

https://dspace.org/

Analysis of laboratory test ordering patterns in relation to costs at Brits District Hospital.

Mhlanga, Themba Wilfred

2014-04-23
http://hdl.handle.net10539/14563

Downloaded from a DSpace repository. https://dspace.org/

ANALYSIS OF LABORATORY TEST ORDERING PATTERNS IN RELATION TO COSTS AT BRITS DISTRICT HOSPITAL

THEMBA WILFRED MHLANGA

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

Themba W Mhlanga Student No: 403871 Supervisor: Mr. Sagie Pillay

DECLARATION

I, Themba Wilfred Mhlanga, 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 for any examination at this or any other University.

.....

24 May 2013

DEDICATION

This research is dedicated to district hospital services in the Bojanala Platinum Health District and to clinicians (in particular medical officers, nurses and the NHLS service) at the Brits District Hospital.

ACKNOWLEDGEMENT

Sincere thanks are extended to all my colleagues at Brits District Hospital, as well as partners, mentors and experts within and outside the employment of the North West Department of Health who generously contributed to the successful completion of this study. The assistance of the following people deserves a special acknowledgement:

• Dr D Basu	My lecturer and programme manager at WITS
• Mr Sagie Pillay	My supervisor and the CEO of NHLS
• Ms Desiree Franker	PA to the CEO of NHLS
• Ms M Govender	Lecturer and advisor at WITS
• Mrs M Rakau	Bojanala Health District Manager (Chief Director)
• Dr A Robinson	Deputy Director General North West DoH
• Dr C Ogunmefun	Health Systems Trust
• Mr Abel Makuraj	NHLS Regional manager for Rekopane Region
• Ms Nim Kalidas	NHLS laboratory manager Brits Hospital
• Mrs KS Dikobe	Supply Chain Manager at Brits Hospital
• Mrs KM Forane	Secretary to Hosp CEO at Brits Hospital
• Mrs C Mhlanga	My wife and my two children, Sikhumbuzo and Ntuthu, for all the support and understanding

ABSTRACT

Laboratory tests are considered a critical clinical intervention in the diagnosis and treatment of various medical conditions. However, ordering of laboratory tests is not immune from abuse (under / over-use), which necessitates that the service be effectively managed. It has been a matter for concern that there actually are no benchmarks in existence against which district hospitals laboratory test ordering patterns can be measured. This study concerns the generation and compilation of a body of knowledge that will serve as a baseline / benchmark for comparison purposes on a month-to-month basis at Brits District Hospital, as well as for comparisons with other district hospitals, towards the development of best practices.

Aim

To describe laboratory tests ordering patterns at Brits district hospital with intent to develop a baseline for comparison between district hospitals within and outside the Bojanala health district.

To describe and analyze laboratory test ordering patterns at Brits district hospital between January and June 2011 in relation to:

- number of laboratory tests ordered per month
- number of laboratory tests ordered by test type / category
- cost of laboratory tests per month
- cost of laboratory tests ordered by test type / category
- comparison of laboratory test orders by section
- comparison of laboratory test orders by test type
- comparison of laboratory test orders on the basis of first (initial) test against repeat tests

Methodology

A descriptive cross-sectional study design is used for this study.

The study population is the NHLS Thusano electronic reports from January to June 2011.

Results

- Casualty (Emergency & Trauma) and the Outpatients Department are major consumers of laboratory tests. Of the 35 980 lab tests ordered in 6 months 63.7% (n= 22 928) were requested from the Casualty and was followed by OPD at 20.9% (n= 7531) and the remainder 15.4% (n = 5 535) from all three wards combined.
- The highest number of laboratory test repeats occurred within 24 hours of the initial test and were followed by repeats after 72 hours of the initial test. Of the 949 laboratory test repeats ordered in 6 months 40.8% (n= 390) were reordered within 24 hours of the initial test and the second highest repeats 34.1% (n= 326) were reordered after 72 hours of the initial test.
- In the six months of the study 14 356 health users (patients) were captured through the PAAB system at the hospital's registry / admissions point, of these 26.4% (n= 3 799) were exposed to laboratory testing.
- In the six months of the study 3799 health users were exposed to laboratory testing, of these 17.7% (n= 675) were further exposed to repeat laboratory testing.
- In the 6 months of the study 35 980 laboratory tests were ordered, of these 89% (n= 32 020) were initial / first / baseline lab tests. Of the 35 980 laboratory tests ordered 11% (n= 3 960) were repeat / reorder / follow up lab tests.
- In the 6 months of the study the overall expenditure of the hospital was R32 038 944 of this 4.3% amounting to R1 396 730 was spent on laboratory tests. The average expenditure per month on laboratory tests was R232 788. The highest expenditure on laboratory tests was in February 2011 totalling R261 889 and the lowest was in April 2011 totalling R207 876

Conclusion

The high laboratory test orders by Casualty followed by OPD both of which are entry points into the hospital are indicative of earlier studies and findings that medical officers do use laboratory tests as a diagnostic tool instead of a tool to confirm a provisional diagnosis that must be arrived at through proper history taking and thorough physical examination.

The highest repeat of laboratory test ordering within 24 hours of the initial laboratory test could be an indication of challenges with turn-around-times whereby clinicians become impatient / anxious about the delay of results and then opt for a reorder / repeat of the initial / baseline lab test. Other reasons could include an inefficient laboratory results reporting and retrieving system between the Casualty / OPD and the laboratory.

The second highest repeat laboratory test orders occurred after 72 hours of the first / initial test. As much as the repeat laboratory testing could be justified for follow up (confirmatory and or prognosis monitoring purposes) a possibility of reordering these tests only because earlier tests cannot be retrieved (due to loss, theft and or misfiling) cannot be ruled out.

When the North West Department of Health (NWDoH) renews its contracts or rather the Service Level Agreement with the National Health Laboratory Service (NHLS) it is important that end users (hospital managers and clinicians) be involved in the finalization of these contracts / agreements so to ensure that some seemingly minor yet critical terms and conditions are built into the agreements. Some conditions that should be clearly captured in these contracts include:

Turn-around-Time (TAT) per laboratory test specimen

List of laboratory tests that can / cannot be ordered at different hospital levels

Information on time validity / applicability / usability of various lab test results

A gate-watch system that will prevent against undue lab test reorders, NHLS and the DoH should actually operate as partners with common business aspirations.

TABLE OF CONTENTS

DECLARATION ..... **ii**
DEDICATION ..... **iii**
ACKNOWLEDGEMENT ..... **iv**
ABSTRACT ..... **v**
TABLE OF CONTENTS ..... **viii**
LIST OF FIGURES **xi**
LIST OF TABLES **xi**
GLOSSARY OF TERMS **xii**
LIST OF ABBREVIATIONS ..... **xiii**
CHAPTER 1 ..... **- 1 -**
INTRODUCTION ..... **- 1 -**
1.1 BACKGROUND ..... - 1 -
1.2 BRITS DISTRICT HOSPITAL ..... - 2 -
1.3 JUSTIFICATION FOR THE STUDY ..... - 3 -
1.4 RESEARCH QUESTION ..... - 3 -
1.5 STUDY OBJECTIVES ..... - 3 -
1.5.1BROAD OBJECTIVE ..... - 3 -
1.5.2 SPECIFIC OBJECTIVES ..... - 4 -
1.6 SUBSEQUENT CHAPTERS ..... - 4 -
CHAPTER 2 ..... **- 6 -**
LITERATURE REVIEW ..... **- 6 -**
2.1 LABORATORY TEST ORDERING PATTERNS ..... - 6 -
2.2 LABORATORY TESTS AND THE PATIENT PROFILES ..... - 8 -
2.3 LABORATORY TESTS AND COSTS ..... - 9 -
2.4 MANAGEMENT OF COSTS FOR LABORATORY TESTS ..... - 9 -
CHAPTER 3 ..... **- 12 -**
METHODOLOGY ..... **- 12 -**
3.1 STUDY DESIGN ..... - 12 -
3.2 STUDY SETTING ..... - 12 -
3.3 STUDY SCOPE ..... - 13 -

3.4 STUDY PERIOD ..... - 13 -
3.5 STUDY POPULATION AND SAMPLING ..... - 14 -
3.6 DATA MANAGEMENT ..... - 14 -
3.6.1 VARIABLES ..... - 14 -
3.6.2 DATA COLLECTION ..... - 14 -
3.6.3 DATA ANALYSIS ..... - 15 -
3.7 PILOT STUDY ..... - 15 -
3.8 ETHICAL CONSIDERATIONS ..... - 16 -
CHAPTER 4 ..... - 17 -
RESULTS ..... - 17 -
4.1 LABORATORY TEST ORDERING (FIRST AND REPEAT TESTS) ..... - 17 -
4.2 COST OF LABORATORY TESTS - 19 -
4.3 COMPARISON OF LAB TEST ORDERING PATTERNS - 21 -
CHAPTER 5 ..... - 26 -
DISCUSSION OF FINDINGS ..... - 26 -
5.1 LAB TEST ORDERING PATTERNS (FIRST AND REPEAT TESTS) ..... - 26 -
5.2 COST OF LABORATORY TESTS - 27 -
5.3 COMPARISON OF LAB TEST ORDERING PATTERNS - 28 -
CHAPTER 6 ..... - 30 -
CONCLUSIONS AND RECOMMENDATIONS ..... - 30 -
6.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY ..... - 30 -
6.1.1 DESCRIPTION OF LABORATORY TEST ORDERING PATTERNS (FIRST AND REPEAT TESTS) DURING THE PERIOD OF STUDY - 30 -
6.1.2 DESCRIPTION AND COMPARIOSN OF LAB TEST COSTS - 31 -
6.1.3 COMPARISON OF LAB TEST ORDERING PATTERNS FOR DIFFERENT MONTHS - 31 -
6.2 LIMITATIONS OF THE STUDY - 32 -
6.3 RECOMMENDATIONS - 33 -
6.3.1 FOLLOW-UP STUDIES / RESEARCH - 33 -
6.3.2 PROPOSED REMEDIAL ACTIONS ..... - 34 -
6.4 SUMMARY AND CONCLUSIONS ..... - 34 -

REFERENCES .....- 35 -

APPENDIX A: APPROVAL BY THE EMPLOYER FOR STUDY TO BE CONDUCTED - 38 -

APPENDIX B: PG APPROVAL - 39 -

APPENDIX C: ETHICS COMMITTEE CLEARANCE CERTIFICATE - 40 -

APPENDIX D: DATA COLLECTION INSTRUMENTS .....- 41 -

LIST OF FIGURES

Figure 1 Map of the Bojanala Platinum Health district.....- 13 -
Figure 2 Comparison If lab test costs (initial vs repeat tests) - 20 -
Figure 3 Difference in hours between initial and repeat lab tests..... - 21 -
Figure 4 Lab tests (all categories) ordered per ward over 6 months - 23 -
Figure 5 Number of lab tests (by category) repeated over 6 months - 24 -

LIST OF TABLES

TABLE 3.1 VARIABLES TO BE MEASURED IN THE STUDY - 14 –
TABLE 4.1 NUMBER OF SUBJECTS SEEN AND EXPOSED TO LAB TESTING - 17 –
TABLE 4.2 NUMBER OF SUBJECTS EXPOSED TO INITIAL AND REPEAT LAB TESTING - 17 –
TABLE 4.3 NUMBER OF LAB TESTS CONDUCTED - 18 –
TABLE 4.4 COMPARISON OF EXPENDITURE OVERALL WITH THAT ON LABORATORY TESTS - 19 –
TABLE 4.5 COSTS OF LAB TESTS (OVERALL / INITIAL / REPEATS) - 19 –
TABLE 4.6 COMAPRISON OF LAB TEST IMPLICATIONS - 21 –
TABLE 4.7 DIFFERENCE IN HOURS FROM INITIAL TO REPEAT TEST - 22 -

GLOSSARY OF TERMS

Basic accounting system: A finance management system that can be used to move / transfer funds and is also used to make electronic payments

Cost containment: Management and facilitation of the efficient and effective use of resources

Correlation : Correlation is a measure of the relation between two or more variables. The value of –1.00 represents a perfect negative correlation, while a value of +1.00 represents a perfect positive correlation. A value of 0.00 represents a lack of correlation.

Financial year : The period of twelve months from the beginning of April to end March of the next year.

Laboratory test : Ordered clinical procedures classified into one of the following categories: chemistry, haematology / coagulation, immunology, microbiology, histology, cytology and toxicology (Beregi, 2005).

Length of stay : The number of days a patient remains in the hospital, from the date of admission to the date of discharge (Beregi, 2005)

Line item : One of the key components that the overall annual budget of a hospital is broken up into. Examples of some line items include medicine, transport, maintenance, laboratory (NHLS) services etc

Monthly Equitable Spending Model: An arithmetical / mathematical desktop spending model that assumes that expenditure is equal and similar for every month of the year

Repeat test : A test that follows a preceding one of the same type regardless of time / interval between the two

Turnaround time : Time interval between the time at which a lab test specimen is received at the laboratory and the time it is reported on / upon

LIST OF ABBREVIATIONS

BAS	Basic accounting system
Com-serve	Community Service (Medical Officer)
DHIS	District Health Information Service
DHP	District Health Plan
DoH	Department of Health
HOD	Head of Department (type of hospital department include Clinical / medical / nursing)
Lab (lab)	Laboratory
MO / MOs	Medical officer / medical officers
NDoH	National Department of Health
NHA	National Health Act
NHLS	National Health Laboratory Service
NWDoH	North West Department of Health
PAAB	Patient Admission and Billing System
PMO	Principal Medical Officer (Grade 2 Medical Officer)
POCT	Point of Care Testing
SCM	Supply Chain Management
SLA	Service Level Agreement (same as contract)
SMO	Senior Medical Officer (Grade 1 Medical Officer)
TAT	Turn-around-Time

CHAPTER 1

INTRODUCTION

The purpose of this study is to describe the laboratory tests ordered at Brits district hospital in terms of the following: first and repeat laboratory tests; comparison of trends in the ordering of first and repeat laboratory tests by different sections in the hospital over a period of the first six months of year 2011. Furthermore, the data generated is to serve as a baseline for comparison with other district hospitals but also to inform and assist the development of best practices on laboratory test ordering within the Bojanala health district.

No similar study has ever been undertaken before.

1.1 BACKGROUND

The origin of laboratory health services dates back to the 1870s when they were referred to as public health laboratories. The focus then was mainly on chemical analysis and conducting the basic analysis of water and milk. The idea of health laboratories as we know them today came into existence around 1887 when Drs Hermann M Biggs and T Mitchell Prudden successfully isolated *Vibrio cholerae* which causes cholera. The use of laboratory tests was further bolstered by the diphtheria crisis of the 1890s, when Dr Biggs proved through laboratory tests that many patients admitted and treated at the New York Diphtheria Hospital were misdiagnosed, which led to mislaid disinfection and quarantine of every suspected diphtheria patient (Harvey, 2002).

Today, some 120 years later, public health laboratory services have become an integral and critical part of health service delivery. The services have subsequently advanced to a level of compromising the intelligence of those who must order them. Accordingly, it is unfortunate that health laboratory services have become one of the major cost drivers in district hospitals. A shotgun

approach in ordering laboratory tests has, of necessity been replaced by the Rifle 'targeted' approach (Wians, 2009).

The position of health laboratory services in health service delivery in South Africa is safely enshrined in a set of norms and standards, *A District Hospital Package for South Africa* (DoH, 2002). The South African National Health Act (Act 61 of 2003) also spells out clearly the position of health laboratory services under Chapter 4 section 25. The National Health Laboratory Services (NHLS) is the only provider of health laboratory services to the public health facilities. The North West Provincial Department of Health (DoH) has subsequently entered into service level agreements (SLA) with the NHLS to set conditions that will govern this relationship (North West Province Department of Health, 2010).

1.2 BRITS DISTRICT HOSPITAL

Brits District Hospital is one of the 21 district hospitals in the North West province. The province has four health districts of which Bojanala is the biggest. The Bojanala Health District includes four local municipalities (sub-districts), of which Madibeng is the second largest. Brits District Hospital is one of two hospitals in Madibeng Local Municipality, but is at the same time the only public hospital that is expected to serve the poorest of the poor. The name "Brits" derives from the town where the hospital is situated. In 2008, the hospital was placed on the Hospital Revitalisation (re-building) Programme and construction is expected to be complete by middle 2013. The hospital serves a population of 391 191 (Bojanala DHP 2010/11).

Currently, all services are rendered from a temporary structure owing to a resolution to completely demolish the then public hospital so to make way for the new Brits district hospital. The temporary hospital has 36 beds (12 male general, 12 female general and 12 paediatric general). Other services include a 24-hour trauma and emergency department, allied services, out-patients service, HIV / AIDS clinic, pharmacy, X-ray services and laboratory services. The budget for the

year 2008/9 was R35 378 355, 2009/10 was R43 912 000, and 2010/11 was R50 877 475. A significant amount of this budget is spent on laboratory tests; for example, by January 2011, the hospital had spent R2 091 092 on laboratory services alone, which gives an average of R209 109 per month, instead of R171 666, a figure based on the equitable spending model and the line item (NHLS) allocated budget of R2 060 000.

1.3 JUSTIFICATION FOR THE STUDY

Expenditure on laboratory tests is one of the major cost drivers in a district hospitals. Monthly spending on laboratory tests at Brits District Hospital ranges between R200 000 and R250 000, which is high in comparison to the yearly budget allocation for this line item. As there are no set benchmarks against which to compare, claim(s) of over-spending on lab tests cannot be substantiated. Moreover, comparisons between hospitals are not realistic / feasible as conditions differ from one hospital to another. Year-to-year budget allocations for laboratory services have had their unique traditional shortfalls, in that the previous year's expenditure (regardless of outputs and outcomes) are used to determine the allocation for the following year.

1.4 RESEARCH QUESTION

'Brits district hospital is overspending on laboratory tests', if so what targets and benchmarks are available to measure ourselves against?

1.5 STUDY OBJECTIVES

1.5.1 BROAD OBJECTIVE

The main objective of this research is to describe and compare the laboratory tests ordering patterns and to establish / determine value for money in the

allocation of resources. The research also aims at generating NHLS related baseline data to be used for monitoring, comparison and quality improvement purposes.

1.5.2 SPECIFIC OBJECTIVES

The specific objectives of this research are to generate data for determination / setting of targets and baselines on the following:

- Proportion of the budget to be allocated and spent on laboratory tests
- Proportion of health users to be exposed / subjected to laboratory testing (initial tests and repeat tests)
- Set turn-around-times (TAT) for the different laboratory tests
- Evidence based improvements to the SLAs between DoH and the NHLS

1.6 SUBSEQUENT CHAPTERS

So far, the background to the research has been discussed. The research question and the objectives were also defined in this chapter. A brief outline of the subsequent chapters follows-

Chapter 2 – Literature review: The purpose of the literature review is to examine literature pertaining to the research and to discuss the reasons why doctors order laboratory tests, the cost of laboratory tests and the interventions aimed at managing (controlling) laboratory test ordering.

Chapter 3 – Research methodology: This chapter describes the research methodology, the study design, the setting, the scope and the data management techniques used in this study.

Chapter 4 – Presentation of results: The chapter looks into the analysis of the collected data and relates this to the aim and objectives of the study.

Chapter 5 – Discussion: The findings on review of related literature are incorporated with the results obtained from the data analysis in order to address the aim and objectives of the study.

Chapter 6 – Conclusions and recommendations: This chapter is the last chapter of the report. Conclusions are drawn based on the data analysis and the findings (as they relate to the aim and objectives of the study). Last but not least recommendations are made and areas for future related research are identified.

CHAPTER 2

LITERATURE REVIEW

Literature on clinical laboratory test utilisation focuses mainly on the cost of laboratory tests and measures to curb over-utilisation. There is a paucity of literature on trends such as the ideal number of tests per patient, demographics, turnaround time (TAT) and the relationships between patient demographics and the laboratory tests that are ordered.

2.1 LABORATORY TEST OREDERING PATTERNS

There is a general belief that clinicians over-utilise laboratory tests. However, Walraven and Naylor (1998) question and critique this supposition. Accordingly, they advance the following arguments to support their view: (a) studies on laboratory test utilisation tend to focus primarily on the physician's laboratory test ordering practice without taking the context into consideration; (b) such studies depend extensively on clinical records without taking into consideration the primary reason for writing these clinical notes, a practice which, by its very nature, allows for the erroneous use of doctors' notes; (c) most studies on laboratory test utilisation are conducted in hospital settings – places where health users are generally less healthy and therefore more likely to require more of these laboratory tests; and (d) a significant number of such studies are conducted in academic hospitals where junior doctors, by virtue of their lesser experience, are likely to order laboratory tests less efficiently. These authors conclude their argument by cautioning that statements on laboratory tests ordered should be made with reservation unless there is adequate evidence to support such claims.

A laboratory test can only assist in diagnosis when it is conducted with proper history taking and clinical examination. For example, Hampton, Harrison and

Mitchell (1975) presented questionnaires to medical practitioners in which they were requested to list three possible diagnoses (a) after a history-taking session; (b) after a physical examination session; and (c) after a laboratory investigation. All the provisional diagnoses were compared to the diagnosis of the general practitioner that referred the patient. In more than 50% of cases, the diagnoses changed after history taking, and in the remaining 50% diagnosis changed subsequent to physical examination and lab testing. These researchers advised that training programmes for student doctors need to place more emphasis on communication (history taking) as the caveat to correct diagnosis of patients.

Young (1988) remarks that no one study has ever produced a lasting positive change in the laboratory test ordering pattern of doctors. He recommends the following interventions as an enabler and a re-enforcer of a lasting positive change: (a) involvement of senior doctors (role modelling); (b) education of junior doctors (mentoring); (c) feedback by senior doctors to junior doctors (reinforcement); and (d) the availability of some protocol on laboratory test ordering (administrative intervention).

Kahan, Waitman and Vardy (2009) fall short of blaming the system (facilities) and management for the real or suspected laboratory test over-utilisation. They appeal to managers to evaluate the efficiency of their laboratory test-ordering procedures from time to time. They claim that, in general, managers do not have the systems to monitor laboratory test ordering, as this is primarily an MO's prerogative, and that, coupled with a class culture that leans towards protectionism, individualism and tribalism, they then tend to assume and exercise this responsibility (privilege) with an autonomous state of mind. For example Wertman, Sostrin and Pavlova (1980) in their study of MOs found that (a) some tests would have not been ordered if patients were personally paying the costs of the tests; and (b) tests that attributed to diagnosis constituted 37%, to screening 32% and monitoring 33%. The three reasons given for conducting laboratory tests have failed to single out one foremost and commonest reason for

requesting laboratory tests. In a South African setting study it was found that only 59.1% of the lab test results could be clearly linked to a physician's management plan of their patients (Prinsloo, Dimpe, Maphakisa, Matika, Shabalala & Joubert 2009)

2.2 LABORATORY TESTS AND THE PATIENT PROFILES

Literature is scant on profiles of patients for whom laboratory tests are commonly ordered. The few studies that could be accessed describe relationships between a particular medical condition and the ages of health users who are exposed to particular laboratory testing as part of the interventions in managing their medical conditions. No literature could be found that explored ethnicity as a variable that contributes to laboratory testing. Almost all authors in this field of study are unambiguous on the commonest indications (without being specific) for ordering laboratory tests, the most cited ones being (a) to screen for diseases; (b) to evaluate and / or monitor previous abnormal results; (c) to determine prognoses; (d) for training purposes; (e) for medico legal reasons; and (f) to guard against possible malpractice (Beregi, 2005; Hampton et al, 1975; Kroeke, Hanley & Copley, 1987; Maskowitz, 1984; Scott & Nguyen, 2009).

Beregi (2005) has conducted numerous studies on the use of clinical tests and his findings include the following: (a) more laboratory testing was done on females than males; (b) health users in the age category 65 to 84 years were exposed to the highest number of laboratory tests as compared to groups in the 21 to 64 years range and the plus 85-year range; and (c) types of laboratory test ordered vary according to the patient's conditions.

- **Chemistry:** Mainly patients with heart diseases
- **Microbiology & immunology:** Mainly patients with pneumonia
- **Toxicology:** Mainly patients with cerebrovascular diseases
- **Chemistry & haematology:** Mainly patients with neoplasm
- **Cytology & histology:** Mainly patients with neoplasm

This study demonstrated that ordering of Chemistry (bio chemistry) and Haematology lab test types had proved to be the most commonest which also concurs with findings of a study by Prinsloo et al (2009).

2.3 LABORATORY TESTS AND COSTS

The mounting cost of laboratory services is making this important component of clinical management unaffordable to many patients, particularly so in developing countries (Mosha, F. 2013). Consequently, both public and private health facilities are looking for innovative ways to manage costs of laboratory tests. Levin, Steele and Atherly (2007) propose rapid testing or rather Point of Care Testing (POCT) as a readily available alternative to most routine laboratory tests. They identify the benefits of POCT as the fact that it is cheap, quick, and saves on travelling costs for the patients - that it “cuts on return visits to check blood results”, it is easy “no specialized training needed”, ideal for facilities without an in-house laboratory service, cuts costs on rejected specimens due to breakage in the cold chain, loss of specimens, transport, phone calls to get the results, printing the results, to mention but a few. The efficacy levels of POCT can never be similar to traditional laboratory testing, but if the POCT is elevated in district hospitals this could lead to a win–win situation for all (the clinician, patient, management and the budget). The ‘Choosing Wisely’ is a program that wants to encourage better utilization of clinical pathology laboratory tests supporting engagements between clinicians and their clients regarding the value and benefits of laboratory tests in the treatment of their ailments (www.darkdaily.com).

2.4 MANAGEMENT OF COSTS FOR LABORATORY TESTS

Hubbel, Frye, Akin and Rucker (1988) advise that proper history taking and physical examination could help to reduce laboratory costs. They found no significant difference in the management of patients exposed to routine laboratory testing and those not exposed (Hubbel et al 1988). They postulate that laboratory testing should never be rushed for admitted patients, as these patients would be put under close medical observation which might lead to the discovery of the signs that would have been detected at a cost by laboratory testing. The majority of routine laboratory test results come out normal and only a few tests ever lead to a change in the management of the patient. Nevertheless, on many

occasions MOs ignore the abnormalities exposed by tests in favour of their clinical findings. In their article 'How to develop cost conscious guidelines' Eccles and Masco (2001) cite a statement by Eddy who reminded his audience that "Health interventions are not free, people are not infinitely rich, and the budgets of [health care] programs are limited. For every dollar's worth of health care that is consumed, a dollar will be paid. While these payments can be laundered, disguised or hidden, they will not go away". Their overarching philosophy is about sensitizing the clinicians of the different cost conscious treatment modalities that have been developed by specialist teams in conjunction with health users. In our context the Batho Pele Principles of Consultation, Openness and Service Standard are a perfect match to Eccles & Masco (2001) treatment modalities. Sander (1979) reports that in a two-year study of 630 medical out-patients, a diagnosis was reached on the basis of history taking in two-thirds of the subjects and laboratory testing was helpful only in the remaining one-third.

Many studies have been conducted with the intention of understanding better the lab test ordering patterns and with intent to develop interventions that may contain this implicit laboratory test over-utilisation. The commonest interventions adopted from such studies include: (a) education of medical officers on laboratory test ordering; (b) developing guidelines on laboratory test ordering; (c) designing and redesigning the lab test-ordering forms; and (d) computerising the test-ordering system. In another study it was found that each of the above cited interventions did produce some positive change but that all these interventions also had some limitations. The commonest limitation was that whatever positive change achieved was not sustainable (Solomon, Hashimoto, Daltroy & Liang 1998). Consequently, Solomon et al (1998) advised that interventions used in monitoring and managing the ordering of laboratory tests should incorporate some behavioural change with an emphasis on the predisposing factors (attitudes), enablers (design / redesign of test ordering forms and developing guidelines) and lastly, reinforcement based on evidence that whatever systems are advocated for do not compromise patient care and are de facto cost effective.

Kroeke et al (1988) concur with findings that the education of MOs and administrative interventions contribute to reduced laboratory test ordering. Administrative interventions require that an MO ordering a lab test should provide reasons for ordering the lab test and that his / her reasons be justified by a senior MO. At the end of their study, the findings revealed that not only did the ordering of laboratory tests decline when controls were put in place, but that the quality of clinically indicated tests had also improved.

The design of the place of work and availability of POCT are also major determiners of how lab tests are ordered. Maskowitz (1984) reported that (a) MOs in a small setting (an office or clinic) tend to order fewer laboratory tests than their counterparts in bigger settings such as hospitals; (b) physicians who have laboratory test instruments in their offices (in-house service) tend to order fewer tests than those who use an outsourced laboratory service; (c) patients are happier if their doctors order lab tests even when an explanation is given that there is no need for such laboratory tests; and (d) generally, MOs do not know how much laboratory tests cost.

What this research will try to achieve is the generation of a database / parameters against which ordering of laboratory tests at Brits district hospital will be measured / compared and later serve as a basis for comparison with other district hospitals.

CHAPTER 3

METHODOLOGY

The methodology for this study was selected on the basis of the aim and objectives of the research. In this chapter the following are discussed: the setting of the study, the scope of the study, the study design and research tools used.

3.1 STUDY DESIGN

A descriptive cross-sectional study design was used for this study.

3.2 STUDY SETTING

Snapshots were obtained on a monthly basis (Jan–June 2011) of laboratory test ordering patterns at Brits District Hospital. All specimens, including blood, body excretions and / or body secretions were included in the study and accordingly categorised into branches of laboratory test analyses; that is, haematology, chemistry and so forth. The only exclusion was the specimens from the ARV / Wellness Unit, as the funding for these tests is obtained from the HIV / AIDS Grant not the Hospital Equitable Share budget.

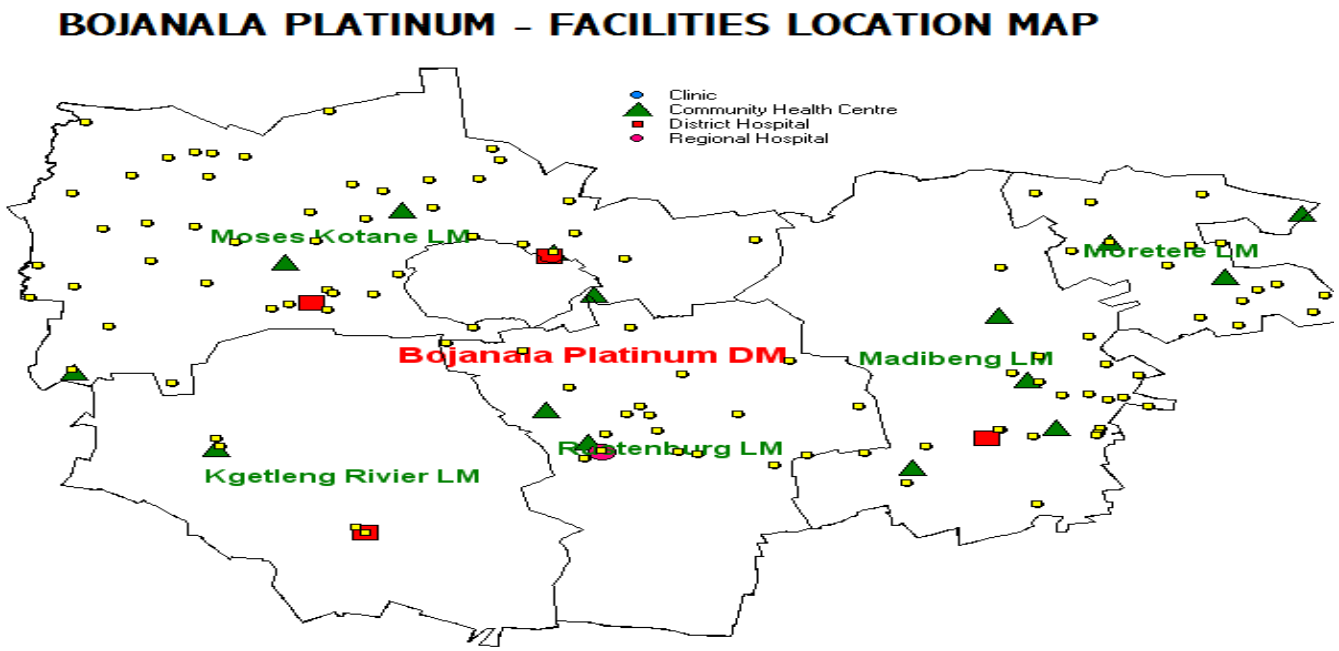


Figure 1: Map of the Bojanala Platinum Health District

3.3 STUDY SCOPE

The study involved the analysis of the electronic reports from the NHLS Thusano electronic laboratory utilization reports over a period of six months, the focus being on (a) number of lab tests ordered per month (b) number of laboratory tests ordered by test type (c) costs per month (d) costs by lab test type / category (e) comparison of lab test orders by section (f) comparison of lab test orders by test type. The data so obtained is to be used as a baseline for subsequent comparisons, monitoring, quality improvement initiatives and last but not least to develop targets / benchmarks / guidelines based on identified best practices.

3.4 STUDY PERIOD

The study covered the period of January to June 2011.

3.5 STUDY POPULATION AND SAMPLING

The study population comprised the monthly NHLS (Thusano) electronic laboratory utilisation reports from January to June 2011, excluding reports on specimens originating from the ARV & Wellness centre. These monthly reports provided a sample of approximately 600 patients and 6 000 tests per month.

3.6 DATA MANAGEMENT

3.6.1 VARIABLES

The following variables were measured during the study:

Table 3.1: Variables to be measured in the study

Objective	Variables	
1	Laboratory tests ordered	- number of patients exposed to laboratory testing - number of lab tests ordered per month - number of laboratory tests ordered by test type - comparison of laboratory test ordered by section
2	Costs of laboratory tests ordered	- costs of laboratory tests ordered per month - costs of laboratory test by test type / category - comparison of lab tests costs *(initial / first / baseline vis-a-vis repeat laboratory test orders)*

3.6.2 DATA COLLECTION

The data used in this study is routinely compiled by the NHLS through the Thusano electronic database and is produced every month end together with the claims (invoices) for services rendered to respective hospitals. This data must be verified by hospitals through their supply chain management (SCM) section. For the purposes of this study, the data from the NHLS database were then exported to an MS Excel-based tools that are exclusively designed for this study.

3.6.3 DATA ANALYSIS

Data of lab tests ordered: Once the data had been exported to the MS Excel tool, it was filtered by test type and ward. It was then established whether the test was an initial or repeat test. Data collected was then compared month to month for the duration of the study.

Costs of tests: Overall cost and volume (quantity) of tests by section were compared month to month for the duration of study. Cost and volumes (quantity) of repeat tests were also compared month to month for the duration of the study.

Epi Info Version 3.4.1 was used to ascertain the following statistics:

- for the mean and median (central tendency) of continuous variables
- for standard deviation and inter-quartile range (spread)
- proportion was used for categorical variables
- to compare continuous variables (means) a t-test was used
- a chi-square test was used to compare categorical variables
- statistical significance will be reported at $p < 0.05$
- a 95% confidence level will be reported

In addition, Excel formulae were used to measure and compare the ratio between two sets of data.

3.7 PILOT STUDY

No pilot study was conducted as all data is routinely collected through the NHLS Thusano electronic database between Jan and June 2011 was to be studied and analyzed.

3.8 ETHICAL CONSIDERATIONS

In the interest of patient confidentiality, patients' names and reference numbers were not captured on the data collection form and the datasheet. Confidentiality and anonymity was maintained throughout all phases of the study, that is: data collection, data capturing and reporting the information.

Approval for this study was granted by the Bojanala Platinum Health District Research Committee before the study commenced.

A submission was made to the University of the Witwatersrand Human Research Ethics Committee (medical) and an approval was granted prior the commencement of this study. Reference number for the Ethics Committee Clearance Certificate is M 110824.

CHAPTER 4

RESULTS

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

4.1 LABORATORY TEST UTILISATION (FIRST AND REPEAT TESTS)

Table 4.1: Number of subjects seen and exposed to lab testing per month

Month	No. of subjects captured by PAAB system at Admissions	No. of subjects exposed to laboratory testing
January 2011	2375	590 (24.8%)
February 2011	2344	**680 (29.0%)**
March 2011	2537	645 (25.4%)
April 2011	2308	643 (27.8%)
May 2011	2549	637 (24.9%)
June 2011	2243	604 (26.9%)
Mean over 6/12	**2392,6**	**633.1 (26.5)**

In the 6 months of the study a total of **14 356** patients (with a mean of **2392.6**) were captured through the PAAB system at patient registry / admission point. In the same period a total of **3 799** patients (with a mean of **633.1**) were exposed to laboratory testing. This data gives indication that **26.4%** of all patients that come to Brits district hospital are exposed to laboratory testing.

Table 4.2: Number of subjects exposed to initial and repeat laboratory testing

Month	No of subjects exposed to initial tested	No subjects exposed to repeat tests	% of subjects exposed to repeat testing
Jan	590	117	19.8
Feb	680	131	19.3
Mar	645	128	19.8
Apr	643	98	15.2
May	637	106	16.6
Jun	604	95	15.7
Mean	633.2	112.5	17.8

In the 6 months of the study **3 799** patients (mean of **633.2**) were exposed to laboratory testing, of these **675** (mean of **112.5**) were further exposed to repeat laboratory testing. This data gives indication that **17.7%** of all patients that are exposed to laboratory testing at Brits district hospital will further be exposed to repeat laboratory testing. The highest proportion of patients exposed to repeat lab testing was in January and March 2011 at **19.8%** each. The highest number of patients exposed to laboratory testing was in February at **131** headcount.

Table 4.3: Number of laboratory tests conducted (all tests combined / initial / repeat)

	No of total lab tests conducted (all tests combined)	No of initial lab tests conducted	No of repeat lab tests conducted
2011 Jan	**5918**	**5190**	**170**
2011 Feb	**6619**	**5885**	**178**
2011 Mar	**6565**	**5612**	**199**
2011 Apr	**5153**	**4788**	**122**
2011 May	**6042**	**5404**	**152**
2011 June	**5697**	**5176**	**128**
Mean over 6/12	**5999**	**5342.5**	**158.1**

In the 6 months of the study a total of **35 980** (with a mean of **5 999**) laboratory tests results were analyzed, of these a **32 020** (with a mean of **5 342**) were the initial / first / baseline laboratory test orders on the patient. This data indicates that **89%** of laboratory tests ordered are initial / first / baseline tests and the remaining **11%** are repeat laboratory test orders.

Of the **11%** repeat laboratory test results only 23.9% (n= **949**) lab tests could be used for the study. The other 76% (n= **3011**) repeat laboratory tests over a 6 months period could not be considered for the study for a number of reasons - to a larger extent spoilt lab test specimen in addition to incomplete data on the laboratory test request forms by either the hospital and or NHLS staff. This alone is by itself an area that demands a further research due to related indirect financial implications.

4.2 COSTS OF LABORATORY TESTS

Table 4.4: Comparison of expenditure (in rand) overall vis-a-vis expenditure on laboratory tests

Month	Actual expenditure for the hosp	Costs of lab tests invoices	% of the expenditure on lab tests
Jan	4 391 739	221 281	5.0
Feb	4 499 208	261 889	5.8
Mar	6 511 767	240 322	3.6
Apr	**3 565 794**	**207 876**	**5.8**
May	6 773 376	240 495	3.5
Jun	6 297 060	224 867	3.5
Mean over 6/12	**5 339 824**	**232 788.3**	**4.5**

Table 4.5: Costs in rand of laboratory tests (overall / initial / repeat)

Month	Costs of all lab tests	Costs of initial tests	Cost of repeat tests	% Cost of repeat tests
Jan	**221 281**	**190 537**	**30 744**	**13,8**
Feb	**261 889**	**228 990**	**32 899**	**12,5**
Mar	**240 322**	**200 076**	**40 246**	**16,7**
Apr	**207 876**	**188 906**	**18 970**	**9,1**
May	**240 495**	**212 020**	**28 475**	**11,8**
Jun	**224 867**	**198 159**	**26 708**	**11,8**
Mean over 6/12	**236 220.4**	**203 114.6** (85.9%)	**29 012,9**	**12,2**

As indicated by table 4.4, Brits district hospital overall expenditure in 6 months was **R32 038 944**, of this **4.3%** (totalling **R1 396 730**) was spent on laboratory tests. The mean overall expenditure for the hospital in these 6 months was **R5 339 824** and the mean expenditure on laboratory tests was **R232 788**. The proportion of expenditure on laboratory tests in the 6 months has ranged from **3.5% - 5.8%** with a mean of **4.5%.** The highest expenditure on laboratory tests was in **February 2011** totalling **R261 889** and the lowest was in **April 2011** totalling **R207 876**

As per table 4.5 above Brits district hospital has in the six months of the study spent **R1 396 730** on laboratory test orders, of this **87.2%** (n= **R1 218 688** with the mean of **R203 114.6**) was spent on initial / first / baseline laboratory test orders and the remaining **12.7%** (n= **R178 042** with the mean of **R29 012.9**) was spent on repeat

laboratory tests. Proportion of repeat tests in the 6 months of study have ranged between **9.1%** (n= **R18 970**) to **13.8%** (n= **R30 744**) with the mean of **12.6%** (n= **R29 012.9**)

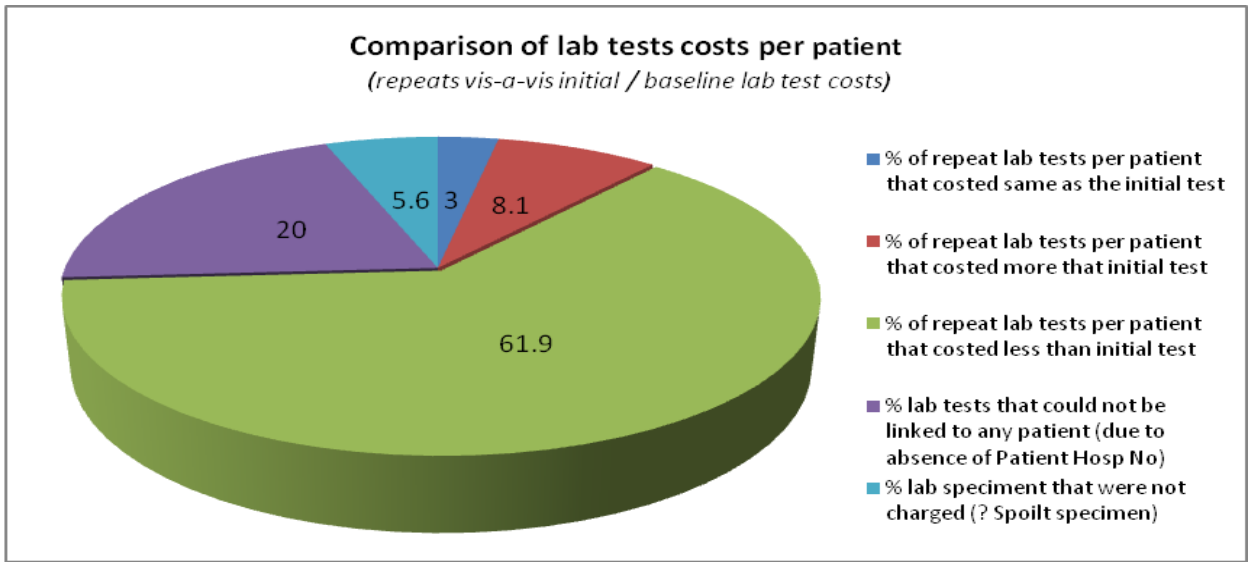


Figure 1: Comparison of lab test costs per patient (cost for repeat tests vis-a-vis initial / baseline tests)

The figure 1 above shows that out of the 949 individual costs / invoices per repeat lab test ordered: 3% (n= 29) of the repeat lab tests costs were the same / equal amount as for the initial lab tests, 8.1% (n= 85) of these costs were higher / more than the amount for the initial lab tests and another 61% (n= 588) of the costs were less than the amount for the initial lab test orders. Twenty percent (n= 194) of the repeat lab test costs / invoices could not be linked to any hospital patient because they did not have a hospital patient number (probably not captured in the PAAB system).

Of the 8.1% repeat lab tests costs or invoices that were higher / more than the amounts for the initial lab tests, some were up to 300% more than the costs for the initial / first / baseline lab test orders.

Table 4.6: Comparison of lab test costs implications *(initial vis-a-vis repeat laboratory test orders)*

	Initial tests	Repeat tests
Minimum cost per one lab test ordered	R10,01	R10,01
Maximum cost per one lab test ordered	R880,00	R348,21
Mode (cost per lab test ordered)	R38,20	R38,20
Average cost per lab test ordered	R43,50	R47,09
Average spending per patient on lab test orders	R367,00	R259,97
Minimum costs per patient on lab tests	R10.79	R21.93
Maximum costs per patient on lab tests	R2132.71	R2039.04

The table above augments information given in figure 1 (immediately above this table 4.6). This study has shown that it is common that repeat lab tests orders are a 100% duplication of the initial / first / baseline test orders and this duplication has at times occurred 2-3 times thus increasing the costs of repeat lab test by up to 300% of the initial / first / baseline lab test costs. In almost all instances where costs per patient on lab test orders exceeded R1000 the reason was due to reorder (duplication) of the initial lab test orders

4.3 COMPARISON OF LABORATORY TEST ORDERING PATTERNS

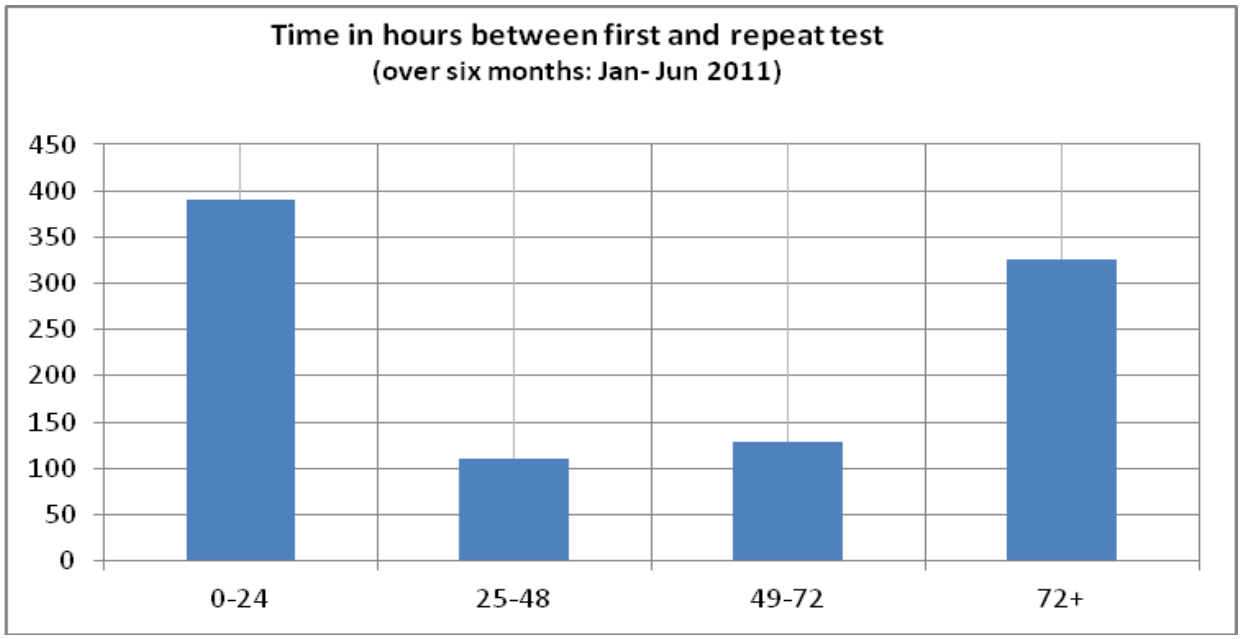


Figure 2: Difference in hours between initial and repeat test – all test categories

The figure 2 above shows the time lapse between the initial test and the repeat lab test. The highest proportion of repeat laboratory test orders **40.8%** (n = **390**) occurred within the first **24 hours** of ordering the initial lab test, while the second highest proportion **34.1%** (n = **326**) of repeat laboratory test orders occurred **72 hours** after the initial lab test. The third (**13.4%**) and fourth (**11.6%)** highest proportions of repeat laboratory tests occurred between 49 and 72 hours (n = **128**) and 25 and 48 hours (n = **111**) of the initial / first / baseline laboratory test order respectively.

In their study, Scott and Nguyen (2009) found that delays in obtaining results (turn-around-time or TAT) was one of the primary reasons for MOs ordering a repeat laboratory tests. The high number of repeat lab tests within 24 hours of the initial lab test may be attributed to the inefficiency of the laboratory in producing the results. It was found that the Brits district hospital laboratory is unable to determine a TAT per specimen – it can only do so for a batch of specimens.

Table 4.6: Difference in hours from initial lab test to repeat lab test by CATEGORY

Laboratory test category	Time difference from initial lab test to repeat lab test over six months				Total number of repeat tests per category
	0-24	25-48	49-72	72+	
Chemistry	163 (34.1%)	68 (14.3%)	75 (15.7%)	172 (35.0%)	**478** (50%)
Microbiology	54 (66.7%)	11 (13.6%)	6 (7.4%)	10 (12.3%)	**81** (8.4%)
Haematology	119 (36.5%)	28 (8.65)	45 (13.8%)	134 (41.1%)	**326** (34.1%)
Serology	47 (77.1%)	4 (6.6%)	0	10 (16.4%)	**61** (6.3%)
Cytology	1 (100%)	0	0	0	**01** (0.10%)
Virology	0	0	1 (100%)	0	**01** (0.10%)
Unclassified	07				**07** (0.7%)

Data in Table 4.6 describes the laboratory tests repeated the most by test type, it further measures lapsed time (gap) from the time of the initial / first / baseline laboratory test was ordered. Chemistry lab test types were ordered the most

comprising **50%** (n= **478**) of all repeat lab tests, followed by Haematology tests at **34.1%** (n= **326**), third was Microbiology at **8.4%** (n= **81**) and Serology **6.3%** (n= **61**) the remaining 1% comprised of Cytology (n= **01**), Virology (n= **01**) and the remainder are tests that could not be classified into one particular test type category (n= **07**).

Chemistry lab tests: These were repeated the most after **72** hours (**35%**) followed closely by repeat lab tests within **24** hours (**34.1%**) of the initial test.

Haematology lab tests: As with Chemistry tests, these repeat lab tests were ordered after **72** hours (**41.7%**) followed by repeat lab tests within **24** hours (**36.5%**) of the initial / first / baseline test.

Microbiology lab tests: Unlike the above two test types repeat lab tests in this category occurred the most within first **24** hours (**66.7%**), followed by repeat lab tests at **25-48** hours (**13.6%**) and the fewest repeats at **48-72** hours (**7.4%**).

Serology lab tests: Unlike the above three these were repeated the most within the first **24** hours (**77.1%**) followed by repeats lab tests after **72** hours (**16.4%**) of the initial / first / baseline test.

The above findings concur with those of a study by Prinsloo et al (2009)

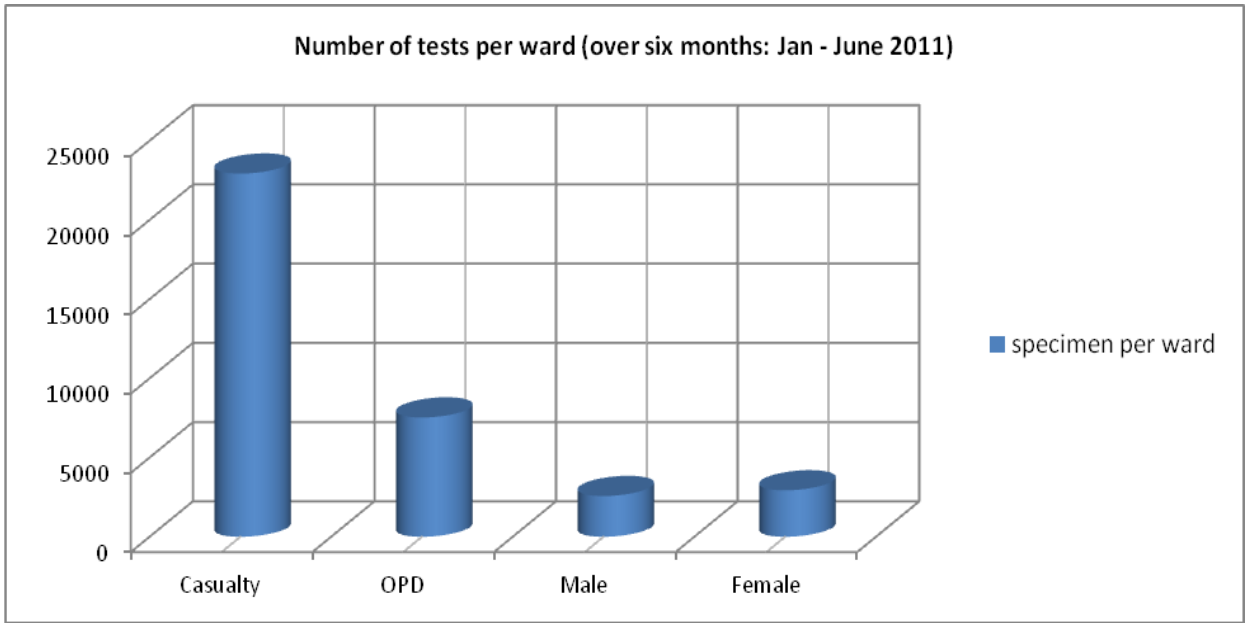
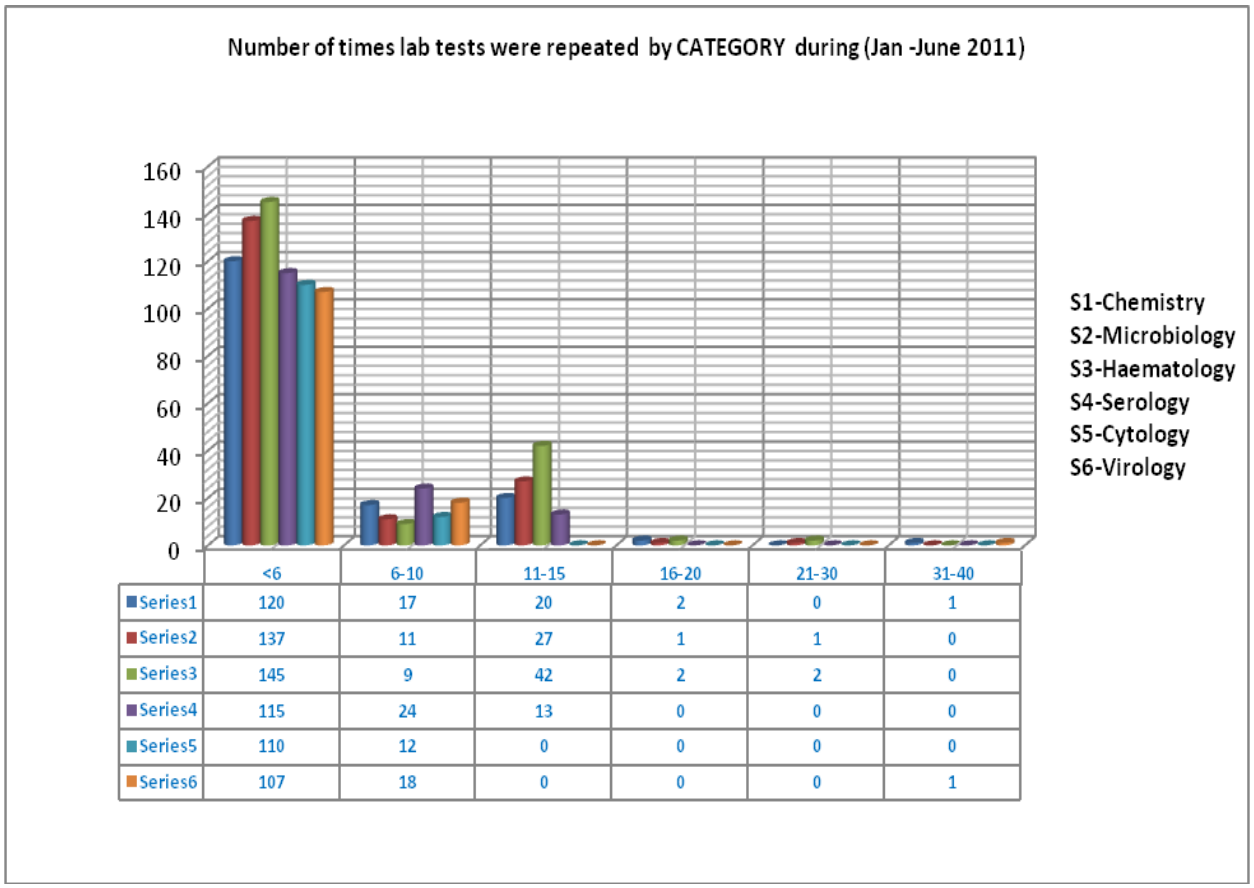


Figure 4: Laboratory tests (all categories) utilised/ordered per ward or section over six months

The figure 5 shows the origination of laboratory test orders. The hospital entry points were the major contributors: **22 928** (**63.7%**) were ordered from Casualty (Trauma & Emergency), followed by another entry point (albeit much smaller) the Outpatients Department with **7 531** (**20.9%**) lab test orders, then Female & Paediatric wards together at **2 932** (**8.1%**) and lastly the Male ward at **2 573** (**7.1%**).



	<6	6-10	11-15	16-20	21-30	31-40
Series1	120	17	20	2	0	1
Series2	137	11	27	1	1	0
Series3	145	9	42	2	2	0
Series4	115	24	13	0	0	0
Series5	110	12	0	0	0	0
Series6	107	18	0	0	0	1

Figure 5: Number of repeat lab tests by category over the 6-month study period

The above, figure 4 indicates the number of times repeat laboratory tests were ordered by category over the period of study.

Chemistry : 120 lab tests were reordered 1-5 times, 20 lab tests were reordered 11-15 times and 17 lab tests were re-ordered 6-10 times

Microbiology: 137 lab tests were reordered 1-5 times, 27 lab tests were reordered 11-15 times and 11 lab tests were reordered 6-10 times

Haematology: 145 lab tests were reordered 1-5 times, 42 lab tests were reordered 11-15 times and 9 lab tests were reordered 6-10 times

Serology : 114 lab tests were reordered 1-5 times, 24 lab tests were reordered 6-10 times and 13 tests were re-ordered 11-15 times

Cytology : 110 lab tests were reordered 1-5 times and 12 lab tests were reordered 6-10 times

Virology : 107 lab tests were reordered 1-5 times and 18 lab tests were reordered 6-10 times

Chemistry and Virology each has had one lab test that was reordered between **30 - 40** times during the six months of study. Chemistry had 2 tests, Microbiology 1 test and Haematology 2 tests that were re-ordered **16-20** times during the period of study.

The study has shown that repeat lab tests ordering is common practice with all laboratory test types. What the study has failed to establish is the reason behind the isolated incidents where one lab test (i.e. Chemistry and Virology lab test) was re-ordered between 30-40 times and some other tests in the categories of Chemistry, Haematology and Microbiology that were re-ordered between 16-20 times.

CHAPTER 5

DISCUSSION OF FINDINGS

This chapter will highlight the key findings of the study and subsequently compare them to the available literature.

5.1 LAB TEST OREDERING PATTERNS (FIRST AND REPEAT TESTS)

No published literature or guidelines are available pertaining to the proportion of patients seen in district hospitals that should be exposed to laboratory testing, nor is there literature on the number of tests that should be ordered per patient.

During the period of the study, a total of **14 346** patients were captured through the PAAB system, giving an average of **2 392** patients per month. Of the 14 346 patients, some 3 799 (**26.4%**) at an average of 633 patients per month were exposed to laboratory testing. Of the 3 799 patients exposed to (initial) laboratory testing, 675 (**17.7%**) patients were further exposed to repeat laboratory testing at an average of 122.5 patients per month.

In the very same period, a total of 35 980 laboratory tests were ordered; of these 32 020 (**89%**) were initial tests and these are further classified as follows: Minimum tests / patient = 01, Maximum tests / patient = 40, Mode = 03 and Average = 8.4. Repeat lab tests amounted to 3 960 (11%) further classified as: Minimum tests / patient = 01, Maximum tests / patient = 54, Mode = 01 and Average = 5.6.

5.2 COSTS OF LABORATORY TESTS

There is no available literature nor guidelines as to what proportion of the facility budget should be spent on laboratory tests, nor is there literature on the ideal amount to be spent on laboratory tests per patient.

During the period of study, Brits district hospital spent **R1 574 825** on laboratory tests. Of this amount, **R1 396 225** (88.6%) was spent on initial tests and the other **R178 600** (11%) on repeat lab tests. Comparing the costs for the initial / first / baseline lab test orders with that for repeat lab test orders it was found that the difference could be as huge / wide as 300% which concurs with findings whereby some lab tests was found to have been repeated up to 40 times on one patient.

It was also found that of the **20%** (n= 195) of the lab test costs that could not be linked to any patient due to incomplete data including (i) No patient hospital number – which leads to speculation that patient was 'intentionally / negligently' not captured on PAAB for billing purposes (ii) Patient without name (iii) Patient without a ward and or doctor. This state of affairs is quite worrying as its implications do not exclude a possibility of ghost patient specimens submitted for analysis at the expense of the hospital.

A **5.6%** of the lab tests costs could be linked directly / indirectly to wastage. In this instance the laboratory did not charge the hospital for processing of the specimen for a number of reasons including: (i) specimen was spoiled 'haemolysed' (ii) more than one specimen was submitted for the same test etc, however regardless of the reason why the specimen was not processed the essence is that some consumables were used, time was spent to collect the specimen and there was administration activities undertaken – all of which have a monetary value.

5.3 COMPARISON OF LAB TEST ORDERING PATTERNS

The figure 3 above demonstrated that Casualty and the Outpatients departments, both of which are entry points into the hospital, were found to be the highest consumers of laboratory test services at 63.7% and 20.9% respectively. In a study conducted among MOs, Wertman et al (1980) found that (a) some tests would have not been ordered if the patient were personally paying the cost of the tests; and (b) tests that attributed to diagnosis constituted 37%, to screening 32% and monitoring 33%, which indicates that there is actually no one outstanding reason as to why MOs order laboratory tests on their first encounter with a patient. This state of affairs supports a view that MOs tend to order laboratory tests as one 'very costly' tool towards making a provisional diagnosis on a patient.

The figure 2 has demonstrated that the highest number of repeat lab test orders occurs within the first 24 hours of collecting the initial lab test, followed by repeat tests after 72 hours of the initial test. The interpretation of this scenario could be that MOs tend to become impatient / anxious waiting for results (loss of confidence in the system) and they then opt to reorder the initial lab test. It should be noted that the NHLS does not have a 'service standard'; that is, that an FBC test will take for example 45 minutes and an HB test 15 minutes and so forth. It should also be noted that the NHLS cannot measure a TAT per specimen. The second highest repeat testing takes place after 72 hours of the initial testing and this could be attributed to poor filing and tracing / retrieval of earlier lab test results.

The utilization of Chemistry and Haematology laboratory tests (Table 4.6) proved to be the most popular first / initial / baseline as well as the most popular repeat lab tests type. The laboratory tests order and reorder patterns over the six months study period can be summed as per Figure 4 and Table 4.6 above:

A total of 734 lab tests orders in all categories were repeated 1 to 5 times during the study, ninety one (91) of lab test orders were repeated 6 to 10 times, one hundred and two (102) lab tests orders were repeated 11 to 15, five (5) were repeated 16 to 20 times, three (3) were repeated 21 to 30 times and two (2) were repeated 31 to 40 times.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the results obtained from this research are 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 and, based on the findings of the study, appropriate recommendations and suggestions for future research are raised.

6.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY

6.1.1 DESCRIPTION OF LABORATORY TEST ORDERING PATTERNS (FIRST AND REPEAT TESTS) DURING THE PERIOD OF STUDY

The experience of medical officers, the right attitude and the understanding of hospital finances with emphasis on the support and supervision given to young MOs is a critical determiner to efficient laboratory test ordering in district hospitals including at Brits district hospital.

- The entry points to Brits District Hospital's health service, that is, the Casualty (Trauma & Emergency) and the Outpatients Departments were found to be the highest consumers of laboratory test services in the hospital.
- The highest number of repeat laboratory test orders was found to take place within 24 hours of the initial lab tests and 72 hours post the initial lab test order.
- The NHLS does not (for now) measure TAT for individual lab tests, it can only do so for batches of lab specimens and there are no set service standard / target for ideal TAT times for various laboratory test orders

6.1.2 DESCRIPTION AND COMPARISON OF LAB TESTS EXPENDITURE

Brits district hospital, Bojanala Platinum Health District and the province at large do not yet have benchmarks or targets against which lab test ordering patterns can be measured. The recent cash flow challenges mainly within NHLS in Gauteng could well be one of the symptoms indicating that lab test ordering patterns is increasingly becoming unaffordable and therefore unsustainable (*The Star*, 2012).

Maximum cost per one lab test order on initial tests was found to be R880 compared to R348 on repeat lab tests, average spending per patient on initial lab tests orders was R367 as compared to R259 on repeat lab test orders, minimum costs per patient on initial lab test orders was found to be R10.79 compared to R21.93 on repeat lab test orders and the maximum costs per patient on initial lab tests was found to be R2132.71 as compared to R2039.04 on repeat lab test orders.

Costs for some repeat lab test orders was found to be up to 300% more than the costs for the initial / first / baseline lab test.

6.1.3 COMPARISON OF LAB TEST ORDERING PATTERNS FOR DIFFERENT MONTHS

Over the six months period of study it was found that 26.4% of patients that present at the hospital were subjected to some form of laboratory tests, the ratio of this is 1 out of every 4 patients. The state of affairs is in tandem with literature / studies that around 75% of clients can be correctly / adequately medically diagnosed on the basis of history taking and a thorough physical examination.

However the challenge was found that around 40.8% of lab tests are reordered within 24 hours of the initial lab test. A shortfall is that there is no reference tool /

table (similar to the supermarkets use / sell by ?? date) that states the time validity / applicability / usability of lab test results. The situation is however confounded by the following amongst others: (i) absence of set TAT for specimens submitted to the lab (ii) culture of routine lab specimen collection sometime even before a patient is seen by the MO (iii) poor record keeping whereby whatever collected lab specimen is not recorded and should staff work shift (MO or nursing team) change the incoming team may repeat (recollect) the very same lab specimen that are submitted already to the laboratory (iv) ineffective communication / handover reports between clinicians and last but not least (v) turnover targets that the laboratory has set for itself and for its sustainability as an organization.

The other factor that has a major impact on lab test utilization patterns in district hospital (Brits hospital in particular) is the patient – doctor ratio. With high patient loads that are so common in public hospitals

a) Taking a lab (blood) specimen could be a way of allaying patient concerns that she / he is being attended to even though a MO may not have seen him / her yet
b) With limited time for comprehensive history taking and thorough physical examination emanating from high patient volumes routine lab testing may as well be an alternative / substitute for shortcuts in the history taking and physical examination processes.

On average 633 patients were exposed to an average of 5 999 lab tests at a cost of an average R236 220 per month and an average of 123 clients per month were exposed to repeat lab tests at an average of 660 lab test per month. Of the 660 repeat lab tests ordered only an average of 23.9% at an average cost of R29 012 per month were ultimately used as part of the patient treatment programme.

6.2 LIMITATIONS OF THE STUDY

The following limitations were experienced in conducting this study.

(a) The data collected from the NHLS Thusano database is not always complete.
(b) Limited literature exists on lab tests ordering patterns (available literature echo claims of exorbitant lab tests albeit ideal targets are nonexistent).
(c) Limited / nonexistent data on lab test ordering patterns (number of tests per patient, cost on lab tests per patient, proportion of patients to be exposed to lab testing etc).
(d) Gray areas in the categorisation of laboratory tests into different specialities, that is, Chemistry, Haematology, Serology, Virology and so forth.

6.3 RECOMMENDATIONS

6.3.1 FOLLOW-UP STUDIES / RESEARCH

This project is the first systematic study of lab test ordering patterns to be conducted in a district hospital setting. A continuing systematic generation and compilation of similar data is essential for the development of a guide / reference tool for hospital management teams. Generation of more related data will in essence strengthen scientific information generation processes that will culminate with efficiently managed laboratory services as part of the revitalization of hospital services in line with the government's goal of rolling out the NHI. Identified glaring gaps in the effective and efficient management of laboratory services which should be areas for future research include:

- Absence of guide on the lab tests menu for district hospital levels
- Absence of guide as to the number of lab tests to be ordered per patient.
- Absence of targets as to expenditure (costs) per patient on lab tests
- Absence of a guide as to time validity / usability of various lab test results
- Absence of norms / standards on TAT for the various lab test orders
- Absence of a guide / benchmark as to proportion of patients to be exposed to laboratory testing

6.3.2 PROPOSED REMEDIAL ACTIONS

a) A maximum of 5% of the facility annual budget shall be set aside for laboratory services
b) A proportion of up to 25% of patients seen shall be exposed to laboratory test orders
c) Of the patients exposed to laboratory tests only 17.5% of them shall be exposed to repeat lab test orders
d) An SOP at provincial / district / facility level that prescribes a menu of lab tests that can be ordered at different hospital levels
e) Development of a SLA per facility (preferably per district) on TATs for the various lab tests prescribed for a specific level of a hospital
f) Development of a signed reference tool as to the time applicability / validity / usability of various lab test results
g) Monthly clinical audits with special attention on lab test ordering patterns

6.4 CONCLUSION

Laboratory service is undoubtedly a critical component of a comprehensive health service delivery system. However with ever increasing reality of having to do more with less, expenditure on laboratory test orders need to be closely monitored and innovations in the form of POCT should also be given more attention. Fortunately, there is a lot that can still be done to ensure value for money in the delivery of laboratory services. The focal intervention areas have been identified as (a) involvement of senior doctors (role modelling); (b) education of junior doctors (mentoring); (c) feedback by senior doctors to junior doctors (reinforcement); and (d) the availability of some protocol on laboratory test ordering (administrative intervention).

Hopefully this study will serve as one other positive step towards standardization and improved cost efficiency in lab test ordering patterns in district hospitals.

REFERENCES

Balbi, K. (2010). *How do I improve turn around time in clinical laboratory using six sigma?* eHow. http://www.ehow.com .[Accessed on 6 March 2011].

Beregi, T. (2005). *Relationships among patient age, diagnosis, hospital type, and clinical laboratory testing*. Health Publications. http://findarticles.com. [Accessed 21 February 2011].

'Choosing Wisely' Program. www.darkdaily.com [Accessed 01 May 2013]

Department of Health (DoH). (2002). *A district hospital services package for South Africa: A set of norms and standards*. Pretoria: DoH.

Eccles, M & Masco, J. *How to develop cost conscious guidelines*. Health Technology Assessment, 2001. Vol 15: no 16 www.hta.ac.uk [Accessed on 20 April 2013]

Hampton, J., Harrison, M. & Mitchell, L. (1975). Relative contributions of history-taking, physical examination, and laboratory investigation to diagnosis and management of medical outpatients. *British Medical Journal*, Vol. 2:486–489. http://www.bmj.com/content .[Accessed 18 February 2011].

Harvey, S. (2002). *Laboratory services*. http://www.highbeam.com . [Accessed 6 March 2011].

Hubbel, A., Frye, E., Akin, B. & Rucker, L. (1988). Routine admission laboratory testing for general medical patients. *Medical Care*, 26(6). http://www.ncbi.nlm.gov.pubmed . [Accessed 6 March 2011].

Kahan, N., Waitman, D. & Vardy, D. (2009). Curtailing laboratory test ordering in a managed care setting through redesign of computerized order form. *The American Journal of Managed Care*, 15(3):173–176.

Kroenke, K., Hanley, J. & Copley, J. (1987). Improving house ordering of three common laboratory tests. *Medical Care*, 25(10).

Levin, C., Steele, M. & Atherly, D. (2007). Analysis of the operational costs of using rapid syphilis tests for the detection of maternal syphilis in Bolivia and Mozambique. *Sexually Transmitted Diseases*, 34(7):S47–S54.

Mangels, J. (2008). *cost effective clinical microbiology*. CAMLT Course Number: DL-984. http://www.camlt.org .[Accessed 17 February 2011].

Maskowitz, M. (1984). *A clinician's view of laboratory utilization*. The Free Library by Farlex. http://www.entrepreneur.com . [Accessed 6 March 2011].

Mepham, S., Squire, S. & Chisuwo, L. (2009). Utilization of laboratory services by health workers in a district hospital in Malawi*. JCP*, Vol. 62:935–938.

Mosha, F (2013). *Advancing the laboratory profession and networks in Africa*. www.aslm.org [Accessed 01 May 2013]

North West Department of Health. (2004). *Service level agreement between the NWDoH and the NHLS.*

North West Department of Health. (2011). *Bojanala: District Health Plan for 2011–12*. Mafikeng.

Prinsloo, E.A.M; Dimpe, MW; Maphakisa, M.V; Matika, M.D; Shabalala, S.L.N.B & Joubert, G. (2009). Doctors' use of laboratory tests in the diagnosis and treatment of patients. *South Afri Epidemiol Infect. 2010:25* [Accessed 01 May 2013]

Republic of South Africa. (2004). *National Health Act, Act 63 of 2003*. Pretoria: Government Printer.

Sander, G. (1979). Costs of unnecessary tests. *British Medical Journal*, 2(6181):21–24.

The Star. 2012. *Services at Gauteng labs are up and running*. February 14.

Scott, M. & Nguyen, D. (2009). Clinical laboratory compliance: Something old something new. *Labmedicine*, 40(7).

Solomon, D., Hashimoto, H., Daltroy, L. & Liang, M. (1998). Techniques to improve physician's use of diagnostic tests. *JAMA*, 280(23).

Walraven, C. & Naylor, C. (1998). Do we know what inappropriate laboratory utilization is? *JAMA*, 280(6).

Walraven, C., Cernat, G. & Austin, P. (2006). Effect of provider continuity on test repetition. *Clinical Chemistry*, 52(12):2219–2228.

Wians, F.H. (2009). Clinical laboratory tests: Which, why, and what do the results mean. *Labmedicine*, Vol. 40:103–113.

Wetman, B.G., Sostrin, S.V. & Pavlov, Z. (1980). Why do physicians order laboratory tests? *JAMA*, 243(20).

Young, D. (1988). Improving laboratory usage: A review. *PMJ*, Vol. 64:283–289.

APPENDIX A: APPROVAL BY THE EMPLOYER FOR STUDY TO BE CONDUCTED

health
Department of
Health
North West Province
REPUBLIC OF SOUTH AFRICA

Tel: 012 252 3311 / 3366
Fax: (012 252 4529
Fax 2 e-mail: 0866 92024
Cell: 083 557 3049
Email: mhlanga@nwpg.gov.za

127 Krokodil street
Provate bag x5030
BRITS
0250

BRITS DISTRICT HOSPITAL

04th September 2011

The Chief Director
Bojanala District Health
Rustenburg

Attention: **Mrs. M. Rakau**

Application to conduct an MPH (Hospital Management) prescribed research at Brits Hospital

Aim
Obtain approval to conduct a research so to satisfy requirements for Master of Public Health (MPH) – Hospital Management degree final year of study.

Background
I enrolled for Diploma in Public Health in 2009 and have since completed the course and was enrolled for MPH in January 2011. Content for MPH is primarily research orientated and my topic is "Utilization of laboratory tests and related factors at Brits District Hospital"

Motivation
The study will generate data regarding trends in the utilization of lab tests at Brits hospital, focusing mainly: Number of tests per patient, costs of tests per patient, times (at admission or post admission) when tests are prescribed the most. The study findings will contribute to development of some norms and standards in prescribing and overall utilization of lab tests in district hospitals. Literature shows that no similar study has been conducted in the country.

Provisional approvals to date
The University of Wits Protocol Committee has granted provisional approval for the study and the protocol is now due for Ethics Committee which demands that approval by the department (NWDoH) be obtained first (see some attached copies of related communiqué).

Recommendation
That approval be granted as requested for conducting research on Laboratory services at my workplace the Brits district hospital to meet requirements towards a degree that is a requirement to my current job.

Requested	**Recommended / Not recommended**	**Approved / Not approved.**
TW Mhlanga	Dr. J. Tumbo (District Family Physician)	Mrs. M. Rakau (CD Bojanala)
Date : 04/09/2011	10/10/2011	14/10/2011

Healthy Living for All

OCT.14.2011 14:54 0145929224 DEPT HEALTH RTB #5128 P.001 /001

APPENDIX B: PG APPROVAL

Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011) 717-2076

Reference: Ms Salamina Segole
E-mail: salamina.segole@wits.ac.za
19 August 2011
Person No: 403871
PAG

Mr TW Mhlanga
Brits Hospital
Private Bag X5030
0250
South Africa

Dear Mr Mhlanga

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

We have pleasure in advising that your proposal entitled "*Laboratory tests and related factors at Brits 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

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX C: ETHICS COMMITTEE CLEARANCE CERTIFICATE

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

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Mr Themba Wilfred Mhlanga

CLEARANCE CERTIFICATE	M110824
PROJECT	Utilization of Laboratory Tests at Brits District Hospital
INVESTIGATORS	Mr Themba Wilfred Mhlanga.
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: Supervisor : Mr Sagie Pillay

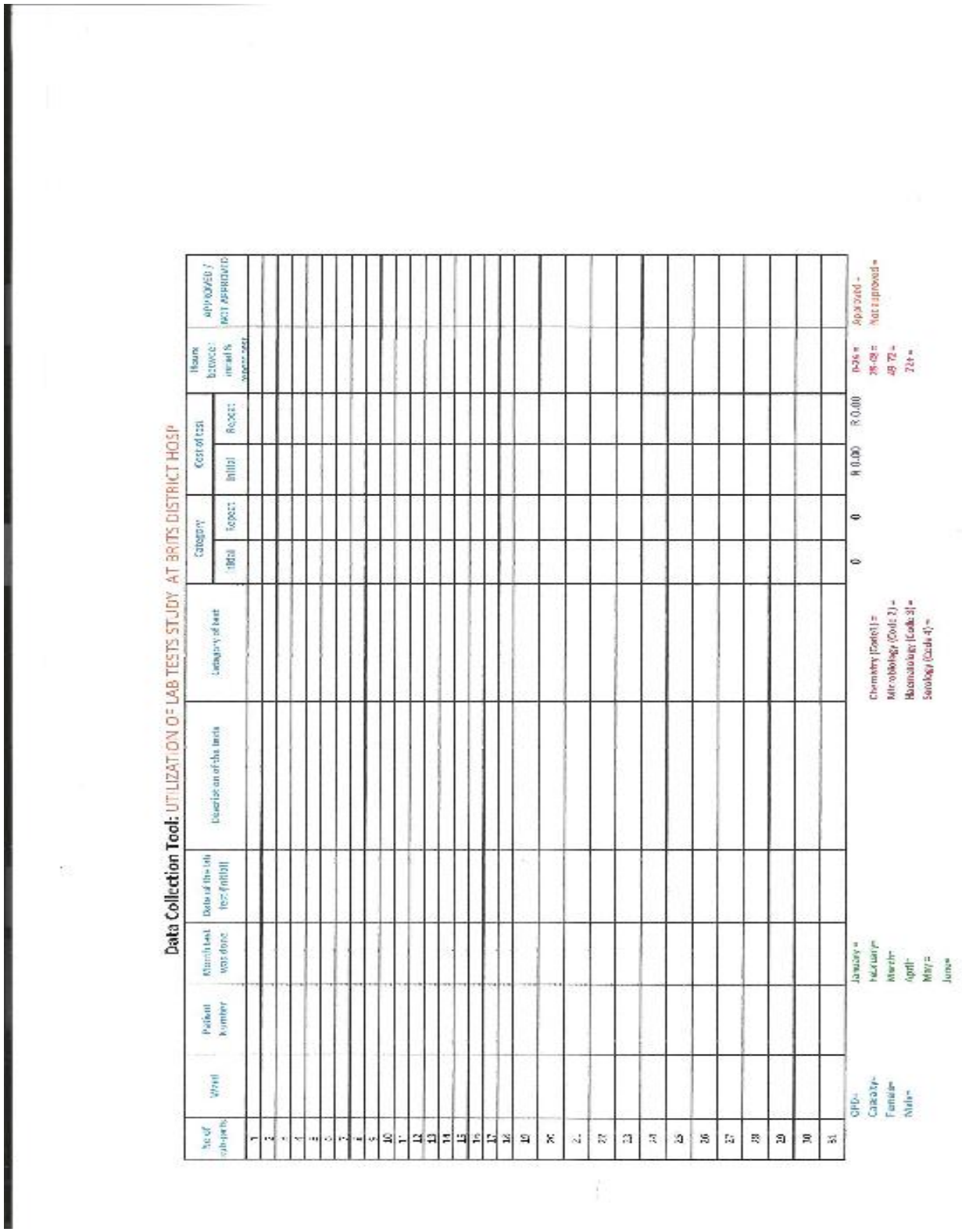
DECLARATION OF INVESTIGATOR(S)

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...

- 40 -

APPENDIX D: DATA COLLECTION INSTRUMENTS



Data Collection Tool: UTILIZATION OF LAB TESTS STUDY AT BRITS DISTRICT HOSP

No of sub-parts	Ward	Patient Number	Month test was done	Date of the lab test (initial)	Description of the tests	Category of test	Category		Cost of test		Hours between initial & repeat test	APPROVED / NOT APPROVED
							Initial	Repeat	Initial	Repeat		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
	OPD=		January =				0	0	R 0.00	R 0.00	0-24 =	Approved =
	Casualty=		February=			Chemistry (Code1) =					25-48 =	Not approved =
	Female=		March=			Microbiology (Code 2) =					49-72 =	
	Male=		April=			Haematology (Code 3) =					72+ =	
			May =			Serology (Code 4) =						
			June=									