OPERATIONAL COSTING OF INPATIENT ORTHOPAEDICS SERVICES AT THE HELEN JOSEPH HOSPITAL

GLADYS MAGUGUDI BOGOSHI

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

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DECLARATION

I, Gladys Magugudi Bogoshi, 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.

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21 September 2011

DEDICATION

This report is dedicated to my mother, son, Lebogang and my siblings for the support, encouragement and understanding of the long hours spent working on the research project. I would like to recognize my friends and colleagues, Florence Otieno and Beauty Pitso for the sharing of the knowledge and input into my studies, support during the most difficult times and bringing in fun into tackling of even the most difficult subjects.

I would also like to thank the staff at the Helen Joseph hospital for their support and provision of information as and when it was needed. Lastly, I would like to thank my friends for their encouragement and support.

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ABSTRACT

BACKGROUND**:** Until recently budget allocation for public hospitals in the Gauteng Province were based on the historical values and not on the costed activities. It is therefore unknown how much of the allocated budget is used per discipline in an institution. Because of recurrent over expenditure by institutions, Gauteng Department of Health and Social Development have decided to change policy for budget allocation of funding public health facilities from historical allocation to activity based costing. Although good financial management of hospitals is a priority for the government, data on real costs of providing health care services is scarce and unreliable. No formal study has been done to estimate the cost to provide inpatient services in the Helen Joseph Hospital, a regional hospital in the Gauteng Province. In view of that, it was decided to initiate this study at the Orthopaedic unit of the Hospital, which would then be extended to the other units.

AIM**:** To estimate the caseload, profile of patients and operational cost of providing the inpatient orthopaedics services at a regional hospital in Gauteng.

METHODOLOGY: A cross-sectional study design was used based on retrospective review of patients' and hospital records of patients admitted during one month study period at the two Orthopaedic Ward in the Helen Joseph Hospital, situated in the Johannesburg Health District in the Gauteng Province.

RESULTS: Total number of patients admitted in the Orthopaedic Unit of the Hospital in the year 2009/2010 was 2160 (The mean number of inpatients per month was 180 ± 28).

Profile of patients

One hundred and ninety seven patients were admitted during one month study period. There were more male than female patients. The median age was 41 years (IQR 31-53 years). More black patients were admitted during this period, even though the main catchment population for the Hospital is predominantly white and coloured. The majority of patients were from a low socio-economic class as reflected by their classification for user fee payment

using the means test. The median inpatient day was 3. The most common cause of admissions is due to injury, poisoning and certain other consequences of external causes as expected in an Orthopaedic Ward. A low complication rate (4.5%) was found to be the lowest as compared to other units in the Hospital. The majority of patients were discharged.

Cost drivers

The major cost driver was human resource which accounted for 70% of the total expenditure. Other cost drivers were material resources used in the unit, which includes: laboratory, blood and blood products, radiology and pharmaceuticals. Expenditure on these items account for only 13.7% of total expenditure.

Cost driver	**Amount**	**Unit cost**
Laboratory	R61,215.57	R412.26
Blood and blood products	R53,164.41	R269.87
Radiology	R52,085.50	R264.39
Pharmaceuticals	R17,315.82	R87.90

The total expenditure during this period was R 1,481,363.30 or R 17,776,359.60 annually. The unit cost of laboratory services (Ward 4: R926.30 and Ward 5: R272.97), blood and blood products (Ward 4: R463.05 and Ward 5: R217.52), radiology (Ward 4: R659.97 and Ward 5: R157.20) and pharmaceuticals (Ward 4: R236.63 and Ward 5: R47.60) and varied significantly between Ward 4 and Ward 5 which might be due to difference in clinical practices between the two Wards.

CONCLUSION**:** This study showed the operational costs needed to provide an inpatient orthopaedic service at a regional health facility. Further study based on more detailed costing at individual patient level is necessary to develop a better understanding of costing at these Wards. This study highlighted the significance of understanding the importance of determining the actual costs needed to provide an inpatient service in a health facility. Simple cost analysis method could easily be done at Unit/ Ward level to provide more insight to Hospital managers who are always criticized for over-expenditure.

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GLOSSARY OF TERMS

DISTRICT HOSPITAL: Provides first level of care. It also provides support to the surrounding clinics and Community Health Centers.

HOSPITAL CLASSIFICATION CATEGORIES: A person is classified as a hospital patient in one of the following classification categories if he or she complies with the requirements indicated under each category and is treated by a medical practitioner who is on duty and in the service of the hospital concerned.

- Category H0: This includes social pensioner (a person who is a recipient of a pension grant excluding a person who is a member of a medical aid), a person who is formally unemployed and who receives unemployment benefits in terms of Unemployment Insurance Act, 2001 and an unknown, unconscious patient, who dies in the hospital, and of whom no particulars are known or obtainable.
- Category H1: A patient whose annual or total value of assets is between R0 – R36 000 per annum.
- Category H2: A patient whose annual income or total value of assets is between R36 000 – R49 000 per annum.

Category Private: A patient with an income of R72 000 per annum or who belongs to a medical aid. The patients will be charged in accordance with the medical aid benefits.

LENGTH OF STAY: Total days of stay of inpatients in a specified ward during a given time period, divide by the number of admissions during the same time.

LEVELS OF CARE: This includes following:

- Level 1 Hospital: Patients requiring treatment which may be adequately and appropriately provided at the first level of referral (e.g. a community hospital) by a generalist with access to basic diagnostic and therapeutic facilities.
- Level 2 Hospital: Hospitals providing specialist services at the provincial level. Such hospital would be equipped with an intensive care unit.
- Level 3 Hospital: Patients requiring the expertise and care associated with the specialities, sub-specialities and less common specialities (such as cardiology, endocrinology, oncology, plastic and trauma surgery, neonatology, sophisticated paediatrics and specialised imaging), or requiring access to scarce, expensive and specialised therapeutic and diagnostic equipment found only at a central or tertiary hospital (the third level of referral)

  Level 4 Hospital: National facilities providing quaternary health care (such as liver transplantation and heart transplants).

PRIMARY HEALTH CARE CLINIC**:** A facility at which a range of Primary Health Care services are provided. It is open at least 8 hours a day Mondays to Fridays.

OPERATIONAL COST: Operating costs are expenses that relate to a business' operations. It can also refer to the costs of operating a specific device or branch of an Institution (such as ward of a hospital).

Patient Day Equivalent (PDE): The PDE cost was the hospital cost of caring for an inpatient on a daily basis, and included the cost of personnel (doctors, nurses & other health workers), food, space, building maintenance and the like. The formula used by provincial hospitals for calculating a Patient Day Equivalent cost was:

$$PDE = \frac{\text{Total Hospital expenditure}}{\text{(Total inpatient days+ [0.5 x Day patients] + [Total outpatient \& casualty headcount x 0.33])}}$$

PUBLIC HOSPITAL**:** A hospital delivering hospital services where the service provider is a government department. By definition the facility will not be for profit making

REGIONAL HOSPITAL: A hospital rendering specialist services that are beyond the normal scope of generalist medical practitioners.

TERTIARY HOSPITAL: A health care facility in which all first, second and third level emergency patients are received and managed.

TOTAL COST: Health facility overall costs that include operational costs by different sources and those that occurred during a certain period of time (e.g. personnel, equipment, materials, drugs, and buildings).

UNIT COST: Average cost of different items used in the Orthopaedics unit

LIST OF ABBREVIATIONS

BOR	Bed occupancy rate
GDOHSD	Gauteng Department of Health and Social Development
NTSG	National Tertiary Service Grant
PDE	Patient Day Equivalent
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

The purpose of this study was to determine the cost of providing inpatient services in the orthopaedic wards at a regional hospital in the Gauteng Province in South Africa. This introductory chapter will cover the background to the study, statement of the problem, its aims and objectives and an outline of subsequent chapters.

1.1 INTRODUCTION

The allocation of financial health resources in the public sector in South Africa remains a challenge. The public health care services are also faced with service delivery challenges. The recent negative media reports regarding the concern about the salaries of health professionals, poor working conditions and the perception of declining standards requires health managers to prioritise effective and efficient utilization of the resources.

Hospitals play a key role in the health care system as referral institutions for higher level of curative care, as well as training facilities for health workers (Minh, Giang, Huong, et al, 2009). However, this positive effect of hospitals is paid for by high costs, which are strongly related to hospitals' caseload, and costs. Newbrander, Barnum, Kutzin (1992) reported that hospitals are the largest and most costly health care institutions that require more human and financial resource, than any other health facility or programme in the sector. This is supported by Minh et al (2009), who described the key factors affecting total costs in hospitals as large capital investments such as buildings and expensive equipment, specialized staff while the unit costs in hospitals are significantly affected by average length of stay, bed occupancy rate and patient throughput. Therefore, in order for hospitals to provide efficient and effective service delivery to the communities they serve, the hospital managers need information on total as well as unit costs of the service they provide.

1.2 HELEN JOSEPH HOSPITAL

This study is planned in Helen Joseph Hospital, a regional public hospital situated in Johannesburg Health District in Gauteng Province. It has 480 approved but 530 usable beds and an 80% bed occupancy rate (BOR). Historically the Hospital is offering a service package that includes primary, secondary and about 30% of tertiary services, which is not in line with the service package of a regional hospital (Department of Health, 2003).

In 2009/2010 financial year, the Hospital budget was R 346,965,000 which included R 215,131,000 budget from the National Tertiary Service Grant (NTSG) and R 131,834,000.00 from the equitable share (Original Budget letter for Helen Joseph hospital, 2009/10 financial year). This amount is not adequate which is demonstrated by the fact that in the past three financial years, the Hospital incurred over expenditure that was above R60 million annually, which translates to more than 22% of the allocated budget. This study was planned against this background.

1.3 JUSTIFICATION FOR THE STUDY

The current budget allocation in the public health facilities is based on the historical values and not on the costed activities per unit. It is therefore unknown how much of the allocated budget is used per discipline in an institution. Because of recurrent over expenditure by institutions, Gauteng Department of Health and Social Development (GDOHSD) had decided to change its policy for budget allocation for public health facilities from historical values to activity based costing. Good financial management of hospitals became a priority for the GDOHSD, even though data on real costs of providing health care services is scarce and unreliable. Based on the directives from the GDOHSD, the Helen Joseph Hospital has introduced activity based costing in various units (such as such as Orthopaedics, General surgery, and Internal medicine). The preliminary analysis of information showed that Orthopaedics is a major cost driver in this Hospital because

many tertiary services are currently delivered in this unit. In view of that, Orthopaedic unit was chosen for this study. This study systematically studied the information routinely collected in the Orthopaedic wards of the Hospital to determine the actual cost of services rendered in these wards. Knowledge gained from this research would assist the Hospital management in developing a better understanding of the actual expenditure in the Orthopaedics wards in order to develop a cost centre that will ensure adequate resource allocation to improve efficiency.

1.4 RESEARCH QUESTION

What is the cost of providing inpatient hospital services in the Orthopaedic wards at the Helen Joseph Hospital?

1.5 AIMS AND OBJECTIVES

1.5.1 AIM

The aim of this study was to estimate the caseload, profile of patients and operational cost of providing the inpatient orthopaedics services at a regional hospital in Gauteng.

1.5.2 OBJECTIVES

1. To describe the caseload of patients admitted in orthopaedics wards during the study period.
2. To determine the profile of patients in orthopaedics wards during the study period.
3. To determine the costs for material resources (laboratory, radiology investigations, and pharmaceutical and blood and blood products, consumables, and non-consumables) and human resources

1.6 SUBSEQUENT CHAPTERS

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

Chapter Two Literature Review: The purpose of the literature review is to review pertinent literature and to discuss concepts related to inpatient hospital services with particular reference to orthopaedic services at public hospitals in South Africa and elsewhere.

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

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

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

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

CHAPTER 2
LITERATURE REVIEW

In this chapter, relevant reports into to orthopaedic services, with particular reference to cost of orthopaedic inpatient services are discussed. In addition to published literature, information from various unpublished sources is also reviewed.

2.1 HOSPITAL COSTING

Very few in-depth investigations have been carried out on the costing of hospitals in developing countries, despite their significance in terms of sector expenditure (Mills, 1990a; Mills, 1990b), and to the fact that health care systems in many developing countries are facing severe financial crisis. Conflict between sustainability and affordability in public health care system also challenges both local decision makers and provincial and national health managers and policy makers.

The increase in the burden of diseases is also putting a lot of strain on health budgets across the world. As health care expenditure is increasing, it is essential for the public health sector to use existing resources efficiently through improving and controlling the management of hospital operations (Riewpaiboon, Malaroji and Kingsawatt, 2007).

Cost information on different aspects is extremely useful to health planners and decision makers, especially hospital managers, to make more evidence based decisions in planning and management (Riewpaiboon, et al, 2007). They are required to continuously evaluate and reduce hospital cost while still maintaining the quality of care. Therefore, a practical and accurate cost accounting system is indispensable in hospitals, to realize an effective cost control (Cao, Toyabe, Akazawa, 2006).

The ultimate purpose of the hospital based cost analysis is to allocate all costs to departments that provide direct patient care. This is done by using an estimation procedure to apportion costs using three stages: first, by grouping of expenditure per line item into smaller categories; then costs will be allocated to intermediate cost centers, such as laboratory; and finally these costs are reallocated to the departments providing direct patient care. In analysing the costs, activity statistics was used for some of the apportioned procedures and for the production of unit costs (Basu, Croce, Porazzi Restelli, et al., 2010).

It is possible to do reasonably accurate hospital based costing study in developing countries despite incomplete and inaccurate data (Mills, Kapalamula, Chisimbi, 1993; Minh, Giang, Huong et al., 2009). Mills et al. (1993) reported that such costing could lead to useful conclusions on resource allocation patterns and hospital efficiencies. Even with limited information, they could find some useful information. For example, they found that public hospitals in Malawi accounted for 61-73% of the district recurrent costs and recurrent salary costs accounted for 27-39% depending on the number of staff, salary levels and their specialty. This is similar to the findings of a study done in Vietnam (Minh, et al., 2009).

In South Africa, the results of the study conducted in five district hospitals showed a considerable variation in the unit costs of inpatient days using admissions, inpatient days and average length of stay (Olukoga, 2007). The average unit cost for maternity patients was more than double the average unit cost for medical patients. Personnel costs were the major cost component and ranged from 73 percent to 82 percent of the unit cost.

2.2 TYPES OF HOSPITAL COSTS

Total costs in a health facility have two components: (a) direct cost and (b) indirect cost. Simple costing can be divided into direct patient care which includes wards and outpatient activities, while other costs can be classified as

intermediate costs such as costs incurred by diagnostic and support departments (such as X-Ray services, laboratory, theatre). Cost of pharmaceuticals and medical supplies are calculated multiplying prices per unit charged by medical depot to the quantities used. This is then converted to a cost per day in a particular ward or unit and hence an annual cost. Costs for human resources is calculated based on estimation from number of staff as well as their types and grades including their total benefits. Lastly, capital costs are divided into hospital buildings and equipment. Their costs are based on estimated replacement cost of a standard unit. Cost should be annualised using an assumption that the life span of a building is 30 years and equipment, 10 years (Basu, et al., 2010).

Unit costs in an organisation are influenced by many factors such as human resources, infrastructure, equipment which are input resources. In addition, in a hospital setting the unit costs vary in different departments. For example, a clinical services costing study in three selected rural district hospitals in Vietnam found that there was little difference in the costs of an outpatient visit across the hospitals, but the cost of operations and inpatient-day varied considerably among different departments (Minh, et al., 2009), which was similar to studies done in similar settings (Steffen, 2004; Mediconsult Vietnam, 2007).

Health care personnel are considered as a costly resource and hence they must be used efficiently (John, Ballusen, Hutubessy, 2006). In a study of the unit costs of inpatient days in a general hospital and in university hospitals in the Netherlands, personnel costs were as high as 83% of the unit cost of inpatient days, with 38%- 48% due to Nursing costs. This was comparable to the more than 80% personnel costs from maternity services in municipal hospitals of Argentina (Borgi, Bastus, Belizean, et al, 2003)

In South Africa similar findings in terms of cost to health personnel were also recently reported. The results of the study conducted at Helen Joseph Hospital acute mental care unit, showed that the unit accounted for 4.6 % of

the hospital's total clinical activity (patient days) with fixed costs (e.g. goods and services, staff salaries) accounting for 90% of the total cost (van Rensburg, and Jassat, 2011). The study described used activity based costing (ABC) as an approach to analyze the recurrent cost of inpatient care for the financial year 2007-2008. This study showed that a cost analysis using an ABC method can be done successfully in South Africa; however this will require a system of medical record keeping for bottom up costing, appropriate computing equipment with administrative and technical support to provide accurate data.

The Department of Health in South Africa uses patient day equivalent (PDE) as an efficiency indicator for public hospitals (Department of Health, 2005). This indicator measures how the resources available to the hospital are being spent and is a marker of the efficiency of the hospital as a whole. The indicator measures the average cost per patient, per day, seen at a hospital, and is expressed as Rands per patient day equivalent. The indicator value is calculated by dividing the total hospital expenditure by the PDE. The PDE is calculated by adding the number of inpatients plus 1/2 of day patients plus 1/3 of outpatient and emergency room visits. It measures and compares the inputs (total financial resources available to the hospital) with the outputs (volume of patients seen). Department of health estimated the PDE for orthopaedics are R 407 and R1115.00 for regional and tertiary hospitals respectively (Department of Health, 2002).

2.3 ANALYSIS OF COSTS

Various types of cost accounting systems have been used and described in different studies namely, Volume based costing (Cao, Toyabe, Akazawa, 2006), Activity based costing (Cao et al, 2006; Suneel, 1996; Robin 1998; Noah, Blackmore, Williams, 2000), and Simplified activity based costing (Cao et al, 2006). Table 2.1 describes their key features.

Table 2.1 Type of cost accounting system

Accounting system	Key features
Volume based costing	• More popular • Simple to use • Rough and inaccurate results
Activity based costing	• Used to allocate overheads to products • All events that incur costs are recognized as "Activities" • Indirect costs are allocated and prepared to each activity • More accurate • Time consuming, costly and more complex.
Simplified activity based costing	• Was implemented in acute care hospitals in Japan since April 2003 • Has fixed daily reimbursement scheme based on a modified case mix classification called "diagnosis procedure combination" • Less workload as compared to ABC by reducing the number of cost drivers used in ABC from seven to four. • More accurate results • It is simple to perform.

Despite the development of new costing methods that are more accurate and reliable, traditional costing methods still play an important role in areas where there is a need to describe basic costing. Secondly, they can be used as the first step to develop a baseline data in preparation to more accurate costing methods.

CHAPTER 3
METHODOLOGY

The methodology for this study was selected on the basis of its aims. The study design is presented first followed by setting and scope of the study, and data collection methods, research tools and data analysis. Finally, issues surrounding ethics are discussed.

3.1 STUDY DESIGN

The study design was a descriptive, cross sectional study. Record review of all inpatients admitted in orthopaedics Wards from 9 June to 9 July 2009.

3.2 SETTING OF STUDY

The study setting was in two orthopaedics Wards of the Helen Joseph Hospital, which is a regional hospital in the Ward 69 within Auckland Park suburb of the Johannesburg Health District. The Hospital is one of the 11 regional hospitals in South Africa and no formal costing study had been done in these hospitals.

Orthopaedic services in the Helen Joseph Hospital

The Hospital offer both in and out-patient services for orthopaedic patients. Although this hospital is expected to provide only Level 2 care, it often provides some of the three Levels of care. There are two orthopaedics wards at the Hospital (Ward 4 and 5) and each Ward has 30 beds. The Wards are mixed and on occasions they admit stable patients from other wards when these Units are full.

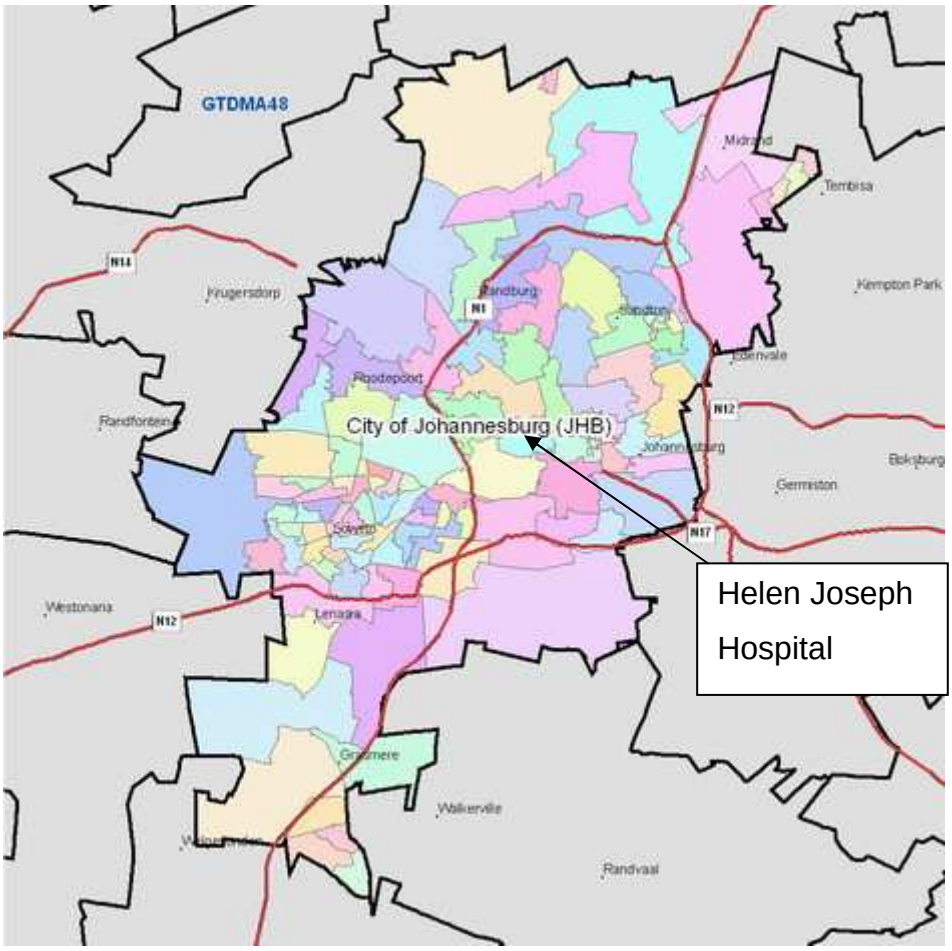

Figure 3.1 Location of Helen Joseph Hospital

3.3 SCOPE OF STUDY

The study was based on retrospective review of routinely collected data. No primary data collection was done for this study and no intervention was done as part of this study.

3.4 STUDY PERIOD

The study period was one month (from the 9 June to 9 July 2009). This period was chosen as there was no public holiday during this period. Therefore, data collected during this period should be a fair reflection of services generally offered in the Orthopaedics Unit.

3.5 STUDY POPULATION

A total of 197 patients were admitted during this period. Their records of inpatient admissions from the two orthopaedic wards were collected by the Principal Investigator over a study period and reviewed.

3.6 DATA ANALYSIS PLAN

3.6.1 INSTRUMENTS

Data sheets based on the MS excel spreadsheet were developed to collect information from medical records of patients admitted in orthopaedics wards and all human and material resources used in the ward.

3.6.2 VARIABLES

Variables for this study are listed in the Table 3.1.

Table 3.1 List of variables

Objectives	Variables	
1	Caseload	No of pt admitted in orthopaedics wards. Categories of operations performed. Number of operations performed.
2	Patient profile	Age Gender Ethnicity Medical aid Hospital income classification Date of admission Date of discharge Length of stay
	Medical information	Operation Final diagnosis Diagnosis using ICD-10 code Complication (if any) Outcome (Discharge/ Transfer/ Death)
3	Costing: material resources	Costs of Laboratory investigations Costs of Radiology investigations Cost of Pharmaceutical products Cost of Blood and blood products Cost of consumables
	Costing Human resources	Cost of Human resources
	Total cost	Cost of Material and Human resources

3.6.3 DATA COLLECTION

Routine information for patients was collected from the Hospital Information System. Cost data was collected from principal sources, namely, human resource, finance, laboratory, pharmacy, and stores.

COSTING DATA

This study was based on volume based costing (Table 2.1). The cost of investigations, drugs, and other hospital expenses was sourced from sources listed in the Table 3.2.

Table 3.2 Sources of costing data

Sources of data for cost analysis:	**Data extracted from the sources**:
National Health Laboratory System (National Health Laboratory services. 2009)	Costs of Laboratory investigations
Provincial Gazettes (Gauteng Government, 2002)	Costs of Radiology
Pharmacy price lists (Gauteng Health Department. 2004)	Costs of drugs and other items
South African National Blood Services	Costs of blood and blood products
Financial expenditure sheets from the office of the Deputy Director Finance) of Helen Joseph Hospital.	- Hospital expenditure on staff, investigations, drugs and the like - Cost of a Patient Day Equivalent (PDE)

Each item, be it a drug or investigation, was specifically coded, the cost data calculated as described below and then entered onto the data collection sheet.

Calculated cost

Unit cost was calculated from the following sources based on the methodology used by Thomas, Manning, Holmes, et al. (2007).

- Pharmaceutical - From the Provincial Pharmacy Price List
- Consumables - From 2009 Gauteng Province Tender List
- HR cost - From HR department of the Hospital

The total direct cost was the sum of the following:

(a) Material cost pharmaceuticals, intravenous fluids, blood and blood products, goods, and

(b) Human resources cost: The Orthopaedic Unit staff rotates between the two wards except the specialists. Therefore, the cost was divided between the two wards.

Total Cost was calculated based on following formula:

$$\text{Total cost (in Rand)} = \sum P*Z_1 + \sum C*Z_2 + \sum F*Z_3 + \sum B*Z_4 + (NA*Z_5)\ (SN*Z_6) + (PN*Z_7) + (DO*Z_8) + (DR*Z_9) + (DS*Z_{10})$$

Where P= number of pharmaceutical products used per type

Z_1 = unit price per pharmaceutical products used per type

C= number of units of consumables used per type

Z_2 = unit price of consumables used per type

F= number of intravenous fluid units of consumables used per type

Z_3 = unit price of intravenous fluid used per type

B= number of units of blood and blood products used per type

Z_4 = unit price of blood and blood products used per type

NA= number of nursing assistant allocated to the ward

SN= number of staff nurse allocated to the ward

PN= number of professional nurses allocated to the ward

DO= number of medical officers allocated to the ward

DR= number of registrars allocated to the ward

DS= number of specialists allocated to the ward

Z_5 = monthly salary of a nursing assistant

Z_6 = monthly salary of a staff nurse

Z_7 = monthly salary of a professional nurse

Z_8 = monthly salary of a medical officer

Z_9 = monthly salary of a medical registrar

Z_{10} = monthly salary of a medical specialist

3.6.4 STATISTICS AND DATA ANALYSIS

The data was exported to MS excel and analysis done using NCSS software (NCSS, 2007). Multi-comparison testing was used to determine statistical significance.

Following descriptive statistics were used based on type of variables:

- Means and standards deviation were calculated for continuous variables such as age, length of stay, bed occupancy rate, number of staff, recurrent costs in salaries, number of consumables used, total cost of consumables.
- Proportions and counts were used to summarize categorical variables such as gender, final diagnosis.

Comparison was done between the two Orthopaedic wards (Ward 4 and Ward 5) to identify any differences. Following analytical statistics were used based on type of variables:

- Unpaired 't' test were used, for comparison of two groups.
- Chi-square test was used for categorical variables.

The main outcome measures were average costs per patient for laboratory and radiology investigations, procedures, pharmacy services, blood and blood products and average total cost. Differences in values were considered to be statistically significant if p value < 0.05.

3.7 PILOT STUDY

The data for this study is routinely collected for the Hospital Information System. There was no primary data collection specifically for this study. In addition tools to be used for this study have been used in another public hospital in Gauteng (Thomas, et al., 2007).

3.8 ETHICAL CONSIDERATIONS

The research report was approved by the Human Research Ethics Committee: (Medical) of University of the Witwatersrand, research number: M10838.The Gauteng Health department also approved the study. All information was collected anonymously in the data collection sheet, and respected patient confidentiality. The patient details were linked to a data

collection sheet with the hospital number only, and no names were entered in the data collection sheet.

CHAPTER 4
RESULTS

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

4.1 NUMBER OF PATIENTS ADMITTED IN OTHOPEADICS IN THE HOSPITAL

The monthly numbers of orthopaedic admissions during the year 2009/2010 are described in the Table 4.1 (Figure 4.1). Total number of in patients during this period was 2160. The mean number of inpatients per month was 180 (± 28).

Table 4.1 Number of orthopaedic inpatients at the Hospital during one year

	Total no of patients admitted	**Ward 4**	**Ward 5**
April 2009	151	61	90
May 2009	169	81	88
June 2009	156	64	92
July 2009	159	57	102
August 2009	225	84	141
September 2009	186	70	116
October 2009	225	79	146
November 2009	202	74	128
December 2009	148	62	86
January 2010	164	66	98
February 2010	172	58	114
March 2010	203	67	136
Total	2160	823	1337

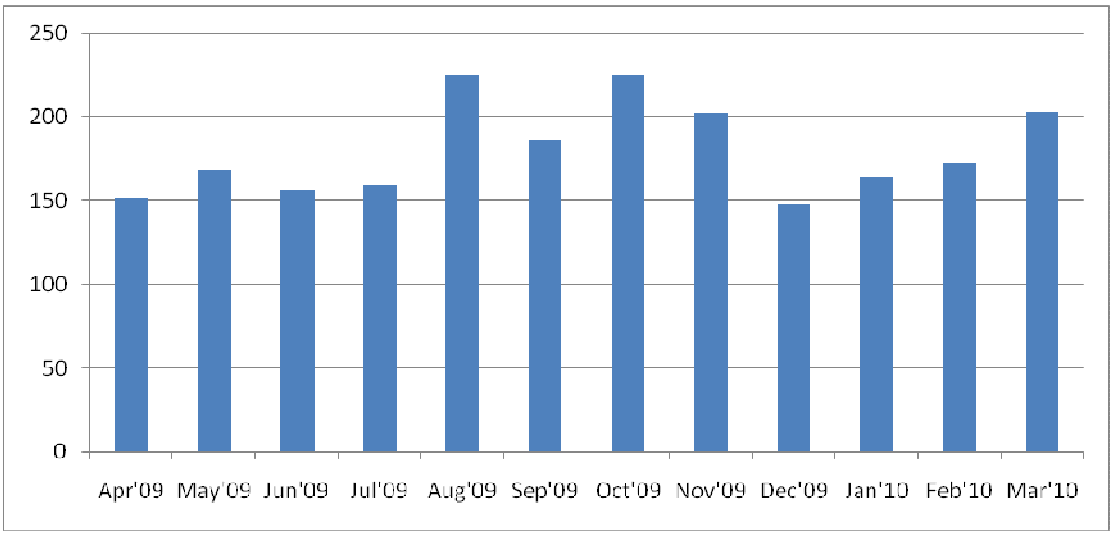

Figure 4.1 Monthly admissions in Orthopaedic Wards

The number of patients admitted during the study period was 197. The details of these patients are described below.

4.2 SOCIO-DEMOGRAPHIC PROFILE OF PATIENTS

4.2.1 AGE

The age distribution of the subjects was described in Table 4.2 (Figure 4.2). The age was not normally distributed. The median age was 41 years (IQR 31-53 years). There was no significant differences in age between the two Wards (Mann Whitney's U test, p=0.06).

Table 4.2 Age of the subjects

Age in years	Total	Ward 4	Ward 5
Median Inter-quartile range	41 (31 – 53)	43 (36 – 53)	37 (28-53)
Range	9 – 95	26 – 95	9-84

There was also no significant difference in age between male and female patients (Mann Whitney's U test, p=0.10).

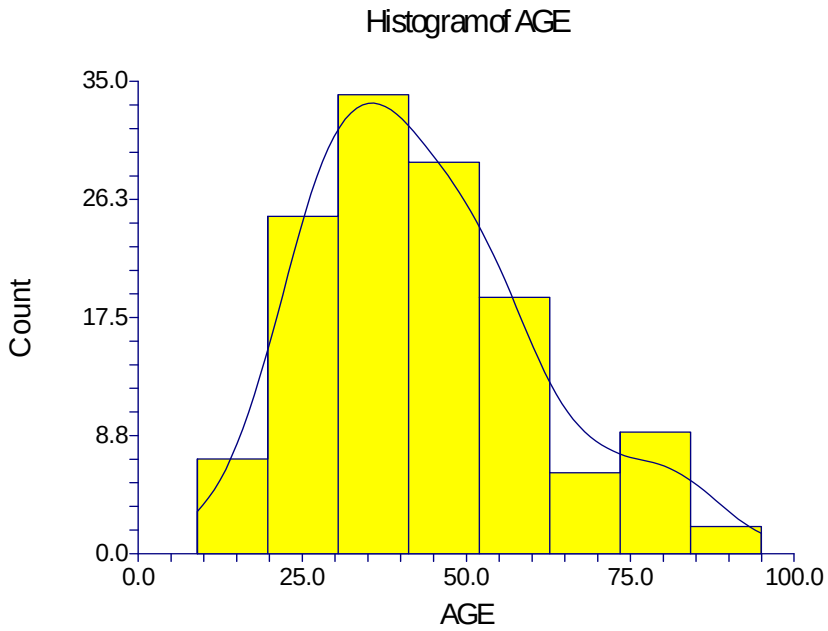

Figure 4.2 Age distribution of the subjects

4.2.2 GENDER

The gender of the patients is described in Table 4.3. There was no significant association between gender and admission Wards (Mann Whitney's U test P<0.0001).

Table 4.3 Gender of the subjects

Gender	Total	Ward 4	Ward 5
Male	103 (52%)	25 (59.5%)	78 (50.3%)
Female	94 (48%)	17 (40.5%)	77 (49.7%)
Total	197 (100%)	42 (100%)	155 (100%)

4.2.3 ETHNICITY

The ethnicity of the patients is described in Table 4.4. There was a significant association between ethnicity and admission Wards (Mann Whitney's U test p<0.01). More white patients were admitted in Ward 5 where as more Black and Coloured patients were admitted in Ward 5.

Table 4.4 Ethnicity of the subjects

Ethnicity	Total	Ward 4	Ward 5
Black	138 (70.2%)	32 (75%)	106 (68.5%)
Coloured	17 (8.6%)	7 (17.5%)	8 (5.4%)
Indian	5 (2.6%)	1 (2.5%)	4 (2.7%)
White	36 (18.5%)	2 (5%)	36 (23.4%)
Total	197 (100%)	42 (100%)	155 (100%)

4.2.4 HOSPITAL CLASSIFICATION

The Hospital Classification of the subjects was described in Table 4.5. There was no significant association between hospital classification and admission wards (Chi-square test, p=0.9). There are only three private patients (one of them was a MVA).

Table 4.5 Hospital classification

Hospital classification	Total	Ward 4	Ward 5
H0	26 (13.2%)	5 (11.8%)	21 (13.6%)
H1	116 (59%)	26 (61.8%)	90 (58.2%)
H2	51 (25.7%)	11 (26.5%)	40 (25.5%)
HG	1 (0.7%)	0	1 (0.9%)
P	3 (1.4%)	0	3 (1.8%)
TOTAL	197 (100%)	42 (100%)	155 (100%)

4.2.5 INPATIENT DAYS

The inpatient days of the subjects was described in Table 4.6. The inpatient days were not normally distributed. The median inpatient days was 3 (IQR 2-6). There was no significant difference in inpatient days between the two Wards. (Mann Whitney's U test, p=0.91).

Table 4.6 Inpatient days

Age in years	Total	Ward 4	Ward 5
Median	3	3	3
Inter-quartile range	(2 – 6)	(1 – 9)	(2-6)
Range	1 – 30	1 – 30	1-23

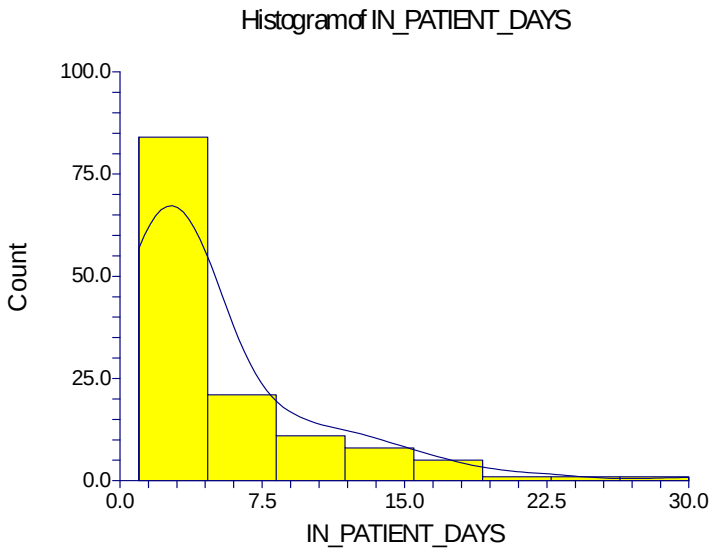

Figure 4.3 Inpatient days

4.3 CLINICAL PROFILE OF PATIENTS

4.3.1 CLINICAL DIAGNOSES

The clinical diagnoses of all the patients (197) admitted in the two orthopaedics Wards is described in Table 4.7. The most common cause of admissions is due to injuries (S00: S99) as expected in an Orthopaedic Ward.

Table 4.7 Clinical Diagnoses

ICD-10	Description	Total n (%)	WARD 4 n (%)	WARD 5 n (%)
A00 – A99	Bacterial, Rickettsial and other infectious diseases	9 (4.6%)	3 (6.1%)	4.1 (4.1%)
B00 – A99	Viral and other infectious diseases	2 (0.8%)	0	1 (1.0%)
C00 – C-97	Malignant neoplasm	2 (0.8%)	1 (3.0%)	0
D00 – D89	Benign neoplasm and Diseases of the blood and blood forming organs and certain disorders involving the immune mechanisms.	6 (3.1%)	1 (3.0%)	3.1 (3.1%)
E00 – E90	Endocrine, nutritional and metabolic diseases.	8 (3.8%)	1 (3.0%)	4.1 (4.1%)
F00 – F99	Mental and behavioural disorders.	0	0	0
G00 – G99	Diseases of the nervous system.	12 (3.2%)	4 (9.1%)	5.2 (5.2%)
H00 – H59	Diseases of the eyes and adnexa.	0	0	0
I00 – I99	Diseases of the circulatory system.	24 (6.2%)	9 (18.2%)	9.3 (9.3%)
J00 – J99	Diseases of the respiratory system.	18 (4.7%)	4 (9.1%)	9.3 (9.3%)
K00 – K93	Diseases of the digestive system.	6 (1.6%)	0	4.1 (4.1%)
L00 – L99	Diseases of the skin and subcutaneous tissue.	9 (2.3%)	1 (3%)	5.2 (5.2%)
M00 – M99	Diseases of the musculoskeletal system.	9 (2.3%)	1 (3%)	5.2 (5.2%)
N00 – N99	Diseases of the genitourinary system.	6 (1.6%)	3 (6.1%)	2.1 (2.1%)
O00 – O99	Pregnancy, childbirth and the puerperium.	0	0	0
P00 – P96	Certain conditions originating in the perinatal period	0	0	0
Q00 – Q99	Congenital malformations, deformations and chromosomal abnormalities	2 (0.4%)	0	2 (1.0%)
R00 – R99	Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified.	8 (1.9%)	1 (3%)	6 (4.1%)
S00 – S99	Injury, poisoning and certain other consequences of external causes.	**66 (16.8%)**	**9 (18.2%)**	**58 (37.1%)**
T00-T98	Burns, Poisoning and certain other consequences of external causes.	8 (1.9%)	3 (6.1%)	5 (3.1%)
V01 – V99	Accidents	0	0	0
W00-X59	Other external causes of accidental injury	2 (0.4%)	0	2 (1.0%)
Z00 – Z13	Factors influencing health status and contact with health services.	3 (0.8%)	1 (3%)	2 (1.0%)
	Total	**197**	**42**	**155**

4.3.2 COMPLICATIONS

The complications while admitted are described in Table 4.8. Only 3.8% patients admitted were reported to have developed complications. There was no significant differences in complications between the two wards (Chi square test, p = 0.39). These complications include post-operative haematoma and sepsis.

Table 4.8 Complications

	Total	**WARD 4**	**WARD 5**
No	188 (95.5%)	39 (93.8%)	149 (96.2%)
Yes	9 (4.5%)	3 (6.3%)	6 (3.8%)
Total	**197 (100%)**	**42 (100%)**	**155 (100%)**

4.3.3 FINAL OUTCOMES

The outcomes of patients admitted in the Wards are described in Table 4.9. The majority of the patients were discharged home. There were few transfers to other hospitals and only two deaths.

Table 4.9 Outcomes

OUTCOME	**Total**	**WARD 4**	**WARD 5**
Death	2 (0.8%)	0	2 (1%)
Discharge	174 (88.7%)	39 (93.3%)	135 (87.3%)
RHT	5 (2.3%)	0	5 (2.9%)
Transfer	16 (8.3%)	3 (6.7%)	13 (8.8%)
Total	**197 (100%)**	**42 (100%)**	**155 (100%)**

4.3.4 SUMMARY OF THE CLINICAL PROFILE OF PATIENTS

The median inpatient day was 3 and there was no significant difference in inpatient days between the two Wards. This was found to be lower than the national target for a regional hospital, which is 4.8 days. The most common cause of admissions is due to injuries (S00: S99) as expected in an Orthopaedic Ward.

A low complication rate at 4.5% was found to be lower than the other units in the Hospital (Hospital monthly report). Only three patients (6.3%) had complications in Ward 4 and six (3.8%) in Ward 5. There was no significant difference in the complications from the two Wards with a mortality rate at <1%. In terms of health outcomes both wards had < 1% of mortality while majority of patients were discharged.

4.4 COSTS

4.4.1 LABORATORY

The total cost for laboratory tests requested from the Wards during this period was R 81,215.57 (Table 4.10). The total laboratory expenditure was almost similar although Ward 4 has fewer patients than Ward 5.

Table 4.10 Laboratory costs

	Total	WARD 4	WARD 5
Total cost	R 81,215.57	R 38,904.55	R 42,311.02
Unit cost	R 412.26	R 926.30	R 272.97

4.4.2 RADIOLOGY

The expenditure for radiological services during this period was R 52,085.50 (Table 4.11). The Unit cost for the Ward 4 is very high in comparison to the Unit cost of Ward 5.

Table 4.11 Radiology costs

	Total	WARD 4	WARD 5
Total cost	R 52,085.50	R 27,718.80	R 24, 366.70.
Unit cost	R 264.39	R 659.97	R 157.20

4.4.3 PHARMACEUTICALS

The cost for Pharmaceuticals during the study period was R 17,315.82. Both wards are offering the same service. However, the Unit cost of pharmaceuticals was higher than unit cost of Ward 5.

Table 4.12 Pharmaceutical costs

	Total	WARD 4	WARD 5
Total cost	R 17,315.82	R 9,938.51	R 7,377.31
Unit cost	R 87.90	R 236.63	R 47.60

4.4.4 BLOOD AND BLOOD PRODUCTS

Table 4.13 describes the expenditure for blood and blood products for the Orthopaedics wards during the study period. Although Ward 5 had considerable high amounts of blood utilization as compared to Ward 4, Unit cost for blood and blood products is significantly higher than Ward 5.

Table 4.13 Blood and blood products costs

	Total	Ward 4	Ward 5
Total cost	R 53,164.41	R 19,448.25	R 33,716.20
Unit cost	R 269.87	R 463.05	R 217.52

4.4.5 GOODS

Table 4.14 describes the total cost for goods used by the two wards during the study period. Like other costs, Unit cost for Ward 4 costs was much higher than Ward 5

Table 4.14 Cost of goods

	Total	Ward 4	Ward 5
Total cost	R 16,355.41	R 11,305.23	R 5,050.18
Unit cost	R 83.02	R 269.17	R 32.58

4.4.6 HUMAN RESOURCES

Table 4.15 list the expenditure for human resources. The Orthopaedic Unit staff rotates between the two wards except the specialists. Therefore, the cost was divided between the two wards. The major cost to the orthopaedics department is the doctors. The unit cost of human resources was R 5,367.74.

Table 4.15 Human resource costs during the study period

Rank	Compensation
MEDICAL	
Specialists	R 178,797.73
Registrars	R 184,923.94
Medical officers	R 119,150.85
Interns	R 148,983.84
MEDICAL TOTAL	**R 631,856.36**
MEDICAL ALLIED	
Physiotherapy	R 20,788.65
Occupational therapy	R 23,109.86
NURSING	
Hospital nurses	R 310,722.75
Agency nurses	R 43,303.17
Total	R 354,025.92
MEDICAL ALLIED TOTAL	**R 397,924.43**
OTHERS	
Keyboard operating clerk	R 9,358.00
Cleaners	R 18,306.50
OTHERS TOTAL	**R 27,664.50**
TOTAL HUMAN RESOURCES COST	**R 1,057,445.29**

4.4.7 TOTAL COSTS OF ORTHOPAEDIC SERVICES

Table 4.16 lists the total costs of orthopaedic service in Ward 4 and Ward 5. Human resource is the major cost driver (70%) for both the Wards. The total cost and Unit cost varies significantly between the two Wards.

Table 4.16Total costs of orthopaedic services

	Total	**Ward 4**	**Ward 5**
Pharmaceuticals	R 17,315.82	R 9,938.51	R 7,377.31
Blood & blood products	R 53,164.41	R 19,448.25	R 33,716.20
Laboratory	R 81,215.57	R 38,904.55	R 42,366.70
Radiology	R 52,085.50	R 27,718.80	R 24,366.70
Goods	R 203,781.30	R 96,010.11	R 107,826.91
Total Material resources	**R 423,918.01**	**R 203,325.45**	**R 220,704.00**
Total Human Resource	**R 1,057,445.29**	**R 528,722.65**	**R 528,722.65**
Total cost	**R 1,481,363.30**	**R 732,048.10**	**R 749,426.65**
Unit cost	R 7,519.61	R 17,429.72	R 4,835.01

CHAPTER 5
DISCUSSION

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

5.1 STUDY POPULATION

The study population included all patients who were admitted in the two Orthopaedic Wards (Ward 4 and Ward 5) during one month study period. A total 197 patients were admitted during the study period, of which 103 were males and 94 females. No records were missing. A number of patients from Medical wards were admitted in these two wards due to a high volume of admissions in internal medicine. These patients were counted within the Study population as the operational costs of the two Wards increased due to these patients.

The annual admission trend between the two wards depicts the same picture as show in Table 4.1. The Ward 4 had less number of patients as compared to Ward 5 because it was recognized earlier that there was a need to provide sterile cubicles in Ward 4 for post-operative care for patients with clean wounds to prevent infections and other unintended consequences especially with admission of internal medicine patients.

The median age was 41 years. There were slightly more male (52%) than female patients (48%). However, there were no significant differences in age between male and female patients. Although both wards were mixed, more male were admitted in the Ward 5 as compared to females. The majority of patients admitted were blacks (70.2%) who were probably not from the catchment area of this Hospital. This Hospital was historically catered for white and coloured population and the catchment area of the Hospital is still dominated by people from these two ethnic groups. Despite this, only 8.8% admissions were coloureds and 18.5 % whites. This confirms the findings of a

previous survey done at this Hospital Outpatient department which showed a high number of patients coming from outside the Hospital's catchment area with the majority from Soweto and some as far as Springs.

Classification of patients using the means test showed that more that 95% patients accessing health care at the Hospital are uninsured whereas 59% fell into the category of patients classified as H2 and only 1.4% patients were classified as private. The H2 patients are those whose combined incomes are between R 36,000 and R 71,999 per annum. They are required to pay only R35 for an outpatient consultation and R 45 on admission irrespective of the type of procedures performed. Analysis of the Hospital revenue records in the past also showed that the highest right offs for non-payment of fees was within this category of patients (H2). A formal study is necessary to develop an understanding of the issues surrounding non-payments and this would definitely assist the Hospital to generate more revenues. While the answer to this question was beyond the scope of this study, it demonstrates the need for a multi-layered approach to address issues of access to health care by the poor communities.

5.2 COSTS

In most developing countries, public hospitals, rather than the preventative and primary healthcare sectors, are the major consumers of healthcare resources. Overall, they receive the largest share of resources, consume as much as 5% of the gross domestic products, account for 5% to 10% of government expenditure, and 50% to 80% of public sector healthcare resources in these countries (Olukoga, 2007). This is because they require huge capital investments to employ highly-trained staff, and to provide maintenance of buildings and equipment. Furthermore, in any hospital setting, the costs of inpatient hospitalisation are usually the major components of the total treatment costs. This is because inpatient care consumes more resources and currently technology-driven to be effective (Olukoga, 2007).

Table 5.1 Helen Joseph Hospital summary of the actual expenditure for financial year 2009/10

Government Financial Services Classification	**2009/10 Actual Expenditure R'000**
Compensation of employees	R 255,555,000
Goods and services	R 243,403,000
Transfers	R 240,000
Capital and assets	R 1,705,000
Total	**R 501,010,000**

The total actual expenditure for the Hospital for the financial year 2009-2010 was R 501,010,000 (Table 5.1). The total expenditure on all staff for that financial was R 255,555,000 of which R 12,684,000 (4.9%) was for Orthopaedics Unit staff. This was found to be higher than the cost of mental health care staff at this Hospital. The unpublished study done at Helen Joseph Hospital in 2008 by Dr Van Rensburg estimated that of the total expenditure on staff for the financial year 2007/08, R 5.1 million (2.8%) of the R184.4 million, was spent on mental health staff.

The total Hospital laboratory expenditure for this period was R 3,622,917 in comparison to R 81,215.57 spent for the Orthopaedic inpatients in the entire period. It was not clear the laboratory expenditure for other inpatient Units.

Similarly, the total Hospital blood and blood products expenditure for this period was R 1,112,666.67 in comparison to R 53,164.41 spent for the Orthopedic inpatients in the entire period. It was not clear the expenditure for other inpatient Units.

Human resource is the major cost driver (70%) for the Orthopaedic Unit. Other cost drivers include goods (R 203,781.30).

The Total cost and Unit cost varies significantly between the two wards. This might be due to difference in clinical practices between the two Wards. The

Unit cost for Ward 4 is more than three times the Unit cost for Ward 5. These Wards are offering the same type of service and there should not be a difference in costs. The out-lying medical patients can be a contributing factor. The other reason could be a tendency to keep patients from theatre in Ward 4 to minimize cross infection. More detailed study is necessary to understand this difference.

CHAPTER 6
CONCLUSION 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 were listed. Based on the findings of the study, appropriate recommendations and suggestions for future research were included.

6.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY

Based on the objectives of the study, the following could be concluded:

6.1.1 DESCRIPTION OF THE CASELOAD OF PATIENTS ADMITTED IN ORTHOPAEDICS WARDS DURING THE STUDY PERIOD

The total number of patients admitted in the Orthopaedics unit of the Hospital in the year 2009/2010 was 2160 and the mean number of patients per month was 180.

6.1.2 DETERMINATION OF THE PROFILE OF PATIENTS IN ORTHOPAEDICS WARDS DURING THE STUDY PERIOD

More blacks were admitted during the study period even though the main catchment area of the hospital is predominately white and coloured.

6.1.3 DETERMINATION OF THE COSTS FOR MATERIAL RESOURCES (LABORATORY, RADIOLOGY INVESTIGATIONS, AND PHARMACEUTICAL AND BLOOD AND BLOOD PRODUCTS, CONSUMABLES, AND NON-CONSUMABLES) AND HUMAN RESOURCES

The most common cause of admissions was due to injuries as expected in the Orthopaedics ward with a complication (4.5%) was found to the lowest as compared to the other unit s reflected in the monthly infection control data.

This study demonstrated that a cost analysis of using the volume based approach can be done successfully in a public health facility in South Africa. The study has managed to provide an estimate average cost of phramcuetical, investigations, length of stay and the cost for the all the patients reviewed. Whether or not theses amounts are reliable is a limitation of this study, especially considering the lack of similar studies in the country.

6.2 LIMITATIONS OF THE STUDY

The limitations of the study are listed below:

- The setting of this study was the Orthopaedics wards of the Helen Joseph Hospital and therefore, the findings of this study might not be generalisable to other hospitals before further studies are done in other regional hospitals.
- Since it was a cross-sectional study over a period of one month (based on a randomly selected period), seasonal variations in admissions could not be adjusted for. As the costs estimated were of a specified period of time, it could not be concluded the costs would be similar for all other months.
- Estimates of costs were based on overall expenditure incurred in these two wards for Pharmaceuticals, Laboratory and Blood and blood products. Although it provided an overall idea about the expenditure in

the Orthopaedic Wards, more detailed costing at individual patient level is necessary to develop a better understanding of costing at these Wards.

6.3 RECOMMENDATIONS

This study has highlighted that simple operational costing could easily be done at ward and unit levels to develop an understanding about the expenditure. This information could be used by hospital mangers and policy makers to ensure that the scarce public resources are used efficiently and effectively for better health outcomes.

6.3.1 PLANS FOR UTILIZATION AND DISSEMINATION OF RESULTS

The researcher will discuss the report with the head of the Orthopaedics Department and other staff members as well as senior management of the Helen Joseph Hospital. This would assist the Hospital management to make a decision about allocation of future funding at the Unit level and to develop cost centres in the Hospital. In addition, the report will also be forwarded to the GDOHSD for dissemination to other hospitals in the Province.

6.3.2 FUTURE RESEARCH

Further research is necessary to develop an in-depth understanding of costing of Orthopaedic services currently offered in public hospitals. This would assist these hospitals to identify actual expenditure for different type of patients and prepare them for National Health Insurance.

6.4 SUMMARY AND FINAL CONCLUSION

This study is the first study which provided the estimation of operational costs in an inpatient orthopaedic service at a regional hospital. The major cost driver was human resource which accounted for 70% of the total expenditure. Other

important cost driver was goods. Expenditure on Pharmaceuticals, Laboratory and Blood and blood products account for only one seventh of total expenditure. The total expenditure during this period was R 1,481,363.30 (Approximately R 17,776,359.60 annually). The Unit cost varied significantly between the two Wards, which might be due to differences in clinical practices between the two Wards. Further study based on more detailed costing at individual patient level is necessary to develop a better understanding of costing at these Wards. This study highlighted the significance of understanding the importance of determining the actual costs needed to provide an inpatient service in a health facility. Simple cost analysis method could easily be done at Unit/ Ward level to provide more insight to Hospital managers who are always criticized for over-expenditure.

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APPENDICES

APPENDIX A

ETHICS CLEARENCE CERTIFICATE

LETTER OF APPROVAL FROM THE FACULTY OF HEALTH SCIENCES

GAUTENG DEPARTMENT OF HEALTH

APPENDIX B

DATA COLLECTION TOOLS