounted for 20% of the total budget. Grossman (1983) highlighted that whereas there is ample evidence that excessive utilisation of laboratory tests in the form of unnecessary and inappropriate tests repetition, there is no other cost effective way in which clinicians can reliably confirm the presence of bacteria's like TB bacillus in clients' body without collecting sputum for laboratory testing.

Almost 20% of the laboratory budget is spent on tests for HIV. Again, these tests are an essential component of primary health care.

The costs of laboratory tests in Sekhukhune District may be viewed as high when looking at the over expenditure incurred by the District during the period under review without analysing it. These tests were ordered for both diagnostic and preventative purposes. This was to assist and ensure that health professionals arrive at the concrete decisions on the nature of the diseases and correct treatment to curb these diseases from complicating or spreading, thus improving quality of life for communities. The average district expenditure per patient per annum was R39.80.

4.4 LIMITATIONS OF THE STUDY

The following limitations were experienced in conducting this study.

4.1.1 The study was conducted in one rural district; therefore the findings of this study may not be generalized to other districts.

4.1.2 The subject is hardly researched in districts; therefore the literature related to the subject is scanty.

4.1.3 There were no records from majority of facilities showing the tests that were requested; therefore the study relied only on invoices obtained from NHLS.

4.1.4 Makhuduthamaga sub district data not included in the study as there were no records of tests done, therefore a total number of 21 PHC facilities were excluded.

4.1.5 It is not clear whether there was repetition of testing for the same clients.

CHAPTER 5
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.

5.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY

This was a cross-sectional study that looked at broad issues pertaining to the laboratory testing pattern of Sekhukhune District, a district in a rural province in the Limpopo Province during one year study period.

There were more than 10,000 tests performed during the period. The majority of the tests done were appropriate for the level of care. TB was the most popular test performed whereas glucose and pregnancy tests are the least tests performed and the indication or rationale may be that Point of Care testing for Diabetes and Pregnancy were introduced in facilities. The majority of the tests ordered were tests that are relevant for primary care and preventive diagnostic purposes.

5.2 RECOMMENDATIONS

The recommendations made based on the findings of the study.

5.2.1 TESTING PATTERNS

This project is the first systematic study to be done at the Sekhukhune District. This study identified areas in facilities where tests were not done. The district management need to further investigate the reasons for absence of these tests, to improve on monitoring and record keeping of tests requested.

It is further highlighted that there were few requests for laboratory tests, which may imply lack of knowledge with regard to these tests by health professionals in those facilities. This will assist the district management to develop measures to improve laboratory testing patterns.

5.2.2 COST MONITORING

NHLS monitoring committees per local service area should be established to monitor the laboratory testing service provision and expenditure. This will assist the district management team in ensuring proper laboratory testing management.

Proper allocation of clinics to respective sub districts to enable separation of accounts into sub district/cost units and facilitate proper management and monitoring of the tests.

The results of the study will be disseminated to the Sekhukhune District management and Provincial Office of Limpopo Department of Health.

It is vital that costs of laboratory testing is quantified by the utilisation and impact it has on patients.

5.2.3 FUTURE RESEARCH

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

(a) There is a need to conduct a similar study using a quantitative method, comparing the records from the facilities and NHLS invoices.
(b) The capacity of PHC facilities and Community Health Centres should be researched, to evaluate health demands and the laboratory service's needs.

(c) In order to determine over/under expenditure for laboratory tests, following additional data would be required (a) compliance with clinical guidelines (b) disease burden in the community.

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APPENDICES

APPENDIX A: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ms Letty M Morewane

CLEARANCE CERTIFICATE	M110823
PROJECT	Assessment of Laboratory Testing Patterns and Costs in Sekhukhune Health District, Limpopo Province
INVESTIGATORS	Ms Letty M Morewane.
DEPARTMENT	School of Public Health
DATE CONSIDERED	26/08/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

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

DATE 26/08/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisors: Mr Sagie Pillay

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

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Enquiries: Selamolela Donald Ref:4/2/2

Morewane ML

P O Box 350

Apel

0739

Dear Ms Morewane

Re: Permission to conduct the study titled: Assessment of laboratory testing patterns and in Sekhukhune health district, Limpopo Province

1. The above matter refers.
2. Permission to conduct the above mentioned study is hereby granted.
3. Kindly be informed that:-
   - Further arrangement should be made with the targeted institutions.
   - In the course of your study there should be no action that disrupts the services.
   - After completion of the study, a copy should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.

Your cooperation will be highly appreciated.

General Manager: Strategic Planning, Policy and Monitoring

Date 2013/07/22

18 College Street, Polokwane, 0700, Private Bag x9302, POLOKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: http/www.limpopo.gov.za

APPENDIX C: DATA COLLECTION INSTRUMENTS

Sub District	Name of Facility	Specimen Number	Date	Code	Full Description	Quantity	Charge